# SECTION 5

# ALTERNATIVE PLAN DEVELOPMENT

## Summary of Alternatives

In Section 4, alternative types of collection, treatment, and disposal systems are discussed and evaluated. Based upon those evaluations, the following conclusions were reached regarding alternative elements of the plan:

1. A conventional gravity sewer collection system is deemed the most appropriate in light of zoning density and area topography.

2. Land application is the most suitable option for disposal of effluent from a community-wide publicly owned treatment plant.

3. Of the many types of central wastewater treatment plants that could meet the needs of the area, a plant using the sequence batch reactor process is deemed to be the most appropriate in light of the ease by which the process can be operated for nitrogen removal.

4. For service to small cluster areas, the most appropriate type of system is one utilizing individual septic tanks discharging to a recirculating sand filter and disposal to community drainfield.

5. Continued reliance upon septic tanks in the long-term is an acceptable option for the community if a community maintenance program is established, and strict requirements are placed upon design, installation, and maintenance.

Given these conclusions relative to collection, treatment, and disposal components of a sewerage system, four alternative plans were identified for more detailed evaluation. While these alternatives do not involve similar base assumptions relative to service area or level of service provided, they are deemed reasonable representatives of the various options available to the community for satisfying its long-term wastewater needs. The four alternatives are:

Alternative 1 - Community Collection and Treatment
Alternative 2 - Community Maintenance Program with Public Ownership of Cluster Systems
Alternative 3 - Continued Reliance Upon On-Site Systems With a Community Maintenance Program
Alternative 4 - Continued Reliance Upon On-Site Systems Without a Community Maintenance Program (no action)

## Alternative #1 - Community Collection and Treatment

Under this alternative, the Phase 1 Service Area would be served by a publicly owned collection and treatment system. This alternative is presented graphically in Figure A6 of Appendix A.

This alternative assumes that the collection system would rely upon conventional gravity sewers. As discussed in Section 4, this type of collection system is deemed the most appropriate for the Yacolt area. The Phase 1 West Node collection system would discharge to a pump station located along the southern town limits, just east of Yacolt Creek. The pump station would discharge to the Phase 1 East Node collection system via force main. The Phase 1 East Node collection system would discharge directly to the treatment plant. Implementation of this alternative would require the abandonment of existing on-site systems, following the availability of community collection. Connection would involve not only the abandonment of the septic tank and drainfield per WDOE regulations, but extension of the service lateral from termination at the right-of-way to the individual home sewer.

For the purpose of analysis, it was assumed that the system would serve all of the Phase 1 Service Area. While it may be difficult to implement a project of this scale, the plan of serving the entire Phase 1 Service Area is presented as a basis of comparison to other alternatives. Additional information regarding implementation is presented in Section 7.

This plan assumed that the sewers would discharge to a central treatment plant using a sequence batch reactor process. The disinfected wastewater would be disposed of by land application or subsurface disposal. As was mentioned in Section 4, a sequence batch reactor was selected as the most cost effective and environmentally sound process for treating wastewater from a community-wide sewer system.

The sequence batch reactor would consist of two tanks sized for a hydraulic detention time of 24 hours. Wastewater would be routed to one of the tanks until it was full. At that time, the treatment process would begin and the other tank would be filled. A sequence batch reactor acts as an aeration basin and a settling basin. As the reactor is filling, the system is in the aeration mode, which is typically accomplished by a surface mechanical aerator. When aeration is complete, mixing is halted so that the solids can settle. Next, the liquid in the reactor is decanted. The solids are then routed to a solids holding and treatment facility. Some of the solids would be pumped back to the sequence batch reactor, where they would help maintain a population of bacteria in the reactor for purposes of converting the organic material in the wastewater to biological mass.

One potential location for the treatment plant is shown in Figure A6. With a gravity system, the location of the treatment plant is not arbitrary. Ideally, it should be down-gradient of the Town and up-gradient of the land application site. Approximately 2 acres of property is required for the treatment plant. The location of the disposal site can be more flexible than that of the treatment plant site. While gravity flow to the land application site is preferred, effluent from the treatment plant could be pumped to a disposal site located anywhere within close proximity to the treatment plant.

Land area requirements will vary by type of disposal method selected. For land application, about 25 acres would be necessary. For subsurface disposal, about 10 acres would be required. For cost estimating purposes, we have assumed that a subsurface disposal site of 10 acres would be purchased at a cost of $10,000 per acre, and that it would be located within one-half mile of the treatment plant.

The wastewater from the reactors would flow through an ultraviolet disinfection system, from which it would gravity flow or be pumped to the land application location. Solids removed from the settling basins would be held in aerated storage tanks, and would be disposed of by land application. The sludge must be stabilized before it is land applied; the most feasible way to do this in Yacolt is by lime stabilization. Because of the proximity of tree farms to the Yacolt area, the option of lime stabilization and land application is optimal for the community. As examined in Section 4, approximately 18 acres of land application area will be required for effluent disposal per 1,000 population served.

## Alternative #2 - Community Maintenance Program With Public Ownership of Cluster Systems

In this alternative, it was assumed that service would be limited to small cluster areas. The remaining service area would continue to be served by privately owned septic tanks under a septic tank maintenance program. The small cluster areas would be served by individual septic tanks discharging to community drainfields. This alternative is presented graphically in Figure A7 of Appendix A.

The selection of the cluster areas was somewhat arbitrary. Currently the only commercial businesses in Yacolt are located in the center of Town, along Yacolt Road. Under the current growth management plan this commercial area will grow, but will remain centered in the same area. There currently is no industry located in the Town. If an industry decides to locate in Yacolt in the future, additional cluster systems would be required.

For this alternative, we have assumed that each separate cluster would be served by a separate system. In each, we have assumed that a recirculating sand filter would be installed to provide pretreatment prior to disposal to the drainfield. Implementation of a sand filter will reduce the size of the drainfield, and thus the land requirement. This alternative assumes that drainfield disposal trenches would be sized as discussed in Section 4.

The size of the sand filter and drainfield would vary depending upon the size of the service area and the quantity of wastewater generated in that area. Section 4 includes information regarding sizing.

## Alternative #3 - Continued Reliance Upon On-Site Systems With a Community Maintenance Program

Under this alternative, the only change from the current situation is that a community maintenance program would be established. Information regarding the community maintenance program is presented in Section 4.

## Alternative #4 -Continued Reliance Upon On-Site Systems Without a Community Maintenance Program

This is a "no action" alternative. The community would continue to grow with new development served by individual septic tanks.

## Construction Cost Estimates

### *Alternative #1 Construction Cost Estimate*

Alternative #1 is the only alternative for which construction costs can be estimated with any degree of certainty. Even with this alternative, the assumptions regarding the location and length of sewers, and the number of service connections is rather arbitrary. The construction cost for Alternative #1 assumes that all of the collector mains shown in Figure A6 would be constructed. It also assumes that the treatment plant would be sized for year 2016 projected loadings under the high growth scenario. In light of the fact that the cost for the collection system will depend upon the number of service connections, construction costs are presented based on four different assumptions for service connections.

**Table 5.1**
**Alternative #1 Cost Estimates**

| | Cost Estimates (1996 dollars) | | | | |
|---|---|---|---|---|---|
| Connections ① | Treatment Plant & Pump Station ② | Main-line Sewers & Force Main ③ | Service Connections ④ | Total Costs | Cost Per Connection |
| 100% connected, 630 connections | 3,400,000 | 2,362,500 | 630,000 | 6,392,500 | 10,147 |
| 75% connected, 473 connections | 3,400,000 | 2,362,500 | 473,000 | 6,235,500 | 13,183 |
| 50% connected, 315 connections | 3,400,000 | 2,362,500 | 315,000 | 6,077,500 | 19,294 |
| 25% connected, 157 connections | 3,400,000 | 2,362,500 | 157,000 | 5,919,500 | 37,704 |

*Assumptions:*

① Total estimate of connections for Phase 1 Service Area from population projections in Table 3.2 assuming 3.0 people per equivalent connection.

② Cost estimate includes both treatment plant and Phase 1 West Node pump station construction.

③ Cost figure assumes construction of main line sewer (approximately 33,000 lineal feet) and force main (approximately 1,750 lineal feet), as shown in Figure A6. An average unit price of $70 per foot was used for main line sewer, which includes manholes and service laterals to the property line. A unit price of $30 per foot was used for force main construction.

④ Service connections are estimated at $1,000 each, and include abandonment of the on-site system and connection between public sewer lateral and house sewer.

⑤ All costs include a 30% surcharge for engineering, finance charges, and contingency.

The cost for the low connection assumption in Table 5.1 is somewhat deceiving. For all of the scenarios, the cost for treatment and outfall assumes that these items would be designed for the 20-year design flows. The costs do not reflect the allocation of capacity. In the event that this alternative was selected, and the projected connections were assumed to be low, it is likely that the costs would be reduced as a result of reduced length of sewers, and reduced size of the treatment plant.

***Alternative #2 Construction Cost Estimate***

Any estimate regarding alternative #2 is entirely arbitrary. The cost of serving a particular cluster system will vary significantly depending upon its size and density of development. Rather than identify a cost estimate for this alternative, the following information is presented for typical cluster systems.

**Table 5.2**
**Typical Cluster System Construction Costs**

| | Estimated Construction Cost of Cluster System | |
|---|---|---|
| Service Type | Total Cost ($) | Cost Per Equivalent Dwelling Unit ($) |
| 50-seat restaurant ①② | 41,600 | 5,000 |
| 10-acre residential development with 1 acre lots. ①③ | 87,500 | 8,750 |
| 10-acre residential development with ½ acre lots ①③ | 162,500 | 8,125 |

*Assumptions:*

① All estimates assume that land for the drainfield would need to be purchased at a cost of $20,000 per acre (this is double the cost estimate used for the treatment plant disposal land, due to the need to locate the drainfield in the urban area).

② For a 50-seat restaurant, assumption is that equivalent loading would be 6 seats per equivalent dwelling unit for an average wastewater flow of 2,500 gallons per day,

③ Cost estimates for residential developments will vary significantly depending upon the layout of the project. Estimates assume a basically rectangular parcel of property with the recirculating sand filter and drainfield located within the limits of the site. Estimates for residential projects assume that an interceptor tank would be installed adjacent to each home, and that homes would be located centrally within rectangular lots.

## Operating Costs

Operating costs include the costs for system maintenance, administration, monitoring, and equipment repair and replacement. Operating costs for centralized wastewater treatment systems vary amongst jurisdictions. Operating costs for on-site and cluster systems are extremely variable. In all cases, operating costs per unit decrease with size and customer base. Costs for maintenance of the collection system are inversely proportional to density.

***Alternative #1 Monthly Cost Estimate***

Regardless of the type of wastewater system installed, the cost of operation and maintenance for a small community is high. This is due to the economics of scale. Unit costs decrease as size increases and vice versa. Yacolt is at the low end of the size range for communities that have a public sewer system.

Administrative costs are particularly dependent upon the nature of the operating agency. Administrative tasks that will be necessary include hiring operational personnel, public involvement, billing, and general system management. The cost estimates herein assume that the system would be operated by an independent agency. Many of these costs would be reduced (by as much as 20% to 25%) if the system was operated by the Town, who could combine many of the administrative functions with the water utility.

The system will require a certified operator. This can be performed by a hired staff person, or alternatively, a contract operator. Operation and maintenance activities would include:

- Operating the plant's equipment.
- Periodic maintenance of mechanical equipment.
- Periodically checking the collection system relative to general deterioration and accumulation of debris.
- Testing effluent and reporting test results.

Estimates for operating costs are based upon studies for other small communities. Monthly operating cost estimates for Alternative #1 for various customer base estimates are as follows:

**Table 5.3**
**Alternative #1 Monthly Operating Cost Estimate**

| Number of Connections | Monthly Operating Cost Per Single Family Residential Unit |
|---|---|
| 250 | $25 |
| 500 | $23 |
| 1,000 | $21 |
| 2,000 | $20 |

Again, the monthly cost estimates presented above could be reduced by as much as 25% by consolidating operations with the Town water utility.

### *Alternatives #2 and #3 Monthly Cost Estimate*

For an agency operated on-site system, the operating costs will be similar regardless of whether the on-site systems are individual or part of cluster systems. Monthly costs will vary significantly with the size of the customer base, and the level of service provided. Costs will also vary significantly depending upon whether the agency responsible for operating the system is a separate agency whose single purpose is operation of the sewer system, or a multi-purpose agency such as the Town of Yacolt Public Works. If the customer base is small, it will be very costly to establish an agency whose sole purpose is to operate the system. A small number of customers will have to pay for the agency's overhead. If the customer base is very large, it will be much less costly for the system to support the overhead costs of the agency.

Cost estimates are presented as follows. These assume that operation under the smaller customer base assumptions would be in conjunction with administration of the water system. Again, these estimates are very approximate.

**Table 5.4**
**Alternative #2 and #3 Monthly Operating Cost Estimate**

| Number of Connections | Monthly Operating Costs |
|---|---|
| 20 | $16 |
| 100 | $10 |
| 500 | $5 |
| 1,000 | $4 |
| 2,000 | $3 |

# SECTION 6

# EVALUATION OF ALTERNATIVES

## Views of Public and Concerned Interests on Alternatives

A public hearing regarding this draft study was held at 7:00 p.m. on February 10, 1997. The public hearing was well attended with about 55 people present, in addition to members of the Town Council. Reuel Emery, representing the Southwest Washington Health District, was in attendance to assist the Town in responding to questions from the public. Following a presentation of findings and recommendations from the draft study, the public responded with questions. Most of the responses from the public were inquiries regarding technical issues. Although opinions differed amongst the individuals in attendance regarding the issue of public sewers, there was general approval of the conclusion that public sewers were not feasible at this particular time. In regards to the issue of a septic tank maintenance program, the public generally expressed the opinion that the matter warranted further evaluation, prior to taking specific action at this time.

## Comparison of Alternatives

In Section 5, four basic alternatives were developed for meeting the long-term wastewater treatment needs of the community:

Alternative #1 - Community Collection and Treatment

Alternative #2 - Community Maintenance Program With Public Ownership of Cluster Systems

Alternative #3 - Continued Reliance Upon On-Site Systems With a Community Maintenance Program

Alternative #4 - Continued Reliance Upon On-Site Systems Without a Community Maintenance Program (no action)

Although cost information regarding these alternatives is presented in Section 5, cost is not the overriding issue. The costs of the alternatives vary, but so do the nature of the alternatives. The alternatives are too dissimilar to warrant selection based upon costs. Growth management and environmental considerations are deemed more relevant to the evaluation of the alternatives.

**Table 6.1**
**Ranking of Final Treatment System Alternative Proposals**

| | Alt 1 | Alt 2 | Alt 3 | Alt 4 |
|---|---|---|---|---|
| 1. Environmental Effects | 1 | 1 | 1 | 4 |
| 2. Monetary Costs | 4 | 3 | 2 | 1 |
| 3. Implementation Capacity | 4 | 3 | 2 | 1 |
| 4. Contribution to Objective and Goals | 1 | 1 | 1 | 4 |
| 5. Energy and Resources Use | 4 | 2 | 1 | 1 |
| 6. Reliability | 1 | 2 | 3 | 4 |
| 7. Public Acceptability | 4 | 3 | 2 | 2 |
| 8. Composite Ranking | 3 | 2 | 1 | 4 |

Note: The higher the number, the lower the ranking.

None of the alternatives would have significant primary adverse impacts upon:

a) ecosystems, including plant and animal communities,

b) endangered or locally threatened species,

c) unique or vulnerable environmental features,

d) unique archeological, historic, scientific, or cultural areas, parks, wetlands, or stream corridors,

e) community growth patterns and land use,

f) air quality, or

g) aesthetics.

The environmental impacts that differ among the alternatives include:

1. Alternative #1 offers the greatest degree of water quality benefit. Not only would it produce a higher degree of treatment, but it would offer greater reliability. Alternative #4 would have the least degree of reliability, due to the fact that none of the system is under municipal maintenance. While Alternatives #2 and #3 offer less in terms of water quality benefits, this

study concludes that both of these alternatives will meet water quality objectives. This study also concludes that Alternative #4 will have an adverse impact upon future water quality. Because of these water quality impacts, this study concludes that Alternative #4 should be rejected. This relates primarily to the high probability that problems with existing septic tanks will continue, with the end result being the discharge of wastewater that is high in nitrates to the aquifer, and perhaps even to Yacolt Creek. There is also the risk of contaminating the aquifer, which is used as a drinking water source, with hazardous chemicals. Another factor in rejecting Alternative #4 is that it is possible that additional substandard systems will be installed in the future, and probable that some of the future systems will fail or otherwise be operated in an unsatisfactory manner. Although Alternatives #2 and #3 rely upon the continued use of septic tanks, the fact that a public agency will be responsible for their performance would likely mean that new systems would be constructed to much higher standards. Even more important, under Alternatives #2 and #3 , it is considerably more likely that the deficiencies with existing on-site systems will be corrected.

2. Alternative #1 would decrease the total amount of terrestrial habitat as a result of the land area lost to construction of the treatment facilities. The impact of this would be relatively minor, and is thus considered insignificant.

3. Alternative #1 would require a considerable amount of energy use relative to the other alternatives. Alternatives #2 and #3 would both require minimal energy use.

4. Alternative #1 would reduce the amount of groundwater recharge. The percentage of recharge from septic systems is estimated to be 0.5% of the total annual recharge to the Yacolt Aquifer, or about 16 million gallons per year. This is minimal and is therefore considered insignificant.

5. Given the apparent lack of enthusiasm for paying the cost of public sewers that currently exists within the community, Alternative #1 would be very difficult, if not impossible to implement, under the current land-use plan. Alternative #2 would be less difficult to implement, and Alternative #3 would be even less difficult.

## The Selected Plan

On the basis of costs, environmental considerations, and operational considerations, this study concludes that Alternative #3 - Continued Reliance Upon On-Site Systems With a Community Maintenance Program - is the preferred alternative. Under this alternative, a maintenance program would be established under the jurisdiction of a local agency, either an existing agency such as the Town of Yacolt, or a separate agency created for the administration of this program. The Town would take the lead in ensuring that new on-site systems are designed, constructed, and maintained properly.

Alternative #1 was rejected due to its high cost and limited benefit. If future zoning permits higher densities, Alternative #1 may be selected; however, under current zoning, it is simply not practical.

Alternative #2 was rejected for the same reason as was Alternative #1 - difficulty of implementation. While it is recommended that Alternative #2 be rejected, in the event that an industry, or major commercial establishment (restaurant) were to be deterred from locating in the community by lack of sewer service, Alternative #2 should be re-evaluated. If Alternative #3 is selected, it would be an excellent platform from which to move forward with the Alternative #2 plan, should the need arise.

## Environmental Impacts of Selected Plan

This study concludes that the selected alternative will have negligible direct impacts upon the environment.

# SECTION 7

# IMPLEMENTATION

## Community Maintenance Program

For the Yacolt Community, the recommended plan is the continued reliance upon on-site systems with a Community Maintenance Program. There are a large number of options available as to the functions of, and types of organization for a Community Maintenance Program. These are discussed in the following paragraphs.

### *Program Functions*

On-site management programs can have the following functions:

- Performance Monitoring and Enforcement
- Operation and Maintenance
- System Evaluation, Repair and Rehabilitation
- System Design Review
- Inspection During Construction
- Septage Removal and Disposal
- Public Education

**Performance Monitoring/Enforcement**. Performance monitoring is one of the more important functions of a community maintenance program. Lack of monitoring is a major cause of septic tank failures. A good monitoring program can save property owners money, as well as ensure satisfactory performance of the system in the long-term. A monitoring program is ineffective without an ability to enforce non-compliance. If a system needs pumping, or is in need of repair or replacement, there must be a legal mechanism by which an agency can enforce action. This legal mechanism is established by state or local ordinance.

**Operation and Maintenance.** If a system is installed properly, and monitored adequately, operation and maintenance is generally limited to periodic pumping of septic tanks. Septic tank pumping is generally required on a frequency of 3 to 5 years. In the year 2000, all on-site systems in Washington will be required to have inspection and maintenance performed every three years.

**System Evaluation, Repair and Rehabilitation**. If a system is in need of repair or replacement, an operating agency can provide technical expertise which will result in the lowest cost solution. In addition, a program can be established whereby the operating agency offers low-interest loans for system repair.

**System Design Review.** While the local health department is responsible for design review, a program can be established to supplement this effort. If alternative systems are utilized, this function becomes particularly important. In light of the fact that specific design standards are being recommended for septic tanks installed in the Yacolt area, this function is of prime importance.

**Inspection During Construction**. Like design, inspection during construction is the responsibility of the local health department. Staff limitations, as well as political issues, may interfere with the local health department's ability to ensure that all systems are installed properly. A local management agency can work hand-in-hand with the local health department to ensure that all systems are installed properly.

**Septage Removal and Disposal.** Removal of septage is commonly accomplished by private parties. A public agency's involvement may reduce the cost of septage removal and disposal.

**Public Education.** A key element of a maintenance program is public education. Users often discharge detrimental chemicals into their on-site system. These may interfere with the performance of the system, or possibly result in direct contamination of the groundwater. A good public education program will result in users being aware of what is an acceptable discharge.

### *Implementing a Management Program*

If the community does elect to implement a management program, the Town's working relationship with the Southwest Washington Health District will be very important. The Health District currently has, and would continue to have, the lead regarding regulatory issues. Given the technical expertise of the Health District, the Health District is the logical choice for technical input, including issues related to design, installation, and inspection. Given the fact that the Town staff has the local presence, it is logical that Town staff take the lead in public education (with technical input from the Health District). In any event, an effective management program undertaken by the Town could not be successful without the full support of the Health District. A good working relationship with the Health District is deemed to be of critical importance to the success of any effective program. Detailed information regarding the establishment of a management program is available from the references listed in Appendix C. Following are the basic steps that need to be followed in implementing a program:

1. Identify Functions

   The functions of a management program are briefly discussed above. These should be carefully considered, as they will influence the type of program established.

2. Identify Service Area Boundary

   Given the previous planning efforts that have been completed, the boundaries of Yacolt are well defined. Nonetheless, the service area boundary should be clearly defined.

3. Identify Type of Agency

   There are basically two options for the formation of a management program agency: 1) form a new local agency such as a special district or 2) have the program administered by the Town.

4. Formation of Agency

   This will only be required if a special district is being formed. The legal requirements for the formation of a special district are established by state law.

5. Development of a Management Plan

   A written management plan should be developed. It should clearly state the goals and functions to be performed.

6. Adoption of Ordinances

   As with district formation, ordinance adoption requirements are established by state law.

It is recommended that the Town work closely with the Southwest Washington Health District in each of these steps.

## Possible Future Plan - Community Maintenance Program With Public Ownership of Cluster Systems

Although this study concludes that the preferred alternative is for the continued use of privately owned on-site systems (Alternative #3), the study also concludes that future developments may create the need for small publicly owned systems to serve one or more clusters of development (Alternative #2).

## Water Quality Monitoring Program

It is likely that the decision to continue to rely upon on-site systems will be criticized as detrimental to water quality by some individuals in the area. If water quality issues are going to be raised, they should be done so on the basis of factual information. A long-term monitoring program is the best way to provide that factual information.

Testing should focus upon two parameters: nitrates and fecal coliforms. As discussed in Section

2, water quality samples have already been taken in Yacolt Creek, downstream of the developed portion of the Yacolt community. Tests have also been taken at other locations within the East Fork Lewis River Watershed by the County. A water quality sampling plan could be accomplished by cooperating with the County. The frequency of the testing will depend upon the availability of funds. If a monitoring program is established, and fees are collected, the monitoring program could be funded from those fees. Grants may also be available to fund a program of monitoring.

## Funding

Although the conclusion of this study is that continued use of on-site systems is the preferred alternative for meeting the long-term sewerage needs of the Yacolt community, the alternative of constructing a community-wide public sewer system will always be the preferred alternative for some members of the community. Because of this, the following discussion presents information regarding the financial implications of Alternative #1. The financial impact of a community-wide sewer system is largely dependent upon the availability of grant funding. Table 7.2 presents estimates of monthly sewerage rates necessary to pay the cost of the community-wide system alternative.

### *Operating and Maintenance Costs Versus Capital Improvement Costs*

Historically, federal and state funds have been utilized to finance the construction of major sewer systems. The recent trend has been towards a decreasing availability of federal and state funds. When federal and state grants were utilized for sewer system expansions, the end result was that existing residents helped to finance growth. Often, given the nature of the tax structure, people were unaware that they were financing growth. In many cases, the issue was viewed as one of "water quality" rather than "paying for growth". Now that state and federal funds are limited, there is a sensitivity to the question of who pays for growth. It is becoming very important to address sewer funding issues so that the public can distinguish between those expenditures which benefit all citizens equally, and those expenditures that exclusively serve new growth.

Operation and maintenance costs clearly benefit all ratepayers, as do capital expenditures for repairs of existing facilities. The benefit of capital expenditures for collection system expansions into new service areas is clearly limited to the new ratepayers being served by those expansions. The issue of who pays for growth is clearly a "policy" issue. Although policies vary from one community to the other, the most common policy is to have growth pay for itself. In such cases, revenue from monthly sewer bills is used to pay for operation and maintenance costs, and utility extensions are paid by new development.

***Funding Options for Capital Improvements***

There are a number of methods available for financing sewerage system expansions. If the community did elect to move forward with the construction of a community sewerage system, it is likely that the improvements would be financed by a combination of the methods summarized below, depending upon variable design elements and timing considerations for the proposed projects.

A. Local Improvement District (LID)

For wastewater collection system expansions, a local improvement district (LID) for the area to be served can be formed. In LIDs, the revenue bonds can be sold whereby the property owners recover the expenses through monthly service charges.

B. Bonds

Wastewater facilities typically require a large one-time expenditure, such as a wastewater treatment plant expansion. These improvements can be financed by a general obligation or revenue bond that is repaid during the life of the new facility. The bond is normally repaid from revenues derived from monthly service charges. Normally, all customers share in the bond repayment. If bond payments are made from monthly utility charges, the existing citizens effectively finance a proportionate share of the growth. If bond payments are made from future impact fees, then growth pays for itself. Where system development charges are used to retire the bond, these charges should be set sufficiently high to also pay for other distribution and collection system capacity upgrades that will be needed to restore the capacity lost as a result of that development.

C. Connection Charges

Revenues have historically been generated for utility system improvements through the collection of connection charges. As connections to the system are made, a connection fee is charged. It is used to finance capacity upgrades. The rationale behind these fees is that the existing system has a limited amount of excess capacity. As growth occurs, the capacity is decreased. The fees are meant to collect funds to replace lost capacity. Connection fees can be classified as either General Facility Charge (GFC), or System Development Charge (SDC). The GFC is limited to an amount equal to the net investment in the estimated original cost of non-donated system assets. SDC's are limited to special districts for projects included in an "adopted" comprehensive plan.

D. Revolving Loan Fund Program

The State of Washington has a program whereby the City can obtain low interest loans to finance utility system improvements. The loan could be paid back with a funding program similar to that used to retire bonds.

E. Developer Financing

Sewerage collection and/or treatment facility improvements could be developer financed. This method of financing for utility line extensions is often used in conjunction with system development charges. In some cases, the developer is reimbursed for expenditures from future connection charges (latecomer fees). The developer constructs the necessary utility line extensions and also pays a system development charge which covers the downstream utility lines and necessary treatment facility capacity. If latecomer fees are imposed, the developer who constructs the improvements is reimbursed by the future connections to that particular improvement.

F. State and Federal Funding Programs

There are a number of State and Federal funding programs available to finance sewerage facility expansions. The nature of these programs varies with the political climate. The recent trend has been for the availability of funds from these programs to decrease. Another recent trend has been for the funds to be limited to current needs and environmental improvement projects, rather than to finance expansions for future growth.

***Discussion of Alternative Funding Programs for System Operation***

In Section 5, operating cost estimates were presented for various assumptions regarding the number of connections. Monthly service charges would have to pay the cost of system operation, and the cost of funding. To estimate the monthly service charge requires an assumption relative to the amount of local share. Table 7.1 presents estimates of annual costs for various assumptions regarding funding, and Table 7.2 presents estimates of monthly costs in a summarized form.

## Table 7.1
## Annual Costs for Community-Wide Sewer System (Alternative #1 Plan)

| Funding Scenario | Local Share of Cost | Annual Debt Payment | Cost Per Equivalent Residential Dwelling Unit | | |
|---|---|---|---|---|---|
| | | | Annual Debt Share | Annual Operating Cost | Total Annual Costs |
| *0% Grant Funded* | | | | | |
| 100% connected | 6,392,500 | 470,488 | 747 | 264 | 1,011 |
| 75% connected | 6,235,000 | 458,933 | 970 | 276 | 1,246 |
| 50% connected | 6,077,500 | 447,304 | 1,420 | 288 | 1,708 |
| 25% connected | 5,919,500 | 435,675 | 2,775 | 300 | 3,075 |
| *25% Grant Funded* | | | | | |
| 100% connected | 4,794,375 | 352,866 | 560 | 264 | 824 |
| 75% connected | 4,676,625 | 344,200 | 728 | 276 | 1,004 |
| 50% connected | 4,558,125 | 335,478 | 1,065 | 288 | 1,353 |
| 25% connected | 4,439,625 | 326,756 | 2,081 | 300 | 2,381 |
| *50% Grant Funded* | | | | | |
| 100% connected | 3,196,250 | 235,244 | 373 | 264 | 637 |
| 75% connected | 3,117,750 | 229,466 | 485 | 276 | 761 |
| 50% connected | 3,038,750 | 223,652 | 710 | 288 | 998 |
| 25% connected | 2,959,750 | 217,838 | 1,388 | 300 | 1,688 |
| *75% Grant Funded* | | | | | |
| 100% connected | 1,598,125 | 117,622 | 187 | 264 | 451 |
| 75% connected | 1,558,875 | 114,733 | 242 | 276 | 518 |
| 50% connected | 1,519,375 | 111,826 | 355 | 288 | 643 |
| 25% connected | 1,479,875 | 108,919 | 694 | 300 | 994 |
| *100% Grant Funded* | | | | | |
| 100% connected | -0- | -0- | -0- | 264 | 264 |
| 75% connected | -0- | -0- | -0- | 276 | 276 |
| 50% connected | -0- | -0- | -0- | 288 | 288 |
| 25% connected | -0- | -0- | -0- | 300 | 300 |

*Assumptions:*

1. Total cost assumes that the construction costs are as shown in Table 5.1. If the size of the service area were to be decreased, the cost would decrease proportional to the reduction in length of pressure sewer main.
2. Annual debt is calculated assuming a low interest loan of 4% over a period of 20 years using a capital recovery factor of 0.0736.

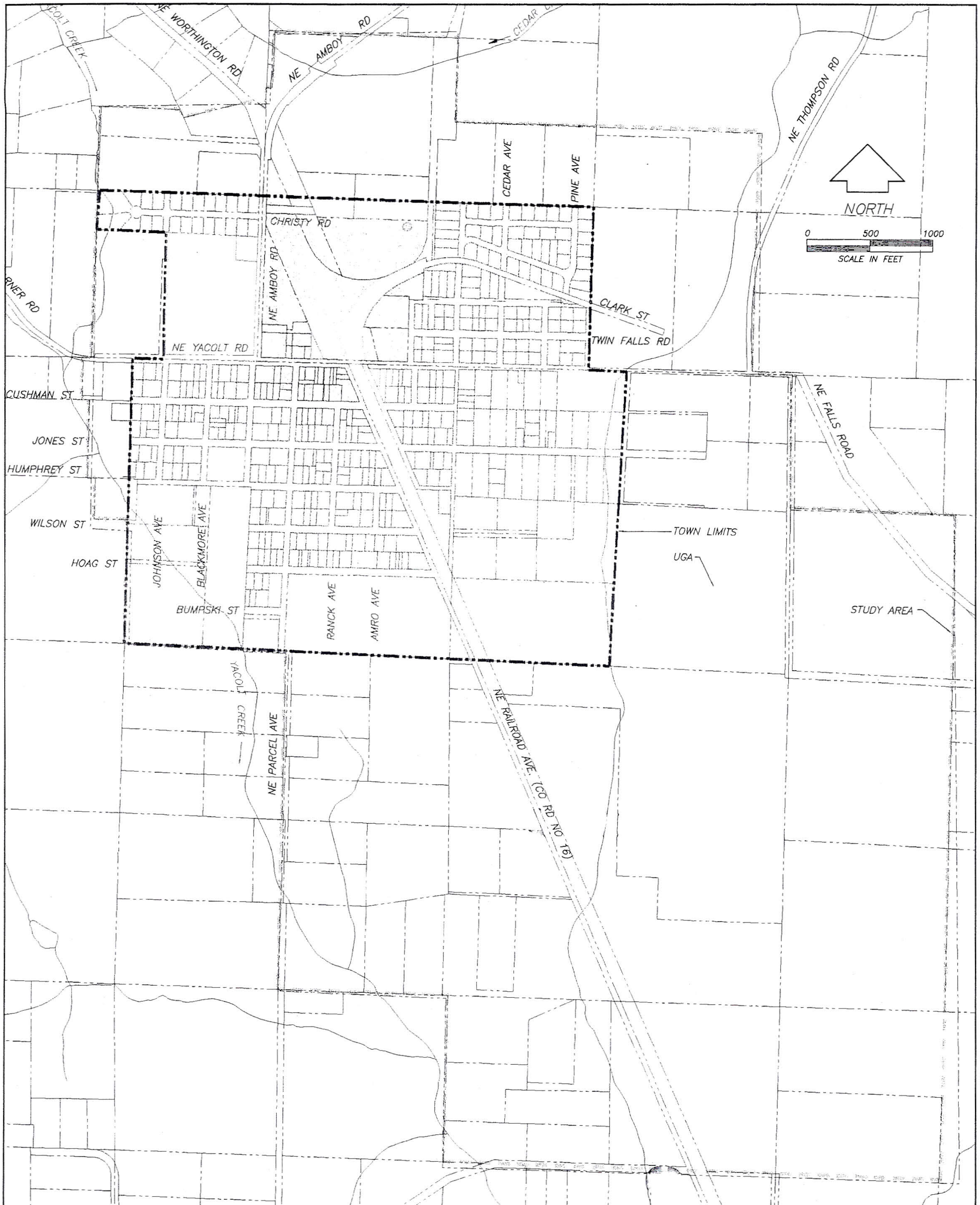
The previous listed costs do not assume any of the debt would be retired by revenue from connection fees. In the event that connection fees were to be set at $3,000 per connection, which is not excessive for sewer districts attempting to fund new improvements, the monthly payments would be reduced provided the community experienced continuous growth. If growth slowed or stopped, the revenue stream from connection fees would need to be covered by increasing rates. For various alternative growth scenarios, and connection fee charges, Table 7.2 presents the monthly sewer rates.

**Table 7.2**
**Monthly Costs For Community-wide Sewerage System (Alternative #1)**

| | Percent Connected / Number of Connections | | | |
|---|---|---|---|---|
| Funding Scenario | 25% / 157 | 50% / 315 | 75% / 473 | 100% / 630 |
| 0% Grant Funded | 256 | 142 | 104 | 84 |
| 25% Grant Funded | 198 | 112 | 84 | 69 |
| 50% Grant Funded | 141 | 83 | 63 | 53 |
| 75% Grant Funded | 83 | 54 | 43 | 38 |
| 100% Grant Funded | 25 | 24 | 23 | 22 |

# APPENDIX A

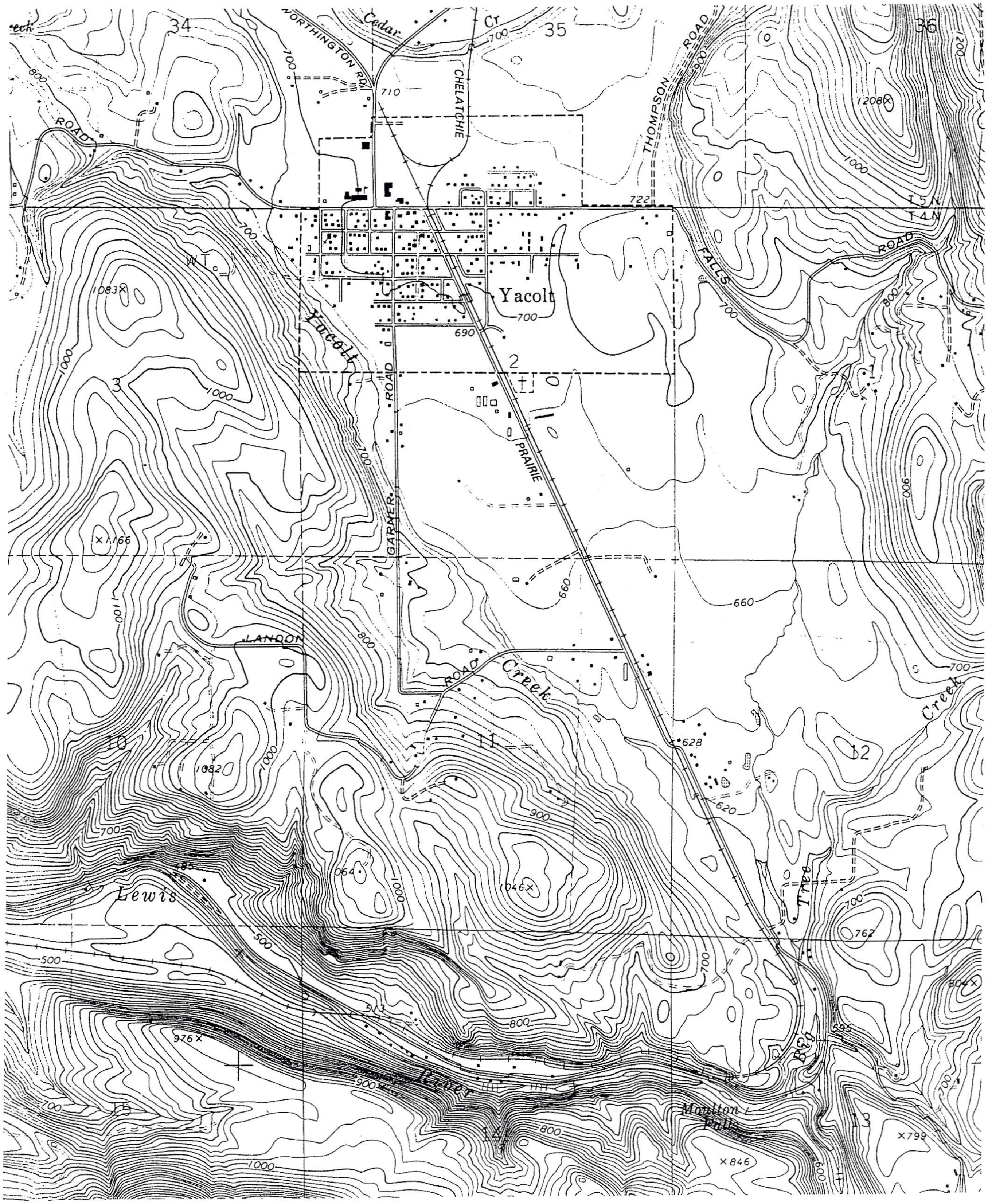
# FIGURES




COMMERCIAL
RESIDENTIAL
PARKS/OPEN SPACE
PUBLIC FACILITY

FIGURE A1
YACOLT LAND USE

YACOLT SEWER FEASIBILITY STUDY
Wallis Engineering February 1997

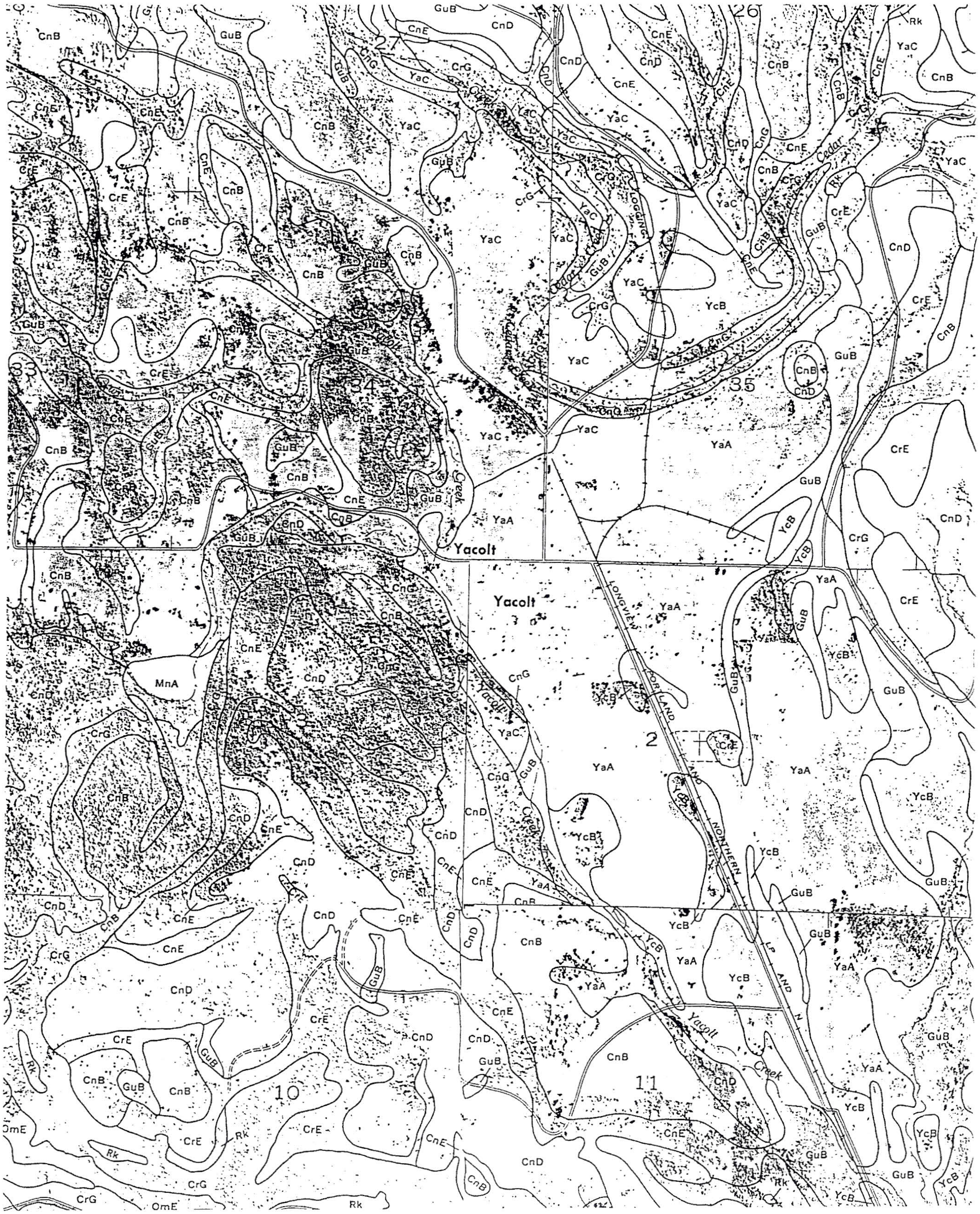



NORTH

0 1000 2000
SCALE IN FEET

FIGURE A2
TOPOGRAPHIC MAP

YACOLT SEWER FEASIBILITY STUDY
Wallis Engineering November 1996



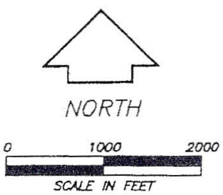
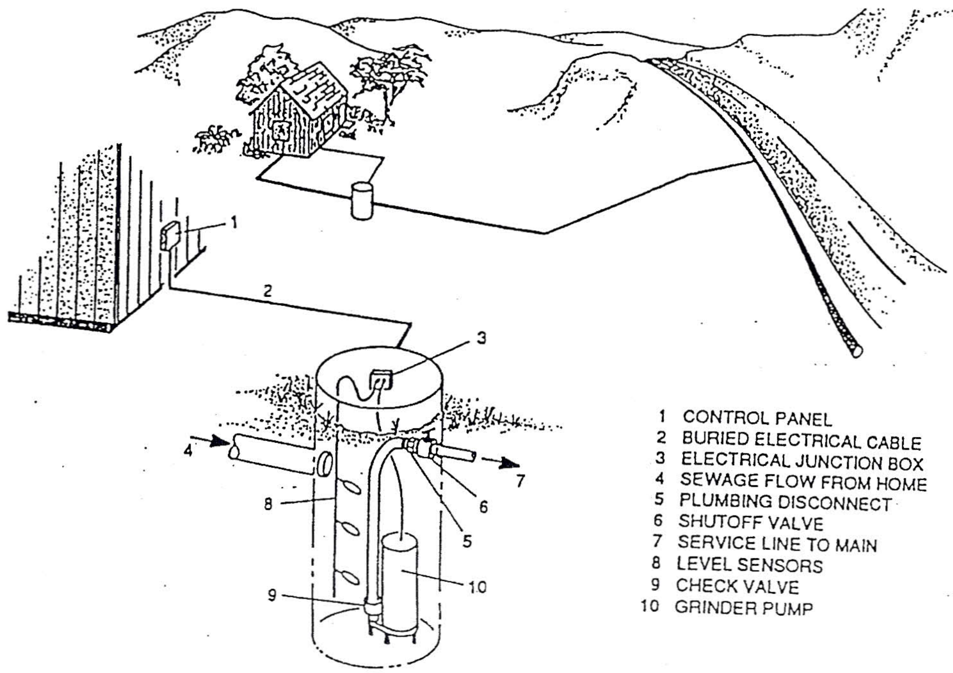




FIGURE A3
SOIL MAP

YACOLT SEWER FEASIBILITY STUDY
Wallis Engineering November 1996

**Grinder Pump (GP) system.**




**Septic Tank Effluent Pump (STEP) system.**

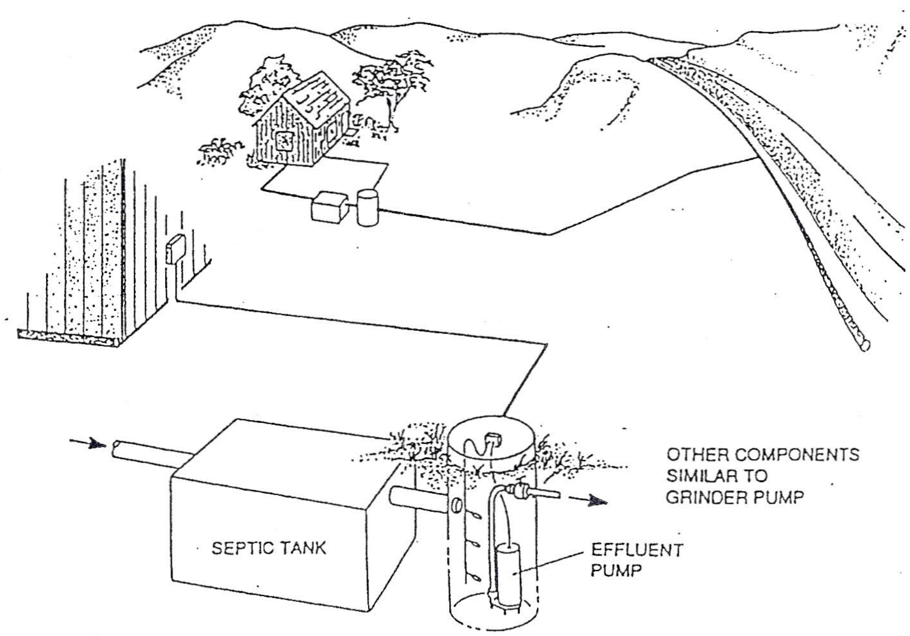



FIGURE A4
GRINDER PUMP AND STEP SEWER SYSTEM SCHEMATICS

YACOLT SEWER FEASIBILITY STUDY

Wallis Engineering November 1996

Schematic of a SDVG system.

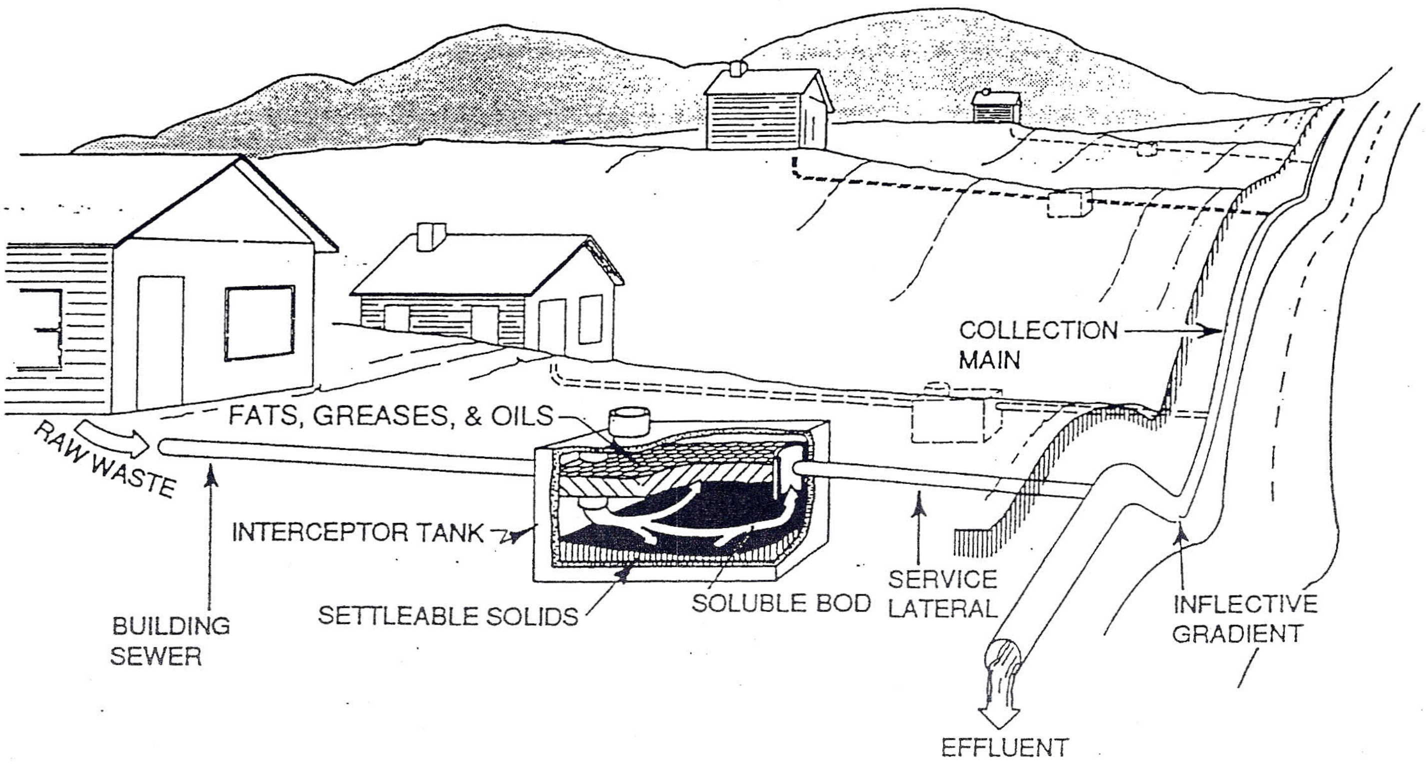



FIGURE A5
SDVG SEWER SYSTEM SCHEMATICS

YACOLT SEWER FEASIBILITY STUDY

Wallis Engineering November 1996

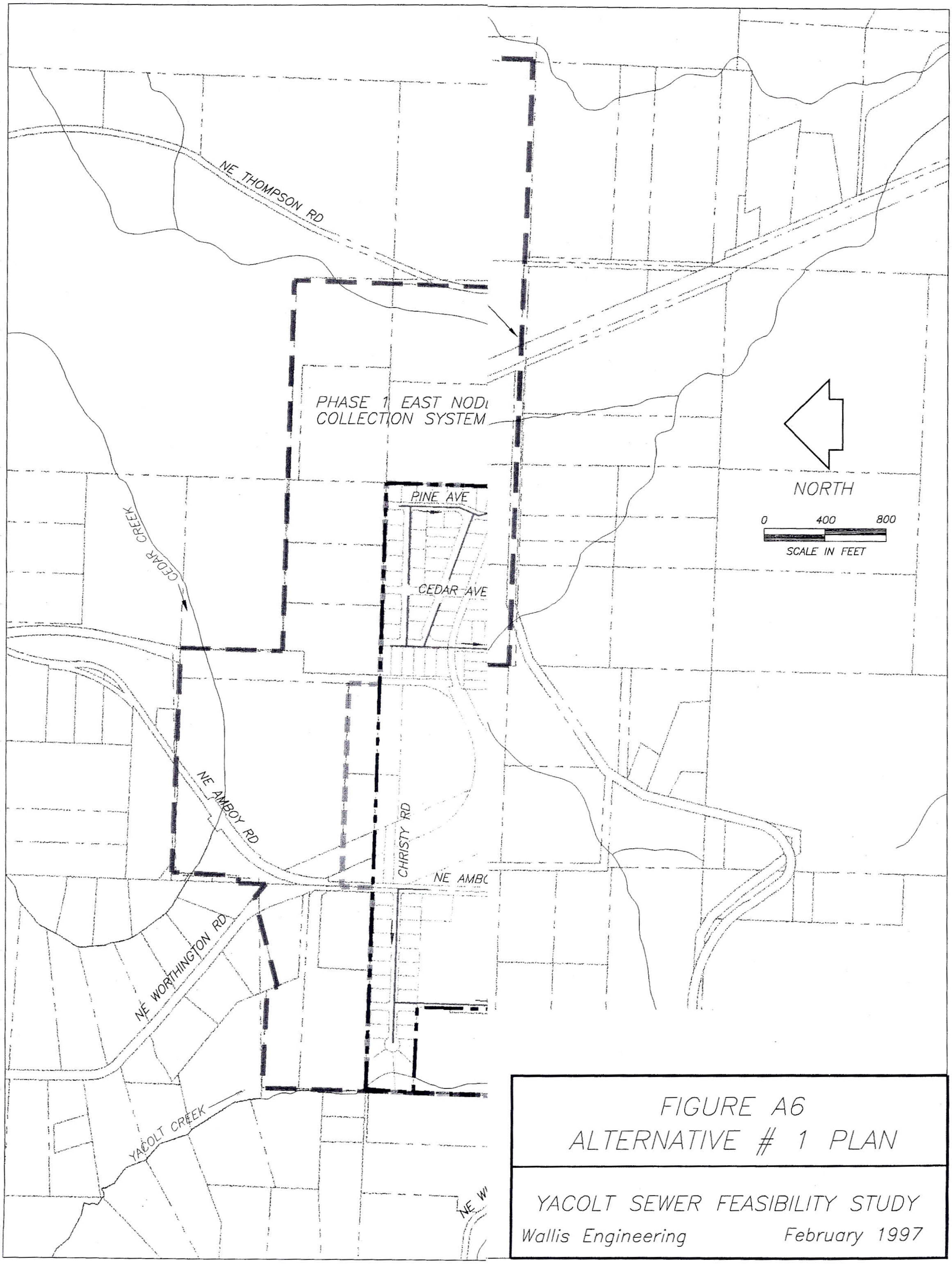



FIGURE A6
ALTERNATIVE # 1 PLAN

YACOLT SEWER FEASIBILITY STUDY

Wallis Engineering February 1997

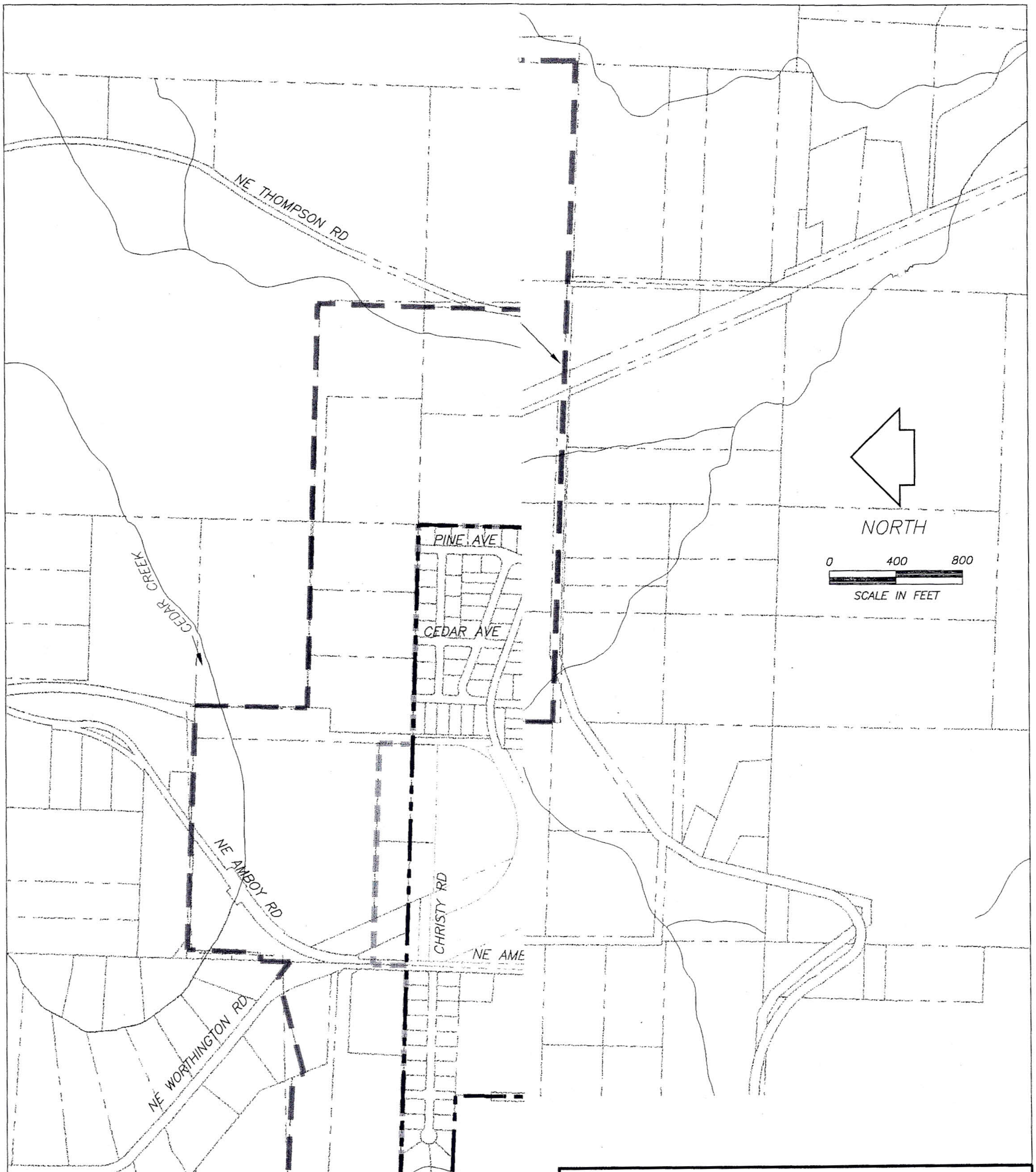
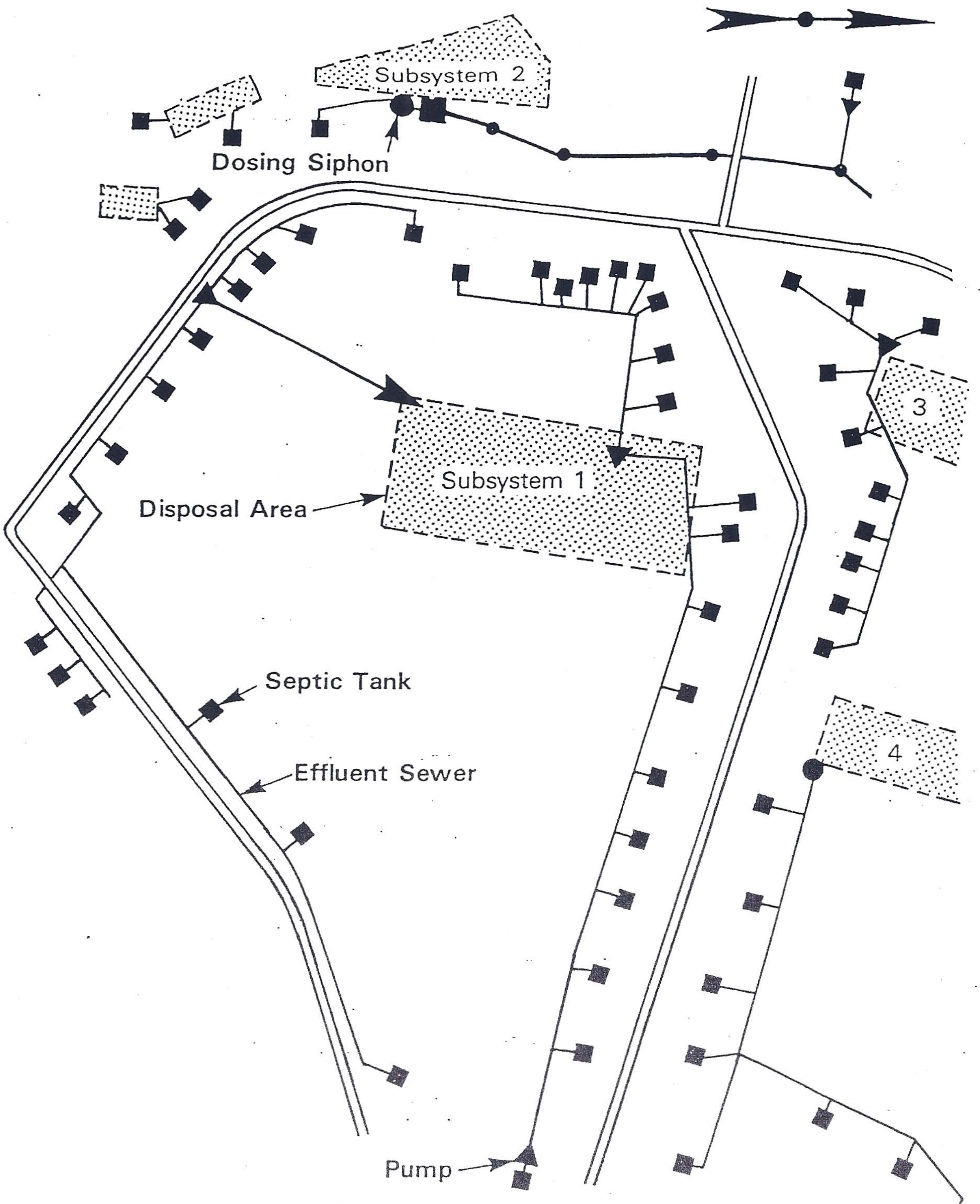



FIGURE A7
ALTERNATIVE # 2 PLAN

YACOLT SEWER FEASIBILITY STUDY
Wallis Engineering February 1997




Community Subsurface Disposal Plan

FIGURE A8
TYPICAL CLUSTER SYSTEM
SCHEMATIC

YACOLT SEWER FEASIBILITY STUDY

Wallis Engineering November 1996

## State-of-the-Art Activated Sludge Process for the Treatment of Municipal and Industrial Wastewater

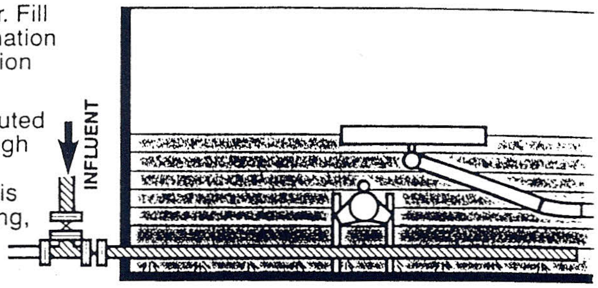
The Sequencing Batch Reactor, SBR, is a fill-and-draw, non-steady state activated sludge process in which one or more reactor basins are filled with wastewater during a discrete time period, and then operated in a batch treatment mode. The SBR accomplishes equalization, aeration and clarification in a timed sequence, in a single reactor basin, whereas a conventional continuous flow process requires multiple structures and extensive pumping and piping systems. A single cycle for each reactor consists of five discrete periods, Fill, React, Settle, Draw and Idle. The purpose of each period is described in the illustration.

Varying the operating strategy enables aerobic, anaerobic or anoxic conditions to be achieved. Precise control of these conditions allows Organism Selection to take place—the proliferation of specific desirable microorganisms is encouraged, while the growth of undesirable microorganisms is inhibited. Microorganisms can also be acclimated to a wide range of industrial and chemical processing wastes.

### Anoxic Fill Phase

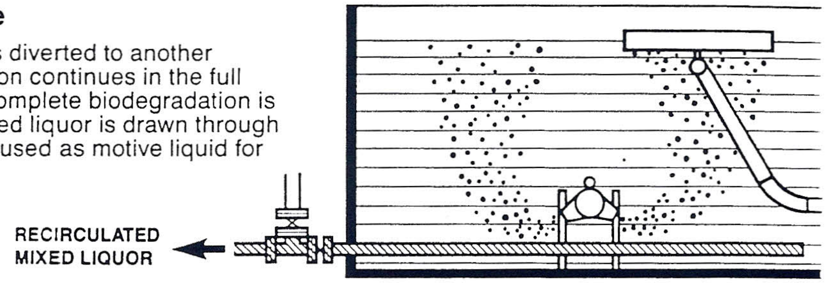
The reactor is filled with wastewater. Fill can be aerated, anoxic, or a combination of aerated and anoxic. Biodegradation is initiated.

During Anoxic Fill Influent is distributed throughout the settled sludge through the Influent Distribution Manifold. Pumps are not operated, no power is used. Influent is not diluted by mixing, making biological nutrient removal much more reliable.



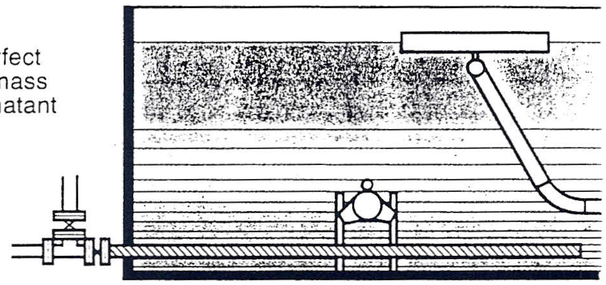

### React Phase

Influent flow is diverted to another reactor. Aeration continues in the full reactor until complete biodegradation is achieved; mixed liquor is drawn through the IDSC and used as motive liquid for the jet aerator.



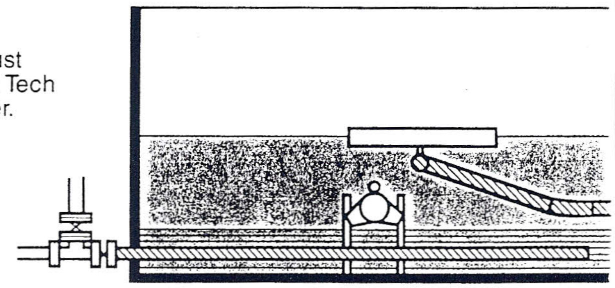

### Settle Phase

The aerators are turned off and perfect quiescent conditions allow the biomass to settle, leaving the treated supernatant above.



### Decant Phase

Treated effluent is removed from just below the liquid surface by the Jet Tech Floating Solids Excluding Decanter.



### Idle/Waste Sludge Phase

The reactor waits to receive flow. Settled sludge is drawn through the IDSC and pumped to an aerobic digester. The jet motive liquid pump is utilized as a waste sludge pump.

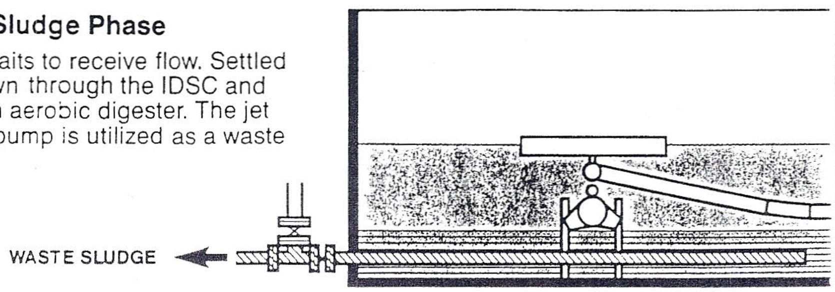



FIGURE A9
SEQUENCING BATCH REACTOR SCHEMATIC

YACOLT SEWER FEASIBILITY STUDY

Wallis Engineering — November 1996

# APPENDIX B

# COMMUNITY SURVEY AND PUBLIC INVOLVEMENT INFORMATION

# QUESTIONNAIRE #1

# YACOLT SEWER FEASIBILITY STUDY

October 8, 1996

*To assist The Town of Yacolt in evaluating the feasibility of constructing a sewer system for the Yacolt community, please complete the following questions and return by mail by October 11, 1996.*

1. Is your current septic tank and drainfield functioning to your satisfaction? Yes___ No ____

   If "No", please describe the problem. ______________________________

   ______________________________

   ______________________________

   ______________________________

2. Do you anticipate a need for public sewers in the future? Yes _____ No _____

   If "Yes" when? 0-5 years _____

   5-10 years_____

   10-15 years ____

   If "Yes" why?______________________________

   ______________________________

   ______________________________

   If "No" why?______________________________

   ______________________________

   ______________________________

   ______________________________

3. Do you have plans to develop your property in the near future? Yes ____ No ____

   If "Yes" would the availability of sewers influence your development plans? Yes ___ No ___

4. Do you view growth in Yacolt as positive for the community? Yes ___ No ___

5. Do you think that it's a good idea to limit growth to approximately 1200 people by not constructing sewers? Yes ___ No ___

6. Do you feel that the cost of a sewage collection and treatment system is a worthwhile investment to encourage growth within Yacolt? Yes ___ No ___

7. Are you willing to pay $20-$35 per month for sewers? Yes ___ No ___

8. Please write any additional comments that you may have:

_______________________________________________
_______________________________________________
_______________________________________________
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# QUESTIONNAIRE #2

# YACOLT SEWER FEASIBILITY STUDY

January 10, 1997

*To assist The Town of Yacolt in evaluating the feasibility of constructing a sewer system for the Yacolt community, please complete the following questions and return by mail by February 1, 1997.*

Questions 1 - 6 are reprinted from Questionnaire #1. If you already answered these questions, please begin with Question #6.

1. Is your current septic tank and drainfield functioning to your satisfaction? Yes___ No ____

   If "No", please describe the problem. ________________________________________

   ________________________________________________________________________

   ________________________________________________________________________

   ________________________________________________________________________

2. Do you anticipate a need for public sewers in the future? Yes _____ No _____

   If "Yes" when? 0-5 years _____

   5-10 years_____

   10-15 years ____

   If "Yes" why?________________________________________________________

   ________________________________________________________________________

   ________________________________________________________________________

   If "No" why?_________________________________________________________

   ________________________________________________________________________

   ________________________________________________________________________

   ________________________________________________________________________

3. Do you have plans to develop your property in the near future? Yes ____ No ____

   If "Yes" would the availability of sewers influence your development plans? Yes ___ No ___

4. Do you view growth in Yacolt as positive for the community? Yes ___ No ___

5. Do you think that it's a good idea to limit growth to approximately 1,400 people by not constructing sewers? Yes ___ No ___

6. The cost estimate for a public sewage collection and treatment system is approximately $6,392,500.00. Do you feel that this is a worthwhile investment to encourage growth within Yacolt? Yes___ No ___

7. Monthly sewer rates for the construction and operation of the public sewer system would range between $22-$256 depending on grant funding. If you were to support a community sewer system, which monthly sewer rate would you be willing to pay:

$20 - $25 ___

$26 - $30 ___

$31 - $35 ___

$36 - $40 ___

$41 - $50 ___

More than $50 ___

8. A community maintenance program would help protect groundwater and would postpone the need for a public sewer system. Would you support such a program if it cost $3-$6 per month? Yes ___ No ___

9. Please write any additional comments that you may have:

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

## *Yacolt Sewer Feasibility Study Survey #1 Results ~ Need for Community Sewer System*

Wallis Engineering, November 11, 1996

| | | | |
|---|---|---|---|
| Total Surveys Mailed: | 292 | | |
| Total Surveys Returned: | 69 | Percent Returned: | 23.6% |

**Question 1 - Is your existing septic system functioning to your satisfaction?**

| | | |
|---|---|---|
| Yes | 65 | 94.2% |
| No | 2 | 2.9% |
| N/A | 2 | 2.9% |

| Problems Identified | | |
|---|---|---|
| | Can't build on the drainfield | 1 |
| | Improper installation | 1 |

**Question 2 - Do you anticipate a need for public sewers in the future?**

| | | |
|---|---|---|
| Yes | 32 | 46.4% |
| No | 35 | 50.7% |
| Blank | 2 | 2.9% |

| If Yes, When? | | | |
|---|---|---|---|
| | 0-5 years | 12 | 41.4% |
| | 5-10 years | 11 | 37.9% |
| | 10-15 years | 6 | 20.7% |
| | Blank | 3 | 10.3% |

| Reasons for "Yes" Answer | | |
|---|---|---|
| Population Growth | 23 | 72% |
| Environmental Impacts | 19 | 59% |
| Other | 4 | 13% |
| Business and Industrial Growth | 4 | 13% |
| No response | 3 | 9% |

| Reasons for "No" Answer | | |
|---|---|---|
| Preserve Yacolt | 15 | 43% |
| Not Necessary - Onsite Fine | 11 | 31% |
| No response | 8 | 23% |
| Cost | 5 | 14% |
| Other Response | 3 | 9% |

*Note: Totals may exceed 100% as multiple responses allowed.*

**Question 3 - Do you have plans to develop your property?**

| | | |
|---|---|---|
| Yes | 10 | 14.5% |
| No | 58 | 84.1% |
| Blank | 1 | 1.4% |

Does the availability of public sewer influence your decision to develop

| | | |
|---|---|---|
| Yes | 8 | 80.0% |
| No | 2 | 20.0% |

| | | | |
|---|---|---|---|
| Question 4 - Do you view growth in Yacolt as positive for the community? | Yes | 34 | 49.3% |
| | No | 33 | 47.8% |
| | Blank | 2 | 2.9% |


| | | | |
|---|---|---|---|
| Question 4 - Do you view growth in Yacolt as positive for the community? | Yes | 34 | 49.3% |
| | No | 33 | 47.8% |
| | Blank | 2 | 2.9% |


| | | | |
|---|---|---|---|
| Question 5 - Do you think that it's a good idea to limit growth to approximately 1200 people by not constructing sewers? | Yes | 38 | 55.1% |
| | No | 27 | 39.1% |
| | Blank | 4 | 5.8% |

| | | | |
|---|---|---|---|
| Question 6 - Do you feel that the cost of a sewage collection and treatment syst is a worthwhile investment to encourage growth within Yacolt? | Yes | 23 | 33.3% |
| | No | 41 | 59.4% |
| | Blank | 5 | 7.2% |

| | | | |
|---|---|---|---|
| Question 7 - Are you willing to pay $20-$35 per month for sewers? | Yes | 20 | 29.0% |
| | No | 47 | 68.1% |
| | Blank | 2 | 2.9% |

***Yacolt Sewer Feasibility Study Survey #2 Results ~ Need for Community Sewer System***

Wallis Engineering, February 28, 1997

| | | | |
|---|---|---|---|
| Total Surveys Mailed: | 292 | | |
| Total Surveys Returned: | 67 | Percent Returned: | 22.9% |

| | | | |
|---|---|---|---|
| **Question 1 - Is your current septic tank and drainfield functioning to your satisfaction?** | Yes | 63 | 94.0% |
| | No | 2 | 3.0% |
| | N/A | 2 | 3.0% |
| **Question 2 - Do you anticipate a need for public sewers in the future?** | Yes | 32 | 47.8% |
| | No | 33 | 49.3% |
| | Blank | 2 | 3.0% |
| **Question 3 - Do you have plans to develop your property in the near future?** | Yes | 8 | 11.9% |
| | No | 58 | 86.6% |
| | Blank | 1 | 1.5% |
| Does the availability of public sewer influence your decision to develop? | Yes | 8 | 80.0% |
| | No | 2 | 20.0% |
| **Question 4 - Do you view growth in Yacolt as positive for the community?** | Yes | 33 | 49.3% |
| | No | 32 | 47.8% |
| | Blank | 2 | 3.0% |
| **Question 5 - Do you think that it's a good idea to limit growth to approximatel 1400 people by not constructing sewers?** | Yes | 37 | 55.2% |
| | No | 26 | 38.8% |
| | Blank | 4 | 6.0% |
| **Question 6 - The cost estimate for a public sewage collection and treatment system is approximately $6,392,500. Do you feel this is a worthwhil investment to encourage growth within Yacolt?** | Yes | 23 | 34.3% |
| | No | 41 | 61.2% |
| | Blank | 5 | 7.5% |
| **Question 7 - Monthly sewer rates for the construction and operation of the public sewer system would range between $22-$256 depending on grant funding. If you were to support a community sewer system, which monthly sewer rate would you be willing to pay?** | $20 - $25 | 23 | 34.3% |
| | $26 - $30 | 4 | 6.0% |
| | $31 - $35 | 5 | 7.5% |
| | $36 - $40 | | 0.0% |
| | $41 - $50 | 1 | 1.5% |
| | None | 11 | 16.4% |
| | No Answer | 23 | 34.3% |

# APPENDIX C

# REFERENCES

# REFERENCES


1. Roy F. Weston, Inc., "Management of On-Site and Small Community Wastewater Systems," USEPA, Municipal Environmental Research Laboratory, Cincinnati, Ohio, M687, November, 1979.

2. Deese, P.L. and J.F. Hudson, Planning Wastewater Management Facilities for Small Communities, EPA 600/8-80-030, August, 1980.

3. EPA, Management of Small Waste Flows, EPA 600/2-78-173, September 1978.

4. Wiswall, K.C. and P.A. Ciotoli, "Managements of Alternative Systems: Issues, Problems, Constraints and Opportunities," in Individual Onsite Wastewater Systems, Proceeding of the Sixth National Conference, 1979, Ann Arbor Science, Ann Arbor, Michigan.

5. Winneberger, J.T. and J.A. Burgel, "Onsite Wastewater Management Districts," Hancor, Inc., July 1977.

6. Kreissl, J.F., "Status of Pressure Sewer Technology, prepared for the EPA Technology Transfer Design Seminar for Small Flows, EPA Municipal Environmental Research Laboratory, Cincinnati, Ohio.

7. Government Finance Research Center, "Small Community Wastewater Systems: Financial Guidelines for Planning and Managements," Municipal Finance Officers Association, Financial Management Assistance Program, Mary, 1980.

8. Ciotoli, P.A., G.M. Johnson and D.C. Niehus, "Role of Public Agencies and Private Interests in Implementing Onsite and Small Community Wastewater Management Programs," in Individual Onsite Wastewater Systems, Proceedings of the Sixth National Conference, 1979. Ann Arbor Science, Ann Arbor, Michigan.

9. EPA, "Design Manual, Onsite Wastewater Treatment and Disposal Systems, EPA 625/1-80-012, October, 1980.

# APPENDIX D

# POLICY AND SPECIFICATIONS FOR THE USE OF ONSITE WASTEWATER DISPOSAL SYSTEMS WITHIN THE DEXTER SANITARY DISTRICT

D R A F T

# POLICY AND SPECIFICATIONS FOR THE USE OF ONSITE WASTEWATER DISPOSAL SYSTEMS WITHIN THE DEXTER SANITARY DISTRICT

**Dexter Sanitary District**

**W.C. Bowne**
**Consulting Engineer**

REGISTERED PROFESSIONAL ENGINEER 7065 OREGON JULY 16, 1971 WM C. BOWNE

**May 16, 1996**

1. The Dexter sanitary system is a small diameter gravity sewer using a septic tank for pretreatment at each home. This is called a STEG system (septic tank effluent gravity). The sewer is currently at permitted capacity due to excessive infiltration and inflow of storm and ground water. The State Department of Environmental Quality (DEQ) has encouraged the use of onsite disposal facilities such as septic tank - drainfield systems and sand filters to serve developing properties within the District. The District Board wishes to cooperate to provide the most responsive service to the public, and to issue this policy so septic tanks can be used as part of the sewer system at such time as increased capacity is available. Standards given here are in addition to the DEQ Onsite Sewage Disposal Rules.

2. To obtain a septic tank permit within the District, the property owner shall sign the Agreement appended to this policy, agreeing to abandon the drainfield and to connect to the sewer at such time as capacity is available and request is made by the Board. The property owner shall further agree to pay the prevailing fees, assessments and charges, to provide easements and rights of entry, and to abide by the use ordinance, especially regarding elimination of infiltration and inflow, and other requirements of the District. The review charge, for this phase of the work, is $200. (I presume your lawyer will draft the Agreement form.)

3. Lane County, in administering the DEQ onsite rules, shall cooperate with the District and keep the District abreast of applications, processing, and inspections. District personnel may, at their option, accompany the County in making site visits.

4. Septic tanks shall be located where future connection to the sewer is practical. The minimum slope of the building sewer shall be 2%, and the minimum slope of the service line shall be 0.4%. The septic tank shall preferably be buried between 6 and 12 inches, maximum 36 inches.

5. Only precast, reinforced concrete septic tanks shall be allowed. Steel, fiberglass, and polyethylene tanks are specifically prohibited unless written exception is given on a case by case basis.

6. A minimum 20 inch diameter riser shall be over the tank outlet, and an 8 inch diameter riser over the tank inlet. The larger riser cover shall fasten with tamper proof fasteners. The smaller riser cover shall fasten with spring-loaded cage nuts and screws to function as a sewer relief valve. The tops of the risers shall be a minimum of 3 inches above grade, with the ground surface sloping away for infiltration control. (A 20" riser, extending to grade is a DEQ requirement.)

7. The floor of the excavation for the septic tank shall be dewatered if necessary, imported rock base shall be placed if necessary, and compacted, to provide a solid, base for the tank that will not settle appreciably.

8. Inlet and outlet piping in the septic tank shall be joined to the building sewer and service line using Caulder or Fernco type neoprene couplings, intended to accept minor differential settlement between the tank and the piping.

9. A 4 inch diameter cleanout shall be provided on the building sewer, immediately adjacent to the tank, with the top a minimum of 3 inches above grade, with the ground surface sloping away for infiltration control.

10. A septic tank effluent filter shall be provided, supplied by the District, of the type that inserts within the standard 4" sanitary outlet tee (Zabel or Thorsby & Bowne).

11. Septic tanks complete with risers shall be guaranteed watertight for a 5-year period from date of installation. Workmanship on septic tank and building sewer installations shall be guaranteed for 1-year, specifically including correction of settlement.

# APPENDIX E

# TERMINOLOGY
# AND
# SMALL WASTEWATER SYSTEM ALTERNATIVES

## Terminology

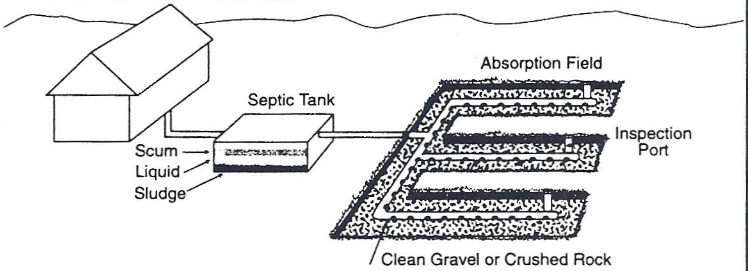
| | |
|---|---|
| BOD | Biochemical oxygen demand. This is the measurement of dissolved oxygen used in the oxidation of wastewater which is used in sizing wastewater treatment plants. |
| Ecology | A short term for the Washington State Department of Ecology. |
| Effluent | Wastewater flowing out from a wastewater treatment plant or septic tank. |
| Fecal Coliform | Any of several bacilli which are present in the digestive tract of warm blooded animals. The presence of fecal coliform in water is an indication of pollution from animal waste, human or non-human. |
| GWQS | Ground Water Quality Standards promulgated by the State of Washington which establish limits for pollutants in groundwater. |
| Influent | Wastewater flowing into a wastewater treatment plant or septic tank. |
| Interceptor Tank | This is the same as a septic tank, but is the terminology used when the tank is part of a STEP sewer system. |
| LOSS | Large On-site Sewer System. An on-site sewer system serving a large customer. Commonly a large septic tank with drainfield but may be other type of systems. |
| Nitrate | A chemical in municipal wastewater which is not commonly removed by wastewater treatment plants or septic tanks and drainfields. It is toxic to humans at high concentrations. |
| OSS | On-site Sewer System. Commonly referred to as a septic tank and drainfield. |
| SDVG | Small Diameter Variable Grade. An unconventional sewer system where each sewer service discharged to an interceptor tank and flows through a small diameter pipe by gravity. Also referred to as Variable Grade Sewer or VGS. |
| STEP | Septic Tank Effluent Pump. Used to define an unconventional sewer system where each sewer service is discharged to an interceptor tank and pump discharging to a pressure sewer system. |

| | |
|---|---|
| Suspended Solids | Insoluble solids that either float on the surface of, or are in suspension in wastewater. This is a measurement commonly used to assess the performance of wastewater treatment facilities. |
| SWHD | Southwest Washington Health District. The agency responsible for regulating the use of septic tanks for individual homes. |

# COMMON ONSITE SYSTEMS

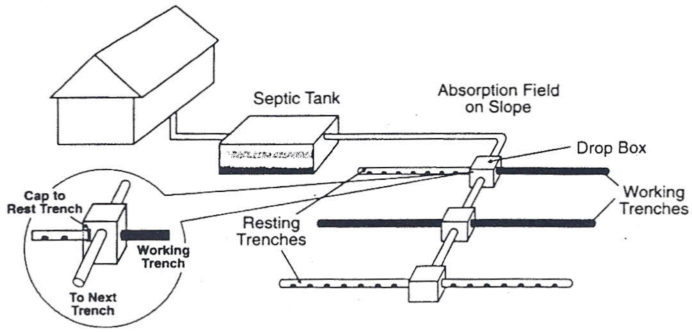
## 1 Septic Tank & Gravel Absorption Trench

This is the most common system used on level land with adequate soil depth above the water table. Heavy solids in the liquid settle and greases float to the top of the tank. Bacteria break down some solids. The liquid flows from the tank through a closed pipe into perforated pipe and into gravel-filled trenches where it seeps into the soil. Bacteria and oxygen purify the liquid as it slowly moves through the soil. Inspection ports permit checking liquid depth. Regular pumping of the tank reduces the solids discharged into the trenches and extends the life of the system. Using two compartment septic tanks and resting the trenches (#4) are also recommended to extend trench life.



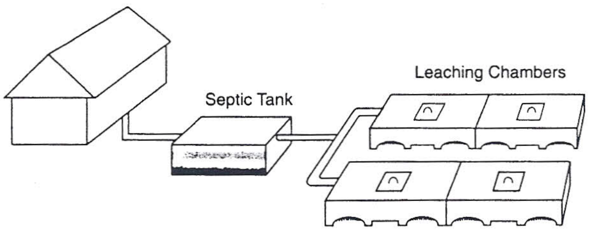

## 2 Septic Tank With Serial Distribution

Starting with the highest, each trench fills completely, then overflows through one drop box to the next. The effluent floods all soil surfaces. The drop box enables inspection of the system and control of discharge into each trench. Capping the pipe outlets in the upper trench forces resting. Serial distribution automatically loads upper trenches and minimizes the loading on lower trenches. Used on gently to steeply sloped sites.



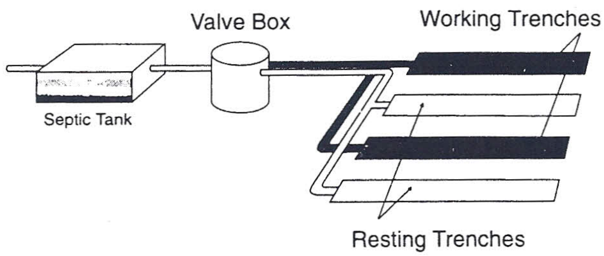

## 3 Septic Tank & Leaching Chambers

Open bottom concrete chambers or arched plastic chambers create an underground cavern that stores effluent. The effluent floods the soil surface prior to seeping vertically through the bottom of the chamber.



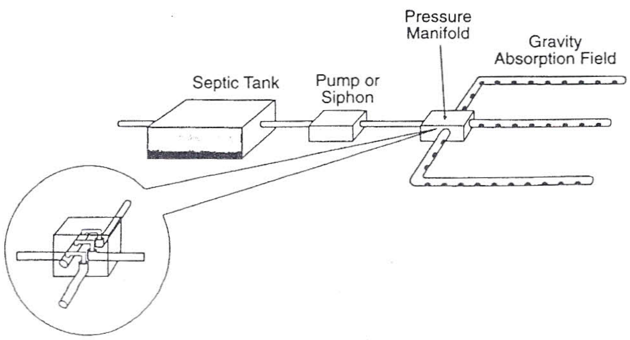

## 4 Septic Tank With Alternating Trenches

One set of trenches rests while the other treats the liquid from the septic tank. This design extends system life and provides a backup should one field clog. For system repairs, a new field and valve box may be added to the old system. The new field works while the old field rests and renews. Switch the fields annually in the summer.



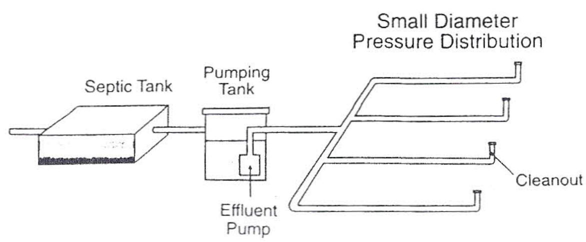

## 5 Pressure Dosed Distribution

A pump or siphon doses a pressure distribution manifold that disperses the effluent evenly to each trench. Dosing prolongs system life by flooding a larger area and by forcing the exchange of air in the soil. Dosed systems are more common for larger flows. The pressure manifold can include valves or plugs that permit more control over trench loading or trench resting. Annual inspection is suggested.



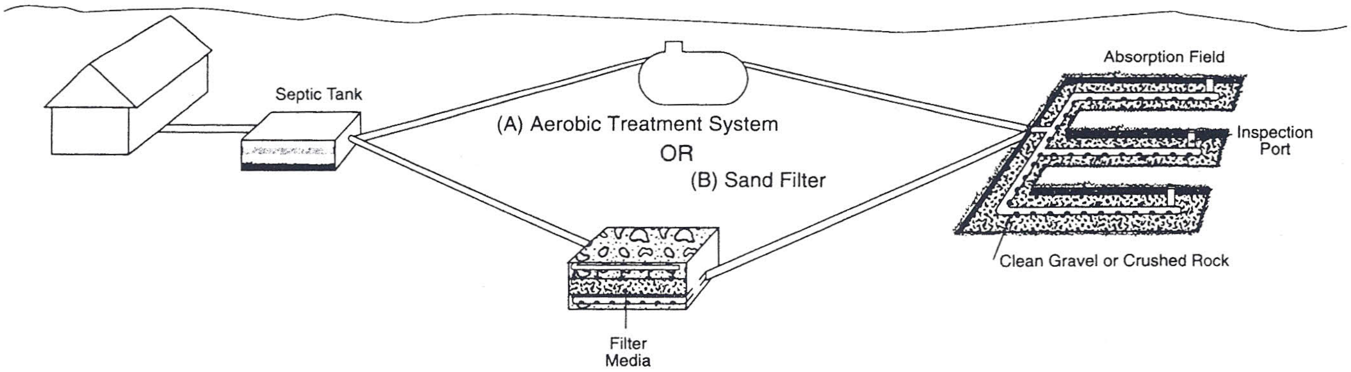

## 6 Shallow Trench Low-Pressure Pipe Distribution

Small diameter pipe, located at a more shallow depth than a conventional system, receives pumped effluent. Effluent moves under pressure through small holes in the pipe and soaks the entire trench network area. Even dosing of more open and aerobic soil horizons improves treatment. Used in areas with high groundwater or shallow soils (because it places the treatment higher in the soil profile) or on steep slopes that require hand excavation. Professional maintenance is needed to flush the lines annually.



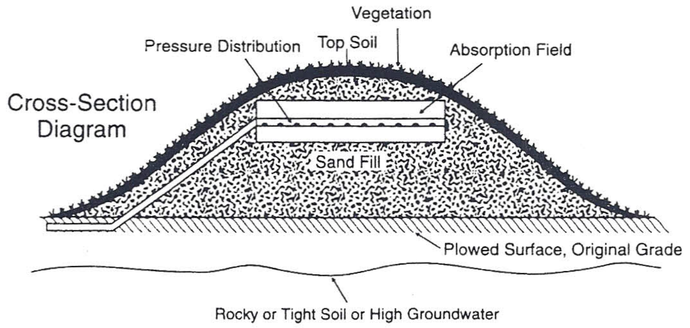
## 7 Pretreatment & Soil Absorption

Pretreatment addresses the need to treat higher strength waste (such as from restaurants) and can help repair biologically overloaded systems where no additional absorption area is available. Aerobic treatment systems and filters can be used for this purpose. For aerobic treatment (called "package plants"), wastewater and air mix in a tank. Bacteria grow in the tank and break down the waste. For filters, septic tank effluent passes over porous media that trap the solids. Bacteria that grow in the media break down the waste. Professional maintenance by certified operators and a lot of energy are required for aerobic systems.



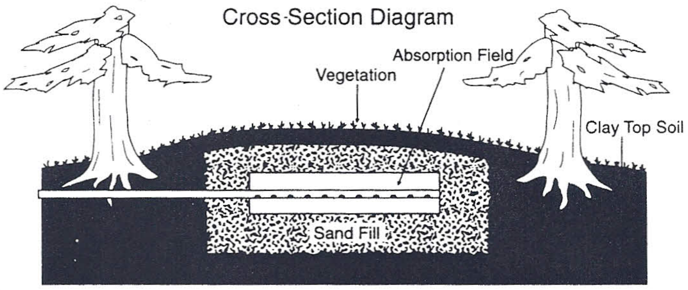

## 8 Septic Tank & Mound System

Pumps dose effluent (#6) into a gravel bed or trenches on top of a bed of sand. Sandy soil carefully placed above the plowed ground surface treats the effluent before it moves into the natural soil. The system extends onsite system use in areas with high groundwater, high bedrock, or tighter clay soils. Regular inspection of the pumps and controls and flushing of the distribution network are needed.



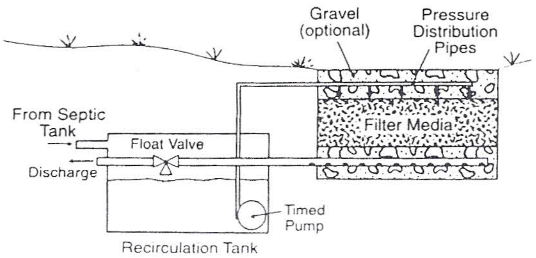

## 9 Evaporation & Absorption Bed

Effluent from a septic tank or aerobic tank flows into gravel trenches or chambers in a mound of sandy soil. Less permeable soil placed at the surface of the mound helps shed rain from the system. Trees that grow around the system and plants on top of the system pull liquid from the sand and transpire the water into the air. Some effluent may seep into the soil. This system requires a climate where evaporation consistently exceeds rainfall.



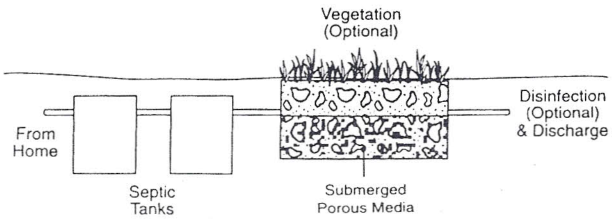

## 10 Septic Tank, Sand Filters, Disinfection & Discharge

Open or buried beds of sand may receive single or repeated applications of effluent. Effluent passes through the media and drains from the gravel and pipe network below the filter. Effluent may be discharged to the environment directly or into a soil absorption or land treatment system (#16). Disinfection often precedes discharge into a stream or land irrigation. Certain types of filters can significantly reduce nitrogen and may be used in areas where soil absorption is not possible. Requires inspection and periodic maintenance. Surface discharge requires management.




## 11 Constructed Wetlands

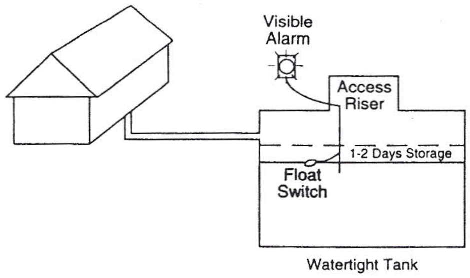
Effluent from a series of septic tanks passes through a bed of rocks planted with reeds. Liquid evaporates and drains into a soil absorption system or discharges. Used for additional treatment or where soils are not suitable for absorption. Discharge usually requires disinfection.



# OPTIONS FOR SPECIAL SITUATIONS

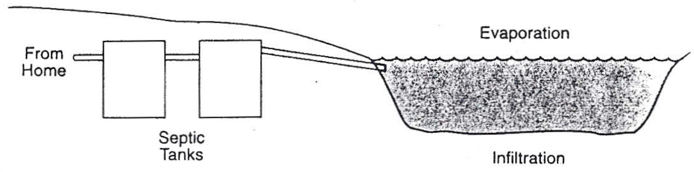
## 12 Holding Tank

Sewage flows from low-flush toilets and water-saving fixtures into a large watertight storage tank. The alarm in the tank signals the owner to have the sewage hauled away. Only recreational housing utilizes holding tanks because of the high hauling cost. Public management is frequently required. Contracting for hauling helps to reduce costs.




## 13 Lagoon

A series of septic tanks or other pretreatment systems (#7, #10, #11) discharge into a lagoon. Sunlight and long storage times support the natural breakdown of the waste and die off of harmful organisms. Effluent evaporates, slowly seeps into the soil, or receives further treatment through land application (#16). Onsite lagoons require large lots and may be fenced.




## 14 Waterless or Ultra Low-Flush Toilet System

**Composting Toilets:** No water
Serve commercial and single family units. Well-designed units produce a dry mixture that should be managed by professionals. Reduces discharge of nutrients into water resources. Electric vent, fan, and heating element common. Proper care is essential.

**Incinerating:** No water
Electricity, gas, or oil burns solids and evaporates the liquid, which is vented to the roof. Small amounts of ash are removed weekly. Proper care is essential. Limited to less frequent use sites, such as recreational cabins.

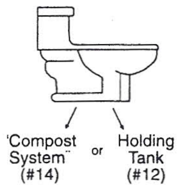
**Water Conservation Toilets:** Low water
Low-flush toilets use 1.6 gallons or less per flush. They generally cost slightly more than conventional units, but pay for themselves by lowering the water bill. They perform well. Many work as well as 4 gallons per flush models.

**Recycling Water:** Low water
Treated wastewater or graywater recycles to flush toilets. Treatment systems use electricity and require professional maintenance.

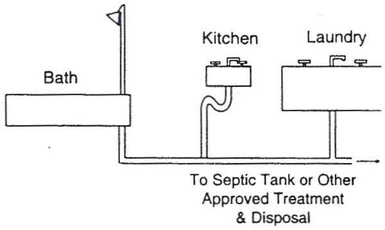
## 15 Dual Systems

Two systems treat the waste. Composting toilets or low-flush (1.6 gallons or less) toilets coupled with a holding tank (#14, #12) exclude nutrient rich toilet wastes (blackwater) from the wastewater disposal system. All other household wastewater (graywater) must be treated in an approved septic tank and absorption system, which is usually smaller.

(A) Blackwater (Toilet Wastes)



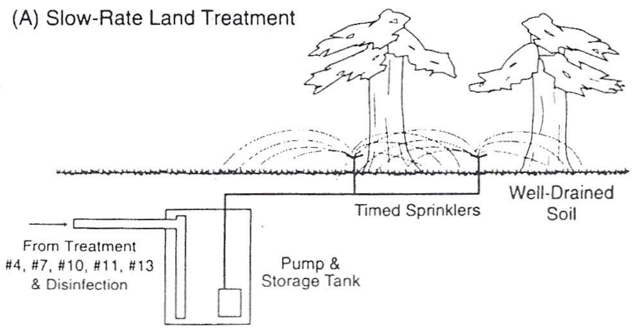

(B) Graywater
(Other Household Wastewater)



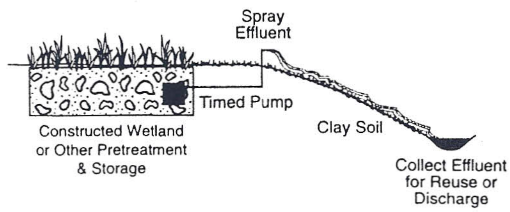

## 16 Land Application

Effluent from a septic tank is further treated (#7, #10, #11, #13) and stored. Timed sprinklers apply the effluent at night or below the soil surface to plants and trees in a large treatment area. Protects high groundwater in more permeable soils as plants take up nutrients and water. Disinfection and fencing may be required for individual home use. More common in warm climates, but not widely permitted by health authorities.

(A) Slow-Rate Land Treatment



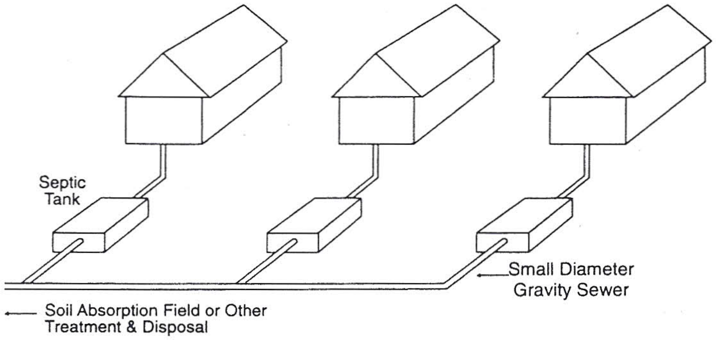

(B) Overland Flow




Treated effluent from a lagoon (#13) or wetland (#11) is sprayed on the surface of a gentle, grass covered slope. Effluent flows over the clay soil through the grass and collects at the base where it is disinfected before being discharged. Best for tight soils where absorption systems are not possible. A professional operator usually cares for the grass and disinfection system.

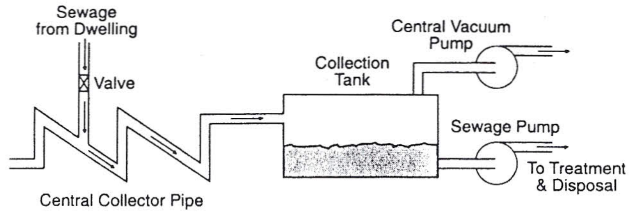
## 17 Small Diameter Gravity Sewers

Liquid from a septic tank flows under low pressure in 3-inch or larger collection pipes. Houses below the pipe must use small pumps (septic tank effluent pumps such as #19A and #20). Houses higher than the pipes may drain by gravity. Larger developments favor treatment by a discharging technology such as #10, #11, #13, or #16. Common in rural areas where the community treatment site is generally downhill. Central management is required.




## 18 Vacuum Sewers

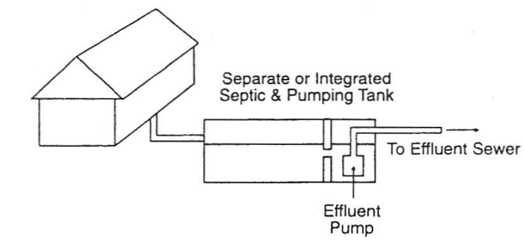
A vacuum station maintains a vacuum in the collection lines. When the sewage from one or several homes fills the storage pit, a valve opens, and the sewage and air rush into the collection line toward the vacuum station. Pumps in the vacuum station transfer the sewage to a treatment system. Power is required only at the vacuum station. Most economical where many homes are served or in areas with high excavation costs and lift stations. Requires a professional operator.



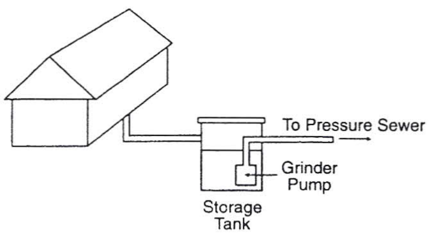

## 19 Pressure Sewers: Grinder Pump (GP) or Septic Tank Effluent Pump (STEP)

Sewage is first pretreated in a septic tank or grinder pump and then a pump forces the liquid through small diameter lines to a conventional gravity sewer or to a neighborhood treatment plant such as #10, #11, #13, or #16. The community usually owns and operates shared pumping units. Plastic lines located near the surface ease installation and reduce cost. Best for low-density or slow-growth areas or where conventional sewers are costly. Central management is required.

(A) Septic Tank Effluent Pumping System




(B) Grinder Pump System




## 20 Alternative Effluent Collection System

Liquid from most onsite septic tanks flows by gravity in small diameter effluent lines (#17) to a small neighborhood pump station on public property. A few homes below the sewer may also use small effluent pumps. The neighborhood lift station stores the liquid then pumps it into a higher pressure sewer going to a treatment system. This design can cut costs in flat terrain or where one pump unit can easily serve a number of homes. Central management is required.