TOWN OF PARADISE
WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL
PRELIMINARY DESIGN REPORT

VOLUME 1

Nolte and Associates

Volume 1
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CHAPTER I
EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

The Town of Paradise is developing a wastewater management plan for the entire Town. The largest portion of the Town will be remaining on onsite wastewater systems. A relatively small portion of the Town will be connected to a sewer system and wastewater treatment plant. The purpose of this preliminary design report is to describe the engineering analysis of alternative wastewater collection, treatment, and disposal systems and to provide a recommendation of the best alternative for the Town of Paradise.

The report is divided into two volumes. Volume 1 contains a general overview of the recommended wastewater collection, treatment, and disposal plan and the financial analysis. Volume 2 contains details of the extensive evaluation that was undertaken to select the best apparent wastewater management alternative, background data, and cost estimates.

A. PROJECTED SERVICE AREA

Criteria used in determining the boundary of the Town of Paradise sewer district service area were:

1. Current land use and zoning, including proposed updates to the General Plan.
2. Wastewater loading rates
3. Soils and soil conditions
4. Surface water quality
5. Septic tank failure and repair records
6. Property owners requests

The area of Town to be sewered is shown in Exhibit A. Characteristics of the sewer district include the high density commercial, industrial, and multi-family residential areas of the Town. The total service area for the formal sewer district comprises 1,665 net acres. Currently 1,100 onsite systems and 3,010 Equivalent Dwelling Units (EDU's) exist in the area to be sewered. At buildout, it is estimated that the service area will contain 7,800 EDU's. One EDU in the Town of Paradise has a wastewater flowrate of 200 gallons per day.

B. WASTEWATER COLLECTION SYSTEM ALTERNATIVES

The alternatives considered for wastewater collection included conventional gravity sewers, septic tank effluent pump (STEP), septic tank effluent gravity (STEG), and a combination or hybrid system featuring conventional gravity sewers along the Skyway and STEP/STEG for the Clark Road areas. For comparison purposes, it was assumed in each alternative that all existing septic tanks in the service area would be replaced or abandoned. Criteria for selection of the best collection system included capital costs,

operating costs, ease of installation, public acceptance, environmental impacts, aesthetics, and compatibility with water reuse options.

The recommended option is the hybrid collection system consisting of conventional gravity sewers for the Skyway area and a STEP/STEG system for the Clark Road, Buschmann, and Pearson/Elliott corridors. The hybrid system has the advantage of being a tailored sewer system for the particular terrain, type of development and potential for water reuse. The capital cost of the hybrid system is $12,443,000 which represents a savings of $4,350,000 compared to a conventional gravity collection system for the whole service area. The capital, operation and maintenance, and total present worth costs of the three each sewer system alternatives are presented in Table I-1. The cost of each sewer system includes onsite piping (laterals) to hook up all existing development from the house/business to the main sewer line. Reductions in capital costs are expected during final design when retention of some existing septic tanks and the use of effluent gravity systems can be optimized.

TABLE I-1

TOWN OF PARADISE COLLECTION SYSTEM ALTERNATIVES
TOTAL PRESENT WORTH[a]

Collection System Alternative	Capital Costs ($)	Operations & Maintenance Costs ($)	Present Worth ($)
Conventional Gravity System	16,796,000	100,000	17,855,000
STEP/STEG System	11,797,000	164,000	13,534,000
Hybrid System	12,443,000	114,000	13,651,000

[a] Assumes 20 yr life cycle and 7% capital recovery.

C. SEPTAGE HANDLING ALTERNATIVES

The septage handling alternatives considered for the Town of Paradise included land treatment and disposal (no treatment prior to land application), construction of an independent septage treatment facility (separate from the wastewater treatment plant), and co-treatment at the wastewater treatment plant. Land application without pretreatment is not recommended by regulatory authorities. Some type of stabilization process, such as liming or lagooning, is recommend to reduce the risk of disease transmission by pathogens contained in the septage. Implementation of a separate septage handling facility featuring composting, lagooning, or solar aquatics was determined to be far more expensive than sizing the proposed treatment plant to accommodate the septage.

The recommended septage handling alternative is co-treatment at the wastewater treatment plant. The beneficial uses of septage associated with land treatment and disposal can still be realized with co-treatment by stabilizing the septage with the wastewater sludge and using the combined residuals in a land application operation.

D. WASTEWATER TREATMENT/DISPOSAL SYSTEM ALTERNATIVES

Combined flows of wastewater and septage will be treated to standards set by the Regional Water Quality Control Board (RWQCB) and disposed of in an environmentally safe manner. The average design flow for the first 20 years of operation is 0.90 mgd with an expected buildout average flow of 1.56 mgd (including 24,000 gpd of septage).

Sites evaluated for a Town of Paradise wastewater treatment plant included Elliot Spring, Upper Horning Ranch, Lower Horning Ranch, the Sanders Parcel (west of Highway 99), lower Skyway, and specific areas within the Town of Paradise. Discharge or reuse options included surface water discharge to Nugen Creek, irrigation reuse on Lower Horning Ranch and the Sanders Parcel, habitat wetlands on Lower Horning Ranch, and rapid infiltration (percolation basins) adjacent to Butte Creek and in the Town of Paradise.

Appropriate treatment operations and processes were evaluated within the categories of preliminary treatment, primary treatment, secondary treatment, advanced treatment, and sludge treatment and disposal. The secondary treatment systems that were evaluated included partial mix aerated ponds, oxidation ditch, sequencing batch reactor, wetlands, and overland flow. Appropriate wastewater treatment/disposal systems were developed for the sites under consideration and the applicable discharge requirements.

The recommended treatment/disposal system is overland flow at Upper Horning Ranch with discharge into Nugen Creek. The estimated capital cost for the treatment plant and the land is $5,376,000. A habitat wetland will be developed on Lower Horning Ranch at a cost of $875,000 to gain approval from the Regional Water Quality Control Board (RWQCB) for year-round discharge into Nugen Creek. Aerated ponds will be used for primary treatment and sludge storage. Sand filtration followed by ultraviolet light disinfection will be used to obtain the high effluent quality required prior to stream discharge. Sludge will be stabilized within the primary ponds. Every 3 to 5 years, the sludge will be dredged from the ponds and applied during the summer to land adjacent to the treatment plant.

E. IN-TOWN WASTEWATER REUSE

To conserve potable water that is currently used for irrigation, an analysis was conducted of the potential for in-town water reuse. Reuse areas within the Town of Paradise were divided into categories of parks and playgrounds (50 acres) and landscape irrigation (87 acres). Landscape irrigation was determined to be the most cost effective, due to lower treatment standards required by the California Department of

Health Services (DHS). Based on large water demand and central location, the following sites were selected for construction of reclamation facilities and use of reclaimed water:

1. Paradise Cemetery
2. Tall Pines Golf Course
3. Proposed Expansion of Paradise Cemetery

Septic tank effluent from the Clark Road, Buschmann, and Pearson/Elliott corridors would be used as the influent wastewater to the reclamation plants. The estimated cost to construct the three reclamation facilities is $2,387,000. Construction of the most inexpensive of the three facilities, the Paradise Cemetery, would cost $631,000. For treatment and disposal, in-town reclamation exceeds the cost of the main treatment plant by 56% or $351/acre-ft. The operations costs also exceed the costs at the main plant by $111/acre-ft. Although the Town could save 230 acre-ft of potable supply, the high costs make it difficult to recommend in-town reuse at this point in time.

It is not uncommon for reclamation/reuse programs to subsidize the cost of reclamation especially in the early years of a program where the alternative water supply is relatively inexpensive. The PID charges for irrigation water are currently $89/acre-ft. Without the Town subsidizing the cost of reclaimed water, the price paid by the user would be $450/acre-ft. Although the current water prices cannot justify the conversion, future costs of developing new supplies, expected to be in the range of $1,750 to 2,800/acre-ft, may make reclamation desirable in the future.

F. SUPPORT AND OPERATIONAL REQUIREMENTS OF THE RECOMMENDED PLAN

Operational requirements of the proposed sewer district include labor, equipment, energy, chemicals, and miscellaneous supplies. Staffing of the sewer district will include positions in administration, collection system maintenance, and treatment and disposal system operation. Administration of the district will require a district manager and a clerk typist. Collection system maintenance will require two maintenance personnel, a lead person and one helper. Operation and maintenance of the treatment plant and monitoring of the disposal system will require two operators, a lead operator and an operator/laboratory technician. The total annual cost for labor, equipment, energy, and miscellaneous supplies is estimated to be $364,000.

G. FINANCIAL ALTERNATIVES

The capital costs of the recommended wastewater management plan is $20,921,000. To finance this cost it is proposed that a combination of grants, loans, and assessments be used. Grants from the Economic Development Administration, the Community Development Block Grant process, the State Water Resources Control Board, the Wildlife Conservation Board, and the Environmental Protection Agency are being pursued. A low interest loan from the State Water Resources Control Board (WRCB)

is available based on the recently acquired Priority B ranking. Loans from the WRCB cannot exceed $20 million per project in any one year.

The capital cost of the collection, treatment, and disposal system will be spread over a buildout total of 7,800 EDU's and a 20 year capacity total of 4,400 EDU's. The average monthly cost for capital facilities will be $17.16 per EDU.

Operation and maintenance (O&M) costs will be spread over the initial 3,010 EDU's. Typical O&M cost per EDU will be $10.08 per month for collection, treatment and disposal.

CHAPTER II
PROJECTED SERVICE AREA AND WASTEWATER CHARACTERISTICS

II. PROJECTED SERVICE AREA AND WASTEWATER CHARACTERISTICS

The unique characteristics of the Town of Paradise environment result in the need for the application of different types of wastewater treatment systems. Some areas of Town, due to favorable soil conditions and low density zoning, are best suited to onsite systems. Other areas, due to unfavorable soil conditions and/or high wastewater loading rates, are not suited to onsite wastewater treatment. The areas determined to be unsuitable for onsite systems are being considered for sewer hookup to a central wastewater treatment facility. Based on land use, soil types, septic system failures, and wastewater loading rates, a formal sewer service area has been delineated for the Town of Paradise. The Town of Paradise environment, the proposed service area, and the projected characteristics of the wastewater from the service area are described in the following paragraphs.

A. TOWN OF PARADISE ENVIRONMENT

Elements of the town environment described in this section include soils, groundwater, climate, surface water resources, land use, and population.

1. Soils

The soils of Paradise have been mapped in considerable detail by Wert and Associates in *Soils of Paradise and Their Ability to Treat Domestic Wastewater*, April 1992 [2-1]. A majority of the soils are of volcanic ash origin with embedded hard gravels and boulders. Volcanic mud flows and intermittent ash flows, which are collectively known as the Tuscan formation, underly the Town to a depth of approximately 1,000 ft. Most of the flows are relatively free of hard fragments and have weathered to produce a deep, well drained, clay soil known as the Aiken series. The Tuscan formation in its unweathered state can be difficult to excavate, requiring blasting or use of a rock saw. On broad ridges, the Aiken soil predominates. In swales, colluvium deposits have collected. Soils in swales typically have 2 to 5 ft of clay loam over a clay pan 2 to 3 ft thick. Below the clay pan there can be 10 to 30 ft of weathered Tuscan formation.

2. Groundwater

The average slope of the ground surface within the Town of Paradise is approximately 4%. Drainage is conveyed from the upper elevations of Paradise to the steep canyons south of town. Areas of Town exist where bedrock has caused water to collect. Old hand dug wells have tapped these areas for domestic water but the water supply is limited. Much of the ground surface consists of a permeable loam underlain with clay. Adequate gradient exists in most areas to move perched rainwater down-gradient on top of this clay layer. However, portions of Town with a gentle slope can have a prolonged temporary perched water table during the wet season.

There are approximately 200 private wells in town. During drought years, when water has been rationed by the Paradise Irrigation District (PID), homeowners use the well water to maintain their landscaping.

3. Climate

The climate of Paradise is typical of the Sacramento Valley with mild winters and hot dry summers. Temperatures can be as low as 32°F in winter and as high as 105°F in summer. The elevation of Paradise varies from 1,300 ft at the southern end of Town to 2,200 ft at the northern end. Average annual precipitation ranges from 40 in./yr in the lower elevations to 60 in./yr in the higher elevations.

4. Surface Water Resources

Water for the town is currently supplied by PID. The PID system includes a metered distribution with approximately 9,800 connections and two storage reservoirs, the Magalia and Paradise reservoirs. PID has water rights for 18,000 ac·ft of water per year, but storage capacity of only 14,140 ac·ft per year. PID currently has enough water to meet the needs of the Town until 1995. The district has explored three alternatives to meet the Town's future water demands:

a. Raise the Paradise Dam

b. Strengthen and raise Magalia Dam

c. Develop a new well

PID is pursuing the option of strengthening and raising Magalia Dam. The Division of Safety of Dams is currently questioning the Magalia Dam's ability to meet existing seismic requirements. It is possible that a project to strengthen the existing dam may be mandated.

The ability of the District to meet the Town's water needs is a function of the daily water usage. The District has encouraged conservation for many years. The goal of the District is an average annual water use of less than 250 gal/cap per day. During the drought of 1976-1977 water use ranged 175 to 225 gal/cap per day, but lately water use has exceeded the 250 gal/cap per day target. The immediate needs of the PID and the projects required to solve future water supply problems have not been resolved.

5. Land Use

An update of the General Plan for the Town of Paradise is currently underway. In the past, land use and zoning of Paradise have been dictated to a large extent by onsite wastewater disposal as influenced by soil types and related leach field characteristics. As outlined in the following section of this chapter, the service area for the collection system includes primarily the commercial, industrial, and multi-family residential zoned

areas of town. A small amount of single family residential is included in the service area due to proximity to the sewered area and small lot size.

The residential character of the community is evident in that 85% of the Town is zoned for single family homes, and 6% is zoned for multi-family complexes. Commercial and industrial zoned land constitutes 6.5% of the total. Open space is not only reserved in the extensive rural residential zoning, but by resource conservation and community facilities that include the golf course, schools, hospital grounds and cemetery. About 30% of the land zoned for construction is vacant, and 24% is utilized in transportation thoroughfares. The occupied commercial and industrial land comprise about 2.5% or perhaps half of the net areas designated for those uses. There is still some land in agriculture, but the total acreage has decreased dramatically in recent years. At one time, Paradise was famous in the local region for apple orchards and vineyards.

6. Population

The population of the Town of Paradise, as estimated by the State Department of Finance for 1992, was 26,008. The historical annual growth rate for the Town from 1980 to 1990 was 1.3%. The average age of the population is 45.3 years with 26% of the population 65 years or older. The ethnic origin is 97% caucasian. There are estimated to be 11,483 housing units within the Town of Paradise with an average of 2.27 persons per household.

B. SEWER DISTRICT SERVICE AREA

The need to create a "formal" service area as part of the implementation of a centralized wastewater treatment system was concluded in previous studies commissioned by the Town of Paradise [2-2, 2-3, 2-4]. The previous studies relied on land use designations and surface water quality issues as primary factors in determining where septic tank systems would be replaced by conventional sewers. Results of the studies were used as a baseline for establishing the boundary of the currently proposed service area.

1. Boundary Determination Criteria

Criteria used in determining the sewer district boundaries included: current land use and zoning designations, wastewater loading rates, soils and soil conditions, surface water quality, failure and repair records obtained from the county, and property owners requests.

a. Land Use and Zoning

The 1980 General Plan and Land Use Map for the Town of Paradise was used as the basis for the determination of projected land uses and densities. A windshield survey (drive-by survey of the Town to identify structures and determine occupancy) was conducted by Quad Consultants in 1992 as part of the General Plan

Update [2-8]. This survey was examined to develop a wastewater loading map, in gallons/acre-day. An overlay of land use, soils conditions, and loadings was used to further evaluate the proposed sewer district boundary.

The Draft 1992 General Plan update was recently made available and has been compared to the proposed sewer district boundary. The proposed general plan land use designations specifically refer to the potential sewers in determining land use and densities. A summary of the sewer dependent land use types and their estimated wastewater loading rates are presented in Table II-1.

TABLE II-1

LAND USE TYPES IDENTIFIED IN THE DRAFT GENERAL PLAN TO BE DEPENDENT ON SEWERS

Land use Category	Residential Density (units/acre)	Loading Rate (gallons/acre-day)
Town Residential	2 - 5[a]	400 - 1000
Multi-Family Residential	5 - 10[b]	825 -1,650
Central Commercial	N/A	2,000
Town Commercial	N/A	2,000
Light Industrial	N/A	2,000

[a] Five units/acre in areas zoned Town Residential will require sewers.

[b] 10 units/acre in areas zoned Multi-Family Residential will require sewers.

b. Wastewater Loading Rates

Wastewater loading rates were determined by an extensive review of PID records during the winter months augmented by site specific studies of metered water use. The wastewater generation rates associated with residential uses are listed in Table II-2. The current and projected residential wastewater generation rates were plotted on base maps of the Town and compared to the threshold loading rate of 900 gallons/acre-day. The threshold rate was based on the maximum acceptable nitrogen loading rates determined by Ryder and Associates in 1985 [2-3]. Areas outside of the proposed sewer district were also analyzed in terms of the threshold loading rate. Several factors were analyzed to determine the feasibility and need to connect these areas to the formal system, as described in

more detail in a separate report prepared by NorthStar Engineering (*Remote Cluster Systems for the Town of Paradise*).

TABLE II-2

TOWN OF PARADISE RESIDENTIAL WASTEWATER GENERATION RATES

Single Family Residential	Multi-Family Residential	Mobile Home Park
200 gallons/residence per day[a]	165 gallons/residence per day	125 gallons/residence per day

[a] Represents one equivalent dwelling unit (EDU)

c. Soils and Soil Conditions

The soils of Paradise are described in detail in *Soils of Paradise, and Their Ability to Treat Domestic Wastewater* prepared by Wert and Associates [2-1]. The report and the associated soils map detail the soil types and conditions found in Paradise and their ability to treat wastewater. In general, the Aiken soils which comprise approximately 67% of the Town, accept and treat domestic wastewater very effectively. However, the installation of septic systems within the Town is hindered in some areas by the presence of shallow groundwater and limited space in which to place an effective system. Ground disturbance (cuts and fills), over-covering, setbacks from waterlines and streams, and topography all limit the available area for installation.

d. Surface and Groundwater Quality

Degradation of surface water quality within the Town of Paradise has been documented by the Regional Water Quality Control Board (RWQCB) and various consultants [2-5, 2-6, 2-7]. Bacterial indicators of human waste have been found in surface water samples. Bacteria detected in the Town of Paradise surface water include total and fecal coliform and fecal streptococcus.

The bacteriological results of the sampling program are indicative of marginal surface water quality. In the most recent round of testing, fecal coliform exceeded the Basin Plan standard of 200 MPN/100 mL at 14 of 22 sampling stations [2-7]. The most significant degradation of surface water quality was found in the Middle Honey Run Basin and the Pearson Basin. However, due to the limited number of samples collected, there is no conclusive link between the fecal contamination and septic tank effluent [2-7].

Groundwater quality was also investigated for bacterial contamination, but the results were not indicative of widespread fecal pollution [2-7]. The small concentrations of bacteria detected within some wells may be related to a poor sanitary seal or long periods of non-use. Groundwater quality is considered to be good and there is no strong evidence that groundwater quality has been impacted by septic tank effluent.

e. Property Owners Requests

Several property owners have expressed interest in obtaining sewer capacity and service. Most notable are the land owners associated with the proposed development of the golf course area and the area between the golf course and Buschmann Road (the Moe West project). Both of the projects are consistent with the Paradise General Plan and have been in the discussion stage for several years. The owners of the Cypress Convalescent Hospital, located north of Wagstaff on Clark Road, have also expressed interest in a sewer hookup.

f. Septic System Failure and Repair Records

Currently, Town of Paradise wastewater is treated and disposed of by approximately 11,800 residential and 400 commercial septic tank and leachfield systems. Of these systems, roughly 39% are 10 years old or less, 24% range in age from 11 to 20 years, 20% are 21 to 30 years old, and 17% are greater than 30 years old.

A detailed analysis of septic system failures during 1990 and 1991 was undertaken through investigating the records of the Environmental Health Department and interviewing sanitarians. The results of the analysis reflected a Town-wide average failure rate of 1% (or roughly 100 systems) per year. Unfortunately, the location of these failures was not readily correlated with physical factors such as soil type or depth to groundwater and could not be considered in delineating the sewer service area.

3. General Boundary Description

A map of the service area boundaries is included as Exhibit A. The description of the sewer district boundary is divided into the following corridors: Skyway (Town limits to North of Wagstaff), Upper Clark Road (Buschmann to North of Wagstaff), Lower Clark Road (Town limits to Buschmann), Buschmann Road, and Pearson/Elliott.

a. Skyway (Town Limits to North of Wagstaff)

The Skyway corridor is bounded to the south by the Town limits. The northwesterly boundary of the corridor extends to the rear of parcels fronting on Skyway, between Bille Road and Wagstaff Road. The Northerly boundary

includes the currently zoned community-commercial property north of Wagstaff Road and the eastern boundary follows the abandoned railroad right of way.

The northwesterly boundary of the Skyway corridor generally follows the zoning line that separates single family residential from commercial/multi-family. Some existing single family residences are included within the corridor due to the inconsistency between the zone and the current land use. In addition to the property clearly located within the boundaries described above, Skyway includes the existing apartment project and commercial uses in the "island" between the divided roadway. At owner request, a large undeveloped parcel south of Skyway is also included. The owner is anticipating the construction of a single family residential subdivision of approximately 4 units per acre.

b. Upper Clark Road (Buschmann to North of Wagstaff)

The northern Clark Road corridor is contiguous to the Pearson/Elliott area and the Moe West project. The easterly boundary from Buschmann to the north follows the zoning line between single family and commercial/multi-family and extends one or two parcels deep from Buschmann Road to Elliott Road. The boundary was extended along Elliott to include the existing multi-family projects in the area.

The zoning line between single family and commercial/multi-family is followed from Elliott north to Wagstaff. The Country Oaks Subdivision has been excluded from the sewer district because it is new and meets the current onsite standards. It is recommended that the zoning/general plan be amended to reflect single family for this parcel. The boundary on the west side of Clark between Wagstaff and Elliott essentially follows the zoning line between single family and commercial/ multi-family residential. The mobile home parks contiguous to the original boundary were added.

An area between Copeland Road and the existing commercial area is indicated in the Draft General Plan as Town Residential. This area has been included in the proposed sewer district. The principal additions to the sewer district north of Wagstaff consist of the Cypress Acres Convalescent Hospital, Pine Springs Mobile Home Park, and the Apple Village Mobile Home Park. Inclusion of Cypress Acres was at the request of the owners. The Apple Village Mobile Home Park was included based on the density, extensive soil disturbance during construction, overcovering of soil with impervious surfaces, and the lack of alternative sites for onsite disposal. Pine Springs Mobile Home Park was included for similar reasons.

c. Lower Clark Road (Town Limits to Buschmann Road)

The southern Clark Road corridor consists primarily of the Paradise Industrial Park, the previously mentioned Moe West property, the Tall Pines golf course, and other commercial and multi-family parcels. Vineyard Acres Mobile Home Park, currently under development by Gary Guardino, has been included in the district because connection to the sewer is a development requirement. The southern Clark Road corridor area is the most difficult to serve by the sewer district, because all wastewater must be pumped to a sewer main on Buschmann Road.

d. Buschmann Road

Buschmann Road corridor is bounded by Buschmann and Pearson Roads. The area contains a variety of land uses, including a Little League ball park, two schools, a park, a medical center, and single family homes. The single family residential areas were not included in the sewer district, but all of the other areas have been included. Portions of the Buschmann Road corridor are subject to high groundwater.

e. Pearson/Elliott

The Pearson/Elliott area is generally bounded by Pearson Road to the south and Elliott Road to the north. Outside of these general boundaries, the corridor includes the high school and the multi-family residential units along Maxwell Road. Most of the Pearson/Elliott area was included in the sewer district because it is either zoned or developed as multi-family or other high wastewater flow uses. Some pockets of single family development exist in the area and were omitted from the sewer district designation. Areas of high groundwater and areas within impacted basins were included in the sewer district.

The gross acreages of the proposed sewer district associated with the various land uses identified in the Paradise General Plan are presented in Table II-3. The total service area comprises 1,665 acres of which 37% is dedicated to commercial/industrial properties and 20% to multi-family residential.

C. WASTEWATER CHARACTERISTICS

A summary of the wastewater characteristics used in the preliminary design of the recommended treatment/disposal system is presented in Table II-4. Design flowrates for the Town of Paradise wastewater treatment plant were based on predicted flows from the sewer system and predicted septage loads from septic tank pumping. Wastewater flows from the sewer system were estimated by the number of equivalent dwelling units (EDU's) in the sewer district service area. Approximately 3,010 EDU's presently exist within the service area.

The treatment plant will be constructed to handle wastewater flows occurring during the first 20 years of operation. If population growth in the sewer district increases at approximately 2% per year for 20 years, 4,400 EDU's will be contributing wastewater at a predicted rate of 200 gpd/EDU in the year 2014. The contribution of wastewater from the sewer system will therefore be 0.88 mgd. The total volume of septage predicted to be received at the plant in the year 2014 is 0.024 mgd (0.022 mgd from septic tanks in the onsite district and other areas of Butte County and 0.002 mgd from STEP systems). The average dry weather flow (ADWF) for the first 20 years of operation of the Town of Paradise wastewater treatment plant will be 0.90 mgd (wastewater flow rates plus septage). Peak dry weather flow (PDWF) is predicted

TABLE II-3

TOWN OF PARADISE PROPOSED SEWER DISTRICT SERVICE AREA

Land Use Category	Residential Density (Units/Acre)	Population Density (Persons/ Dwelling Unit)	Gross Acres in Sewer District
Agricultural Residential	1	2.36	24
Suburban Residential	1-2	2.36	333
Town Residential	2-5 (sewered)	2.36	222
Multi-Family Residential	5 to 10	1.92	313
Central Commercial	N/A[a]	N/A	102
Town Commercial	N/A	N/A	349
Community Service	N/A	N/A	56
Recreational	N/A	N/A	68
Public Institutional	N/A	N/A	99
Light Industrial	N/A	N/A	99

[a] N/A - Not Applicable

to be 2.2 mgd, based on an overall peaking factor of 2.44. Peak wet weather flow (PWWF) of 2.5 mgd was calculated from the sum of the PDWF and estimated infiltration rates.

Flowrates occurring at Town buildout will be approximately 1.6 mgd (ADWF) and 3.9 mgd (PWWF). The buildout flowrates were estimated based on maximum densities as allowed by zoning category and a water use of 200 gpd/EDU.

Wastewater quality was determined using a mass balance prepared from the expected concentrations and flowrates of the various waste streams entering the treatment plant. Approximately one half of the sewer district service area will be hooked up to conventional gravity sewers and the other half will utilize STEP systems. Step system effluent is less concentrated than conventional sewer effluent due to settling of solid particles in the septic tank. The concentrations of BOD_5, TSS, nitrogen, and phosphorus associated with wastewater from the conventional sewer system, wastewater from the STEP systems, septage from conventional septic tanks, and septage from STEP systems are listed in Table II-4. The treatment plant design concentrations were calculated to be 310 mg/L BOD_5 and 530 mg/L TSS.

D. EXPECTED WASTEWATER DISPOSAL REQUIREMENTS

Effluent quality objectives were derived based on proposed wastewater disposal/reuse options and correspondence with the Regional Water Quality Control Board (RWQCB). The disposal/reuse options under consideration, surface water discharge (Hamlin Slough through Nugen Creek), rapid infiltration, and agricultural reuse are described in Chapter VI of Volume 2. The likely wastewater disposal requirements used in the evaluation and selection of appropriate wastewater treatment processes, are enumerated in Table II-5.

TABLE II-4

PROJECTED WASTEWATER CHARACTERISTICS FOR THE TOWN OF PARADISE THROUGH DESIGN YEAR 20

Wastewater Component	Wastewater Characteristics				
	Flow (mgd)	BOD_5 (mg/L)	TSS (mg/L)	Total N (mg/L)	Total P (mg/L)
Conventional Sewer Effluent	0.44	220	220	40	8
STEP Effluent	0.44	150	40	45	8
Septage from Conventional Septic Systems	0.022	5,000	15,000	600	150
Septage from STEP Systems	0.002	5,000	15,000	600	150
ADWF (combined flows)	0.90	310	530	57	12
PDWF (PF=2.44) (combined flows)	2.2	----	----	----	----
PWWF (combined flows)	2.5	----	----	----	-----

TABLE II-5

LIKELY WASTEWATER DISPOSAL REQUIREMENTS FOR THE TOWN OF PARADISE WASTEWATER TREATMENT PLANT

Disposal Alternatives	Effluent Limitations				
	BOD_5 (mg/L)	TSS (mg/L)	Coliform[a] (MPN/100 mL)	Chlorine Residual (mg/L)	Un-ionized[b] Ammonia (mg/L)
Surface Discharge	10	10	≤ 23	<0.1	<0.01
Rapid Infiltration	30	30	--	--	--
Agricultural Reuse	40	--	≤ 23	--	--

[a] Total Coliform

[b] Nitrified Effluent

REFERENCES

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CHAPTER III
RECOMMENDED WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL PLAN

III. RECOMMENDED WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL PLAN

Brief descriptions of the recommended wastewater collection, treatment, and disposal systems for the Town of Paradise are presented below, followed by a discussion of the recommended components of an upstream reclamation system. Within each description, capital costs of the proposed systems are enumerated and proposed implementation schedules are discussed.

A. WASTEWATER COLLECTION

The service area of the formal collection system is a mix of commercial, high density residential, and single family residential parcels. Wastewater from the service area will be collected in a system consisting of several different types of sewers. The appropriate type of collection system for each site was chosen based on site and area topography, development density, and wastewater loading rates.

1. Types of Collection Systems

The recommended collection system alternative for the Town of Paradise is a "hybrid" system of conventional gravity, STEP and STEG technologies. Typical house connection details for the STEP and STEG systems are presented in Figures III-1 and III-2.

Wastewater from the Skyway corridor will be collected by a conventional gravity sewer system with the exception of a few low lying areas. In lieu of small lift stations, STEP units are to be used in these areas. Wastewater from the Clark and Buschmann Road corridors will be collected by a combination of STEG and STEP systems. The parcels that can be serviced by gravity will drain to a trunk line on Clark or Buschmann Road. Others too low to be served by gravity will use the STEP system technology to lift the wastewater into the trunk lines. The design and subsequent cost estimates are based on the trunk lines being no deeper than 8 ft due to the lack of geotechnical data and probability of hardrock at greater depths. Additional geotechnical information must be obtained before commencing collection system design. Borings taken along the proposed alignments would confirm the probability of encountering hardrock. If the trunk line depths can be increased, then fewer STEP units will be required. The additional cost of deeper trenches would be offset by the reduced capital and operations and maintenance (O&M) costs associated with the pump units in the STEP systems.

2. Locations of Facilities

A majority of the collection system pipelines will be located in existing road right of way as shown in Exhibit B of Volume 2. A few easements will be required to eliminate pump stations. House laterals (4 in. gravity sewers from the house/business to the septic tank or gravity sewer main) will be installed by the contractor. Some owners with raised foundations and back lot tanks may choose to reverse the house

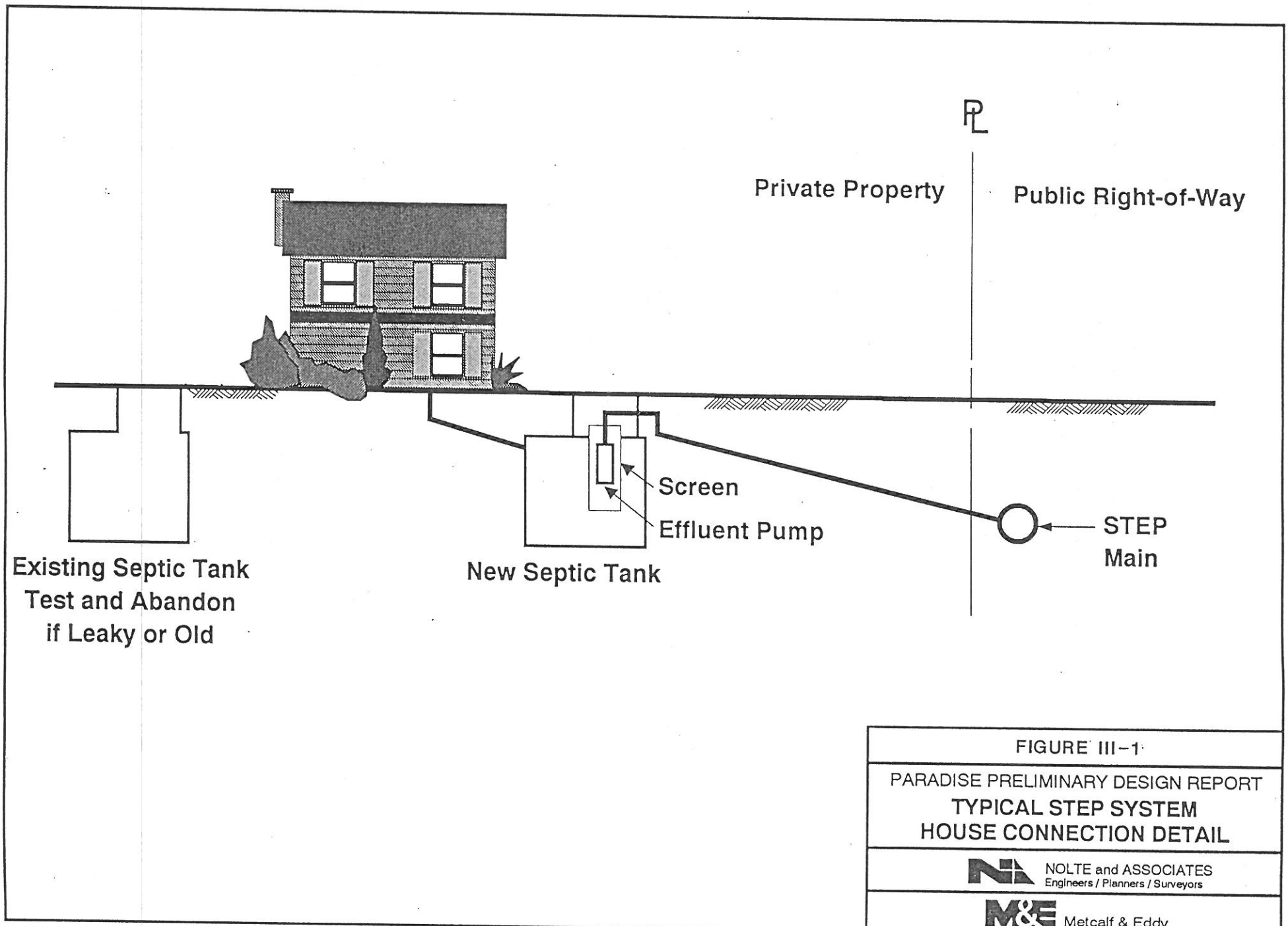

FIGURE III-1

PARADISE PRELIMINARY DESIGN REPORT

TYPICAL STEP SYSTEM
HOUSE CONNECTION DETAIL

NOLTE and ASSOCIATES
Engineers / Planners / Surveyors

M&E Metcalf & Eddy

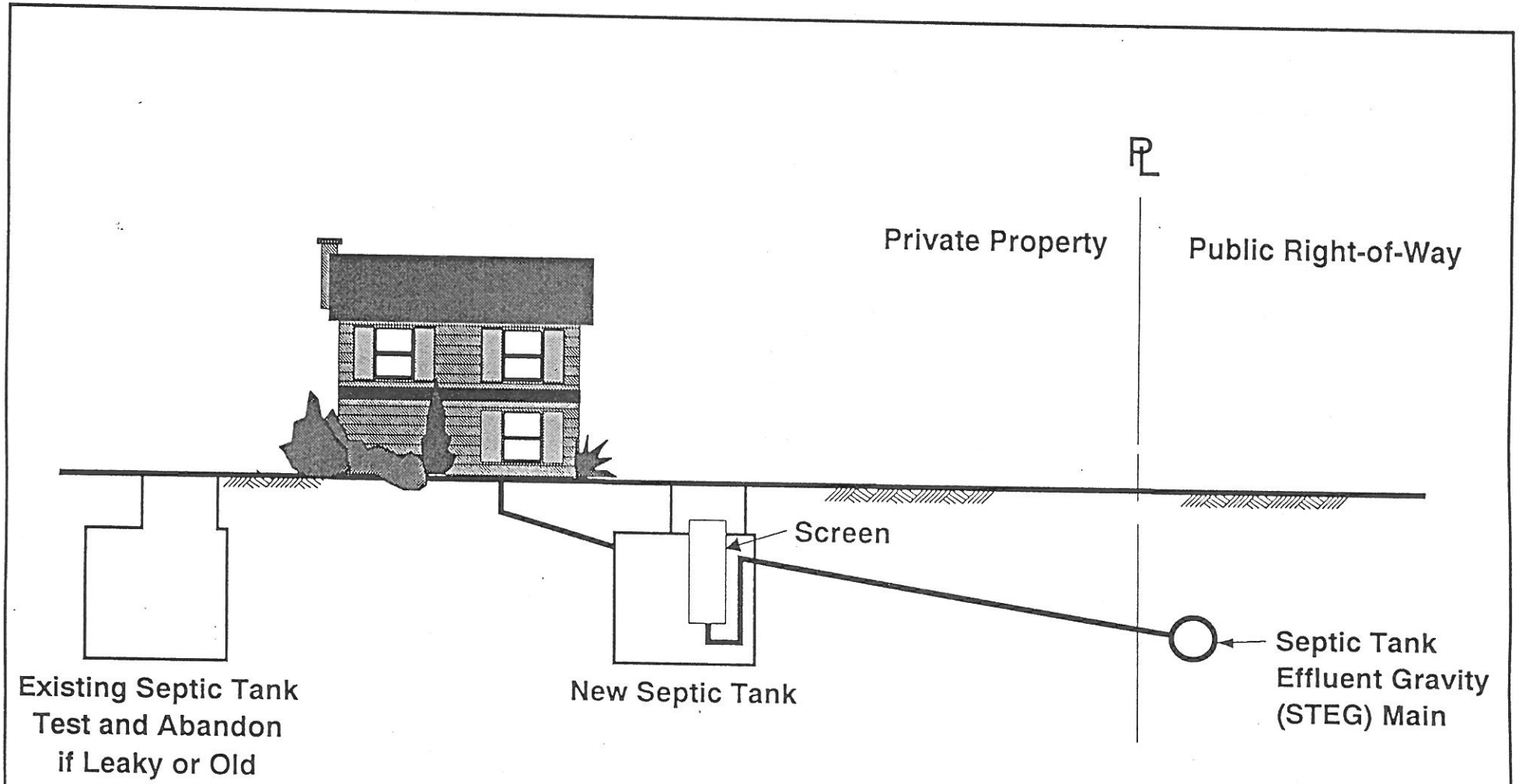

FIGURE III-2.

PARADISE PRELIMINARY DESIGN REPORT

TYPICAL STEG SYSTEM HOUSE CONNECTION DETAIL

NOLTE and ASSOCIATES
Engineers / Planners / Surveyors

M&E Metcalf & Eddy

plumbing to reduce lateral length or to mitigate adverse grade. STEP/STEG improvements will be installed as appropriate to minimize costs.

The wastewater conveyance pipeline will follow existing easements on Neal Road and then divert south along a PG&E gas pipeline easement to the wastewater treatment plant.

3. Design Criteria

The collection system is designed for ultimate buildout based on existing zoning classifications as shown in the revised Town of Paradise General Plan. Each individual collector line is designed to carry all upstream peak flows at 80% of pipe capacity. The transmission line is also designed to convey the ultimate flows of the entire service area at buildout at 80% of pipeline capacity.

4. Capital Costs

The construction cost for the "hybrid" alternative collection system is estimated to be $12,443,000 including pipelines, public laterals, STEP/STEG improvements, pump stations, easements, land acquisition and septic tank replacement and abandonment. The cost of private laterals are also included.

5. Implementation Schedule

It is estimated the final design of the collection systems and transmission pipeline will take 6 months assuming prompt State reviews. The construction period of 12 months should be provided for the collection system lines and laterals. The construction area will be broken into three contracts; Element A (Skyway), Element B (Upper Clark), and Element C (Lower Clark).

Disturbance to businesses in the service area during construction will be minimized by enforcing a traffic control plan and maintaining separate entrances to driveways. Approximately 1,500 linear feet of trench will be open at any given time.

B. WASTEWATER TREATMENT AND DISPOSAL

The wastewater collected from the Town of Paradise is to be treated in a centralized wastewater treatment facility prior to disposal in an environmentally sound manner. Septage generated from the surrounding areas is to be co-treated with the wastewater, as discussed below.

1. Treatment/Disposal Sites

The treatment facility is to be located at Upper Horning Ranch, with discharge to Nugen Creek and a habitat wetlands on Lower Horning Ranch. A map of the proposed treatment and disposal sites is presented as Figure III-3. The Upper Horning Ranch

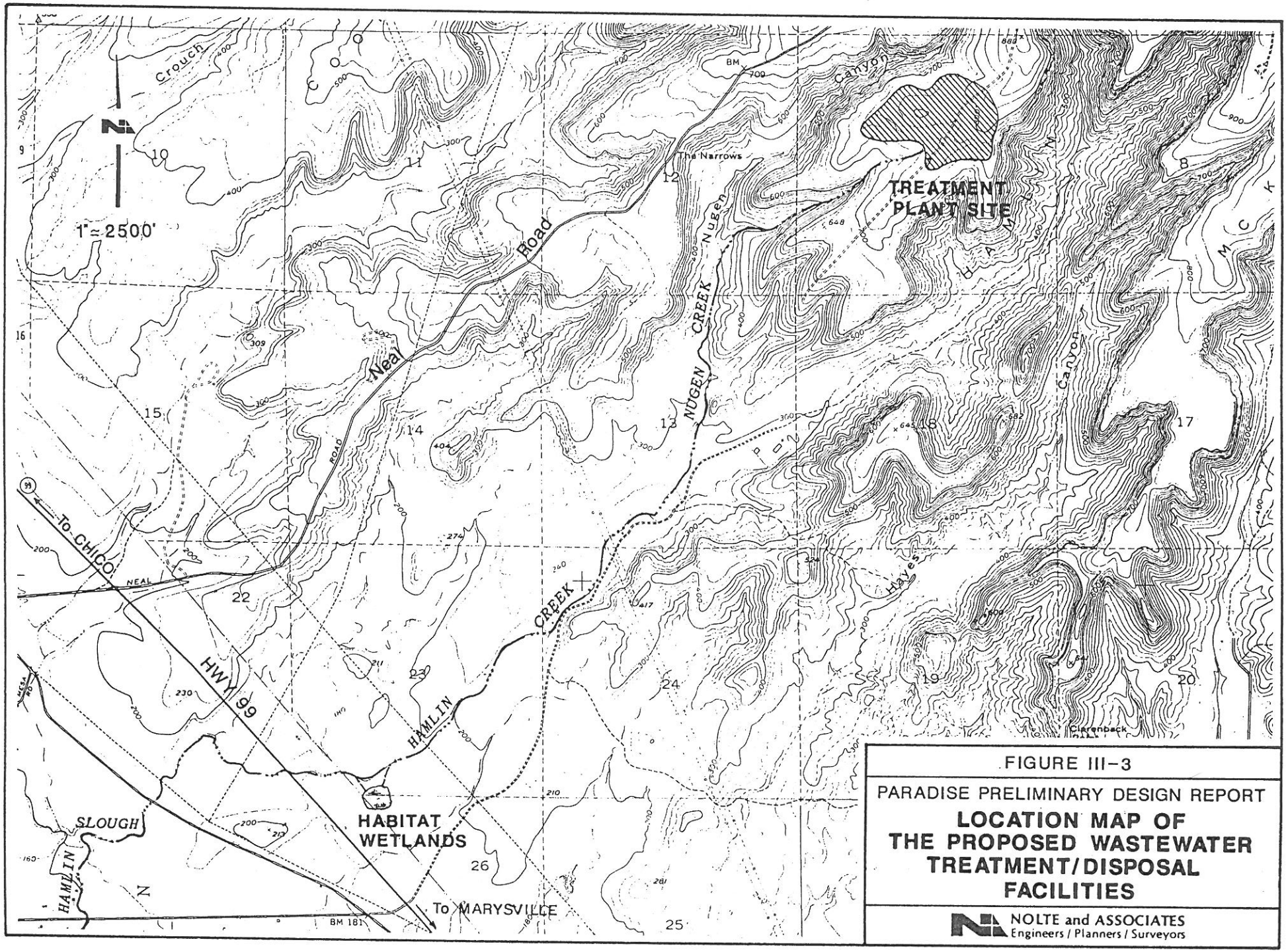

FIGURE III-3

PARADISE PRELIMINARY DESIGN REPORT

LOCATION MAP OF THE PROPOSED WASTEWATER TREATMENT/DISPOSAL FACILITIES

NOLTE and ASSOCIATES
Engineers / Planners / Surveyors

site has favorable existing topography for the treatment methods selected and offers isolation from Neal Road and existing residences. Approximately 280 acres of land should be purchased by the Town for the treatment facility, which will ensure adequate land area for facilities expansion, sludge disposal, and buffer area from neighboring properties.

Following treatment, the wastewater will be discharged to Nugen Canyon to create a perennial stream. A portion of the water will be diverted from the stream at Lower Horning Ranch to create a 20 acre wildlife habitat wetland. Below the wetland, stream flow will continue to Hamlin Slough.

2. Treatment/Disposal Methods

A process flow schematic for the recommended wastewater treatment/disposal system is presented as Figure III-4. The following discussion includes a description of the treatment plant operation.

The septage receiving station will be located in a locked enclosure adjacent to the main treatment plant. Septage haulers will be issued keys to the receiving station for after hours or weekend deliveries. Septage will be deposited in a manhole structure equipped with flow measurement and sequential sampling devices. The septage haulers will be responsible for monthly reporting of the quantities and sources of pumpings to the Town for billing purposes.

The combined septage/wastewater flow will receive preliminary treatment at a headworks structure. Preliminary treatment will consist of flow measurement, composite sampling, and screening. A mechanically cleaned bar screen will be the duty equipment, and a manually cleaned bar screen will serve as backup.

Primary treatment (settling) will be accomplished in an aerated pond. Two ponds will be constructed, but one pond will normally remain empty for emergency storage. The ponds will be lined with asphalt pavement to prevent seepage and will have a short (approximately 1 day) detention time. Floating mechanical aerators will ensure that the dissolved oxygen content in the ponds is sufficient to prevent nuisance odor conditions.

Secondary treatment will be accomplished with an overland flow treatment system. An overland flow system consists of graded slopes planted with water tolerant grasses. The wastewater is treated as it flows in a thin sheet over the slopes. Low pressure sprays or perforated pipe will be used to distribute the wastewater on the slopes and the wastewater will be collected at the bottom of the slopes in lined ditches.

Advanced treatment will be accomplished by filtration with a traveling bridge filter system. Equalization of the flows into the filter will be accomplished in a one acre wetland and backwash from the filters will be pumped to the primary treatment ponds. Advanced treatment will remove suspended matter from the wastewater which could not be removed by secondary treatment alone.

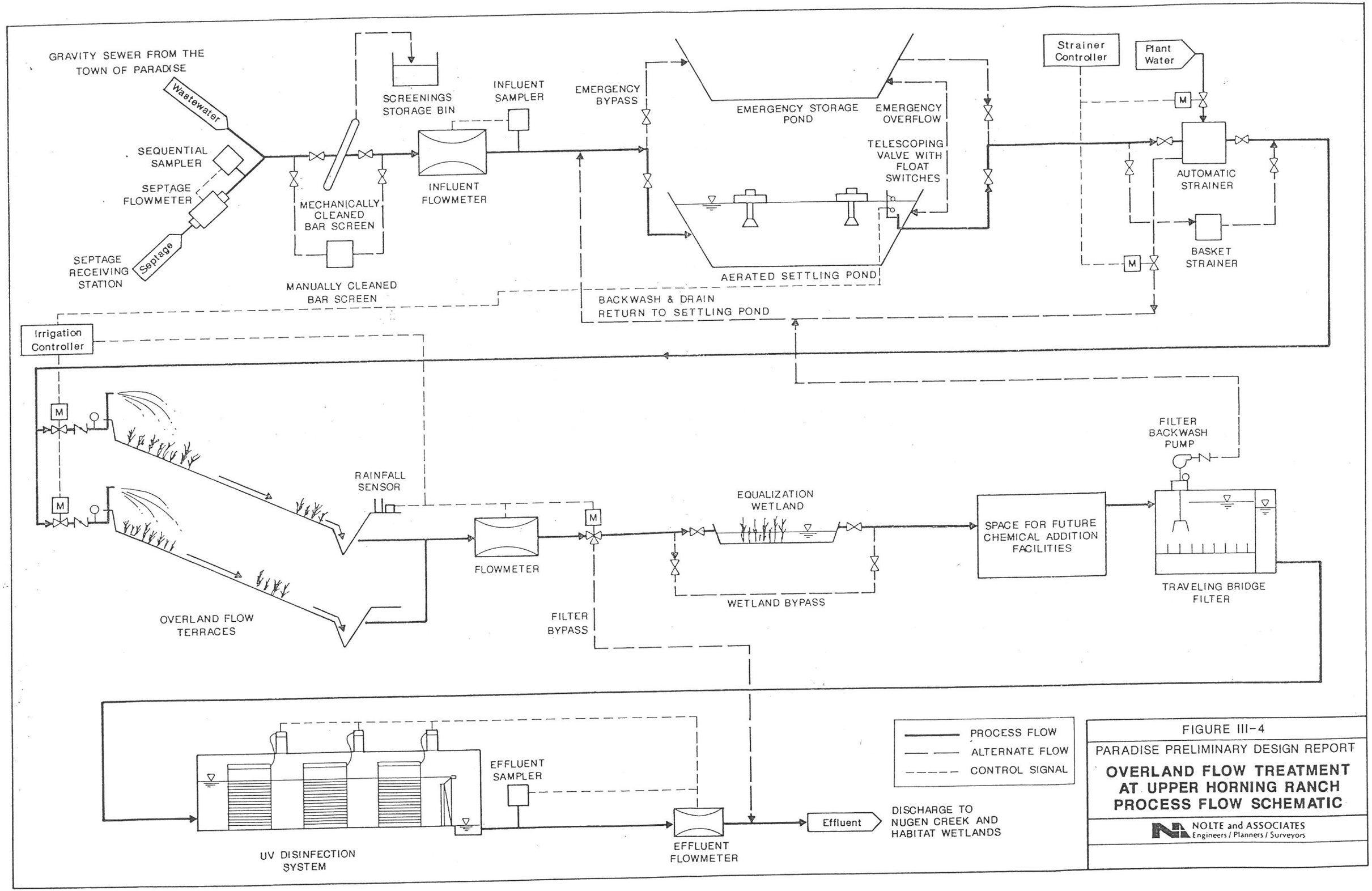

FIGURE III-4

PARADISE PRELIMINARY DESIGN REPORT

OVERLAND FLOW TREATMENT AT UPPER HORNING RANCH PROCESS FLOW SCHEMATIC

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The treated wastewater will be disinfected with an ultraviolet light disinfection system prior to disposal. Ultraviolet light energy will be transmitted through the wastewater stream at a wavelength and intensity sufficient to render bacteria unable to replicate. The process requires no chemicals and leaves no residual that may be toxic to fish.

Sludge from the wastewater treatment processes will be stored in the primary treatment pond. The sludge will be periodically removed and applied to land adjacent to the wastewater treatment plant. The sludge will be applied at rates which will balance the application of nutrients, such as nitrogen, with the nutrient uptake of the dominant grasses found in the area.

3. Design Criteria

The treatment plant will be designed for an average dry weather flow of 0.9 mgd, which will provide capacity for up to 24,000 gpd of septage and allowances for 20 years of 2% annual growth in the Town. The peak wet weather flows are expected to be 2.50 mgd or less.

Detailed design criteria for the various recommended unit processes are presented in Chapter VI of Volume 2.

4. Capital Costs

The construction cost for the wastewater treatment and disposal facilities is estimated to be $6,251,000, including the cost to purchase land and easements.

5. Implementation Schedule

It is estimated that the final design of the recommended facilities will require 6 months to complete from notice to proceed to the submittal of bid documents. A minimum 15-month period should be provided from advertising to notice of substantial completion of the construction. Construction of the habitat wetlands on the Lower Horning Ranch will occur under a separate contract from the main treatment plant facilities.

C. IN-TOWN WASTEWATER REUSE

The construction of upstream reclamation facilities for the Town of Paradise is difficult to justify economically at this time. However, the Town may wish to implement a reclamation program for non-economic considerations. Recommendations for the implementation of an upstream reclamation program are discussed below.

1. Treatment/Reuse Sites

The Paradise Cemetery, the Tall Pines Golf Course, and the proposed cemetery expansion project on Roe Road are all appropriate sites for water reclamation. Less wastewater treatment would be required under current California Department of Health

Services (DHS) regulations for reclamation on these sites than at the various parks and schools in the town. Construction of small treatment plants located adjacent to the intended use areas would be more economical than the construction of centralized facilities and a reclaimed water distribution system.

2. Treatment/Reuse Methods

The preferred wastewater source for upstream reclamation is septic tank effluent from STEP/STEG sewers, because the treatment facilities for this effluent would be smaller and simpler to operate. Wastewater would be treated to meet DHS Class III reclamation standards.

If upstream reuse is implemented, a recirculating filter system followed by hypochlorite disinfection is recommended for a reclamation plant located at the Paradise Cemetery. The STEP/STEG sewers in the upper Clark Road area above Elliott Road would supply the wastewater for reclamation. Any wastewater not diverted for reclamation or any excess reclaimed water would be transported to the main treatment plant in the sewer system. The existing Paradise High School recirculating filter system could be modified to provide a portion of the secondary treatment required at the cemetery.

A submerged bed wetland system followed by hypochlorite disinfection is recommended for a reclamation plant located at the Tall Pines Golf Course. A submerged bed wetland uses less energy for operation than a recirculating filter, but requires more land area. The small diameter sewers of the Clark Road corridors and the area immediately north of the golf course below Buschmann Road would supply the wastewater for reclamation. A flow control valve system would be used to regulate the amount of water diverted from the Clark Road sewer system. Any wastewater not used for reclamation and any excess reclaimed water would be pumped up to the sewer on Buschmann Road.

A submerged bed wetland system followed by hypochlorite disinfection is recommended for a reclamation plant located at the proposed cemetery expansion site. The conventional gravity sewer on Skyway would supply the wastewater for the reclamation plant. Primary treatment consisting of a modified Imhoff tank would be located near Skyway to reduce the length of the solids return piping. Any excess reclaimed water would be returned to the sewer on Skyway.

3. Design Criteria

The reclamation plants would be sized to provide 100% of the irrigation needs during the months of May and September. Supplemental water from PID would be used during the remaining summer months as needed. The reclamation capacities of the cemetery, golf course, and cemetery expansion projects would be 0.125 mgd, 0.150 mgd, and 0.200 mgd, respectively. Detailed process design criteria for each alternative are presented in Chapter VII of Volume 2.

4. Capital Costs

The cemetery project is estimated to cost $631,000 to construct plus $200,000 to $250,000 for purchase of the Paradise High School wastewater treatment system (under negotiation). The golf course and cemetery expansion projects are estimated to cost $764,000 and $992,000, respectively. Land acquisition costs for the cemetery, golf course, and cemetery expansion projects are estimated to be $50,000, $125,000, and $175,000 respectively. The cemetery and cemetery expansion project land costs are likely to be lower than the estimate because the properties are owned by a public entity. The land cost for the golf course system will be highly dependent on the land owner's overall interest in the project.

5. Implementation Schedule

All three reclamation alternatives could be implemented on a phased schedule. Adoption of an ordinance requiring the use of reclaimed water where available is recommended prior to design and construction of any facilities. A pilot subsurface drip irrigation project should be undertaken prior to design of facilities at the golf course. Subsurface irrigation, if proven to be reliable using secondary effluent, could considerably reduce the amount of wastewater which would have to be pumped up to Buschmann Road from the lower Clark Road area during the winter season. The reclamation facility for the proposed cemetery expansion should be designed in conjunction with design of the cemetery facilities to maximize efficiency and aesthetics.

D. TOTAL CAPITAL COSTS OF THE RECOMMENDED PLAN

The total capital costs of the recommended plan are summarized in Table III-1. The costs of upstream reclamation facilities are not included in Table III-1 because implementation of a reclamation program is considered currently to be optional.

TABLE III-1

RECOMMENDED WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL SYSTEM SUMMARY OF PROBABLE COSTS

Item	Probable Construction Cost ($)
Wastewater Collection:	
Conventional Gravity/STEP for Skyway	6,472,000
STEP/STEG System for Clark Road Area	5,971,000
Wastewater Conveyance Pipeline	1,956,000
Miscellaneous Equipment	51,000
Subtotal	14,450,000
Wastewater Treatment and Disposal:	
Septage Receiving Station	78,000
Wastewater Screening (Headworks)	174,000
Aerated Settling Ponds	606,000
Overland Flow System	1,118,000
Filtration	414,000
UV Disinfection	572,000
Ancillary Facilities	1,886,000
Habitat Wetlands	875,000
Sludge Disposal	61,000
Miscellaneous Equipment	71,000
Land Purchase	396,000
Subtotal	6,251,000
SUMMARY OF PROBABLE COSTS	20,701,000

CHAPTER IV
OPERATIONAL REQUIREMENTS FOR THE RECOMMENDED WASTEWATER MANAGEMENT PLAN

IV. SUPPORT AND OPERATIONAL REQUIREMENTS OF THE RECOMMENDED WASTEWATER MANAGEMENT PLAN

Support and operational requirements of the proposed Town of Paradise sewer district include labor, equipment, energy, chemicals, and miscellaneous supplies. Staffing of the sewer district will require positions in administration, collection system maintenance, and treatment and disposal system operation. An organizational chart for the sewer district staff levels is presented as Figure IV-1.

Staff titles and responsibilities are described in detail in the following paragraphs. At the end of the chapter the annual costs for operations and maintenance of the Town of Paradise sewer district are summarized.

A. ADMINISTRATION

The administrative staff will be responsible for the management of the onsite wastewater disposal zone and the sewer district. The onsite wastewater disposal zone is the area of Town that will remain on onsite wastewater treatment systems. For purposes of operational cost estimating, it was assumed that the administrative staff will split their time between the two entities.

A district manager and a clerk typist will be required to complete the administrative duties of the onsite wastewater disposal zone and the sewer district. The district manager will be responsible for operation of the onsite and sewer districts and will oversee collection system, treatment plant, and onsite zone personnel. The clerk typist will be responsible for billings, miscellaneous correspondence, and dispatching.

B. COLLECTION SYSTEM

Wastewater collection in Paradise will be a mixture of several different types of systems; conventional gravity, septic tank effluent pump (STEP) and septic tank effluent gravity (STEG). Initially, it is estimated that two maintenance personnel (one lead person and one helper) will be required to complete the collection system maintenance responsibilities. Various tasks may include annual cleaning and maintenance of sewer lines, service calls for blockages, inspection of new installations, collection system spot repairs, equipment replacement, and service calls for odors or complaints. Initially, inspection of new installations is expected to require a significant amount of time. As the sewer district is built out and the collection system ages, more staff time is expected for the other tasks.

C. TREATMENT PLANT

The recommended wastewater treatment system includes settling ponds, overland flow, filtration, and UV disinfection. A description of the labor requirements for the

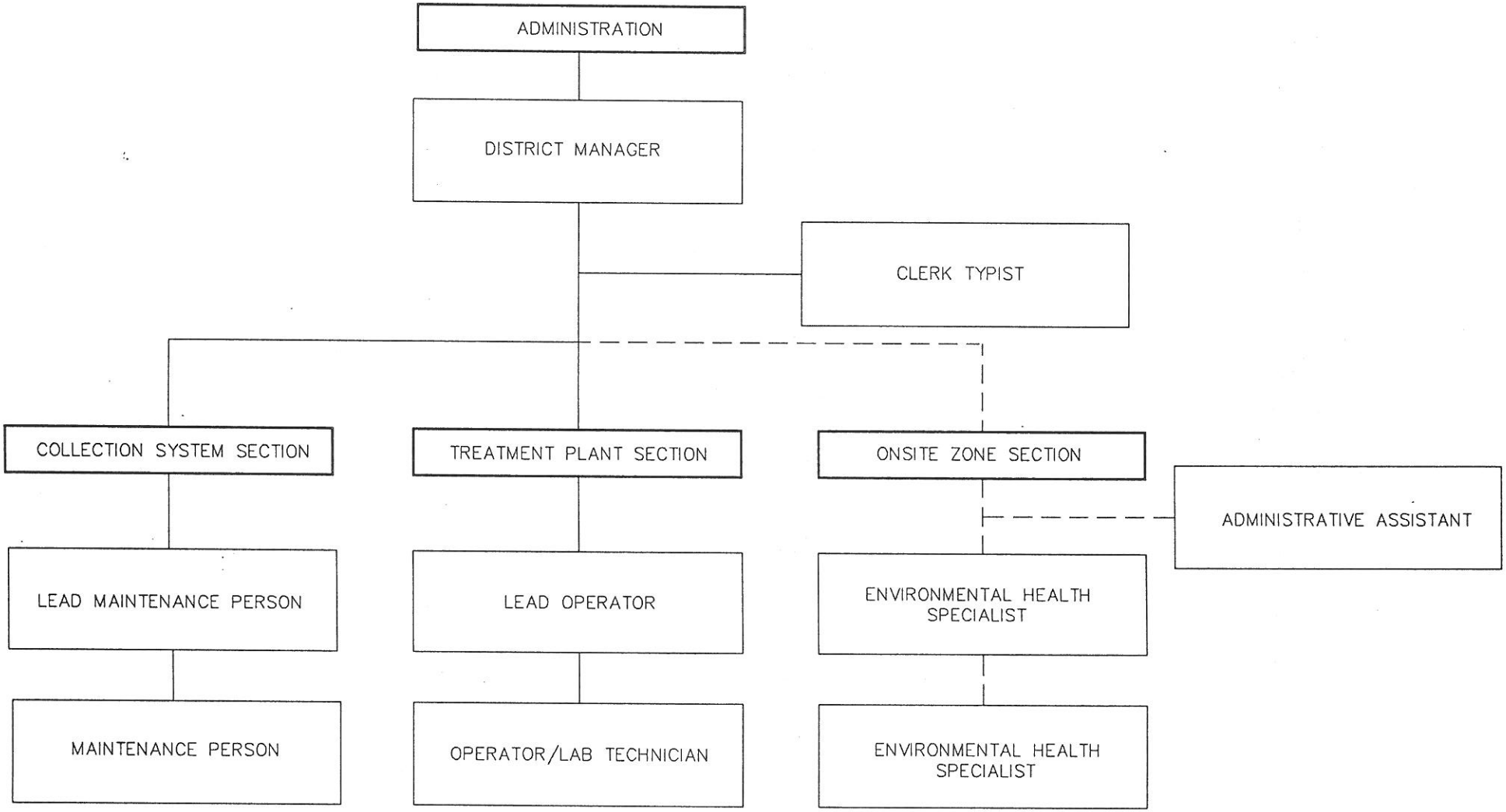


FIGURE IV–1

PARADISE PRELIMINARY DESIGN REPORT
FORMAL SEWER DISTRICT
ORGANIZATION CHART

NOLTE and ASSOCIATES
Engineers / Planners / Surveyors

wastewater treatment plant, as well as the personnel qualifications, responsibilities, and certification are included in the following section.

1. Labor Requirements

Execution of the normal operation, maintenance, and laboratory work for the Town of Paradise wastewater treatment plant will require initially two trained operators, a lead operator and an operator/lab technician. This staffing arrangement is considered to be the minimum necessary without the upstream scalping plants for reclamation. The number of personnel required may vary depending on actual plant operation, the experience level of the operators, and staff productivity. The final staffing level will be refined after the plant is fully operational.

The wastewater treatment plant will normally operate 24 hours a day, 7 days a week, 52 weeks a year. Redundant facilities or emergency procedures will be provided that will allow the plant to meet its waste discharge requirements continuously. The plant should be staffed 8 hours per day, seven days per week. Problems occurring after hours or on holidays will be responded to by the off-duty operators after notification through an emergency response system. Plant alarms will be forwarded to the police or fire station which is staffed around the clock. The dispatcher on duty will then call the lead operator, and if the lead operator is unavailable, will call the operator/lab technician to respond to the alarm.

2. Plant Operation When Understaffed

The treatment plant can be operated for a relatively short period (a few weeks) with less than full staff. The plant can continue to meet the discharge requirements during this period, but it will be difficult for an understaffed crew to keep up on noncritical work such as landscaping, general cleanup, preventative maintenance and laboratory tests not completely essential to operation of the plant.

If circumstances arise when there is less than full staff assigned to the plant, the operators will have to adjust their work schedules and concentrate on accomplishing essential duties. Three essential duties that must be accomplished are:

a. Production of a plant effluent that meets discharge requirements.

b. Completion of laboratory tests and monitoring tasks that must be reported monthly to the Regional Water Quality Control Board.

c. Maintenance of chemical and material supplies to avoid shortages and impacted plant operations.

3. Staff Titles

The following paragraphs include a description of the job designations and the predicted responsibilities assigned to the operators of the Paradise wastewater treatment plant.

a. Lead Operator: The lead operator will have responsibility for the overall operation of the treatment facilities. The lead operator must report the status of the treatment facilities on a routine basis to the district manager, prepare an annual budget, and see that monthly and annual effluent quality reports are prepared and submitted to the proper governmental agencies. The lead operator must review operations, maintenance, and personnel schedules with the district manager regularly and request additional labor when vacancies occur.

   The lead operator will have additional responsibilities for daily maintenance and operation of the treatment facility. Routine daily maintenance may include landscaping, janitorial, preventative maintenance of all equipment, minor equipment overhaul, and repair activities.

b. Operator/ Laboratory Technician: Operator is the normal entry level of employment at a treatment facility. The responsibilities of the operator will include operation of the treatment facility under supervision of the lead operator and routine daily maintenance of the plant. Routine maintenance may include landscaping, janitorial, preventive maintenance of all equipment, minor equipment overhaul, and repair activities. The duties assigned within the laboratory technician designation will include routine process monitoring of pH, dissolved oxygen, and temperature and collection of all wastewater samples to be sent out for analysis.

4. Qualifications

Any person performing day-to-day duties in wastewater treatment processes which may have any effect on meeting discharge requirements must be certified. Certification exams are conducted regularly by the State of California. Certification levels are designated as Grade I (lowest) through Grade V (highest). The required grade is determined by the classification of the treatment plant and the responsibility level of the position.

The Town of Paradise wastewater treatment plant will be classified by the State of California as a Grade III Plant. The operator having direct responsibility (lead operator) for the operation of the plant must possess a Grade III, or higher, State of California Wastewater Treatment Plant Operator certificate. The operator/laboratory technician should have at least a Grade I certification.

D. WASTEWATER DISPOSAL

The recommended wastewater disposal plan includes stream discharge of effluent to Nugen Creek and the creation of a habitat wetland. Due to the minimal operations and maintenance requirements of the system, treatment plant personnel could easily incorporate the periodic responsibilities into their daily routine. The responsibilities associated with the disposal system will involve driving to Lower Horning Ranch a few times per week to inspect the streambed and wetlands, collect samples, and perform onsite analyses.

E. TOTAL OPERATIONS AND MAINTENANCE COSTS OF THE RECOMMENDED PLAN

The operations and maintenance costs of the recommended wastewater management plan encompass the annual costs incurred by all sections of the Town of Paradise sewer district (Table IV-1). As mentioned previously, it was assumed for cost estimating that the administrative staff would spend approximately 50% of their time in support of the onsite wastewater disposal zone. Salaries for the collection system and treatment plant personnel were based on a 40 hr work week and an average wage of $25.00/hr. Equipment maintenance was estimated to be 2% of the capital costs. The costs of energy, chemicals, and other supplies were estimated based on expected levels of operation.

TABLE IV-1

TOWN OF PARADISE
OPERATIONS AND MAINTENANCE COSTS OF
THE RECOMMENDED WASTEWATER MANAGEMENT PLAN

Description	Annual Cost ($/yr)
Administration:	
District Manager (1/2 time)	27,500
Clerk Typist (1/2 time)	9,500
Collection:	
Labor[a]	104,000
Equipment	23,000
Energy (Power & Fuel) [b]	5,000
Other supplies	3,000
Treatment:	
Labor	91,500
Equipment Maintenance	21,000
Chemicals	6,500
Energy (Power & Fuel)	53,000
Other Supplies	7,000
Disposal/Reuse:	
Labor	12,500
Energy (Power & Fuel)	500
Total	364,000

[a] Labor - $25/hr including all benefits and overhead
[b] Electricity - $0.10/kWh
Fuel - $1.20/gal

CHAPTER V
FINANCIAL ALTERNATIVES

V. FINANCIAL ALTERNATIVES

The Town of Paradise is preparing to implement a Town-wide wastewater management plan. The plan consists of onsite wastewater treatment systems in the less-dense, residential portions of the Town, and a formal collection and treatment system (the sewer district) in the more-dense, mixed-use areas of the Town. The onsite wastewater disposal zone will be funded by an assessment district. Details of the onsite zone financing plan are not included in this report. Septage from the onsite systems will be hauled to the treatment plant for treatment along with the wastewater. Tipping fees and a cash contribution from the existing assessment district will be used to pay the cost of septage treatment. There will be no additional cash contributions from the area outside the formal sewer district for collection and treatment plant construction. Wastewater collection, treatment, and disposal for the sewer district will be financed by grants and revenue-based funding tools.

The following paragraphs include a discussion of the costs and financing techniques for the recommended wastewater collection, treatment, and disposal system of the Town of Paradise sewer district.

A. PROJECT COSTS

The recommended wastewater management system is divided into six elements for purposes of design, construction, and financing. The cost estimates for the public facilities of these six parts and estimated ancillary costs are listed in Table V-1. Each of these components benefit different areas of the formal system in different ways, and each lends itself to a different financing technique.

1. Elements A, B and C

Elements A, B, and C of the project benefit three distinct service areas. The respective costs of the elements can be spread across the equivalent dwelling units (EDU's) in the area of benefit. Although revenue-based funding alone could be used for these facilities, a combination of grant funds, direct benefit-based assessments, and some revenue-based financing would be the most viable alternative. Each service area has unique engineering requirements and costs. A pure revenue-based financing would not allow for a financing allocation based on those varying costs. However, by combining direct benefit assessments, with revenue financing, the Town can allocate costs in a more equitable manner.

The financing plan for Elements A, B and C will include a provision for credits given to those properties previously assessed for the original Skyway transmission line. The new financing program provides for acquiring that facility by repaying or allowing a credit to the original assessees. The acquisition price will be added to the costs of the new program.

TABLE V-1

TOWN OF PARADISE
WASTEWATER MANAGEMENT SYSTEM
PRELIMINARY COST ELEMENTS

Elements	Description	Costs ($)
Element A	Skyway Sewer Lines	6,472,000
	Skyway Capacity Acquisition	220,000
Element B	Upper Clark Sewer Lines	4,180,000
Element C	Lower Clark Sewer Lines	1,791,000
	Miscellaneous Equipment	51,000
Element D	Wastewater Conveyance Pipeline	1,956,000
Element E	Treatment Plant and Land Purchase	5,376,000
Element F	Habitat Wetlands	875,000
TOTAL FACILITIES COSTS		20,921,000

2. Element D

The wastewater conveyance pipeline running from the Town to the treatment plant could be financed through direct, benefit-based (EDU-based) assessments or through a revenue method. The key determining factor is the Town's and the property owners' desires to pay semi-annual assessment installments versus monthly sewer charges. For example, if the semi-annual installment is higher, then the monthly sewer charge would be lower.

3. Elements E and F

The treatment plant and the habitat wetlands may also be financed through either revenue-based or benefit assessment techniques. Again, the trade-off between fixed assessments versus monthly sewer charges must be explored. This element will receive a cash contribution of about $850,000 from the 1991 assessment district, and approximately $900,000 from Butte County, both to pay for treatment plant capital costs of the onsite district. The treatment plant is designed to provide the onsite district with appropriate capacity for septage treatment.

4. Summary of Costs

The capital costs are summarized in Table V-2. The onsite costs of $1,693/EDU would not be charged to vacant lots. The cost of sewers and interceptor includes the cost to acquire the $220,000 of Skyway capacity from the 1974 assessment. The impacts of grants and loans are not included in Table V-2.

TABLE V-2

SUMMARY OF CAPITAL COSTS FOR RECOMMENDED ALTERNATIVE

	Capital Cost ($)	Cost ($)[a]/ EDU
Wastewater Collection:		
On Private Property Construction[b]	4,032,000	1,203
Sewers and Interceptor[c]	10,638,000	1,416
Wastewater Treatment[c]	6,251,000	801

[a] Costs are not reduced by expected grants.
[b] On private property improvements spread over initial 3,010 EDU's.
[c] Costs spread over 7,800 EDU's.

B. FINANCING TECHNIQUES

The financing techniques explored for the Town of Paradise included grants, cash contributions, revenue-based funding tools, and benefit assessments.

1. Grant Funding Sources

Grant funding may be available from several different sources for the sewer district. The following discussion is divided between sources for wastewater collection and treatment and creation of a habitat wetlands for wastewater disposal.

a. Wastewater Collection and Treatment

The Town has applied for and expects to receive a federal Economic Development Administration (EDA) grant to fund work on the collection system (Elements A, B and C). This grant is expected to be in the amount of $2.0 million. The Town expects a formal answer on the prospects of this grant by July 21, 1992. If given approval at that time, the formal application will be submitted in September, 1992.

The Town has also pursued a grant under a proposed federal public works bill. This $1.5 million grant would be used for the wastewater conveyance pipeline (Element D) from the Town to the treatment plant. Because the bill is an election-year anti-recession measure, passage is not certain at this time. The financing plan will proceed assuming no grant is received, but approval would clearly reduce the funding requirements of the wastewater conveyance pipeline.

Loans and grants are available for wastewater conveyance and treatment works from Farmer's Home Administration (FmHA). The loan interest rates vary from 5 to 6.7% for terms up to 40 years. Health Department studies or facility plans are submitted with the loan application to demonstrate the need for the project. The Paradise project is considered a large project and would require pooling of FmHA funds. The median income of $12,800 would allow Paradise to obtain a loan/ grant combination. FmHA grants are available for the poorest of rural communities.

Loans and grants are targeted for poor rural unincorporated areas with a population less than 10,000 people. In addition, a majority of the flow must be residential. Paradise is incorporated with a 1985 population of 24,500. The service area is approximately 4,000 people, but there is no exception to this rule. The entire town population is considered. The procurement of FmHA financing requires many levels of review, administration and meetings. Therefore funds from FmHA can be considered unavailable and if they were available would be considered as a source of last resort.

Finally, under the existing Clean Water Bond Bill, small community grants are available for cities with a population less than 2,500. A proposed 1993 Bond Bill would make available grants up to $3.5 million to cities with a population less than 10,000. The State may recognize the Town of Paradise service area with a population estimated at approximately 4,000 eligible for the grant. This alternative should be thoroughly explored if the Clean Water Bond Bill is passed.

b. Habitat Wetlands

The habitat wetlands portion of the wastewater treatment system may have grant funding sources separate from other system components. Several potential sources of grant funding were investigated, and the three most promising sources of funds are described below. In each case the Paradise project would be competing with other projects for limited funds.

(1) Wildlife Conservation Board (WCB), Inland Wetlands Conservation Program: The WCB is the real estate arm of the California Department of Fish and Game. Under this program, grants are available to public agencies and non-profit organizations which can show a benefit to wildlife and to the public. The WCB requires matching by or partnerships with other funding agencies or sources for at least 50% of eligible costs (generally hard

construction costs and land only). Land acquisition requires a deed restriction for wildlife use in perpetuity, and the lead agency must commit to maintain constructed facilities for wildlife purposes for 25 years. Public access requirements are considered on a case by case basis. Funding for the program is limited to $2 million per year.

(2) U.S. Environmental Protection Agency (EPA), Wetlands Protection Program: EPA makes wetlands protection development grants to state agencies and Indian tribes. The program is oriented more to planning than to implementation, but the proposed wetlands habitat may qualify as part of a river corridor multi-use plan. A state agency is required to administer the grant. Guidance for the 1993 fiscal year is expected by September 1992, funding levels known by January 1993, and applications accepted in February 1993.

(3) Ducks Unlimited (DU): DU is a non-profit organization which receives funding from the California Department of Fish and Game and other sources for construction of wildlife habitat. DU has in the past contributed funds for wetlands habitat components of wastewater projects such as those in Hemet, Tracy, Woodland and Arcata. However, funds are said to be scarce this year.

2. Cash Contributions

The Town of Paradise project will receive cash contributions from two sources: the onsite district and Butte County. The onsite district will contribute $850,000 toward capital costs of the treatment plant for septage treatment. The County will make a cash contribution for the same purpose for the right to treat septage from County residents' septic tanks.

3. Revenue-Based Financing Tools

A revenue-based financing includes any method that involves borrowed funds repaid from the revenue of the wastewater enterprise. These financing tools include sewer revenue bonds, certificates of participation, state or federal loan programs, non-profit corporation bonds, or any combination of the above with a joint powers or Marks-Roos authority. Whichever funding technique is used, the money (debt service) is repaid by net sewer system revenues (gross revenues less operations and maintenance costs). For purposes of the financing plan, all of these techniques are the same. The interest rates may vary, but they are all revenue-based.

The Town is applying for a loan from the state revolving loan program. The Federal Clean Water Act has provided for a State Revolving Fund (SRF) loan program capitalized in part by federal funds. Effective October 1, 1988, loans have been available through the State Water Resources Control Board at an interest rate of 1/2 the State bond rate, or roughly 3.5%. The loans are amortized for a period of 20 years

with annual payments. A priority list is prepared ranking loan applicants annually. If an applicant is not funded in one year, they are rolled over to the next year. The Regional Water Quality Control Board (RWQCB) is preparing the documentation to support the placement of Paradise on the Project Priority list for the 1993 fiscal year. The list will be adopted in September 1992 and projects will be funded according to rank and class. Projects are funded each year on an "as ready" basis until funds are exhausted. Of the $18.4 million amount being requested by the Town, the savings equal about $460,000 per year compared to conventional revenue bonds. That translates to about $4.91 per month per EDU (assuming 7,800 EDU's). Obviously, the state program should be pursued with all due vigor. There is also a potential for increasing the amount applied for which would increase the savings from the reduced interest rate. Some or all of the debt service could be levied as a benefit assessment, so that monthly service charges do not become excessive.

Other revenue-based financing tools are (a) revenue bonds or (b) installment sale agreement-backed securities. Revenue bonds require a 50% plus 1 vote of all residents participating in the election. An installment sale agreement financing is a method whereby the Town enters into an installment sale agreement with another entity (such as a non-profit corporation or a joint powers authority). The Town promises to make semi-annual payments of principal and interest as the purchase price for the financed improvements. The other entity then uses that promise to secure an issue of bonds or certificates of participation.

In each case described above (state loan, revenue bonds or installment sale), the Town pledges and covenants to levy and collect sewer system charges sufficient to pay operations and maintenance and debt service/installment payments on the loan or bond amount.

4. Benefit Assessment Financing

Benefit assessment financing is performed under the 1913 and 1915 Acts (Streets and Highways Code). The costs of the facilities are levied against each property within the area of benefit according to the property's direct benefit. Sewer collection and treatment system costs are typically levied based on an EDU formulation. Each project component is allocated across the EDU's according to benefit.

The amount of the total levy is equal to the component cost, plus financing costs and a reserve fund. Bonds are issued in the amount of the total levy. Each property owner makes semiannual payments of principal and interest. A one-time payment can also be made. The payments are due with the regular property tax payments and do not constitute debts of the owner of the property, but are debts secured only by the property. The lien amount is not prepaid with a sale of the property unless the buyer/seller desires to prepay.

Benefit assessment financing could also be used as a mechanism for repayment of the state Revolving Fund loan through assessments rather than through monthly service

charges. This would permit maximizing the amount borrowed at subsidized interest rates and decrease the amount borrowed by the sale of assessment bonds at market rates, yet keep monthly service charges at a minimum.

Under this procedure, the state or the Town of Paradise could purchase the bond using the proceeds of the state loan. The amount of the bond service would be posted to the tax roll. There would be two assessments, one for the loan amount at the subsidized interest rate and another for the remaining project costs at the market interest rate. The two assessments would be merged so that a single amount is collected.

An Integrated Financing District (IFD) is a type of benefit assessment financing whereby the Town can levy a "contingent assessment" against a property that will benefit from the improvements at some future time. For example, a proposed new development might be given a contingent lien as long as the property remains undivided and undeveloped. When a subdivision map or development plan is approved, the property begins to make annual assessment payments, reducing the payments due from other properties. Another example would be defining a certain class of property or property use that would be exempt from payment until the land use or ownership changes.

An IFD may be useful in the Town's project to ensure that any future developments using the plant and system will pay a fair share. We also feel that an IFD should be considered to allow for small or nil initial assessments against certain single family residences within the formal system. Properties currently developed with a single family home within what is generally a commercial or multi-family area (i.e. a "non-conforming" land use) that (a) are not part of the degradation problem and (b) do not hook up to the collection/treatment system, could be given a contingent assessment.

At such time as a development plan is approved by the Town for the parcel, the owner would be required to pay in full the accumulated principal and interest and assume all future annual installments of principal and interest with respect to the original contingent assessments. If the development plan includes a subdivision of the parcel, the owner would be required to prepay all the remaining principal amount of assessment. If the property's loading changes sufficiently to require connection to the system, the owner would begin to make annual installment payments on an assessment amount equal to the original contingent assessment plus all interest accrued to date.

C. FINANCING RECOMMENDATIONS

A financing summary is shown as Table V-3. A breakdown between revenue-based financing and assessment-based financing is summarized in Table V-4.

TABLE V-3

FINANCING SUMMARY

Element	Costs ($)	Less Grant Funding ($)	Less Cash Contrib ($)	Revenue Funding Reqts ($)	Assessment Funding Reqts ($)	Total Funding Reqts($)
Element A	6,692,000	2,000,000[a]		10,714,000		12,714,000
Element B	4,180,000					
Element C	1,842,000					
Element D	1,956,000	1,500,000[b]		456,000		1,956,000
Element E	5,376,000	2,000,000[b]	1,750,000[c]	1,626,000		
Element F	875,000	500,000[b]		375,000		6,251,000
Other Costs	850,000[d]				850,000	850,000
TOTAL	21,771,000	6,000,000	1,750,000	13,171,000	850,000	21,771,000

[a] EDA grant for sewer system.
[b] Grants anticipated by the Project Manager, Town of Paradise.
[c] Capital buy-in from 1991 Assessment District ($850,000) and Butte County buy-in for septage treatment ($900,000).
[d] Preliminary design of facilities by Nolte and Associates as provided in the 1991 Assessment District.

TABLE V-4

REVENUE/ASSESSMENT FINANCING BREAKDOWN

	Financing Tool	Funding Requirements[a] ($)
Revenue Financing	State Loan Program	13,171,000
Assessment Financing	Prepaid by 1991 Assessment	850,000

[a] Assumes 100% State Loan Funding.

The total monthly user costs are summarized in Table V-5. The 20 year buildout value of 4,400 EDU's is used for the capital cost value for loan repayment. The initial operation and maintenance costs are spread over 3,010 EDU's. The ultimate buildout condition is for 7,800 EDU's.

TABLE V-5

MONTHLY USER COST SUMMARY

		Monthly Payment $/EDU	
Financing Tool	Total Bond Amount ($)	4,400 EDU's	7,800 EDU's
State Loan[a]	13,171,000	17.16	9.68
Monthly Billings[b]	N/A	10.08	3.89
TOTAL	N/A	27.24	13.57

[a] Assuming a 20-year state loan for all revenue financing at 3.25%.

[b] Assuming a $364,000 annual budget for operations, maintenance, overhead and depreciation and 3,010 EDU's contributing flows initially.

GLOSSARY

Advanced Treatment - Advanced treatment is employed after secondary treatment to remove residual organic matter or nutrients.

Benefit Assessment Financing - In benefit assessment financing, the costs of the facilities are levied against each property within the area of benefit according to the property's direct benefit.

Biosolids - Biosolids is another term for sludge generated during the treatment process.

BOD_5 (5-day Biochemical Oxygen Demand) - BOD_5 is a measure of the amount of oxygen required to degrade organic material within a 5 day period.

Capital Costs - Capital costs are incurred by investment in fixed facilities or equipment.

Coliform - Coliform bacteria are found in the intestines of all warm blooded animals. A test for the presence of coliform is used as an indicator of fecal contamination of water supplies and an indicator of disinfection performance in wastewater. Total coliform measurements include all bacteria belonging to the coliform group. Fecal coliform measurements include those coliforms that are found only in fecal material.

Composting - Composting is an aerobic biological process of transforming waste organic matter (septage, sludge, and yard waste) into a soil conditioner.

Conventional Gravity Sewers - Conventional gravity sewers are sewers that convey wastewater by gravity, as opposed to a pressure system that incorporates pumping.

California Department of Health Services - The Department of Health Services is the agency responsible for regulating wastewater reclamation and reuse.

EDU's (Equivalent Dwelling Units) - An EDU is a typical single family residence within a particular community. EDU's are used to determine wastewater generation rates. In the Town of Paradise, the flow per EDU is 200 gpd.

Equalization - Equalization is the process of minimizing variations in flowrates. Flowrate variation can lead to operational difficulties in downstream processes and oversizing of treatment facilities.

Filtration - Filtration entails the removal of fine solids from wastewater within a granular media bed.

Habitat Wetlands - A habitat wetlands (in the context of this report) is a wetlands created for the sole purpose of attracting and supporting wildlife.

Headworks - The headworks is the first area of the treatment plant reached by the wastewater. Preliminary treatment processes, such as screening, communition, and degritting, are commonly undertaken within the headworks.

Heavy Metals - Heavy metals include nickel, manganese, lead, chromium, cadmium, zinc, copper, iron, and mercury. Many of the metals are classified as priority pollutants by the U.S. Environmental Protection Agency.

Hybrid System - A hybrid system, as defined in this report, is a combination of wastewater collection technologies, namely conventional gravity and STEP/STEG.

Hypochlorite Disinfection - Hypochlorite disinfection is a disinfection process utilizing sodium hypochlorite. Sodium hypochlorite (bleach) differs from chlorine in that it is transported and stored in a liquid form.

Imhoff Tank - An Imhoff Tank is a two story tank used for primary treatment of wastewater. Sedimentation is accomplished in the upper level of the tank and digestion of the settled solids is accomplished in the lower level.

Land Application - Land application is a method of septage or sludge disposal where the waste material is injected or disced into the soil. A crop is usually cultivated on the land application site to utilize the nutrients present in the sludge.

Laterals - Laterals are the pipelines that connect a residence or business to the main sewer line located in the street.

Onsite Wastewater Disposal Zone - The Onsite Wastewater Disposal Zone is the area of the Town of Paradise that will remain on onsite wastewater treatment systems.

Operations and Maintenance Costs - Operations and maintenance costs are the ongoing expenses incurred by operating and maintaining a facility, such as labor, power, supplies.

Overland Flow - Overland flow is a natural systems wastewater treatment process utilizing vegetated hillslopes. Treatment is achieved as wastewater is discharged through sprinklers or gated pipes at the top of the slope.

pH - pH is a measurement of the acidity of a water sample. A sample with a pH less than 7 is considered to be acidic. A sample with a pH greater than 7 is basic.

Preliminary Treatment - Preliminary treatment is the first set of wastewater treatment processes employed at a wastewater treatment plant. Typical preliminary treatment processes include screening, comminution, degreasing, and grit removal.

Primary Treatment - Primary treatment typically involves the removal of floating and settleable solids by skimming or sedimentation.

Recirculating Filter - A recirculating filter is an onsite wastewater treatment system employed after settling within a septic tank. Treatment is achieved by filtration through a sand bed. A portion of the filter effluent is mixed with septic tank effluent and recirculated back to the filter to increase treatment effectiveness.

Regional Water Quality Control Board - The Regional Water Quality Control Board is a regional arm of the California State Water Resources Control Board. As a part of their overall responsibility for maintaining adequate water quality within a specific region of California, the Regional Board grants permits for wastewater treatment plants and monitors treatment plant operation.

Reclamation - Reclamation is the process by which wastewater is treated and disinfected to a very high quality prior to reuse for irrigation or landscape impoundments.

Revenue-Based Financing - In revenue-based financing, borrowed funds are repaid from the revenue of the wastewater enterprise.

Scalping Plants - Scalping plants are small wastewater treatment facilities located upstream of the main treatment facility. As wastewater is transported to the main facility through the sewer system, a portion of the wastewater is "scalped" by the scalping plant and treated for the purposes of irrigation reuse.

Screening - Screening is the process of removing coarse solids from wastewater.

Screenings - Screenings are the solids that are removed from wastewater during screening.

Secondary Treatment - Secondary treatment entails the removal of organic matter from the wastewater by some type of biological or chemical process.

Septage - Septage is the mixture of solids and wastewater that is pumped from a septic tank during cleaning.

Service Area - Service area, as defined in this report, is the portion of the Town of Paradise that will be connected to the sewer system.

Sewer District - The sewer district, as defined in this report, will be the entity overseeing the wastewater collection, treatment, and disposal operations of the Town of Paradise.

Sludge - Sludge is the residual solid material removed from the wastestream during treatment.

Submerged Bed Wetlands - A submerged bed wetlands is a natural systems wastewater treatment process that utilizes subsurface flow. Treatment is achieved as the wastewater flows through a gravel bed that is planted with emergent vegetation.

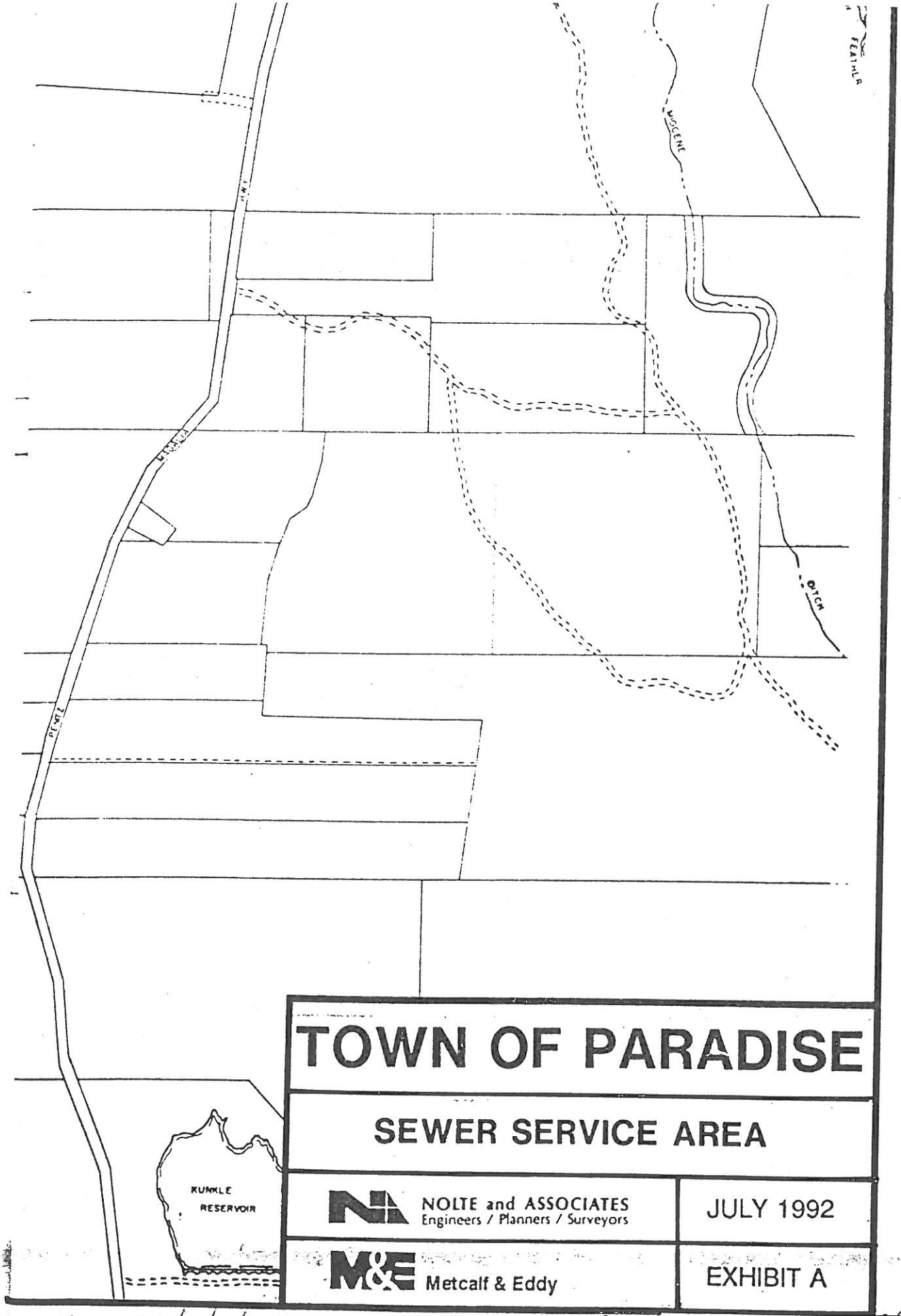
Subsurface Drip Irrigation - Subsurface drip irrigation is a method of irrigation that utilizes perforated pipe or leaky pipe installed under the ground surface. Subsurface irrigation can be more effective than conventional irrigation methods due to the reduction in evaporation and the distribution of water directly to the root zone.

STEG (Septic Tank Effluent Gravity) - A STEG system can be considered as onsite pretreatment for a central wastewater treatment plant. Primary settling is accomplished in a septic tank. The clarified effluent then flows by gravity from the septic tank into the sewer system for conveyance to the wastewater treatment plant.

STEP (Septic Tank Effluent Pump) - STEP systems are identical to STEG systems, except that in STEP the clarified effluent is pumped to the sewer system.

TSS (Total Suspended Solids) - Total suspended solids is the mass of solids filtered from a known volume of water. TSS is frequently used as an indicator of treated effluent quality.

UV (Ultraviolet Light) Disinfection - UV disinfection is a physical disinfection process utilizing ultraviolet light. The UV light damages DNA and RNA of bacterial cells, rendering the bacteria unable to replicate.



TOWN OF PARADISE

SEWER SERVICE AREA

NOLTE and ASSOCIATES Engineers / Planners / Surveyors	JULY 1992
M&E Metcalf & Eddy	EXHIBIT A

For Exhibit A See Original Report in Clerks Office

EXHIBIT A