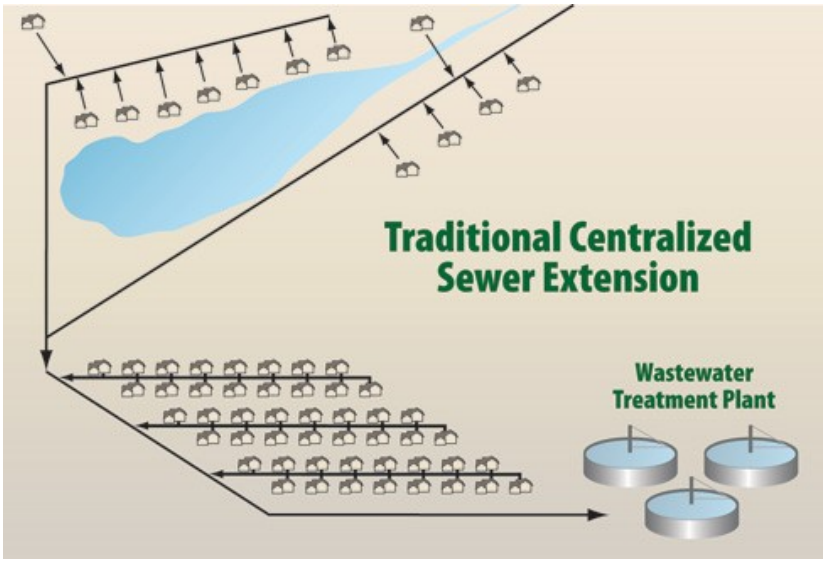
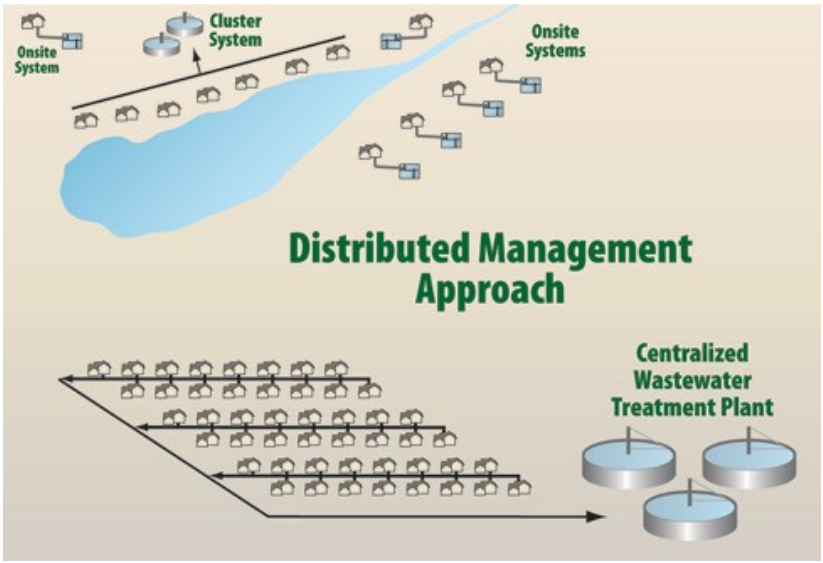
October 2016

Decentralized Wastewater Treatment System Planning

Options Evaluation Methodology
Disposal Solutions Scenarios
Management Model Guidelines





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1.0 EXECUTIVE SUMMARY

This handbook is intended as an introduction to cluster systems, and also provides basic tools for the reader to perform some preliminary planning. The tools are intended to assists the reader in developing a general understanding of their environment, regulatory requirements, and costs required for a cluster system; however, these tools are not intended to replace field investigations, and a certified professional must be consulted should the reader conclude that a cluster system may be a viable option to pursue.

Cluster systems are generally small community sewage treatment systems that serve from two to several hundred customers. In rural communities cluster systems are generally much more cost effective than sewage treatment plants, and offer some strong benefits to individual septic systems. Cluster systems are more common in states located on the country's east coast, mid-west, and southern states were wastewater regulations have been less stringent than California's. However, recent changes in California's regulatory requirements now make cluster systems economically feasible.

The State of California's Regional Water Quality Control Board (RWQCB) regulates sewage treatment facilities, and the regulations are in the process of changing making it easier and more cost effective to install cluster systems provided certain standards are followed. For example, the State has recently allowed counties that have prepare Local Area Management Plans (LAMP) to regulate most of their local wastewater systems provided that they treat less than 10,000 gallons per day of sewage. Additionally, for small treatment systems, the State is willing to waive, under certain conditions, the requirement that a State certified wastewater treatment operator operate and maintain small treatment plants. Certified wastewater treatment operators are hard to find, and command very high wages. By waving this requirement the cost of maintaining and operating cluster systems is likely to be reasonable.

The most important factor to consider with regards to a cluster system is its management. Experience indicates that without proper management a cluster system will not function proper properly, and is likely to eventually fail. To assist communities the Environmental Protection Agency (EPA) has devoted two manual describing cluster system management options, and the reader is encourages to read them.

The manual focuses on small and medium sized cluster systems that serve from four up to one-hundred residences. Larger cluster systems are possible; however, the reader should consult a professional from the onset when considering a larger system.

In addition to being an introduction to cluster systems, this manual presents three explorations evaluating the possibility of installing systems in the Hoopa Valley, California. The sites were selected as examples because of high coliform counts recorded in local steams which are a likely sign of upstream septic system failures. Additionally each has a different sizing requirement ranging from 4 to 82 connections. In each instance the tools presented in this manual are used, and the results shown to give the reader an understanding of how perform each step, as well as develop a general understanding of the findings.

2.0 INTRODUCTION

Tribes and rural communities in California face a difficult challenge with regards to wastewater management. Many of the residences, schools, and businesses in rural areas rely on septic tanks and leach fields that are currently failing. Many rural communities need to upgrade or replace their wastewater treatment systems but find that running extensive sewer lines and building a single, centralized treatment facility is cost prohibitive and generally doesn't make sense on remote lands where populations are dispersed. Rural communities and Tribes need to re-evaluate their options for providing wastewater treatment service to better meet their wastewater treatment goals and protect human health and the environment.

While the federal government made a significant investment in the development of wastewater treatment facilities in the 1970s and 80s, it primarily funded the construction of publicly owned treatment plants in urban centers. However, significant wastewater challenges remain in many small rural communities.

According to the US Environmental Protection Agency (EPA), approximately 50% of septic systems across the US fail due to incorrect design, poor construction, and inadequate maintenance — especially septic systems installed more than 30 years ago before onsite rules were developed or enforced. State agencies report that failing onsite systems are the third most common source of groundwater contamination. In addition, State design standards did not apply in Tribal lands so construction practices included redwood tanks and cesspools.

Fortunately, new technology has resulted in "onsite" and "decentralized" wastewater treatment systems that represent a viable, long-term alternative to centralized wastewater treatment in terms of environmental and public health protection. However, decentralized wastewater treatment systems require more monitoring and maintenance than sewer systems and *must* be operated under a management program to ensure that they function properly. A management program should include planning, siting, design, installation, operation, maintenance, and monitoring. The primary causes of system failure are improper maintenance (frequently because homeowners are unaware of maintenance requirements) and a lack of homeowner accountability for system performance and installation. Therefore the management program must be based on regular inspection and maintenance and give the regulating entity enough authority to ensure failing systems are repaired or replaced (Currently, EPA maintains regulatory authority on Indian lands unless that authority has been delegated to a Tribe).

Because a decentralized approach may include some use of centralized treatment, conventional septic systems, cluster systems, and alternative treatment technologies (wetlands, recirculating sand filters, mound systems, ozone disinfection systems), the system must be managed *with varying degrees of control* to ensure that each component functions properly.

2.1 What is a Cluster System?

A wastewater cluster system is a cooperative wastewater treatment organization that serves a group of homes, businesses, or a combination thereof. They differ from wastewater treatment systems in that they are smaller, use smaller diameter pipe to collect the sewage, will probably not include manholes, and are usually located in rural areas. The communal treatment systems can be a collective septic treatment

system or a small wastewater treatment system. The systems are supervised by a management team to collect fees, and oversee maintenance and operation of the system.

Figure 1: Typical Residential Setup to a Cluster System *(Photo credit: Credit South Blount County Utility District)*

Figure 1 shows a typical cluster system setup consisting of a pipe from the residence, a septic tank, a small, usually one to two inch diameter pipe connecting to a slightly larger three to four inch diameter communal pipe. The communal pipe directs the sewage to a common treatment system then to a drainage field.

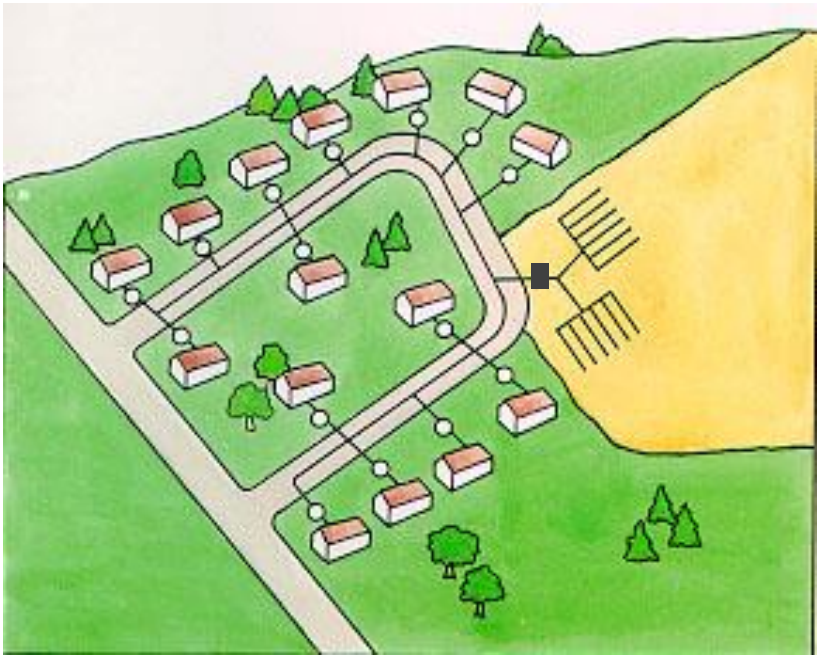


Figure 2: Cluster System *(Photo credit: Courtesy of the Center for Disease Control)*

Figure 2 show a larger view of a cluster system with individual pipes, the circles represent the septic tanks, the square is a treatment system and the forks are the drain field. A communal septic system would not have the treatment system (square) and the area of the drain field would be four to five times larger. The primary requirement of a cluster system is that is must disperse the treated wastewater through a drain field. A drain field is a series of perforated underground pipes that disperse the water in a manner that is unperceivable to the observer above ground.

Key Components of a Cluster System

- A septic tank to remove solids
- Small diameter pipe – two to three inches to convey the sewage to the treatment system
- A system to treat the wastewater and render it benign
- A subsurface drain field with which to disperse the treated water[1]

2.2 Why Consider a Cluster System?

Cluster systems can cost more to install and operate than septic systems; however there are several advantages to installing them. A home connected to a cluster system may have its property value increased because the homeowner does not have to maintain the septic system, will likely have more usable land available because there will be not septic field on their property, if the homeowner is on a well there is less chance sewage will pollute their water, are unlikely to have sewage seep to the land surface, and will protect the environment.

Cluster systems are generally less expensive to install and operate than a large sewage treatment system. However, they can be more expensive to install and operate when compared to a septic system. Cluster systems are common on the East Coast were sewage regulatory requirement are less stringent than in California, and are therefore easier and less expensive to install and operate.

2.3 Cluster System Advantages and Disadvantages

2.3.1 Costs

Cluster systems are generally less expensive to install and operate when compare to the sewer treatment plants. The sewer collections system does not require large pipes and manholes to convey the sewage to a treatment facility, and is easier to repair and maintain. The result is a significant savings in installation and operation costs.

[1] Note the emphasis on subsurface. A surface discharge will require a National Pollution Discharge Elimination System permit, which In turn will require a licensed wastewater treatment operator. Both the permit and operator requirements will significantly raise costs.

2.3.2 Land Use

If a treatment system is installed as a component of the system, as opposed to a communal septic system, a significant area of residential land is then made available to the homeowner to utilize. The treatment system occupies a small area, and the drain field usually requires fifty to eighty percent less land area when compared to a septic leach field. This can result in increased property values.

2.3.3 Maintenance

Cluster systems require a trained technician to maintain and operate them; however, it is not a highly skilled position, and labor costs can be significantly less when compared to the labor costs to operate and maintain a regular treatment plant. Often a local handyman with a little training can operate and maintain the system.

Although the costs of maintaining the system are higher than those associated with a standalone septic system, the maintenance responsibilities are transferred from the homeowner to the entity administering the system. The results should a more dependable treatment system.

2.3.4 Health Benefits

Because the wastewater is treated, the quality of the wastewater effluent should not be a significant health concern. Additionally, treating the water benefits the environment by protecting streams and waterways from pollution.

2.3.5 Disadvantages of Cluster Systems

The primary disadvantage of a cluster system is the amount of maintenance required to keep them operating properly. The primary component of a cluster system is that each connection has a septic tank that collects waste, and it must be supervised. Additionally, the treatment system requires occasional tests to verify the system is operating properly, and weekly checks to review the system's mechanical components. Another disadvantage is that these systems are in rural areas and maintenance personnel may be required to travel long distances to oversee the system which adds to the costs. Also the fewer the number of users connected to the cluster system, the higher the operation and maintenance cost share per user. Finally a serious mechanical failure in the system can result in improperly treated sewage discharges while new parts are being obtained, and some isolated areas that experience long power outages will be required to install a backup generator.

2.4 Cluster System Treatment

Cluster Systems can treat wastewater with a variety of methods. All cluster systems are similar in that they have a treatment system or method to process the sewage. The first step in the treatment process is the septic tank which removes solid waste that is difficult to treat, and allows the liquid wastewater to continue to the biological treatment system. The biological treatment system can be a communal septic or a aerated treatment system. See the chapter on septic system for an understanding of that process. Other treatment processes generally have several things in common: a collection of microorganisms, an air supply to assist the microorganisms in digesting the waste, a method of maintaining the microbial populations, the ability to keep the wastewater in contact with the microorganisms for a set length of time, and the ability to decant the treated water to a drain field.

A broad description of the different types of treatment systems is provided below:

Septic Field

Septic field takes the effluent from the septic tank and distributes the liquid evenly into the septic field through multiple perforated pipes that drains into the soil. Microbes consisting, of bacteria and protozoa that live in the soil, breakdown most of the wastewater into carbon dioxide and water. This renders the wastewater relatively benign.

Activate Sludge

Activated sludge systems consist of an aerated chamber where air (oxygen) is bubbles through the wastewater. The microbial masses that breakdown the wastewater float in the wastewater, and are stirred by air the bubbles. The treated wastewater, with some of the microbial masses, then flows to a settling tank with little circulation where the microbes settle to the bottom, and the microbe free water is decanted off the top. The microbes are pumped from the bottom of the tank back to the aeration chamber, and the treated water then sent to a drain field. Care must be taken not to place too many microbes in the aeration basin, and tests are required to verify that the system is running properly. Surplus organisms are removed from the system and disposed of. The treated wastewater decanted of the top of the settling tank is then sent to a drain field to slowly return to the environment.

Activated sludge systems are complicated to operate and are not generally recommended for a cluster system, especially for a small system with one hundred connections or less. Discussions with the Regional Water Quality Control Board (RWQCB) has indicated that an activated sludge treatment system would likely require a State certified operator to operate the system which would add significantly to operational costs.

Fixed Film

Fixed film systems have an aeration chamber, with air bubbles diffusing through it; however, surfaces such as rocks or plastic media have been added to the system for the microbes to adhere to. Most of the microbes remain in the chamber attached to the media, and there is no need to recycle them. Because a media has been added to the chamber, a slightly larger chamber is required as compared to an activated sludge system. Additionally some microbes detach from the media, and the treated water is still sent to a settling tank; however, the microbes are not recycled, and are allowed to pass through to the drainage field. The treated effluent from the settling tank is then sent to a drain field do be slowly returned to the environment.

Both activated sludge and fixed film systems can be purchased as small pre-fabricated systems from manufacturers. The advantage of buying a package plant is that the manufacturers then provide training and support for their systems. For small communities, initial training and outside support is critically important, particularly because there is likely to be turnover in maintenance personnel, and each successor will need to be trained.

3.0 SEPTIC SYSTEMS

Septic systems are discussed in this section because they can be part of a cluster system, and because cluster systems can replace septic systems. According to the EPA, 23 percent of American homes rely on septic systems to treat and dispose of household wastewater. Almost all of these systems are maintained by home owners who rarely understand that the system requires maintenance to function properly.

3.1 Operation

There are two main components of a septic system. The first is the septic tank which is a watertight container typically made of fiberglass or reinforced concrete, and can contain one or two compartments depending on the tank design. The second component is a field for the treatment and discharge of the wastewater, referred to as a disposal or septic field. Here, microorganisms living in the soil feed on the wastewater for energy and release benign byproducts such as of carbon dioxide and water.

Figure 1 (below) shows the details of a typical septic system. Starting at the residence, raw wastewater is transported through a main drainage pipe (Figure 1, 1), and then into the septic tank (Figure 1, 2).

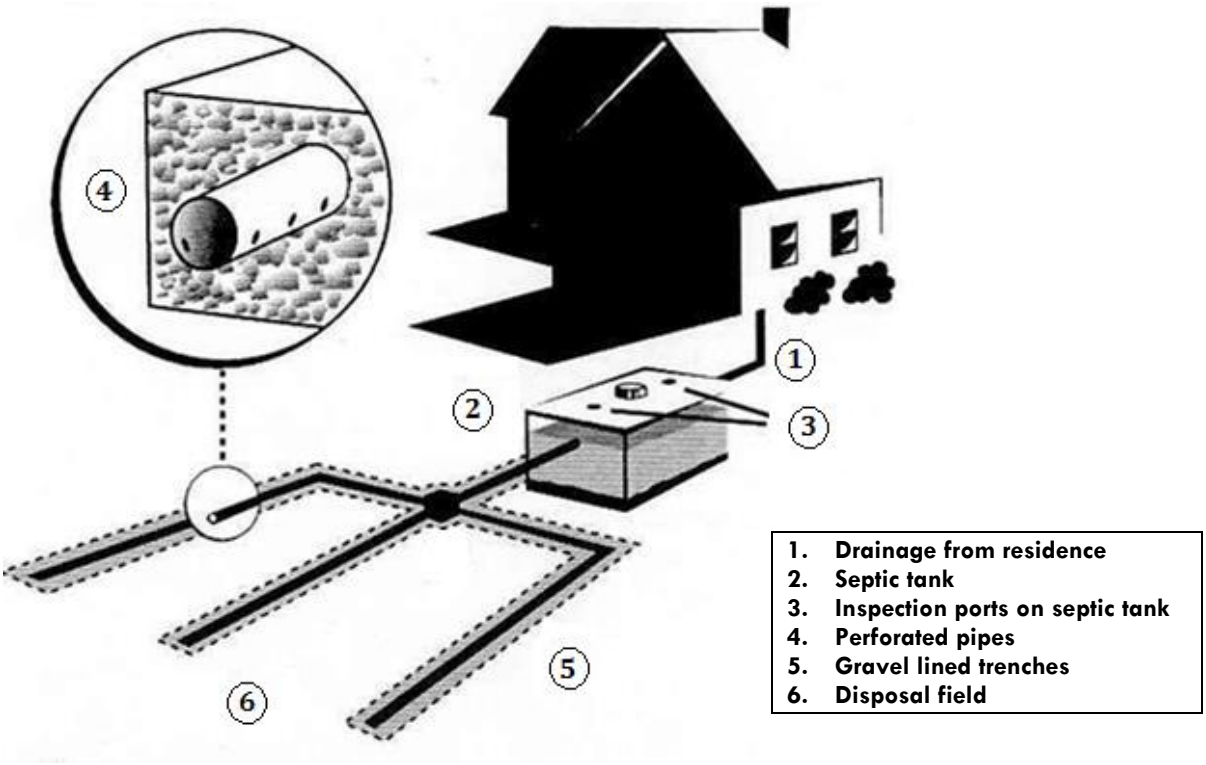


Figure 3: Example of Typical Septic System *(Adapted from Humboldt County Department of Health and Human Services, 2013)*

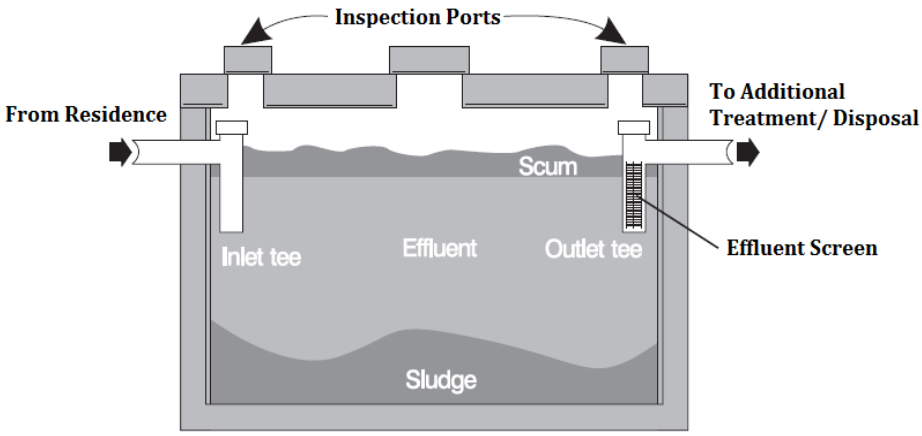


Figure 4: Example of single compartment septic tank *(Adapted from Onsite Wastewater Treatment Systems Manual, 2002).*

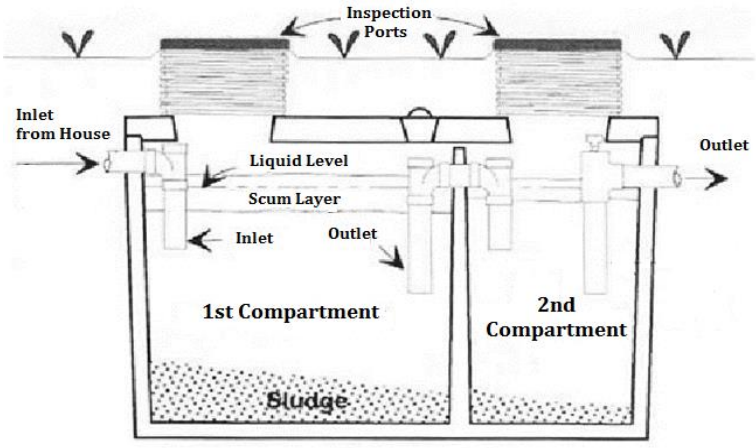


Figure 5. Example of two-compartment septic tank *(Adapted from Humboldt County Department of Health and Human Services, 2013).*

The tank serves as a collection point where the flow of wastewater is balanced though inlet and outlet. Balancing the input and output of water allows the wastewater to separate into three layers. Heavier solids, called sludge, settle to the bottom of the tank where it is partially decomposed by bacteria. The lighter contaminates float on the top of the water, and are called scum. Scum includes substances such as grease, wax and oil. The middle layer of wastewater is referred to as effluent, and is ready for treatment once the solids and scum have been separated out. Both the sludge and scum remain in the tank resulting in buildup that can clog the tank if not removed, or, if allowed to over accumulate in the tank, can flow past the septic tank, and clog the septic field. Pumping is usually required every 3-4 years through inspection ports (Figure 1, Item 3) in order to maintain proper operation and extended life of the system.

Effluent can then travel through the outlets. The outlet may have a screen to catch any remaining solids that have failed to separate out of the effluent. The outlet screen requires regular maintenance to prevent clogging, and consequently some owners choose not to install screens in their tanks. However, solids

allowed to pass into the disposal field may clog the septic field resulting in malfunctions and improper treatment of the effluent.

Perforated pipes (Figure 1, 4), are evenly spaced, and are often placed in gravel lined trenches (Figure 1, 5), to allow the effluent to slowly and evenly discharge into the surrounding gravel. The effluent is stored within the gravel until it can be absorbed into the soil in the disposal field (Figure 1, 6). The disposal field is an unsaturated, shallow area of soil where the majority of the water treatment occurs. This trench system allows for the wide dispersal of effluent. The effluent percolates down through the soil which treats the effluent through chemical, physical and biological processes. This process does require oxygen and the septic field must not be covered to prevent air from entering the ground. Next the treated water is then free to discharge into the surrounding soil.

3.2 Requirements

Typically, the size of a septic tank is dependent upon the amount of wastewater generated. Large amounts of generated wastewater require a larger septic tank and disposal field. The size of the disposal field is also dependent upon soil type. Disposal fields have a specific set of requirements to ensure proper treatment and drainage of water. Regulations for septic systems vary from county to county and state to state. Please contact your local consulting firm for further information regarding septic tank installment or a general assessment of septic stability.

3.3 Maintenance

Maintenance is vital to the longevity and performance of a septic system. All maintenance costs are the responsibility of the owner; although, the owner can hire a professional to oversee and maintain their system. The tank requires pumping every 3 to 4 years to remove the buildup of sludge and scum. Frequent pumping will prevent the system from clogging and backing wastewater into the residence. Conserving water will keep the system from being overloaded which will extend the life of the system. The majority of system failures are due to lack of maintenance or improper use, and owners typically do not act until the system has already failed. Septic systems are more expensive to replace than to maintain.

3.4 Septic System Failures

Septic systems are a balance of chemical and biological process which can be disturbed or destroyed by improper operations such as:

- Excessive use fats, oils and grease have the potential to clog the system. Items include substances such as cooking oil and bacon grease.
- Excessive use of a garbage disposal. Adding unnecessary solids to the system will increase the accumulation rate of the sludge resulting in more frequent pumping. In addition, too many solids may overload the system possible resulting in failure. Garbage disposals systems should be discouraged in homes with septic systems.
- Use of harmful chemicals such as drain cleaner. Caustic chemicals can kill the helpful bacteria that treat wastewater.
- Trash the system cannot handle such as diapers, hair or plastics which may cause a blockage within the system possible resulting in the backing up of sewage into the residence or onto the ground.

- Excessive water in the drainage field will prohibit the disposal field from properly absorbing and treating the effluent resulting in the possible degradation of groundwater or surface waters.
- Lack of maintenance. Septic systems need the sludge and scum pumped from the septic tank every 3-5 years. Lack of pumping could result solids entering the septic field and clogging it.
- Damage to the disposal field via land use. Planting anything other than grass on the absorption field may result in root damage to the system. Placing additional weight on the system, such as driving vehicles or paving it over could crush the pipes or smother system resulting in improper treatment.
- Age of the system is important. Septic systems are designed to last for a finite amount of time and will eventually need replacement.

Signs of system failure include: wastewater backing up into residence, a strong odor around the septic tank and/or drainage field or standing water near the drainage field (Figure 4.)

Figure 6: Effluent visible at ground surface *(Lee and Wood, 2016).*

Unfortunately most septic systems fail by bypassing the septic field and discharging partially or untreated wastewater into the environment. Septic systems that fail in this manner are often unperceived by the homeowner and consequently not repaired. The cluster system examples described later in this handbook are to replace systems that have failed in this manner.

3.5 Environmental Impact of Septic System Failures

The purpose of the septic system is to treat wastewater containing bacteria, diseases and high concentrations of nutrients in order for the treated water to be released to surrounding soil without causing contamination. If the system is not functioning properly, contaminated wastewater can move into the soil and possibly into surface water or groundwater spreading the contamination throughout the water table

and degrading available water sources. Areas with domestic wells are at risk from contaminated groundwater.

4.0 REGULATIONS

As previously stated cluster systems are relatively more common on the east coast and Midwest, but not common in California. This is primarily because, until recently, they were regulated under the local Regional Water Quality Control Board (RWQCB) which required State of California operator certificated to maintain and operate the wastewater treatment systems. Licensed operator are difficult to find, and expensive to hire. Another impediment is finding a licensed operator willing to travel to remote urban areas. Tribes may be required by the Indian Health Services or local Environmental Protection Agency (EPA) to have licensed operators maintaining their systems; however, Federal licenses are much easier to obtain than State of California licenses, but, in California are not valid outside of Tribal lands.

In California the regulations regarding wastewater are changing. The State is allowing Counties to regulate small residential wastewater treatment systems, and this will facilitate their operations and should reduce costs. County which implement a State approved Local Area Management Plan (LAMP) will be permitted to regulate water treatment systems that treat less than 10,000 gallons per day[2]. In the North Coast region Sonoma and Humboldt Counties have submitted draft LAMPs to the State for approval, and it is likely other counties will follow.

The regulations regarding cluster systems will probably vary slightly between Counties. However, their staffing requirements will be much less stringent than the RWQCB's requirements. This does not mean that the treatment water standards will be lowered, the quality of discharge from a cluster system is expected to remain the same.

Tribes are regulated by Indian Health Services and the EPA, and should contact their local representative to determine what regulations will be required by those agencies.

4.1 Nitrates and Phosphates

Nitrates and phosphates are found in wastewater, and are considered undesired constituents in wastewater. They are a concern because their presence often results in the formation of algae in waterways. Algae are beneficial to the environment during the day when they produce oxygen; however, at night they consume oxygen which can result in fish and other organisms suffocating. Additionally, algae can block out sunlight, and prevent photosynthesis in plants. Nitrates can accumulate in groundwater, which, in high concentrations, can result in 'Blue baby' syndrome, a condition whereby nitrates interfere with a baby's hemoglobin's oxygen carrying capacity which can result in death. Therefore, there are circumstances under which a County or the RWQCB may require that a cluster system reduce nitrate and/or phosphate levels in their wastewater effluent.

[2] Industrial and large commercial operations may not be covered under the LAMP program at the discretion of the RWQCB.

Removing nitrates from wastewater will result in higher installation and operational costs, an regulators may require that a State certified operator run the system which will significantly increase costs. When considering a cluster system the reader should determine if their site is located near a groundwater aquifer, and if most of the local community uses wells as their primary source of water. Septic systems are generally poor at removing nitrates and phosphates, and, if wells are the primary source of drinking water in a community, and it is showing signs of nitrate contamination, it would be wise for a community to consider installing a cluster system to reduce the levels of nitrate released into the environment.

Nitrate and Phosphate removal are well beyond the scope of this manual. Some basic tools are included to investigate if there may be a potential problem with these contaminants; however, the reader is encouraged to call their local RWQCB to obtain additional information on possible nitrate and phosphate removal. Currently it appears that most areas considering cluster systems will not be required to treat for nitrates and or phosphate. Additionally, if it appears that nitrate and phosphate removal will be required then a licensed professional or a manufacturer should be consulted to determine the treatment needs for the system.

The determining factor will be the amount of possible damage to the sensitive wildlife or to the local groundwater aquifer.

Readers regulated by the State of California are encouraged to contact the local RWQCB and local County Health Departments to determine what regulations will be required when installing a cluster system. Tribes are regulated by Indian Health Services and the EPA, and should contact their local representative to determine what regulations will be required by those agencies.

5.0 ADMINISTRATIVE MODELS

5.1 Management Guidelines

As previously described, decentralized wastewater treatment systems require more monitoring and maintenance than do centralized systems, and *must* be operated under a management program to ensure they function properly. The benefits of an adequate management program include protection of water quality and public health, protection of investment in home or business ownership, increased onsite service life of the cluster system, and long term savings in replacement costs.

The management program should include planning, sighting, design, installation, operation, maintenance, and monitoring. The primary causes of system failure are improper maintenance (frequently because homeowners are unaware of maintenance requirements) and a lack of homeowner accountability for system performance and installation. Therefore the management program must be based on regular inspection and maintenance, and give the regulating entity enough authority to ensure failing systems are repaired or replaced. Currently, EPA maintains regulatory authority on Indian lands unless that authority has been delegated to a Tribe. Either the EPA or Counties have regulatory authority large wastewater treatment systems on non-tribal lands.

The EPA has developed five "management models" for decentralized wastewater systems (cluster systems)[3]. The management models are intended to be used after a decision to implement a decentralized approach has been made. In general, the models can be distinguished from one another based on the level of environmental protection and level of oversight required. However, each addresses the following elements:

- System performance requirements (protection of human health and the environment);
- System management to fulfill specific and measurable performance requirements;
- Compliance monitoring and enforcement to ensure adequate system performance;
- Guidelines for all aspects of siting, design, construction, and operation;
- Education for all service providers, regulators, planners, and owners;
- Certification/licensing (fi required) for service providers and regulators
- Program reviews to resolve shortcomings and resolve problems.

The guidelines for each management model includes a 14-element program designed to protect and sustain public health and water quality through the use of appropriate policies and administrative procedures that define and integrate the roles and responsibilities of the regulatory authority, system owner, service providers, and management entity (when applicable) to ensure that onsite and clustered wastewater treatment systems are appropriately managed throughout their life cycle. The program elements include:

1. Public education and participation;
2. Planning;

[3] Voluntary National Guidelines for Management of Onsite and Clustered (Decentralize) Wastewater Treatment Systems.

3. Performance;
4. Training and certification/licensing;
5. Site evaluation;
6. Design;
7. Construction;
8. Operation and maintenance;
9. Residuals management;
10. Compliance inspections/monitoring;
11. Corrective actions;
12. Record-keeping,
13. Inventory, and reporting; and
14. Financial assistance and funding.

Therefore, a management program involves, in varying degrees, regulatory and elected official, developers and builders, soil and site evaluators, engineers and designers, contractors and installers, manufacturers, pumpers and haulers, inspectors, management entities, and property owners. Establishing the distinct roles and responsibilities of the partners involved is very important to ensuring proper system management.

If effectively implemented, a management program should complement other requirements and programs (including water quality and storm water management, National Pollutant Discharge Elimination System (NPDES), biosolids and residuals management, source water assessment and protection, and coastal zone management) and can be integrated into a comprehensive watershed approach.

Management services should be provided by properly trained and certified personnel and tracked through a comprehensive management information system.

5.2 EPA Management Models for Decentralized Wastewater Systems

The selection of a management model should be based on site-specific environmental sensitivity, public health risks, the complexities of the wastewater treatment technologies that might or should be implemented, and the size or density of development.

EPA understands that a management model must be tailored to suit the needs of the community and receiving watershed and/or aquifer. Although each management model stands alone, the models are intended only to be guides in developing an appropriate management program. Activities shown in the program elements from one management model may be incorporated into another model to reflect the prevailing circumstances and enhance the effectiveness of the programs in achieving the desired outcomes. However, substituting activities from higher levels into lower-level management programs should be carefully considered because of the interdependence of many activities on overall program capabilities. It is also possible to implement more than one management model, as appropriate.

The Management models described below reflect an increasing need for more comprehensive management as the sensitivity of the environment or the degree of technological complexity increases. The intensity of the management program required (to achieve water quality and public health goals)

increases progressively from one management model to the next as the potential risks to public health and water resources, complexity of the treatment system employed, and the level of oversight required, increases. State another way, the management requirements of wastewater systems become more rigorous as the system technologies become more complex or as the sensitivity of the environment increases.

The management models provide a benchmark for a state, tribal, or local unit of government to:

1) Select appropriate management objectives to meet wastewater treatment needs
2) Evaluate the strengths and weaknesses of an existing program in achieving desired objectives
3) Design a management program and activities needed to meet unique local objectives
4) Develop a plan for implementing the management program.

Model 1—The Homeowner Awareness Model

This model establishes a minimum level of management and specifies appropriate management practices where treatment systems are owned and operated by individual property owners in areas of low environmental sensitivity, i.e., no restricting site or soil conditions such as shallow water tables or drinking water wells within locally determined horizontal setback distances. This model is applicable where treatment technologies are limited to conventional systems, which are passive and robust treatment systems that can provide acceptable treatment under suitable site conditions despite a lack of attention by the owner. Failures that might occur and continue undetected will pose a relatively low level of risk to public health and water resources. The objectives of this management model are to ensure that all systems are sited, designed, and constructed in compliance with sound, prevailing rules; all systems are documented and inventoried by the regulatory authority; and system owners are informed of the maintenance needs of their systems through timely reminders. The model is intended to provide an accurate record of the types and location of installed systems, to raise homeowners' awareness of basic system maintenance requirements, and to better ensure that the homeowners attend to those deficiencies that overtly threaten public health. This model, like all management programs described in this guidance, suggests the use of only trained and licensed/certified service providers. This model is a starting point for enhancing management programs because it provides communities with a good database of systems and their application for determining whether increased management practices are necessary.

Model 2—The Maintenance Contract Model

Recommended model where more complex system designs are employed to enhance the capacity of conventional systems to accept and treat wastewater or where small clusters are used. For example, pretreating wastewater to remove non-biodegradable materials and particulate matter that typically pass through a septic tank may enhance subsurface infiltration system performance on marginally suitable sites (sites with limited area, slowly permeable soils, or shallow water tables). However, such pretreatment units can have mechanical components and sensitive treatment processes, which require routine observation and maintenance if they are to perform satisfactorily. Maintenance of these more complex systems is critical to sustaining acceptable protection in these areas of greater environmental sensitivity. Therefore, these systems should be allowed only where trained operators are under contract to perform timely operation and maintenance. The objectives of this model build on

the Homeowner Awareness Model by ensuring that property owners maintain maintenance contracts with trained operators.

Model 3—The Operating Permit Model

Recommended model where sustained performance of onsite wastewater treatment systems is critical to protect public health and water quality. Examples of locations where this program might be appropriate include areas adjacent to estuaries or lakes where excessive nutrient concentrations may be a concern or situations where a source water assessment has identified onsite systems as potential threats to drinking water supplies. EPA strongly recommends that this be the minimum model used where large-capacity systems or systems treating high-strength wastewaters are present. EPA has determined not to regulate large-capacity onsite systems under the Underground Injection Control program at this time based on the belief that implementation of these Management Guidelines can ensure adequate protection of public health and the environment.(10) A principal objective of this management program is to ensure that the onsite wastewater treatment systems continuously meet their performance criteria. Limited-term operating permits are issued to the property owner and are renewable for another term if the owner demonstrates that the system is in compliance with the terms and conditions of the permit. In subareas where it is appropriate to use conventional onsite system designs, the operating permit may contain only a requirement that routine maintenance be performed in a timely manner and the condition of the system be inspected periodically. With complex systems, the treatment process will require more frequent inspections and adjustments, so process monitoring may be required. An advantage to implementing the program elements and activities of this management program is that the design of treatment systems is based on performance criteria that are less dependent on site characteristics and conditions. Therefore, systems can be used safely in more sensitive environments if their performance meets those requirements reliably and consistently. The operating permit provides a mechanism for continuous oversight of system performance and negotiating timely corrective actions or levying penalties if compliance with the permit is not maintained. To comply with these performance standards, the property owner should be encouraged to hire a licensed maintenance provider or operator.

Model 4—The Responsible Management Entity (RME) Operator and Maintenance Model

EPA recommends Model 4 when large numbers of onsite and clustered systems must meet specific water quality requirements because the sensitivity of the environment is high, e.g., wellhead protection areas or shellfish waters. Frequent and highly reliable operation and maintenance is required to ensure water resource protection. Issuing the operating permit to an RME instead of the property owner provides greater assurance of control over performance compliance. This allows the use of performance based systems in more sensitive environments than the Operating Permit Model. For a service fee, an RME takes responsibility for the operation and maintenance. This approach can reduce the number of permits and the administration functions performed by the regulatory authority. System failures are also reduced as a result of routine and preventive maintenance. The operating permit system is identical to that of the Operating Permit Model except that the permittee is a public or private RME. States may need to establish (and some already have) a regulatory structure to oversee the rate structures that RMEs establish and any other measures that a public services commission would normally undertake to manage private entities in noncompetitive situations.

Model 5—The Responsible Management Entity (RME) Ownership Model

A variation of the RME operation and maintenance concept in the RME Operation and Maintenance Model, with the exception that ownership of the system is no longer with the property owner. The designated management entity owns, operates, and manages the decentralized wastewater treatment systems in a manner analogous to central sewerage. Under this approach, the RME maintains control of planning and management, as well as operation and maintenance. This management model is appropriate for environmental or public health conditions similar to those for the RME Operation and Maintenance Model, but Model 5 provides a higher level of control of system performance. It also reduces the likelihood of disputes that can occur between the RME and the property owner in the RME Operation and Maintenance Model when the property owner fails to fully cooperate with the RME. The RME can also more readily replace existing systems with higher-performance units or clustered systems when necessary.

EPA recommends implementation of the management practices detailed in the RME Ownership Model in cases such as where new, high-density development is proposed in the vicinity of sensitive receiving waters. States might need to establish a regulatory structure to oversee the rate structures that RMEs establish and any other measures that a public services commission would normally undertake to manage entities in noncompetitive situations.

5.2.1 Application of Management Models

Because the wastewater is treated, the quality of the wastewater effluent should not be a significant health concern. Additionally, treating the water benefits the environment by protecting streams and waterways from pollution.

5.2.2 Costs

It is important to note that both the regulatory authority and the property owner will face increased costs as a result of implementing improved management practices and programs. However, additional costs incurred will likely be offset by increased permit fees and improved data management tools. Increased costs to the property owner will likely be offset by reduced repair and replacement costs, increased property values and quality of life, and reduced risks associated with environmental cleanup.

5.2.3 Relationship to Other Rules and Regulations

Governmental roles and authority in implementation of management programs based on the Management Guidelines will vary from jurisdiction to jurisdiction. Application of the NPDES program under the Clean Water Act is required if there is a discharge of pollutants from a point source to a water of the United States (i.e. a river or stream). Similarly, application of the UIC program under SDWA is required if a large capacity system is subject to UIC controls. The provision of the program elements in each model may inform the state, tribe, or EPA in establishing NPDES permit requirements if the NPDES program is applicable. In many cases, states will establish the authority for creation of management entities, provide funding, and provide technical assistance and training to local governments. The local governments would then have primary responsibility for implementation of the management program.

If a decentralized system is required to have a NPDES permit and an authorized state or tribe is administering a decentralized management program under this strategy, the requirements of the program should be incorporated into the applicable NPDES permit, which is the primary regulatory instrument. If a

state or tribe administering the program is not an authorized NPDES authority, the requirements of the program should be submitted to the NPDES permit issuing authority as a Section 401 certification requirement. If the program is being administered by a local authority or tribe without 401 certification ability, the requirements of the program should be recommended to the NPDES permit issuing authority for inclusion in the facilities permit. There are some cases, however, where the state themselves have the primary role and authority to implement the regulatory program at the local level.

5.3 Administration and Importance of Community Education

The most important step to carry out when considering a cluster system is to involve the homeowners that may be a part of the system. Once a basic understanding of cluster system operation and requirements, local stakeholders should be invited to participate in the decision process as early as possible. Ideally this should result in open and frank discussions about possibly installing a cluster system, and result in a greater chance of a system being implemented.

The EPA encourages establishing or designing a management entity for all decentralized projects. Acceptable management entities include cities and counties, special governmental units (e.g. sanitary districts and county service districts), public or private utilities, private corporations, and nonprofit organizations.

Barriers exist, both real and imagined, that can hamper widespread acceptance of decentralized wastewater systems. These obstacles may be due to several factors:

- Lack of knowledge and misperceptions about decentralized systems;
- State and local regulatory barriers;
- Lack of adequate management programs;
- Liability and engineering fee issues; and
- Financial limitations of the community

If decentralized systems are to become accepted as a wastewater treatment solution, the public needs to be educated about the benefits of this choice. In states that offer training programs for owners, sanitary workers, and installers, regulatory officials allow a broader use of alternative onsite technologies with the condition that these systems be managed by professional, certified operators.

Educational materials directed to homeowners should explain proper wastewater disposal and maintenance practices, as well as provide information about the consequences of system failures. Increased awareness about decentralized systems ought to help reduce the number of failing systems and the eventual negative effects on groundwater and surface water.

Managing individual onsite systems within the community presents one of the biggest hurdles officials may face. Brochures, newspaper articles, helplines, and other forms of public information will help homeowners become aware of the importance of managing and maintaining onsite systems.

Another possibility is establishing a steering committee to provide input and guidance and address concerns such as:

- Financial assistance to residents to repair or replace their systems;

- Technical assistance to identify appropriate, cost-effective technologies that perform well in site-specific soil conditions
- Assistance with education regarding onsite wastewater treatment

Public education is also important if the community is considering development of a wastewater management ordinance that generally inspections and fees for residents. Example provisions of an ordinance include requirements that homeowners obtain (and pay for) a septic system operator's permit, valid for a specified period of time (a septic license similar to a dog license that is intended for everyone's protection). Under this approach, property owners are required to submit a plot plan showing the location of the property's well and septic tank and drain field and including a brief description of the septic system. An educational packet is provided with the permit renewal. To renew the permit, homeowners must pay the fee and submit proof that the septic system has either been pumped out or that they have received a waiver from the health department. Waivers could be issued under certain circumstances, such as infrequent use of a vacation home, for which a longer pump-out period would be required. Failure to comply would result in a fine of a specified amount per day with a provision for community service if the community does not want to issue fines. This approach could be implemented by sending out a notice when it is time for renewal and pumping. If there is no response, send another notice in the following month. If two months have passed and the property owner has still not responded, a notice of violation can lead to a summons. In general, community support for a wastewater management program will grow stronger as residents come to understand its benefits and importance.

6.0 FUNDING

Grants and low interest loans are available to communities in California. For State grant and loans, low income communities must have a median income below 80% of the of the State's median income to be considered disadvantaged, and have a median income below 60% to be considered severely disadvantaged. The Department of Water Resources has an interactive map to determine if your community is disadvantaged, which can be found at https://gis.water.ca.gov/app/dacs/

For Federal loans, the federal median income should be used. For additional information on incomes in your area visit the census bureau's website at:
http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml#

Enter a name for your community, when the information appear select the Income box on the left to determine your communities median income.

Grants can be difficult to obtain. Federal grants in particular can be highly competitive. EDA, CDBG, ICDBG, and EPA grants can require considerable experience when applying for those grants. Whenever possible it is wise to consult an authority to assist the applicant with the application process. Most professionals licensed to work on wastewater systems will have the experience necessary to assist with the application (or a contact qualified to do so).

The following is a short list of grants that are available to pay for a cluster system. The reader can also search for Federal grants at http://www.grants.gov/. For the state of California search the Department of Water Resources web site or the SWRCB funding page.

Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) is a low- or no-interest source of funding for installing, repairing, and upgrading wastewater systems in small towns, rural areas, and suburban areas. Federal and state contributions are used to capitalize or set-up the programs. These assets, in turn, are used to make low-interest or no-interest loans for important water quality projects. Funds are then repaid to the CWSRF over terms as long as 20 years. Repaid loans are recycled to fund other water quality projects. These CWSRF resources can help supplement the limited financial resources currently available for decentralized treatment systems.

Projects that may be eligible for CWSRF funding include:

- New system installation (single and cluster systems) to correct an existing non-point source problem
- Replacing, upgrading, or modifying inadequate or failing systems
- Costs associated with establishing a centralized management entity (e.. permitting fees and legal fees)
- Capital costs associated with centralized management programs (e.g. trucks, storage buildings, and spare parts).

SRF is often a loan with low or zero interest; however, for low income populations there is the possibility of loan forbearance. To apply go to the website below and complete the first set of instructions as well as the General Application form. This will place you in the queue in the process and a representative should contact you to assist with the remaining forms.

Federally recognized Tribes are eligible to apply for the SRF program.
In California the FAAST application system (https://faast.waterboards.ca.gov/) will also make the applicant eligible for other State administered grants, such as grants administered by the Department of Water Resources, Water Board and Regional Water Quality Control Board .

United States Department of Agriculture Rural Development

The United States Department of Agriculture (USDA) provides low interest loans and grants to rural communities. For information contact your nearest USDA office. Up to $30,000 is available to qualified applicants for studies and design. Additional information on eligibility can be found at http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

Tribes are eligible to apply for USDA Rural Development grants and loans

For more information regarding eligibility visit:
http://eligibility.sc.egov.usda.gov/eligibility/welcomeAction.do?pageAction=sfp

Community Development Block Grants

Community Development Block Grants (CDBG) are grants awarded to low income households. Grant applications are through a City or County. For more information on eligibility visit the site below.
https://www.hudexchange.info/programs/cdbg-state/state-cdbg-program-eligibility-requirements/

Tribes are not eligible for CDBG grants, but are eligible for Indian Community Development Block Grants (ICDBG). For additional information visit
http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/ih/grants/icdbg

Economic Development Administration

Economic Development Administration (EDA) grants are available to low income communities. These grants are highly competitive and have several requirements for application; however, the applications can be through counties which have often met the preliminary requirements. It is best to contact your local County official regarding eligibility for this grant. The following site has additional information:

https://www.eda.gov/grants/
Tribes are eligible for EDA grants.

Environmental Protection Agency Hardship Grants

The Environmental Protection Agency (EPA) has a hardship grant available to small low income communities. For more information on these grants visit the following site
https://nepis.epa.gov/Exe/ZyNET.exe/20004483.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1995+Thru+1999&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C95thru99%5CTxt%5C00000009%5C20004483.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&De

fSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

Tribes are eligible for hardship grants

Linked Deposit Program

Under this funding structure, the management entity creates a linked deposit program to make low-interest loans available to individual homeowners who need to upgrade or replace their home sewage disposal systems. The homeowner obtains a permit from the county that outlines specifications about proper installation, operation, and maintenance of the onsite system. The homeowner is then issued a certificate, which they can take to any bank that participates in the linked deposit program. The lending institution, using its own criteria) decides whether or not to offer the applicant a loan and at what interest rate and term. The lending institution notified the State and/or local Health Department who then deposits the loan amount in the bank at a reduced interest rate. Savings from the reduced interest rate are then passed on to the loan applicant.

7.0 PROJECT EXAMPLES

7.1 Example Preliminary Project Investigations

Three proposed sites for cluster systems located in the Hoopa Valley (Figure 6) were selected to be investigated as potential sites for cluster systems. The three sites were chosen because the nearby streams have high coliform counts which are indicative of human waste in the water, and likely due to failed septic systems located nearby. The three sites were chosen because each would connect a different number of residences which directly impacts costs.

Supply Creek

The Supply Creek area currently has a cluster system that has failed (Figure 7). The system consists of pipes to collect the wastewater and direct it to a septic field. The septic field appears to have been undersized for the type of soil in the area and is likely unable to properly treat the wastewater. The system currently serves 82 residences, and offices. Although the Hoopa Valley Public Utilities District intend to only replace the treatment system, the costs of installing the entire infrastructure has been included for the reader to develop and understanding of the total costs of installing a complete system.

Mill Creek

The Mill Creek site does not currently have a cluster system in place, and one is being proposed to replace failed septic systems. Eight homes are proposed to be included to reduce the septic pollution in adjacent Mill Creek (Figure 8). Five of the residences will drain to the treatment system and three will require pumping to the sewer main.

Hostler Creek

Hostler Creek does not currently have a cluster system installed; however, one is being proposed to replace the failed septic systems. Four residences are proposed to be included in the cluster system (Figure 9). The monthly fees will be relatively high because of the system serving only eight homes; however, cost should drop if multiple cluster systems are installed in Hoopa, because labor fees will be shared between the systems.

7.2 Supply Creek

As previously stated the Supply Creek area is already served by a cluster system that has failed (Figure 7). The system has likely failed because selected site for the septic field is too small for the type of soils at that location. Using Appendix B Determining the soil type, determined that a significantly larger area of land would be required for that soil type. Additionally, there isn't enough usable land nearby to expand the septic system. Therefore, a fixed film treatment system is recommended to replace the septic field.

A review of the local soils at the proposed site were reviewed using Appendix B, the results were that the soil type was not particularly suitable for a septic leach field, and that a large area, which is unavailable would be required. Therefore a septic cluster system was discounted as a practical solution.

The location of nearby wetlands that might restrict placement of the treatment system was done by following the instructions found in Appendix C. No nearby wetlands were found, however there will be a required setback of 100-feet from the Supply Creek.

As previously stated the Hoopa Valley system is located over a recognized aquifer. Discussions with the Tribe indicate that they are not concerned about nitrates and phosphates in the groundwater, and therefore no nitrate or phosphate removal will be required. Additionally Appendices D & E were used to locate nearby impaired waterways or wells, and none were found.

The amount of sewage to be treated by the Supply Creek system was estimated by assuming 200 gallons per day per connection. 200 gallons per day is an acceptable estimate for low income housing. For middle income housing assume 250 gallons per day per connection. Assuming 200 gallons per day per connection results in an estimated 16,400 gallons per day of sewage to be treated by the treatment system.

The estimated cost to install a new system is estimated to be $2,383,875. This is a budgetary estimate for grant purposes, and the cost estimate is expected to be slightly high. Additionally, not all of the Supply Creek system will need to be replaced, but the costs for a complete system has been included to assist the reader with estimating cost for installing a new equivalent system.

Supply Creek Construction Costs				
Description	Unit	Unit Cost	Unit Amount	Price
4-inch Sewer	L.F.	$120	3900	$468,000
Laterals	EA	$3,000	82	$246,000
Septic Tanks	EA	$2,000	82	$164,000
Force Main	L.F.	$30	30	$900
Pump	EA	$500	0	$0
Geotechnical Report	EA	$10,000	1	$10,000
Permit	EA	(1)	0	$0
Subtotal				$888,900
Aerated Treatment System	EA	$1,040,000	1	$1,040,000
Drainage Field (Aerated System)	S.F.	$8	16875	$135,000
Engineering Costs (15% 0f total)				$272,985
Environmental Costs (10% of total)				$181,990
Total Costs				$2,383,875
(1) Permit costs will vary and have been excluded				

The monthly costs to maintain the system are estimated to be $25.22 per month, and include a $5.00 fee for capital reserves to that there are funds available to replace major components when they fail. Note that if multiple cluster systems are installed in the Hoopa Valley, monthly maintenance costs will drop to roughly $24.50 due to shared travel costs.

Basis if Costs[1]				
Description	Amount	Unit	$/Unit	Cost
Testing [1]	1	Each	$200	200
Labor				
Maintenance Checks	6	Hours	$25	$150
Deliver Samples to Lab	4	Hours	$25	$100
Electrical[2]	1	Each	$40	$40
Septic Pumping[3]	1	Each	$11	$11
Management	2	Each	$25	$50
Capital Reserves	1	Each	$5	$5
[1] Monthly Cost Estimate. Divide this estimated cost by the number of connection				
[2] Cost borne by all connections. Assume $40 per 20 connections with a minimum of $40/month				
[3] Average cost per month per connection. Assumes a septic pumping charge of $400 every three years.				

Description	Connections	Testing	Maintenace	Sample Delivery	Electrical	Septic Pumping	Capital Reserves	Total	Estimated Average Cost Connection
Supply Creek	82	$200	$150	$100	$160	$946	$430	$2,068	$25.22

7.3 Mill Creek

The Mill Creek cluster system is proposed to serve eight residences. High coliform counts in the creek indicate that serval of the residential septic systems have failed (Figure 8). There is potentially enough land to install a communal septic system, and the cost to install both a large septic system and a small treatment plant has been estimated. Three of the residences will require pumps to lift the sewage uphill to the sewer mains.

The location of nearby wetlands that might restrict placement of the treatment system was done by following the instructions found in Appendix C. A printout showing the location of the nearby wetlands has been included in the appendix. No wetlands appear to be located in the north side of Mill Creek. Note that a field investigation will be required to verify that no wetlands are located at the proposed site.

A review nearby groundwater aquifers was done using Appendix D, and the Hoopa Valley system is located over a recognized aquifer. Discussions with the Tribe indicate that they are not concerned about nitrates and phosphates in the groundwater, and therefore no nitrate or phosphate removal will be

required. Additionally Appendices D & E were used to locate nearby impaired waterways or wells, and none were found.

The estimated amount of sewage to be treated by the Supply Creek system was 200 gallons per day per connection which results in a sewer volume of 1,600 gallons per day. The treatment system and septic field were sized to treat that volume of sewage.

The estimated cost to install a new system is estimated to be $367,125 for an aerated cluster treatment system, and $351,125 for a cluster septic system. Again this is a budgetary estimate for funding purposes, and the costs are expected on the high end.

Estimated Mill Creek Construction Costs				
Description	Unit	Unit Cost	Unit Amount	Price
4-inch Sewer	L.F.	$120	1700	$204,000
Laterals	EA	$3,000	8	$24,000
Septic Tanks	Ea	$2,000	8	$16,000
Force Main	L.F.	$30	1100	$33,000
Pump	EA	$500	3	$1,500
Geotechnical Report	EA	$5,000	1	$5,000
Permit	EA	(1)	0	0
Subtotal				$283,500
Septic Field (Septic System)	S.F.	$8	2000	$16,000
Engineering Costs (15% 0f total)				$50,175
Environmental Costs (10% of total)				$33,450
Total Construction Costs				Mill Creek
Aerated System Cost				$367,125
Septic System Cost				$351,125

The monthly estimated cost to maintain the systems are $78.25 for the aerated system and $23.25 for the septic cluster system. The maintenance costs for the aerated system assume that is the only aerated cluster system in the Hoopa Valley. Should the Tribe add additional aerated systems, the Monthly costs should drop to $57.28.

Description	Connections	Testing	Maintenace	Sample Delivery	Electrical	Septic Pumping	Capital Reserves	Total	Estimated Average Cost Connection
Mill Creek	8	$200	$150	$100	40	88	$40	$626	$78.25

The cost estimate above assumes that grant funding will apply for the installation of the system. For low income areas such as the Hoopa Tribe this is highly likely, and for some low income rural areas, particularly those with health or environmental issues recognized by the Stare of Federal government it is likely the construction costs will either be paid in full or partially by a government agency. Moderate and high

income areas will likely be required to borrow money for the installation of their system and these costs should be incorporated into the monthly fees.

7.4 Hostler Creek

The Hostler Creek cluster system is proposed to serve four residences. High coliform counts have been measured in the nearby creek and this indicates that serval of the residential septic systems have failed (Figure 9). Because of nearby wetlands there may not be enough land to install a communal septic leach field. Therefore, a communal septic field was not investigated.

The location of nearby wetlands that might restrict placement of the treatment system was done by following the instructions found in Appendix C. A printout showing the location of the nearby wetlands has been included in the Appendix. There are nearby wetlands, and they do impede the amount of land available for a septic leach field. Note that a field investigation will be required to verify that there isn't enough room for a septic system.

A review nearby groundwater aquifers was done using Appendix D, and the Hoopa Valley system is located over a recognized aquifer. Discussions with the Tribe indicate that they are not concerned about nitrates and phosphates in the groundwater, and therefore no nitrate or phosphate removal will be required. Additionally appendices D & E were used to locate nearby impaired waterways or wells, and none were found.

The estimated amount of sewage to be treated by the Hostler Creek system was 200 gallons per day per connection which results in a sewer volume of 800 gallons per day. The treatment system and septic field were sized to treat 800 gallons per day of sewage.

The estimated cost to install a new system is estimated to be $225,250 for a cluster aerated treatment system. To reiterate this is a budgetary estimate for funding purposes, and the costs are expected on the high end.

Estimated Hostler Creek Construction Costs				
Description	Unit	Unit Cost	Unit Amount	Price
4-inch Sewer	L.F.	$120	940	$112,800
Laterals	EA	$3,000	4	$12,000
Septic Tanks	Ea	$2,000	4	$8,000
Force Main	L.F.	$30	0	$0
Pump	EA	$500	0	$0
Geotechnical Report	EA	$5,000	1	$5,000
Permit	EA	(1)	0	0
Subtotal				$137,800
Aerated Treatment System	EA	N/A	1	$44,000
Drainage Field (Aerated System)	S.F.	$8	1000	$8,000
Engineering Costs (15% 0f total)				$26,070
Environmental Costs (10% of total)				$17,380
Total Aerated System Cost				$225,250

The estimated monthly maintenance costs are high at 129.50. Should additional cluster system be installed in Hoopa the cost could drop to $87.75 per month. Obviously the high the number of connections in a cluster system the lower the monthly fees

Connections	Testing	Maintenace	Sample Delivery	Electrical	Septic Pumping	Capital Reserves	Total	Estimated Average Cost Connection
4	$200	$150	$100	$0	44	20	$518	$129.50

8.0 RESULTS

The estimated construction and maintenance costs clearly show that until the systems become more automated, cluster systems with fewer than about 50 connections may be impractical unless there are severe environmental and or health concerns. Costs can be reduced for smaller cluster systems by placing the residences closer together; however, maintenance costs will still be an issued until testing requirements are reduce and those processes automated. However, monthly maintenance costs for the eight systems in Mill Creek are still less than the fees charged by many municipal wastewater treatment facilities.

9.0 RESOURCES AND REFERENCES

The EPA maintains a website devoted to septic and decentralized (cluster) systems. Their website is a rich source of information.
https://www.epa.gov/septic

Additionally the EPA has published several papers regarding cluster systems:

Voluntary National Guidelines form Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems. EPA 832-B03-001; March 2003
https://www.epa.gov/sites/production/files/2015-06/documents/2004_07_07_septics_septic_guidelines_factsheet.pdf

Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems, An Introduction to Management tools and Information for Implementing EPA's Management Guidelines. EPA No. 832-B-05-001; December 2005
https://www.epa.gov/sites/production/files/2015-06/documents/2005_12_20_septics_onsite_handbook_fs.pdf

Case Studies of Individual and Clustered (Decentralized) Wastewater Management Programs, State and community Management Programs; EPA, June 2012;
https://www.epa.gov/sites/production/files/2015-06/documents/decentralized-case-studies-2012.pdf

Purdue University has a good introductory handbook for cluster systems. The handbook is for Indiana residents; however, most of the information presented is relevant to California.
Small Community Wastewater Cluster Systems. Don Jones, Jacqui Bauer, Richard Wise, and Alan Dunn; Purdue University; July 2001.
https://www.extension.purdue.edu/extmedia/id/id-265.pdf

Massachusetts has printed a detailed handbook on cluster systems:
Cluster Wastewater systems Planning Handbook; Lombardo Associated, Inc; Newton, Massachusetts; August 2004; National Decentralized Water Resources Capacity Development Project.
http://www.ndwrcdp.org/documents/WU-HT-01-45/WUHT0145_web1.pdf

County of Humboldt. "Understanding Septic Systems | Humboldt County, CA - Official Website." Understanding Septic Systems. Department of Health and Human Services, 2006-2013. Web. 24 Oct. 2016.

EPA. "How Your Septic System Works." EPA. Environmental Protection Agency, 23 Sept. 2016. Web. 25 Oct. 2016.

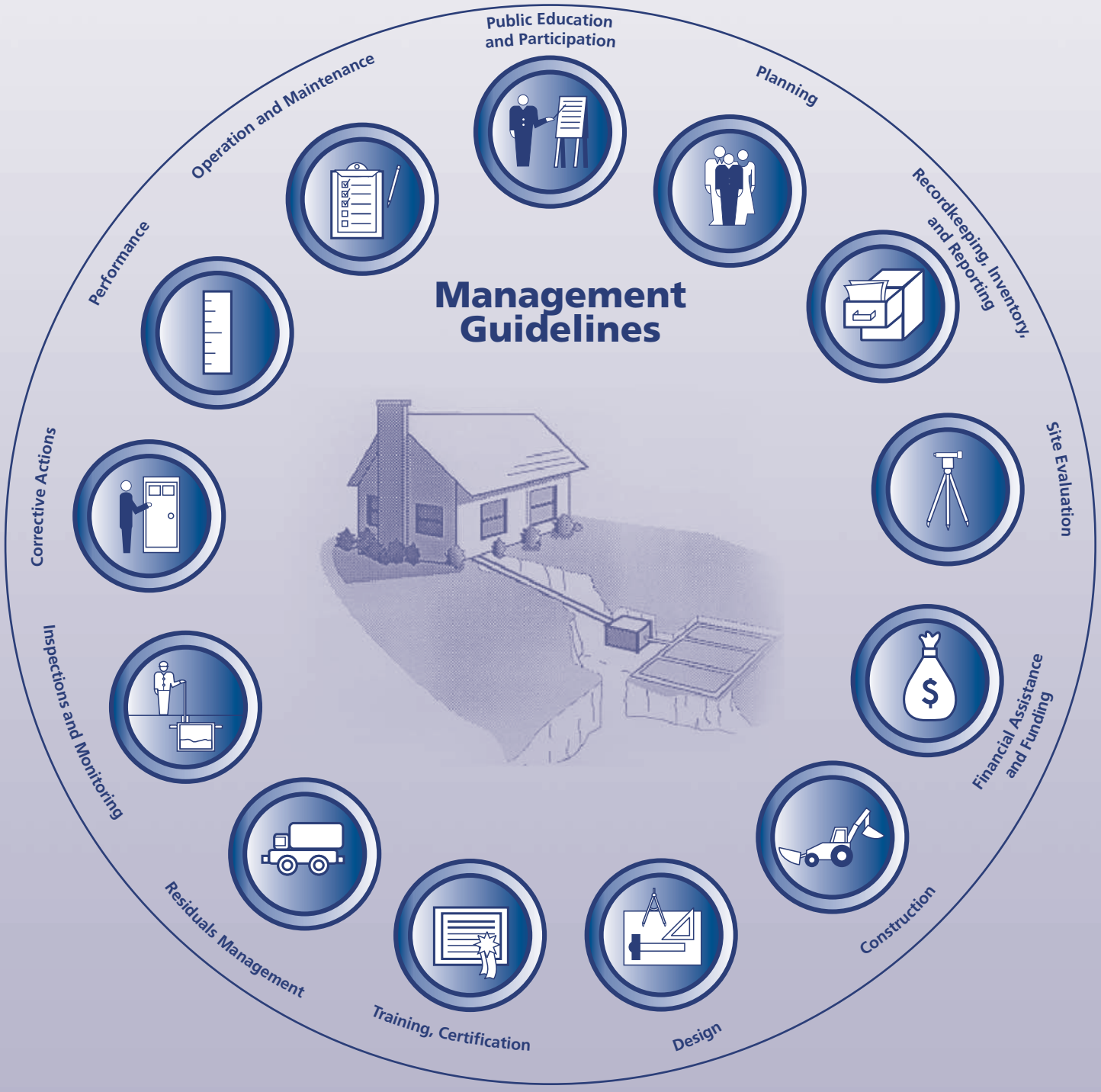
EPA. "Onsite Wastewater Treatment Systems Manual Revised 2002." EPA. Environmental Protection Agency, 2002. Web. 24 Oct. 2016.

Wood, Yvonne A., and Brad D. Lee. "Septic System Failure."Springer Reference (2016.): n. pag. Septic System Failure. UC Agriculture and Natural Resources. Web. 25 Oct. 2016.

APPENDIX A

EPA Management Model Tables

Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems



APPENDIX A: MANAGEMENT MODELS

This appendix presents a description of activities associated with each program element and identifies the party responsible for each activity. A detailed discussion is presented in the Management Handbook. Activities in bold are activities added to program elements from the preceding Management Model.

Note: If applicable, National Pollutant Discharge Elimination System (NPDES) requirements under the Clean Water Act (CWA) or Underground Injection Control (UIC) requirements under the Safe Drinking Water Act (SDWA) supercede any less stringent or inconsistent provisions. Program elements in each model help inform the state, tribe, or EPA in establishing NPDES permit requirements.

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

Objective: To ensure that conventional onsite systems are sited and constructed properly in accordance with appropriate state, tribal, and local regulations and codes; that they are periodically inspected; and, if necessary, that they are repaired by the Owner. The Regulatory Authority maintains a record of the location of all systems and periodically provides the Owner/User with notices regarding operation and preventive maintenance recommendations.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program or rule changes.
	Service Provider	• Be informed of existing rules and review and comment on any proposed program and/or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules and review and comment on any proposed program and/or rule changes. • Participate in advisory committees established by the Regulatory Authority.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend its evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells.
	Owner/User	• Regularly maintain system in proper working order.
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, and pumpers/haulers. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and O&M procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	• When using third-party services, contract with only the appropriate certified/licensed Service Providers.
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources.
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation.

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
 DESIGN	Regulatory Authority	• Codify prescriptive, preengineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria.
	Designer	• Obtain a certification/license to practice. • Design a treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design.
 CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Perform final construction inspection for compliance assurance and inventory data collection. • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct the system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed contractor/installer to construct system. • Submit final record drawings of constructed system to Regulatory Authority.
 OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • Send timely reminder to Owner of when scheduled preventive maintenance is due.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Owner	• Perform recommended routine maintenance or hire a certified/licensed pumper/hauler to perform maintenance. • Hire a certified/licensed pumper/hauler to periodically inspect, service, and remove septage for proper treatment and disposal.
	User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system.
 RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 (Use and Disposal of Sewage Sludge), 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Obtain certification/license to practice. • Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
 COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Conduct final construction inspections to ensure compliance with approved plans and permit requirements. • Perform compliance inspections at point-of-sale, change-in-use of properties, "targeted areas," and systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal.
	Pumper/Hauler	• Inform Owner of any noncompliant items observed during routine servicing of system.
	Owner	• Periodically perform a "walk-over" inspection of the system and correct any deficiencies.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
 CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedule with Owner for correcting documented noncompliance items. • Administer enforcement program, including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply.
	Designer	• Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Owner	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
 RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings of system. • Maintain maintenance records of system. • Provide drawings, specifications, and maintenance records to new property owner at time of property transfer.
 FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

Objective: To allow use of more complex mechanical treatment options or small clusters through the requirement that maintenance contracts be maintained between the Owner and maintenance provider to ensure appropriate and timely system component maintenance by qualified technicians over the service life of the system.

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend its evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • **Establish minimum performance criteria for manufactured component approvals.** • **Establish minimum maintenance requirements for approved systems.**
	Owner/User	• Regularly maintain system in proper working order.
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, and pumpers/haulers. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and O&M procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	• When using third-party services, contract only with the appropriate certified/licensed Service Providers.
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • **Establish alternative site acceptance criteria for approved systems providing enhanced pretreatment.**
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 DESIGN	Regulatory Authority	• Codify prescriptive, preengineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • **Administer an evaluation program for approving manufactured components for use with pre-engineered designs.**
	Designer	• Obtain certification/license to practice. • Design a treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design.
 CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Perform final construction inspection for compliance assurance and inventory data collection. • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner. • **Require Owner to submit a copy of system O&M manual to the Regulatory Authority.**
	Contractor/ Installer	• Obtain certification/license to practice. • Construct the system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • **Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations.** • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed contractor/installer to construct system. • Submit final record drawings of constructed system to Regulatory Authority. • **Submit a copy of system O&M manual to Regulatory Authority to record required maintenance.**
 OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • Send timely reminder to Owner when scheduled preventive maintenance is due. • **Administer a program that requires the Owner to attest periodically that he or she holds a valid contract with a certified/licensed operator to perform scheduled and any necessary maintenance according to the maintenance requirements described in submitted O&M manual.** • **Require Owner to submit a maintenance report signed/sealed by certified/licensed operator immediately following scheduled maintenance.**
	Operator	• **Obtain certification/license to practice.** • **Inspect and service system as necessary in accordance with the submitted O&M manual.** • **Certify to Owner that the required maintenance was performed in a timely manner, describing any system deficiencies observed.** • **Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.**
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner	• Hire a certified/licensed pumper/hauler to periodically inspect, service, and remove septage or other residuals for proper treatment and disposal. • **Maintain contractual agreement with a certified/licensed operator to perform scheduled maintenance as required.** • **Inform Regulatory Authority of any change in maintenance contract status.**
	User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system.

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 (Use and Disposal of Sewage Sludge), 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
 COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Conduct final construction inspections to ensure compliance with approved plans and permit requirements. • Perform compliance inspections at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • **Administer program for confirming that Owners hold valid maintenance contracts with certified/licensed operators and for monitoring timely submittals of certified maintenance reports.**
	Operator or Pumper/Hauler	• Inform Owner of any noncompliant items observed during routine servicing of system.
	Owner	• Periodically perform a "walk-over" inspection of the system and correct any deficiencies. • **Attest to the Regulatory Authority that a valid contract exists with a certified/licensed operator to perform necessary system maintenance.** • **Submit a maintenance report signed/sealed by a certified/licensed Service Provider immediately following scheduled maintenance.**
 CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedule with Owner for correcting documented noncompliant items. • Administer enforcement program, including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply.
	Designer	• Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Owner	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
 RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public. • **Administer an Owner/Service Provider maintenance contract compliance and certified maintenance report tracking system.** • **Record maintenance contract requirement on property deed.** • **Administer a certified maintenance report tracking system.**
	Operator	• Provide certified report of all maintenance and observed system deficiencies to Owner.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings and **O&M manual** of system. • Maintain maintenance records of system. • Provide drawings, specifications, **O&M manual**, and maintenance records to new property owner at time of property transfer.
 FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 3: OPERATING PERMITS

Objective: To issue renewable/revocable operating permits to system Owner that stipulate specific and measurable performance criteria for the treatment system and periodic submittals of compliance monitoring reports. The performance criteria are based on risks to public health and water resources posed by wastewater dispersal in the receiving environment. Operating permits allow the use of clustered or onsite systems on sites with a greater range of site characteristics.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend its evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • Establish minimum maintenance requirements for approved systems. • **Establish performance criteria necessary to protect public health and water resources for each defined receiving environment in Regulatory Authority's jurisdiction.**
	Owner/User	• Operate and regularly maintain system in proper working order. • **Operate system to comply with performance criteria stipulated in operating permit.**
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer a training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, pumpers/haulers, and **inspectors**. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and O&M procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	• When using third-party services, contract with only the appropriate certified/licensed Service Providers.
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • **Establish defining characteristics for each receiving environment in the Regulatory Authority's jurisdiction.**
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation.

MANAGEMENT MODEL 3: OPERATING PERMITS

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 3: OPERATING PERMITS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 DESIGN	Regulatory Authority	• Codify prescriptive, preengineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • **Administer a plan review program for engineered designs to meet stipulated performance criteria.** • **Require submission of routine operation and emergency contingency plans that will sustain system performance and avoid unpermitted discharges.**
	Designer	• Obtain certification/license to practice. • Certified/licensed designer to design treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design.
 CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • **Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications.** • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner. • Require Owner to submit a copy of system O&M manual to the Regulatory Authority.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct the system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • **Certify that construction of the system is substantially in conformance with the approved plans and specifications.**
	Owner	• Hire a certified/licensed contractor/installer to construct system. • Submit final record drawings of constructed system to Regulatory Authority. • Submit a copy of system O&M manual to Regulatory Authority to record required maintenance.
 OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • **Administer a program of renewable/revocable operating permits that are issued to Owner stipulating system performance criteria, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with permit.** • **Track and review compliance monitoring reports to ensure that systems are operating in accordance with operating permits.**
	Operator	• Obtain certification/license to practice. • **Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations.** • Certify to Owner that the required maintenance was performed in a timely manner, describing any system deficiencies observed. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Owner	• Hire a certified/licensed pumper/hauler or operator to maintain system. • Maintain system in proper working order. • **Operate and maintain the system in accordance with O&M manual and/or operating permit stipulations.** • **Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit.**
	User	• Follow recommendations provided by Regulatory Authority and/or Service Providers to ensure that undesirable or prohibited materials are not discharged to system.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
 COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • **Administer a program to monitor timely submittals of acceptable compliance maintenance reports.** • **Notify Owner of impending scheduled submittals of compliance monitoring reports.** • **Perform system inspections randomly and/or at time of operating permit renewal.**
	Operator or Pumper/Hauler	• Inform Owner of any noncompliant items observed during routine servicing of system.
	Owner	• Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. • **Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit.**
 CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedule with Owner for correcting documented noncompliant items. • Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply. • **Require system inspection by certified inspector at time of operating permit renewal.**
	Designer	• Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Inspector	• **Obtain certification/license to practice.** • **Inspect treatment system for compliance with operating permit prior to permit renewal.**
	Owner	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
 RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, and inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public. • **Administer a tracking system for operating permits.** • **Administer a tracking database for compliance reports.**
	Operator or Inspector	• Provide certified report of all maintenance and observed system deficiencies to Owner. • **Perform system monitoring as stipulated in Owner's operating permit.**
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings and O&M manual of system. • Maintain maintenance records of system. • Submit compliance monitoring reports to Regulatory Authority. • Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
 FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.

MANAGEMENT MODEL 3: OPERATING PERMITS

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

Objective: To ensure that onsite/decentralized systems consistently meet their stipulated performance criteria through Responsible Management Entities that are responsible for operation and performance of systems within their service areas.

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Hold public meetings to inform the public of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules and review and comment on any proposed program and/or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	RME	• **Inform Owner/User of care and use of system.** • **Inform Owner/User of RME requirements and prohibited uses of system.**
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
	RME	• **Develop criteria (e.g., site evaluation, design, construction) to be required of systems for acceptance into O&M program and inform Owners.** • **Continuously evaluate existing wastewater treatment needs and forecast future needs.**
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • Establish minimum maintenance requirements for approved systems. • Establish performance criteria necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	Owner	• Regularly maintain system components in proper working order. • **Comply with any RME requirements regarding care and use of the system.**
	RME	• **Operate systems to comply with performance criteria stipulated in the operating permits.**
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, pumpers/haulers, and inspectors. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and operation and maintenance procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• When using third-party services, contract only with the appropriate certified/licensed Service Providers.
	RME	• **When using third-party services, contract with only the appropriate certified/licensed Service Providers.** • **Ensure that RME staff who operate and/or maintain systems obtain appropriate certification(s)/license(s) to practice.** • **Arrange for supplemental training as needed for Service Providers and/or staff to manage, operate, and/or maintain systems.**

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • Establish the defining characteristics of each receiving environment in the Regulatory Authority's jurisdiction. • **Approve and oversee site evaluation procedures required by RME for system acceptance in the O&M program to ensure that system designs are appropriate for the sites and their stipulated performance criteria.**
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation. • **Comply with any additional siting requirements established by RME for system acceptance in the O&M program.**
 DESIGN	Regulatory Authority	• Codify prescriptive, pre-engineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • Administer a plan review program for engineered designs to meet stipulated performance criteria. • Require submission of routine operation and emergency contingency plans that will sustain system performance and avoid unpermitted discharges.
	Designer	• Obtain certification/license to practice. • Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design. • Comply with any additional design requirements established by the RME for system acceptance in the O&M program.
 CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner. • Require Owner to submit a copy of system O&M manual to the Regulatory Authority and RME.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • Certify that construction of the system is substantially in conformance with the approved plans and specifications.
	Owner	• **Comply with any additional construction requirements established by the RME for system acceptance in the O&M program.** • Hire a certified/licensed designer to prepare system design. • Submit final record drawings of constructed system to Regulatory Authority. • Submit a copy of the system O&M manual to the Regulatory Authority and RME to record required maintenance.

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 **OPERATION & MAINTENANCE**	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • Administer a program of renewable/revocable operating permits that are issued to RME, stipulating system performance criteria, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with operating permit stipulations. • Track and review compliance monitoring reports to ensure that systems are operating in accordance with operating permits. • **Consider replacing individual system operating permits with general permits issued to the RME for classes of systems.**
	Operator	• Inspect and service the system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. • Perform system monitoring as stipulated in RME's operating permit. • Certify to RME that the required maintenance and monitoring was performed in a timely manner and noting any system deficiencies. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner/User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system. • Maintain system components in proper working order. • **Comply with any RME requirements regarding care and use of system.**
	RME	• **Operate and maintain systems in accordance with the stipulated operating permit requirements.** • **Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit.** • Hire a certified/licensed pumper/hauler or operator to maintain system.
 **RESIDUALS MANAGEMENT**	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of wastewater treatment system residuals.
	RME	• Hire a certified/licensed pumper/hauler to remove, treat, and dispose of residuals. • **Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.** • **Inventory available residuals handling/treatment capacities and develop contingency plans when insufficient capacities are available.**
 **COMPLIANCE INSPECTIONS/ MONITORING**	Regulatory Authority	• Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • Administer a program to monitor timely submittals of acceptable compliance maintenance reports. • Perform system inspections randomly and/or at time of operating permit renewal.
	Inspector	• **Obtain certification/license to practice.** • **Perform system compliance inspections for RME in accordance with prevailing Regulatory Authority requirements.**
	RME	• **Submit compliance monitoring reports to the Regulatory Authority as stipulated in operating permit.** • **Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit.** • **Conduct regular reviews of management program with Owner/User and Regulatory Authority to optimize system operation program.** • **Hire a certified/licensed inspector to inspect system compliance status.**

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedules with RME for correcting documented noncompliance items. • Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply. • Require system inspection by certified inspector at time of operating permit renewal. • **Negotiate compliance schedules with RME, Owner/User, or both, for correcting documented noncompliance items.**
	Designer	• Provide Owner/RME with documents (drawings, specifications, modifications, etc.) that may be required by the Regulatory Authority prior to corrective actions.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Inspector	• Inspect treatment system for compliance with operating permit prior to permit renewal.
	Owner	• Comply with terms and conditions of the negotiated compliance schedule for component replacement/repairs. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
	RME	• **Comply with terms and conditions of the negotiated compliance schedule for system performance.**
 RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, and inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public. • Administer a tracking system for operating permits. • Administer a tracking database for compliance reports. • **Administer periodic financial, management, and technical audits of RME.**
	Operator or Inspector	• Provide certified report of all maintenance and observed system deficiencies to RME. • Provide certified report of all observed system deficiencies to Owner. • Perform system monitoring as stipulated in RME's operating permit.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings and O&M manual of system. • Maintain maintenance records of system. • Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
	RME	• **Maintain system monitoring and service records.** • **Inventory, collect, and provide permit information to Regulatory Authority.**
 FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.
	RME	• **Conduct regular reviews of management program with Owner/User and Regulatory Authority to optimize operations.**

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 5: RME OWNERSHIP

Objective: To provide professional management of the planning, siting, design, construction, operation, and maintenance of onsite/decentralized systems through Responsible Management Entities that own and manage individual and clustered systems within their service areas.

MANAGEMENT MODEL 5: RME OWNERSHIP

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	RME	• Inform User of care and use of system. • Inform User of RME requirements and prohibited uses of system.
	User	• Be informed of purpose, use, and care of treatment system.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
	RME	• Continuously evaluate existing wastewater treatment needs and forecast future needs. • **Require developers to submit proposed subdivision plats to RME for review and comment to ensure compatibility with RME requirements.** • **Plan most cost-effective approach to meeting treatment needs through appropriate mix of central sewerage, clusters, and individual onsite systems.**
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • Establish minimum maintenance requirements for approved systems. • Establish performance criteria necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	RME	• Operate, maintain, and repair systems to comply with performance criteria stipulated in the operating permits.
	User	• Comply with any RME requirements regarding care and use of the system.
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, pumpers/haulers, inspectors, and operators. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and operation and maintenance procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	RME	• When using-third party services, contract with only certified/licensed Service Providers. • RME staff who site, **design**, **construct**, operate, and/or maintain systems must obtain appropriate certification(s)/license(s) to practice. • Arrange for supplemental training as needed for Service Providers and/or staff to manage, operate, and/or maintain systems.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • Establish the defining characteristics of each receiving environment in the Regulatory Authority's jurisdiction. • Approve and oversee site evaluation procedures used by RME to ensure that system designs are appropriate for the sites and their stipulated performance criteria.
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	RME	• Hire a certified/licensed site evaluator to perform site evaluation.
 DESIGN	Regulatory Authority	• Codify prescriptive, pre-engineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • Administer the plan review program for engineered designs to meet stipulated performance criteria. • Require routine operation and emergency contingency plans that will sustain system performance and avoid the submission of unpermitted discharges.
	Designer	• Obtain certification/license to practice. • Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	RME	• Hire a certified/licensed designer to prepare system design.
 CONSTRUCTION	Regulatory Design	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. • Require that record drawings of constructed system be submitted to the Regulatory Authority by RME.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to RME. • Provide RME with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to RME. • Certify that construction of the system is substantially in conformance with the approved plans and specifications.
	RME	• Hire a certified/licensed designer to prepare system design. • Submit final record drawings of constructed system to Regulatory Authority. • Submit a copy of system O&M manual to the Regulatory Authority to record required maintenance.

MANAGEMENT MODEL 5: RME OWNERSHIP

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 5: RME OWNERSHIP

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 **OPERATION & MAINTENANCE**	Regulatory Authority	• Provide User with educational materials regarding system use and care. • Administer a program of renewable/revocable operating permits that are issued to RME that stipulate system performance, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with operating permit stipulations. • Track and review compliance monitoring reports to ensure that systems are operating in accordance with operating permits. • Consider replacing individual system operating permits with general permits issued to RME for classes of systems.
	Operator	• Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. • Perform system monitoring as stipulated in RME's operating permit. • Certify to RME that the required maintenance and monitoring were performed in a timely manner and noting any system deficiencies. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system. • Comply with any RME requirements regarding care and use of system.
	RME	• Operate and maintain systems in accordance with the stipulated operating permit requirements. • Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit. • Hire a certified/licensed pumper/hauler or operator to maintain system.
 **RESIDUALS MANAGEMENT**	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans when capacities available are insufficient.
	Pumper/ Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of wastewater treatment system residuals.
	RME	• Hire a certified/licensed pumper/hauler to remove, treat, and dispose of residuals. • Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals. • Inventory available residuals handling/treatment capacities and develop contingency plans when capacities available are insufficient.
 **COMPLIANCE INSPECTIONS/ MONITORING**	Regulatory Authority	• Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • Administer a program to monitor timely submittals of acceptable compliance maintenance reports. • Perform system inspections randomly and/or at the time of operating permit renewal.
	Inspector	• Obtain certification/license to practice. • Perform system compliance inspections for RME in accordance with prevailing Regulatory Authority requirements.
	RME	• Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. • Submit a compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit. • Conduct regular reviews of management program with Regulatory Authority to optimize system operation program. • Hire a certified/licensed inspector to inspect system compliance status.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 **CORRECTIVE ACTIONS**	Regulatory Authority	• Negotiate compliance schedules with RME for correcting documented noncompliance items. • Administer the enforcement program including fines and/or penalties for failure to comply with compliance requirements. • Require system inspection by a certified inspector at time of operating permit renewal. • Negotiate compliance schedules with RME for correcting documented noncompliance items.
	Designer	• Provide RME with documents (drawings, specifications, modifications, etc.) that may be required by the Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Inspector	• Inspect treatment system for compliance with operating permit prior to permit renewal.
	RME	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to the Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
 **RECORD KEEPING, INVENTORY, & REPORTING**	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, and inspection reports) of all systems within the Regulatory Authority's jurisdiction. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing, which is available to the RMEs. • Administer a tracking system for operating permits. • Administer a tracking database for compliance reports. • Administer financial, management, and technical audits of RME.
	Operator or Inspector	• Provide a certified report of all maintenance and observed system deficiencies to RME. • Provide a certified report of all observed system deficiencies to Owner. • Perform system monitoring as stipulated in RME's operating permit.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	RME	• Maintain system monitoring and service records. • Inventory, collect, and provide permit information to Regulatory Authority.
 **FINANCIAL ASSISTANCE & FUNDING**	Regulatory Authority	• Provide the legal and financial support to sustain the regulatory program. • Provide a listing of financial assistance programs available to RME and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist RME in upgrading systems.
	RME	• Conduct regular reviews of management program with Regulatory Authority to optimize operations.

MANAGEMENT MODEL 5: RME OWNERSHIP

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

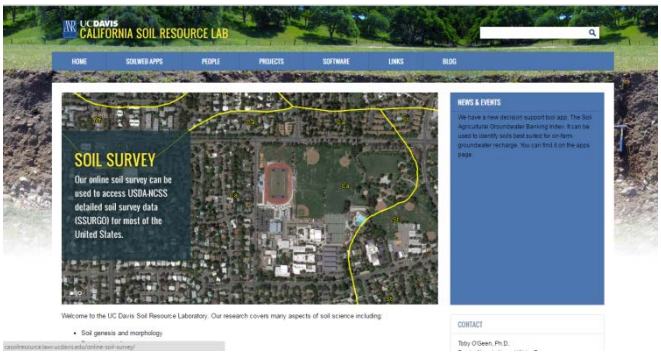
APPENDIX B

Soil Instructions

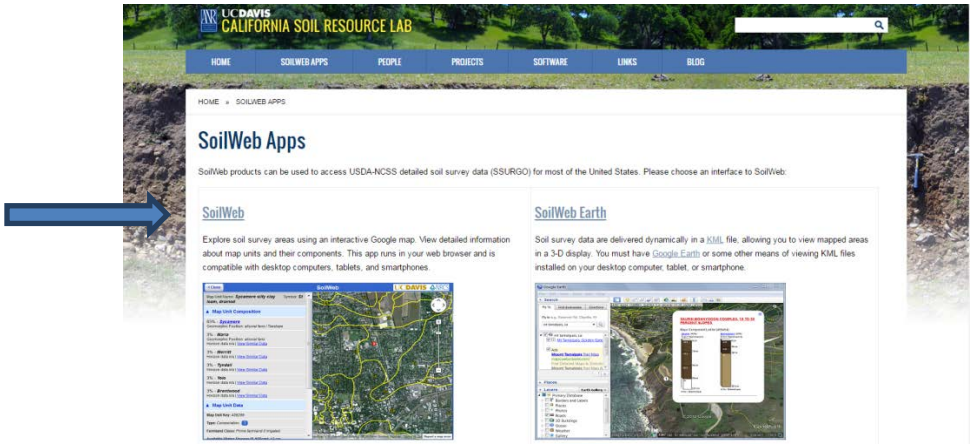
Estimating General Septic Suitability Using SoilWeb

1) Navigate to soils website: http://casoilresource.lawr.ucdavis.edu/

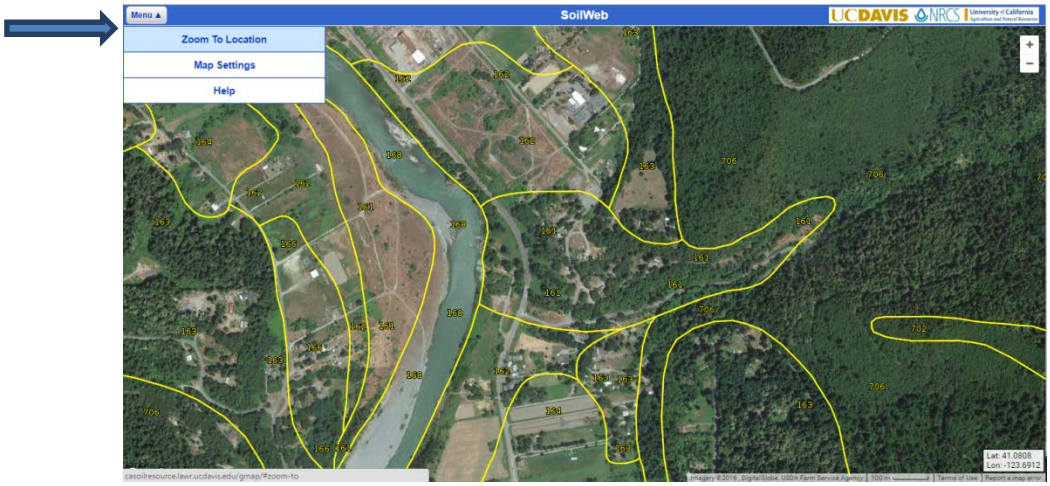
2) Click on Soil Survey.



3) Click on SoilWeb.



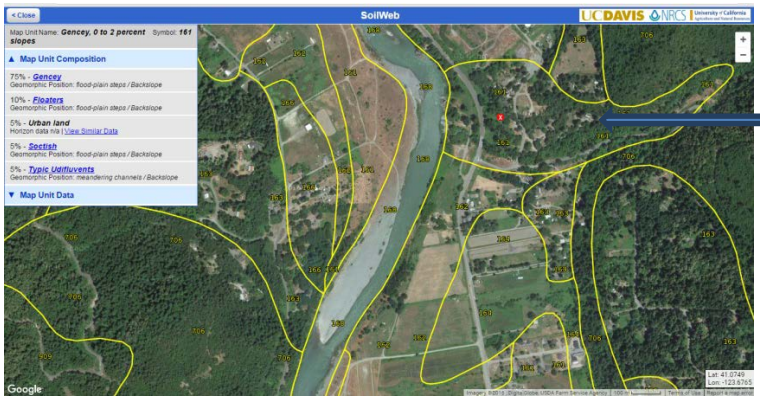
4) Click Menu then Zoom to Location.



5) Enter in the desired location or click the “Use My Current Location” to zoom automatically.

6) Click on a desired location to select a soil unit. Clicking on the map will automatically pull up an overview of the soil for the selected area. Under *Map Unit Composition*, map units for the area in blue and general details in black. Units labeled *Rock Outcrop* are not suitable for septic systems.

Map units within selected area. Area 161 is comprised of 75% Gencey, 10% Floaters, 5% Urban Land, 5% Soctish and 5% Typic Udifluvents.



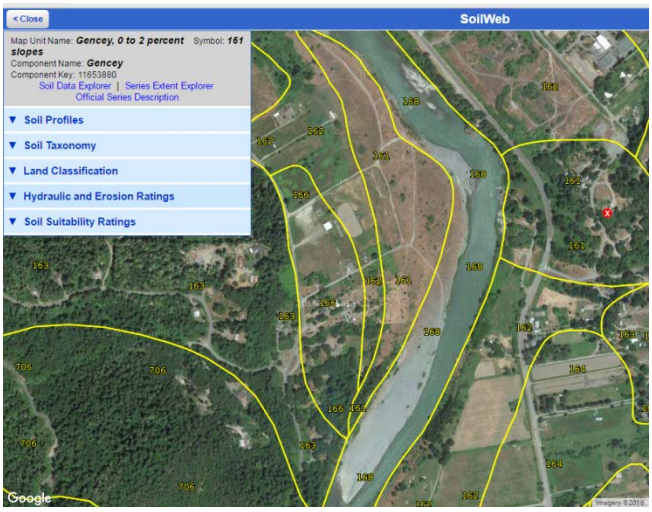
Selected area

Septic systems cannot be placed within rock.

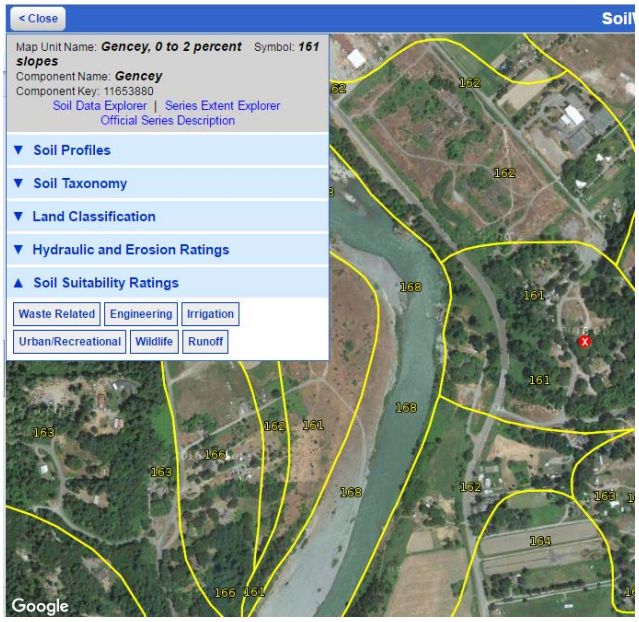
7) Select a map unit to from the *Map Unit Composition* heading to find information such as slope, soil profiles and other information regarding that particular unit.

Humboldt county does not allow septic system son slopes greater than 30% .

In this example, the Gencey unit was selected. This unit has 0-2% slopes and drop-down headings with additional information.



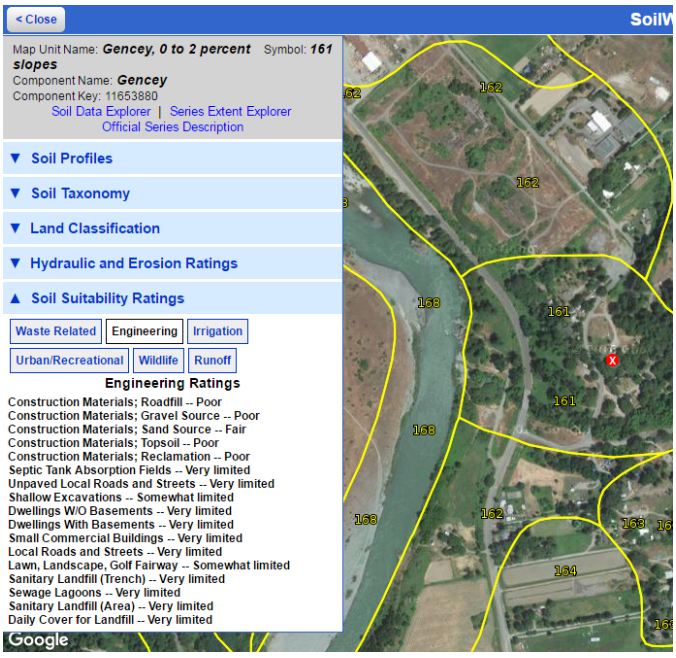
8) Select the *Soil Suitability Ratings* heading.



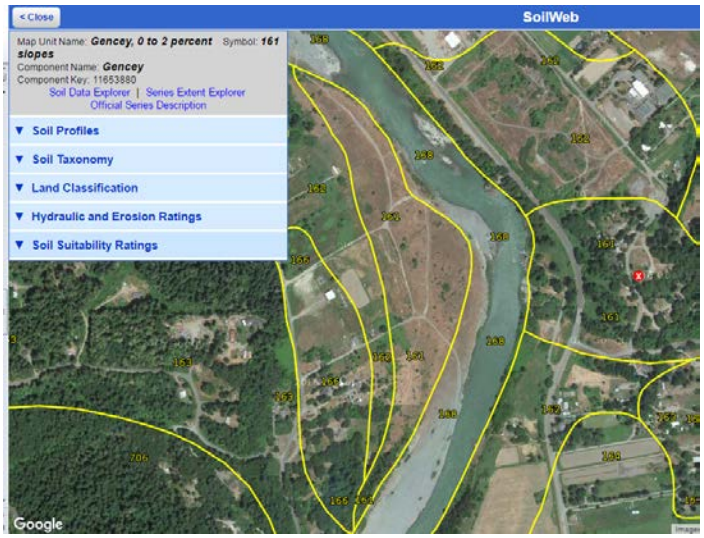
9) Select the *Engineering* tab to access general information regarding septic fields.

Septic categories range from very limited, limited, somewhat limited to not limited.

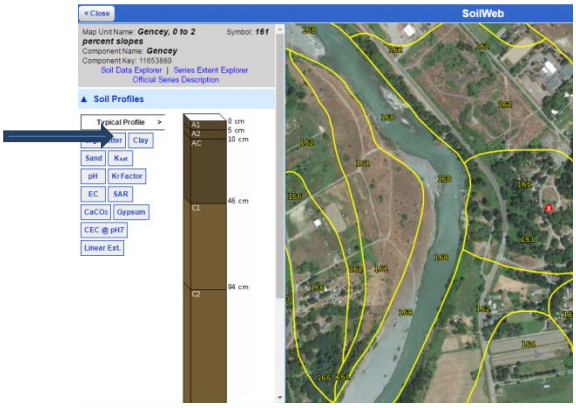
Using the Gencey unit as an example, the septic tank absorption field is very limited.



10) Select the *Soil Profiles* heading to begin a more detailed septic suitability analysis.



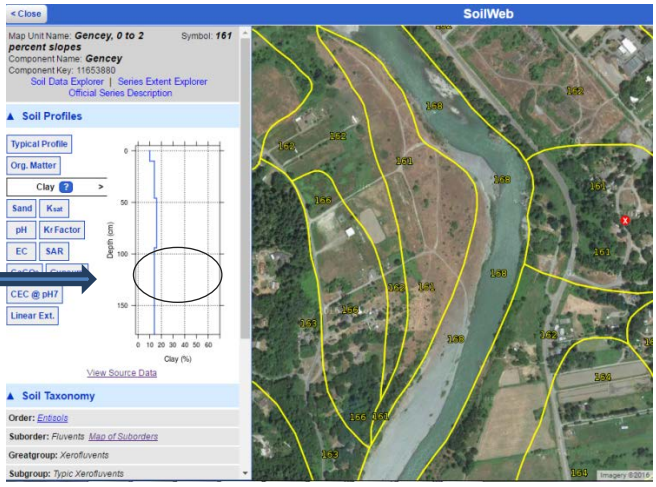
11) Under *Soils Profile* heading, click the *Clay* tab.



12) Using the *Clay* tab, determine the percent of clay within the unit at a depth of 100-150 cm.

Septic tanks need to be at a depth of 3-5 feet or roughly 90-150 cm.

The Gencey unit contains approximately 14% clay at a depth of 90-150 cm.



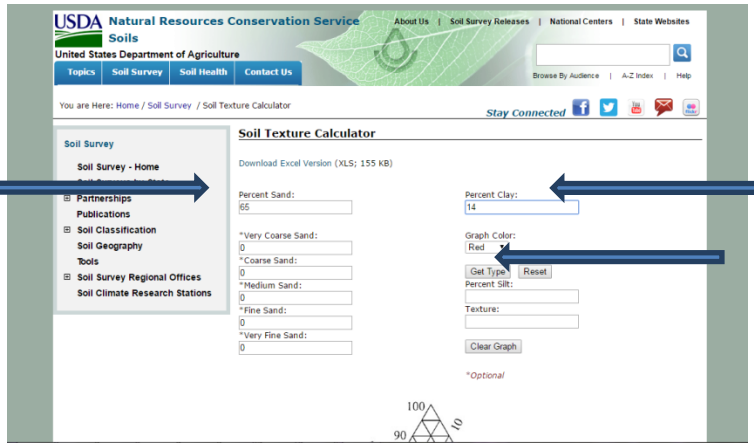
13) Using the *Sand* tab, determine the percent of sand within the unit at a depth of 100-150 cm.

Determine the percent of sand at a depth of about 90-150 cm.

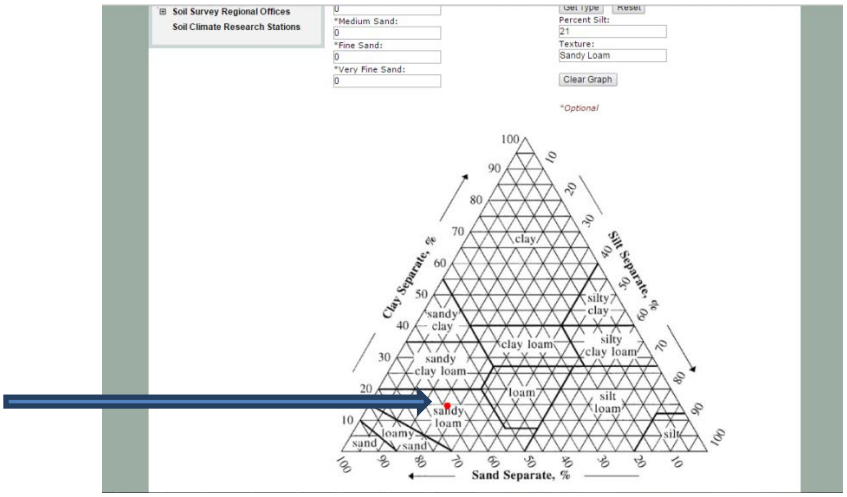
The Gencey unit contains roughly 65% sand at a depth of about 90-150 cm.

14) In order to determine the soil texture, navigate to: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167

15) Enter in the percent clay from step 10 and percent sand from step 11 in order to determine the soil texture of the selected unit. Click the *get type* button to calculate the soul texture.



16) Scroll down the page to see the Soil Texture calculation which can be seen as a red dot.



17) Use the calculated soil texture from step 14 with the table below in order to estimate septic suitability. *Soil Structure Shape* and *Grade* require field exploration and can be disregarded.

Table 1: Design Soil Application Rates

(Source: USEPA Onsite Wastewater Treatment Systems Manual, February 2002)

Soil Texture (per the USDA soil classification system)	Soil Structure Shape	Grade	Maximum Soil Application Rate(gallons per day per square foot) [1]
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	Single grain	Structureless	0.8
Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	Single grain	Structureless	0.4
Coarse Sandy Loam, Sandy Loam	Massive	Structureless	0.2
	Platy	Weak	0.2
		Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Fine Sandy Loam, very fine Sandy Loam	Massive	Structureless	0.2
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.2
		Moderate, Strong	0.4
Loam	Massive	Structureless	0.2
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Silt Loam	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Sandy Clay Loam, Clay Loam, Silty Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.2
		Moderate, Strong	0.4
Sandy Clay, Clay, or Silty Clay	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	Prohibited
		Moderate, Strong	0.2

Traits most desirable for septic systems include:

- Well drained soil (found under the *Hydraulic and Erosion Rating* heading at SoilWeb)
- Less than 50% clay within the soil
- Slope of less than 30%

* These instructions are for general information purposes only. This information does not take into account all variable soil factors and is not intended as a professional opinion. For more information regarding the septic suitability in your area, contact your local consulting firm.

Sources:

"SoilWeb." : An Online Soil Survey Browser. UC Davis California Resource Soil Lab, n.d. Web. 26 Aug. 2016.

"Soil Texture Calculator." Natural *Resource Conservation Service Soils*. USDA, n.d. Web. 26 Aug. 2016.

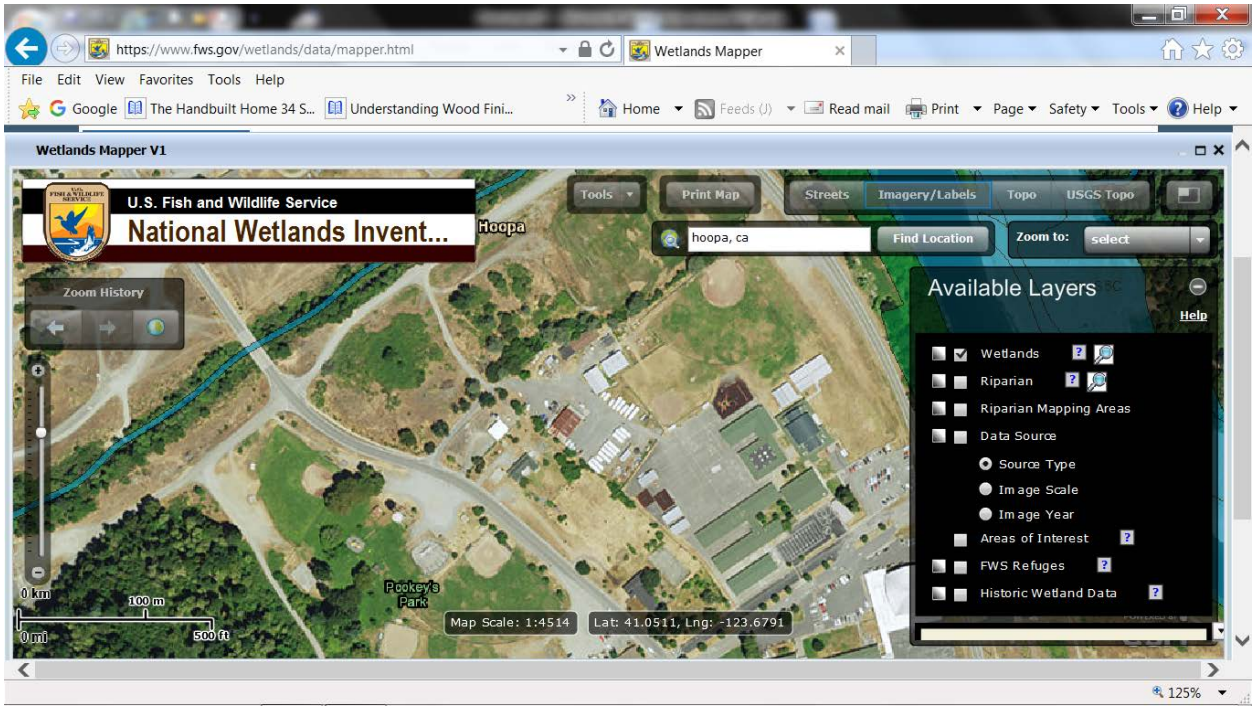
APPENDIX C

Wetland Inventory Map

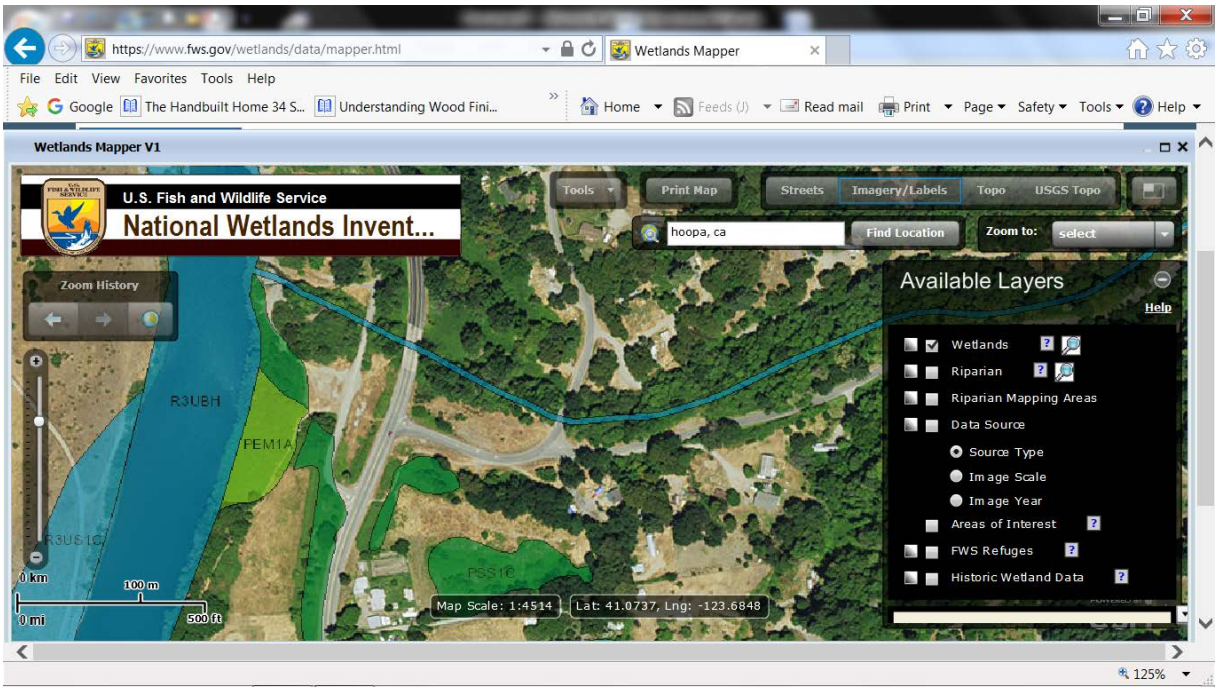
Locating Nearby Wetlands

First go to the National Wetlands Inventory interactive map maintained by U.S. fish and Wildlife located at https://www.fws.gov/wetlands/data/mapper.HTML and select Wetlands Mapper V1. Read the terms and conditions, and, if acceptable click accept, then Navigate to you site. The nearby wetlands will be shown in green.

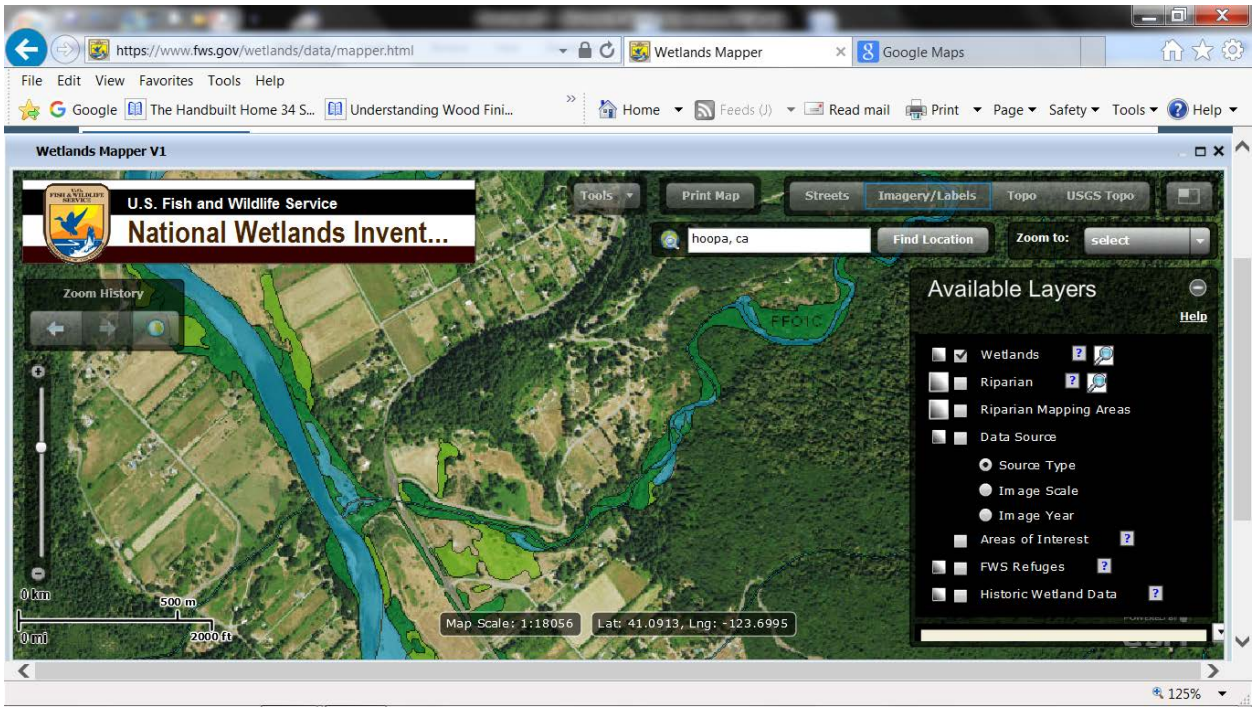
Below are the wetland maps for teh Supply, Hostler and Mill Creek regions in Hoopa



Hostler Creek



Mill Creek



APPENDIX D

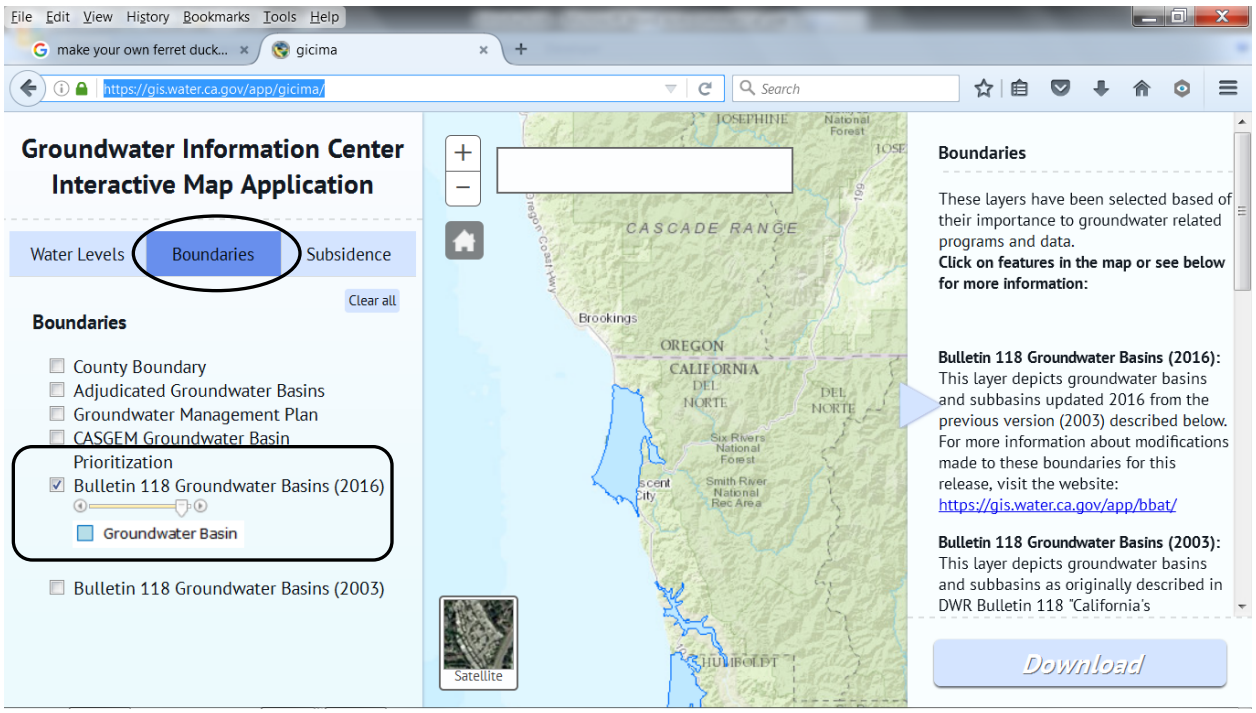
Aquifers and Contaminated Wells

The Water Boards interactive map will show a list of well that have high levels of nitrates in their water. The website is located below and, if you navigate to your area will inform you if there are any well located nearby that have recorded high levels of nitrates.

http://www.waterboards.ca.gov/water_issues/programs/nitrate_project/nitrate_tool/

To determine is your site is located near an aquifer recognized by the Department of Water Resources go to the website below.

https://gis.water.ca.gov/app/gicima/



Select boundaries (circled) and Bulletin 118 Groundwater Basins (2016) (squared) and navigate to the area where you are considering a cluster system. The groundwater basing will be shown in blue. Note that if the site is located over an aquifer it does not necessarily signify that a cluster system will be required to treat for nitrates; most systems located over an aquifer will not be required to treat for nitrated.

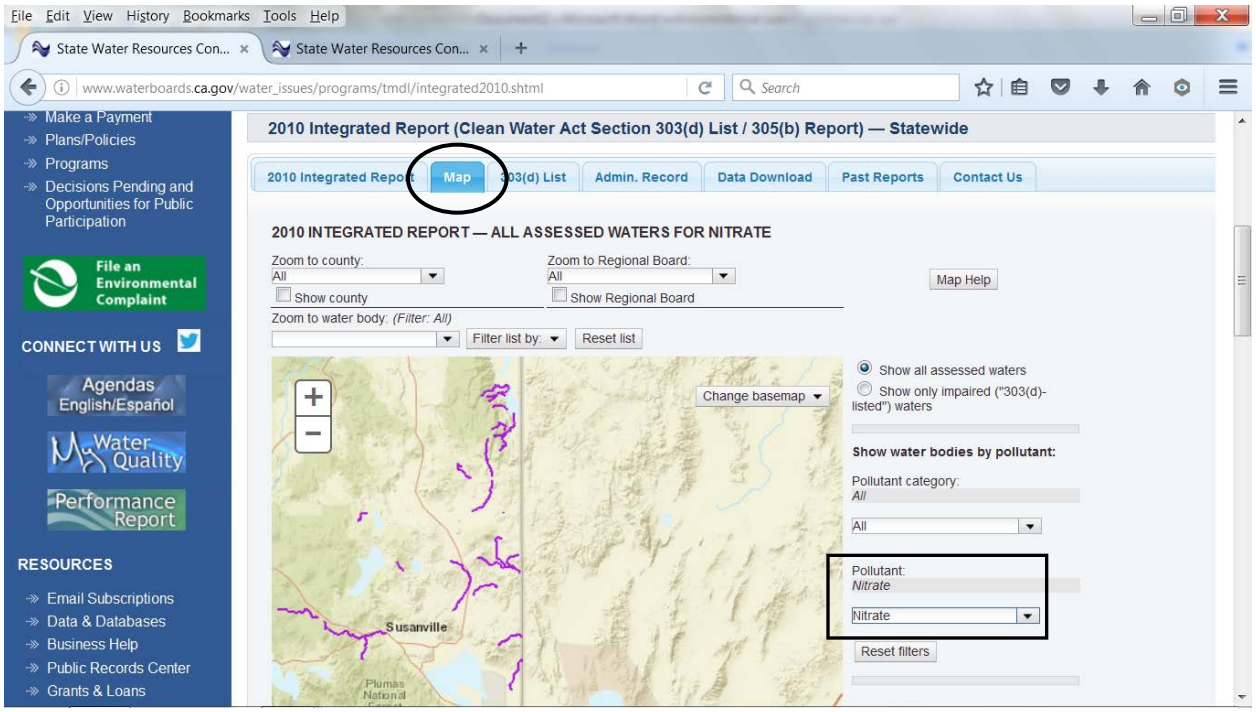
APPENDIX E

Contaminated Waterways

Impaired Waterways and Aquifers

For a list of waterways that have excessive nitrate load go the website below

http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml



Select the Map tab (circled) then select the pollutant (squared) then zoom to the area of interest. Waterways polluted with excess nitrates will be shown in purple (see map)

APPENDIX F

List of Treatment Manufacturers

List of Treatment System Manufacturers

Below is a list of treatment system manufacturers that are adequate for Cluster systems. Inclusion in this list does not imply an endorsement of the product. Additionally, this is not a comprehensive list of available suppliers.

Orenco Systems

814 Airway Avenue
Sutherlin, Oregon 97479
(800) 348-9843
E-mail dlepre@orenco.com

MicroSep Tech

Green Technologies Solutions, Inc.
Kevin Green
23362 Madero, Suite C
Mission Viejo, CA 92691
Phone: 949.305.0651
E-Mail info@gtsinc.email

Aquapoint

39 Tarkiln Place
New Bedford, MA 02745
Tel: 508.985.9050, ext 2
E-Mail: sales@aquapoint.com

Microfast

Bio-Microbics, Inc.
8450 Cole Parkway
Shawnee, Kansas 66227
Phone 913.422.0707
E-mail onsite@biomicrobics.com.