CRESCENT SANITARY DISTRICT
ENGINEERING REPORT
FOR
WASTEWATER SYSTEM IMPROVEMENTS

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1.0 GENERAL

1.1 Introduction

The purpose of this Engineering Report is to provide guidance to the Crescent Sanitary District (District) in providing centralized wastewater collection and treatment services for properties within the District's boundaries. The purpose also covers the potential consideration for expanding facilities to Gilchrist and West Crescent if it is found financially feasible. Existing development in these areas is currently served by individual on-site wastewater systems. This report has been prepared to conform with current Oregon Department of Environmental Quality (ODEQ) regulations and guidelines, and to meet the requirements of Oregon Administrative Rule (OAR) 123-043-000. This report has been prepared in accordance with the guidelines "Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities", in anticipation of the potential for requesting funding from Oregon Business Development Department Infrastructure Finance Authority (OBDD-IFA), Oregon Department of Environmental Quality Clean Water State Revolving Fund (ODEQ-CWSRF) and/or the United States Department of Agriculture (USDA) Rural Development (RD). This report may be used to process the funding request and should clearly describe the District's present situation, analyze alternatives and recommend a specific course of action. The depth of analysis within the report is expected to be proportional to the size and complexity of the proposed project.

Potential funding applicants for USDA RD programs are expected to perform an environmental review concurrently with the preliminary engineering report. The required environmental review pursuant to 7 CFR Part 1794, guidance in RUS Bulletin 1794A-602: "Guide for Preparing the Environmental Report for Water and Environmental Program Proposals" is not included in the scope of work for this report and will be completed as a separate project after an alternative is selected and an implementation plan is solidified. The CDBG program has different environmental review requirements which are completed after an award is made for design and/or construction.

A primary objective of the report is to ensure adequate conveyance and treatment capacity is provided to meet the needs of the District's service area, to ensure such facilities minimize adverse impacts on the environment, and to protect the health and safety of the affected community. An additional priority is to accomplish these goals in an economical and efficient manner. Minimum requirements for the collection system are design guidelines and standards developed by ODEQ. The approach taken in preparation of this report is to:

- Define environmental and physical conditions in the planning area.
- Develop flow and waste load projections.
- Describe existing facilities, capacity and constraints.
- Describe the need for the project.
- Evaluate alternatives to meet project needs.
- Describe the proposed project, costs and implementation plan.

This report utilizes information obtained from the District's archives as well as previous planning and design-related documents. Information provided by District staff

concerning various systems and loading characteristics has been considered and included in this report. It is anticipated that this report will be reviewed by the District, ODEQ, Stakeholders and applicable Funding Agencies.

RELATED DOCUMENTS, STANDARDS AND DESIGN CRITERIA
Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities Financed by:

- Infrastructure Finance Authority
- Oregon Department of Environmental Quality
- Rural Community Assistance Corporation
- United States Department of Agriculture

Crescent Sanitary District Wastewater Facilities Plan 1999, 2007 Update
HGE, Inc.

1.2 Background

The primary concern for the District according to prior Wastewater Facilities Plans is wastewater pollution. Crescent, Oregon, does not currently operate a city-wide wastewater facility, leaving all businesses and residents reliant on individual septic systems. Aged and failing septic systems, coupled with the high permeability of the soils, is resulting in pollution of the local groundwater and the Wild and Scenic Little Deschutes River with high levels of nitrates. The downtown core area of Crescent that includes both commercial and residential zoned land is the critical area for onsite wastewater disposal. The area has a shallow groundwater table that can come at or near (within 24 inches) of the ground surface. Soils in the area are rapidly draining and nitrogen loading to the groundwater is a concern. To make matters worse, the area is platted into small lot sizes. New septic systems cannot be allowed due to high groundwater conditions and hydraulic wastewater loading requirements, leading ODEQ and Klamath County to deny applications. Unfortunately, this means that Crescent can no longer bring in new businesses and/or residents.

In addition to preventing new businesses, the limitations associated with onsite wastewater treatment have forced several businesses to close their doors. The Starlight Café and the Apache Tears Restaurant are examples of businesses that were forced to close due to the onsite wastewater issues. Other businesses, such as the service station located on the corner of Highway 97 and Crescent Cut-off Road, have not been able to expand or repair inadequate systems.

Concerns about pollution and health hazards resulting from wastewater disposal practices through on site systems initiated the formation of the Crescent Sanitary District. In September 1979, a Wastewater Management Plan was developed for the District. The recommended option developed in the management plan included a gravity wastewater collection system with lagoon treatment and land disposal. A more detailed evaluation was conducted in the "Wastewater Treatment Facility Plan," completed in 1983. The selected alternative consisted of gravity collection, stabilization lagoon treatment, and rapid infiltration land application.

Adequate funds were not available at that time for construction of the proposed public wastewater facilities and wastewater disposal is still a major concern in Crescent. The community has an estimated residential population of 535 people within the present service boundary. Crescent is an unincorporated community and population estimates and historical population figures for the community are not included in census information. The District currently provides no wastewater collection and conveyance to the residents within the District's boundary.

High groundwater levels in the area increase the likelihood of groundwater contamination from septic systems. Since well water is the principal source of domestic water supply in the vicinity of Crescent, protecting the quality of the groundwater resource is of high importance. Similar conditions existed in La Pine (located approximately 16 miles north of Crescent), where it was found that private on site systems were polluting the groundwater in that area. Since then, the La Pine Sanitary District has installed a public wastewater system.

Increasing nitrate levels in the ground-water aquifer underlying the Central Oregon City of La Pine and the surrounding area, (which includes Crescent and the Gilchrist area) from contamination of residential septic systems has large public health implications. Health implications result because groundwater is the sole source of drinking water for area residents. A task force steering committee report entitled 'S. Deschutes/N. Klamath Groundwater Protection Project' states:

"DEQ, the US Geological Survey and Deschutes County have determined that the safety of the groundwater in southern Deschutes and northern Klamath counties is threatened by nitrate contamination from traditional on-site septic wastewater treatment systems."

The community of Gilchrist on the north boundary of the Crescent Sanitary District has a centralized sewer system which serves a population of 230 people. This community was originally developed and founded in 1939 by the Gilchrist Timber Company as worker housing for the timber company and the mill. When the Gilchrist Timber Company sold to Crown Pacific in 1991 the 120 homes and other facilities were sold to the residents.

Gilchrist Timber Company installed a collection system prior to 1970 that consists mainly of vitrified clay pipe, and in 1972 they constructed a treatment system. The sewage discharges into a sewage treatment plant that includes three one acre facultative lagoon cells, and a seepage bed consisting of approximately 4,200 lineal feet of disposal pipe. The system was originally installed and owned by Gilchrist Timber Company, but is now owned by Gilchrist Sewer Company LLC., represented by Gil Ernst. Gilchrist Sewer Company LLC is a private, for profit entity.

The system is permitted with ODEQ under Water Pollution Control Facility (WPCF) Permit #102198. In 2006 the ODEQ amended the WPCF permit requiring that the Gilchrist system be monitored for water quality specifically for nitrate contamination and heavy metals to the groundwater. Gilchrist Sewer Company has contracted with EGR & Associates, LLC to sample, test, and report the results to the ODEQ. The most recent

2012-2013 assessment noted 14 instances of levels exceeding the Environmental Protection Agency's (EPA) maximum level of 10 parts per million (ppm) nitrates in the groundwater monitoring wells. Copies of the ground water monitoring reports are on file at the Bend ODEQ office for examination. A Mutual Agreement and Order (MAO) was issued in 2009 between the Gilchrist Sewer Company and the ODEQ to deal with the problems of the Gilchrist treatment system. To date these issues have not been solved. A copy of the MAO and the WPCF permit are included in the Appendix.

The community of West Crescent also does not have centralized sewerage facilities and the residential properties are served with on-site septic systems. West Crescent has high ground water, shallow aquifers, and very permeable pumice sandy soils. The housing density in the West Crescent area is located closer to the Little Deschutes River Basin's sensitive riparian and wetland areas. The concern is that nitrogen released from on-site septic systems may not only contaminate groundwater that supplies drinking water, but may migrate into the surface water, where nitrogen is known to decrease dissolved oxygen and have an adverse effect on pH levels in the river. This can cause increased algae plumes that remove oxygen needed by plants, fish, and animals to sustain a healthy eco-system.

The result of this imminent public health threat leads into the next phase of the engineering report which will outline the wastewater system improvement project and will serve as the catalyst to prepare the final designs, specifications, and bidding documents to construct a wastewater treatment facility for the Crescent Sanitary District.

2.0 PROJECT PLANNING AREA

2.1 Location

The unincorporated area of Crescent is located along Highway 97 approximately 90 miles north of Klamath Falls in northern Klamath County, and approximately 60 miles south of Bend. Crescent borders the southern boundary of Gilchrist. Crescent currently has a post office with the zip code of 97733.

Drainage through the area is generally from south to north and towards the Little Deschutes River. A vicinity map is shown as Figure 2.2. Figure 2.3 shows the Project Study Area. The project planning area is located in Township 24 South, Range 9 East Sections 19 and 30, Township 24 South, Range 8 East, Section 25, and Township 25 South, Range 9 East, Section 6.(See Figures 2.2 and 2.3). Topography is gentle slopes with steeper slopes to the east.

Except for smaller private parcels in the major developed areas the land around the planning area is entirely Forest use. To the East of Highway 97 the major land owner is the Oregon State Department of Forestry, and to the west of Highway 97 is Cascade Timberlands LLC. Federal ownership is also to the north and south of the planning area. Figure 2.1 shows the zoning in the planning area.

Figure 2.1-Land Use Zoning in Project Planning Area

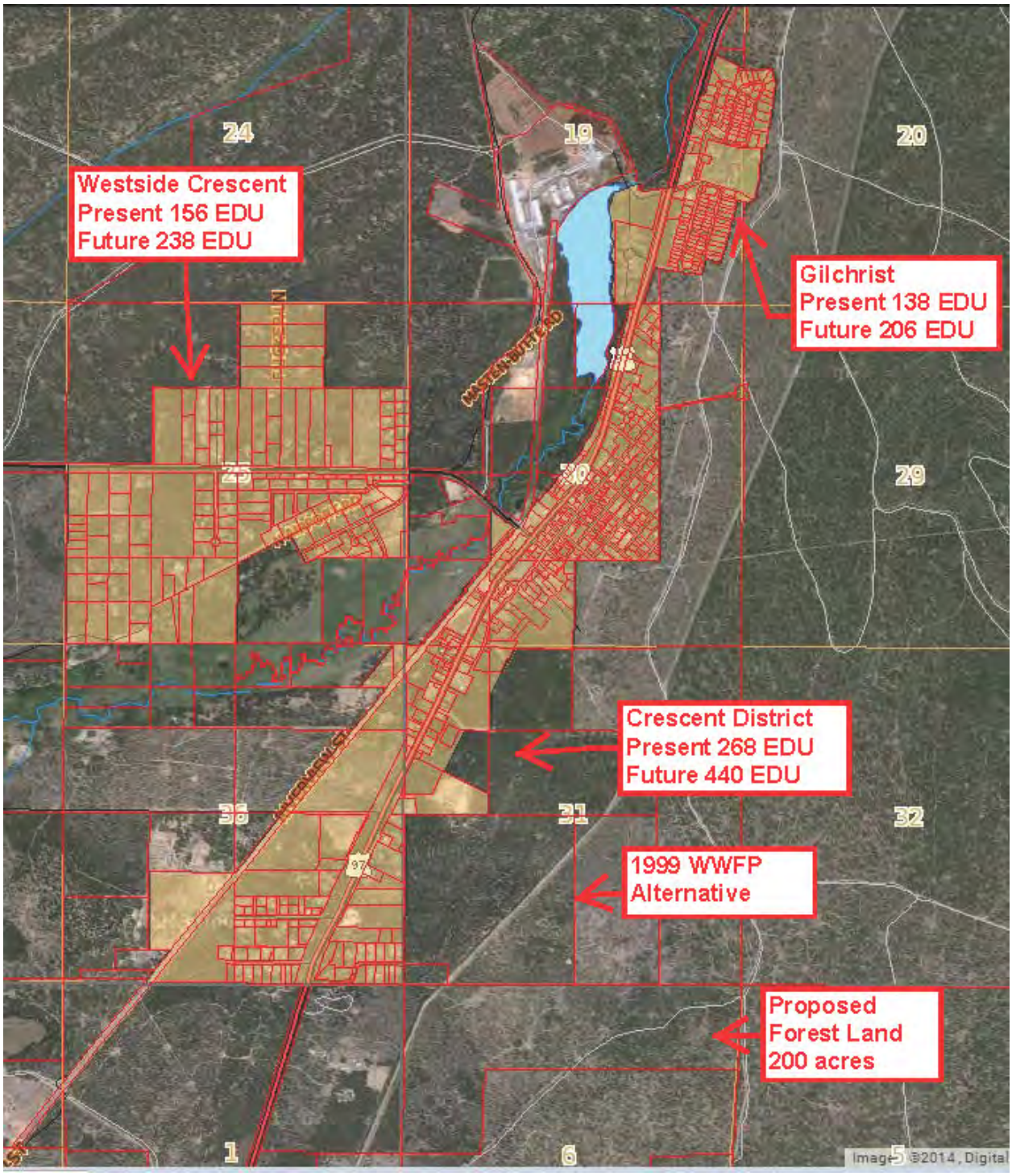
Figure 2.2-Vicinity Map

The planning area for this report includes the Crescent Sanitary District and the communities of Gilchrist and West Crescent.

These established communities and any future development will impact the ultimate capacity of the proposed Crescent wastewater facilities. An additional development proposed in the area is a destination resort on forest land along Crescent Creek. Although this proposed destination resort development is not immediately adjacent to the Crescent Sanitary District, a development of the scope proposed will certainly create overflow development that will impact growth in the District for residential, commercial, and retail services.

When considering these future developments, incorporating adequate wastewater system flexibility is a very important issue for the District. For example, planning for the treatment facilities and effluent disposal should include acquisition of adequate land to allow for expansion and growth. Future large developments are expected to pay for their growth with connection fees and systems development charges.

Figure 2.3-Planning Area Map



The land under consideration for the wastewater treatment facilities and recycled water application is 1.5 miles south of the District's business core and adjacent to the southerly District boundary, more particularly described as Tax Lot 200, Township 25 South, Range 9 East, Section 6, W.M. Klamath County, Oregon. (See figure 2.3 and Exhibit C in the Appendix) This area is included in the planning area for consideration of the sewerage treatment facility. This parcel is owned by Oregon Department of

Forestry and has very little tree cover and has acceptable topography for the treatment plant. Currently the District is working with the Oregon Department of Forestry to obtain the parcel.

The District explored several alternative sites for location of the treatment facility prior to selecting the Oregon Department of Forestry site. The available sites are limited due to the proximity to the Little Deschutes River and watershed, residential areas, and the topography in the area. A site on the southwest area of Crescent was deemed unsuitable due to its proximity to the Little Deschutes River, which raised concerns with ODEQ about possible river contamination. An additional site on the southeast section of Crescent was also rejected because it had several feet of Highway 97 frontage, raising concerns about odors along the highway. The West Crescent area was not suitable due to the density of residents, possible contamination to the river watershed, and the increased elevation which would make pumping the effluent extremely costly. The District is planning to construct a gravity feed system so the site needs to be close in elevation to the lowest area of Crescent. The Department of Forestry site is only slightly higher in elevation and would require minimal pumping of the effluent. The 1999 WWFP looked at the 160 acres parcel just north of the proposed Oregon Department of Forestry property as shown in Figure 2.3. However, this land is privately owned and is closer to Crescent. Locating a treatment plant as far away as practical is always a good idea and will act as a buffer for spring odors, which is characteristic of treatment ponds. The odors during the spring thaw may be unpleasant to residents due to the prevailing wind direction. The District is working with this landowner for a possible access easement to provide access to the Oregon Department of Forestry parcel.

Figure 2.4-Proposed Wastewater Facilities Site

The District will need to negotiate a 30-foot wide access easement from the property currently owned by the US Forest Service or with the private landowner of the adjacent parcel as noted above. Obtaining the easement from the private owner would be a simpler process than obtaining an easement from the U.S. Forest Service. The District is currently working with both the private landowner and the U.S. Forest Service on this issue. The District has met with the U.S. Forest Service regarding their requirements to grant utility corridor/temporary construction access to the site. A Special Use Permit will be required, which the District needs to submit as soon as possible if this access is going to be pursued. The U.S. Forest Service is required to conduct NEPA review and consult with the Tribes. Cultural and environmental reviews are expected to be completed in August 2015.

The site topography gently slopes from east to west at a one-percent slope and is surrounded by forest land on the north, south and east and the U.S. Forest Service property to the west.

Oregon Department of Forestry (ODF) owns the property where the proposed facility will be located and does not currently use the land to raise timber due to the poor soil conditions to grow Ponderosa Pines. Approximately 50 to 60 acres of the proposed parcel will be needed for the facility footprint and ponds. The remainder of the 200 acres will be needed for spraying effluent through a sprinkler system. It is important to note that this large of an area is required to allow land application of the treated effluent while protecting groundwater, given the highly permeable soils. More detail on the land area requirement is included later in this report. ODF will require information on alternatives analysis as well as a property appraisal and survey to move forward with a land purchase or lease option. Currently the District has met with ODF and the Governor's Solution Team to work through securing the parcel.

Zoning of Planning Area

Land-use zoning within the planning area is shown on Figure 2.1 and Figure 2.5. Existing land use consists of R1-Rural Residential, RUC-I-Rural Community Industrial, RUC-C-Rural Community Commercial, and F-Forest. All land use planning is under the jurisdiction of the Klamath County Planning Department. The proposed wastewater treatment site is zoned F-Forest. The Forest Zone completely surrounds the planning area which makes locating a treatment site in an area with different zoning virtually impossible.

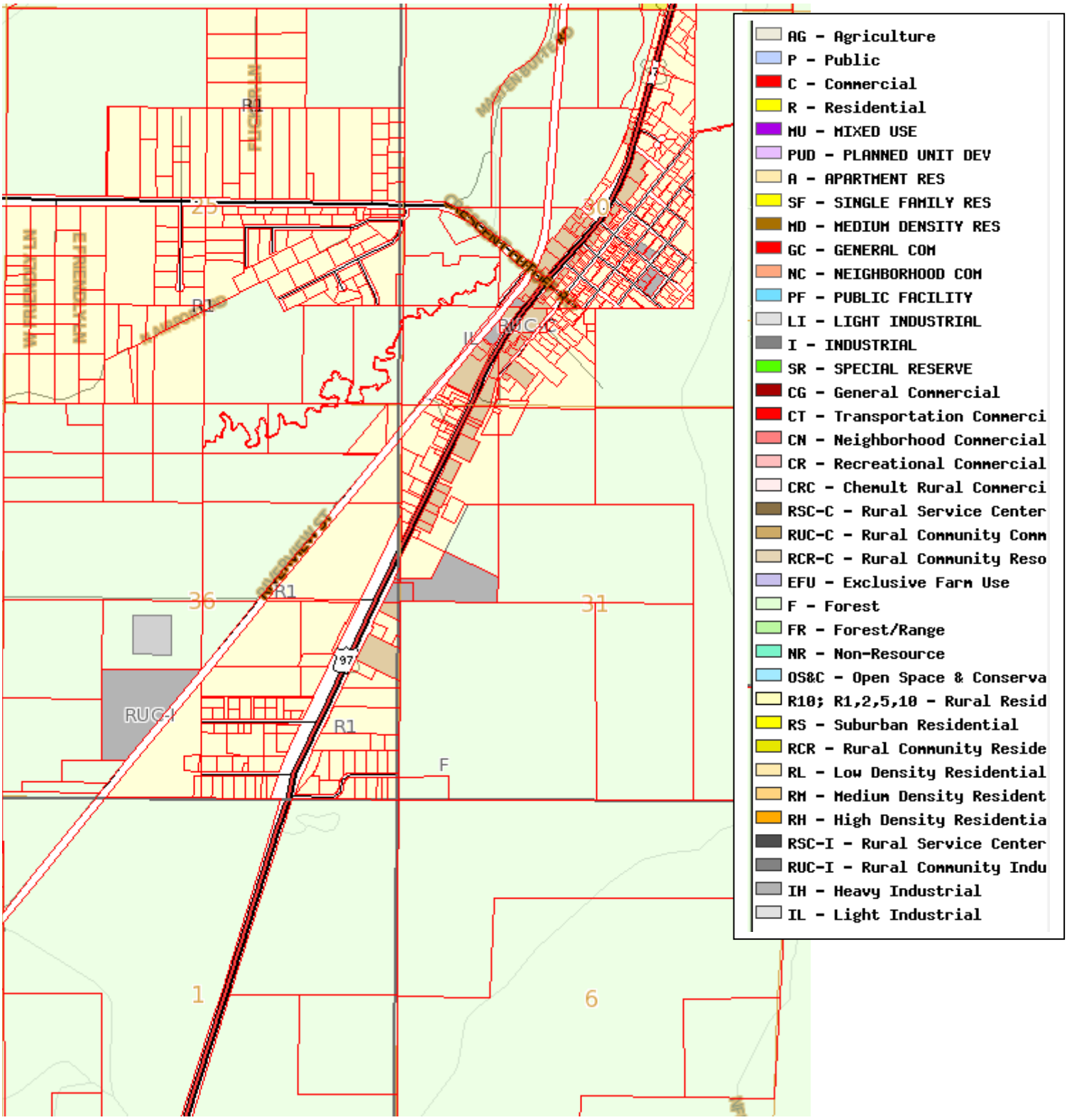
The collection system for the sewerage throughout the planning area will be allowed under the existing Rural Residential and Rural Community zones. However, per the Klamath County Comprehensive Land Use Plan, sewerage treatment is not an approved use in a Forest Zone. The proposed site will require additional effort to resolve the land use issue. However, as all the areas surrounding the project are zoned Forest, any other site selected would also require this process. An exception and re-zoning of the property will most likely be required. Given the lack of differently zoned land near the project area and the need for the system, the District has a strong case for approval of the re-zone.

The land use issues have been discussed with the Klamath County Planning Department and the Department of Land Conservation and Development (DLCD). The

best option at this time involves expanding the Rural Center designation and then rezoning the treatment site parcel. The rural community of Crescent was designated as a “Rural Community” by a Comprehensive Plan Amendment the County adopted in November 2002 as part of Periodic Review Work Task #18. Expanding this designation is allowed under a condition noted in the Oregon Administrative Rules, OAR 660-004-0020.

The District has met with representatives from the DLCD, Klamath County, and the Regional Solutions Team and is exploring the best strategy for obtaining a County Zoning Code Amendment. This needs to be completed immediately for the project to move forward. 60 to 90 days may be required to move through the planning process.

Figure 2.5-Klamath County Zoning-Crescent Oregon



2.2 Environmental Resources

The following is a discussion of the physical conditions within the planning area. This report provides a significant amount of information that will be used for environmental review. Environmental review will be completed as a separate project after an alternative is selected and an implementation plan is solidified.

Topography

The planning area gently slopes from the east to the west towards Little Deschutes River Meadow area. The core commercial area of Crescent at the intersection of the Crescent Cutoff Road and Highway 97 is the approximate low point in the planning area. The low point elevation is 4,460' and the proposed wastewater facility property elevation to the south is at an elevation of 4,478'.

Geology and Soils

The soils descriptions in the 1983 facilities plan do a good job summarizing the soil conditions that were field verified by Anderson Engineering & Surveying, Inc. (AES) and described as follows:

> *Surface soils of the area consist of coarse to fine pumice which resulted from the Volcanic eruption of Mount Mazama. Soils are coarse textured pumice soils and are unsuited for cultivation of crops and are used almost entirely for the production of Ponderosa pine, grazing, and Wildlife habitat. In the Crescent vicinity, the permeable pumice soil is underlain at a depth of 6 to 7 feet by a black and impervious layer of soil believed to be the remains of a former marshy area adjacent to the original position of the Deschutes River and below the present level of the river. The high permeability of the pumice soil underlain by the impervious layer creates a shallow basin for the accumulation of surface water adjacent to the Little Deschutes River. Water level during late spring at the Crescent Administrative Center is approximately two to three feet below the ground surface. In late August or early September, this water level has dropped to 6 feet or more below the ground surface. This phenomenon is believed to result from the accumulation of surface originating water such as snow and rain along the natural slope toward the Little Deschutes River. As the water surface of the Little Deschutes River rises during spring runoffs, groundwater level in the adjacent soils rises correspondingly.*

According to the USDA NRCS Soil Survey of Crescent, Oregon the soils in the developed areas within the planning area are primarily pumice and ash (Map Unit 73 and 75). The map unit is described by Natural Resource Conservation Service (NRCS) as soils relatively high in pumice and ash which do not make good fertile growing soil for woodlands. The photograph on the following page shows the existing site conditions. Vegetation consists of sparsely underdeveloped ponderosa pines, antelope bitterbrush, and needle grasses. The predominate soil type is Lapine gravelly loamy coarse sand (pumice and ash). The predominate soil is highly permeable and rapid draining. Unless the site is properly prepared and maintained undesirable plants may compete with reforestation. Because the coarse textured soil has insufficient anchoring capability trees are subjected to wind throw (uprooted or broken by the wind). The coarse texture

of the soil and inherent low fertility of the subsoil and substratum restrict root development.

Figure 2.6-Existing Site

USDA Soils reports Soil properties and qualities as follows:

73C—Lapine gravelly loamy coarse sand, 0 to 15 percent slopes

- **Map Unit Setting**

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 40 to 44 degrees F
Frost-free period: 20 to 50 days

- **Map Unit Composition**

Lapine and similar soils: 90 percent
Minor components: 3 percent

- **Description of Lapine Setting**

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and gravel-sized pumice derived from dacite

- **Properties and qualities**

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water capacity: High (about 10.5 inches)

- **Interpretive groups**

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6s
Hydrologic Soil Group: A

- **Typical profile**

0 to 1 inches: Slightly decomposed plant material
1 to 8 inches: Gravelly loamy coarse sand
8 to 25 inches: Extremely gravelly loamy coarse sand
25 to 38 inches: Very gravelly coarse sand
38 to 61 inches: Gravelly coarse sand

The entire soil report is included in the Appendix.

On-site soil investigations were conducted on two different occasions at the proposed treatment site area. The first was done by using a hand auger boring conducted by ODEQ staff along with AES and District staff. The auger sample was limited to a depth of 5 feet. Photographs related to soil sampling are shown below:

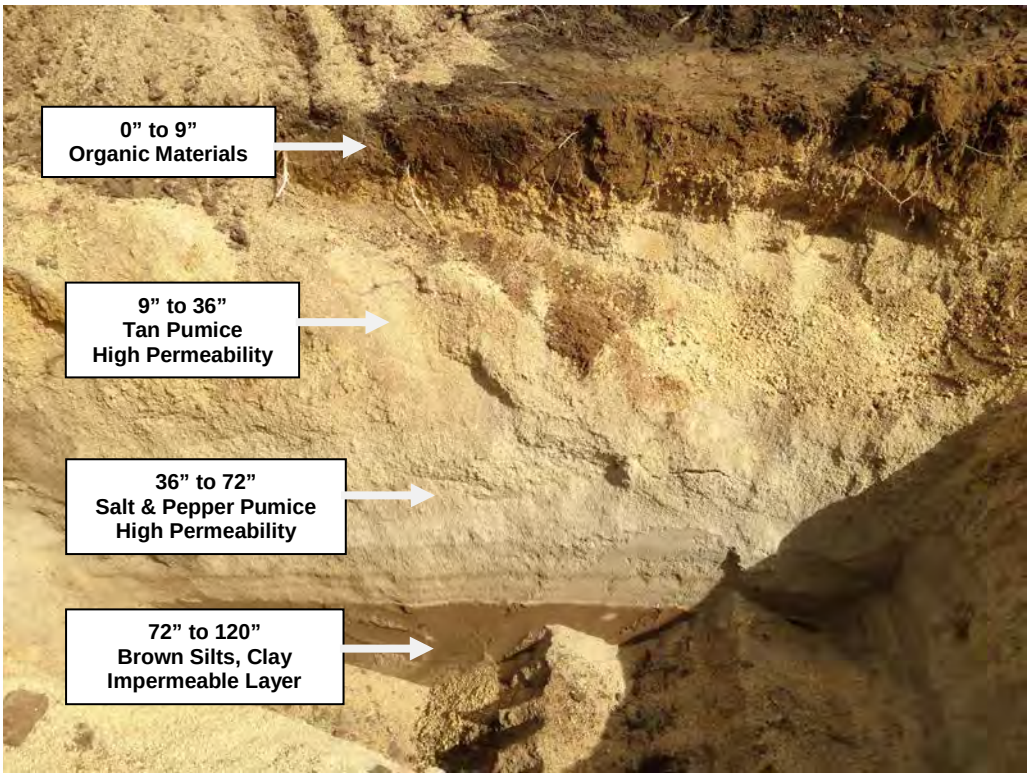
Figure 2.7-Soils Test Hole #1

Figure 2.8-Predominate site soils

Figure 2.6 shows the hand auger being used to bore to a depth of 5 feet. Figure 2.7 shows the predominate site soils to consist of - Tan Pumice Lightly cemented (i.e. Lapine gravelly loamy coarse sand).

A more in-depth on-site soils survey was conducted by using a backhoe owned and operated by the Crescent Water District. The test hole was dug on the proposed parcel for the treatment site and permitted and approved by the Oregon Department of Forestry. A test pit was excavated in April 2014 to approximately 10 feet deep. The ground surface elevation at the test pit location was 4,478'. No groundwater was encountered. A photograph and description of the findings are shown in Figure 2.8.

Figure 2.9-Site Soils Test Hole #2



Planning Area Climate

The summer days are warm, summer nights cool and dry, and winter climate is crisp and cold with subfreezing nights. According to the Western Regional Climate Center (WRCC) Chemult 2 N station, precipitation averages about 21 inches annually, with 3 to 5 inches per month occurring in November through February, in the form of snow. June, July and August are the driest months, averaging less than one inch of rain per month. The average daily temperature range is 26° F low to 58° F high.

Figure 2.10-Historic Temperature and Precipitation

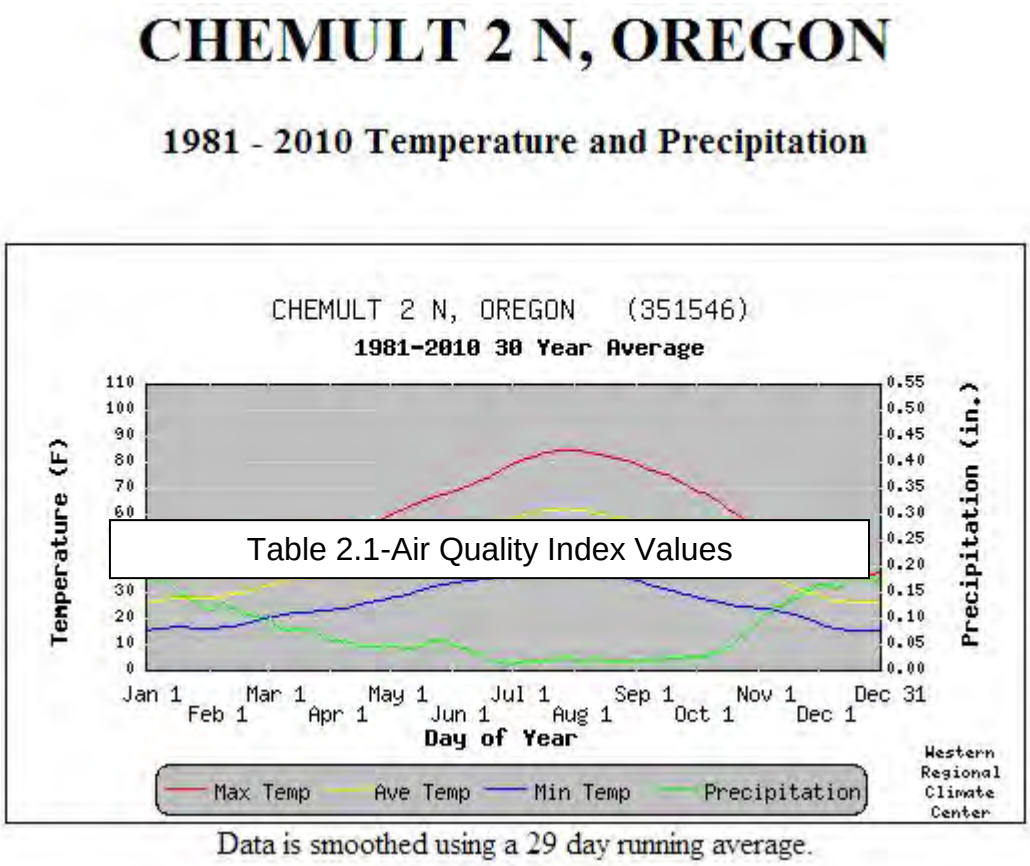


Table 2.1-Air Quality Index Values

Air Quality

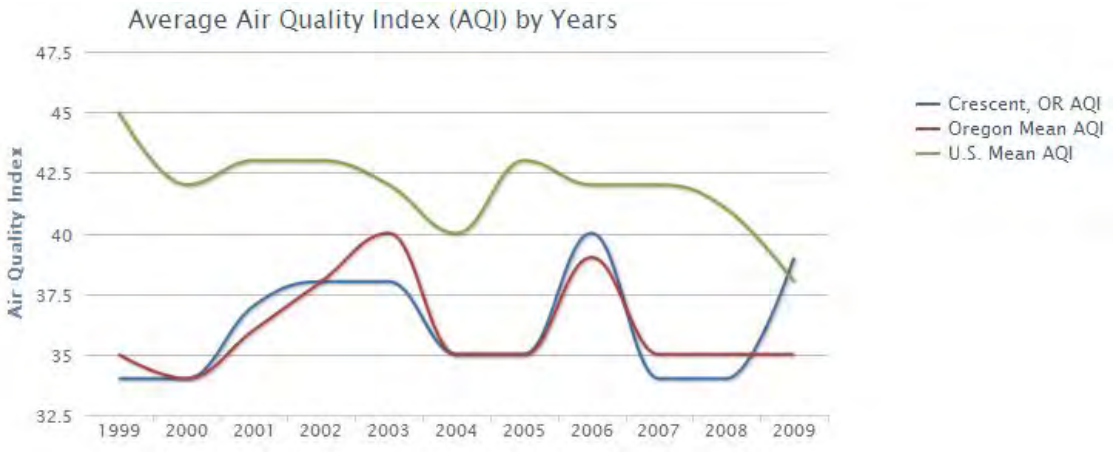
Air quality indices (AQI) are numbers used by government agencies to characterize the quality of the air at a given location. As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects. Air quality index values are divided into ranges, and each range is assigned a descriptor and a color code. Standardized public health advisories are associated with each AQI range. The EPA uses the following AQI:

Table 2.1 – Air Quality Index Values

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

The air quality in Crescent is rated 231 out of 480 communities in Oregon. There is no air quality station in the near vicinity so the air quality is averaged with other sites in the area. The graph below shows that the Air Quality in the area is generally good.

Figure 2.11-Historic Air Quality Index



Design and location of the proposed wastewater facilities will consider prevailing wind directions to minimize objectionable odors.

Water Quality

Surface Water

The Little Deschutes River which is located just outside of the Crescent Sanitary District boundary, sections of the upper Little Deschutes River, and tributary streams are protected under the Federal Wild and Scenic Rivers Act (Act). In 1988 Congress designated a 12-mile section (RM 84 to RM 97) at the headwaters of the Little Deschutes and a 10-mile section of Crescent Creek (from Crescent Lake Dam downstream to County Road 61 crossing) as Wild and Scenic Rivers. See Figure 2.11. Big Marsh Creek from the headwaters to the confluence with Crescent Creek is designated as a recreation stream under the Act. The U.S. Forest Service has developed management plans for these streams that outline measures to protect and enhance key resource values cited in the Act's designation (Deschutes National Forest, 2001). The Wild and Scenic River plan includes resource management goals for scenery, vegetation, geology and hydrology, wildlife, fish habitat, recreation, roads and access, and water quality. The Little Deschutes River headwaters are within Klamath County and the river flows north into Deschutes County; a portion of the eastern edge of the sub-basin is in Lake County. Major tributaries include Crescent and Paulina Creeks, and headwater tributaries Clover, Hemlock, Rabbit and Big Marsh Creeks. A major concern about the water in the river downstream, near Sun River and La Pine areas, is unusually high temperatures in the summer and the abnormal growth of algae.

Groundwater

Nitrate levels in the ground-water aquifer are increasing due to contamination from residential septic systems. The area's highly permeable, rapidly draining soils and high water table with relatively cold water temperatures are not suitable for large numbers of

septic systems. Nitrates, a by-product of septic systems and an indicator of human pathogens, are poorly retained in the fast draining soils and do not easily break down with the cool water temperatures. This contamination has public health implications because groundwater is the sole source of drinking water for area residents. The U.S. Geological Survey, in cooperation with Deschutes County and ODEQ, studied the movement and chemistry of nitrate in the aquifer and developed computer models that can be used to predict future nitrate levels and to evaluate alternatives for protecting water quality. Other studies indicated that there are problems with groundwater loading of nitrogen. Groundwater sampling was conducted as a part of the 1999 Wastewater Facilities Plan Update. Nitrate concentrations as high as 13 mg/L were detected at the central core of the community near the commercial district. The maximum contaminate level established by the EPA for drinking water is 10 mg/L. A copy of the nitrate sampling report is included in the Appendix. Funding was not available to perform groundwater sampling for this report and the 1999 report is the most recent data available.

Figure 2.12-Little Deschutes River Basin

Flood Plains

The Federal Emergency Management Agency (FEMA) has defined the extent of the 100-year flood boundary in order to establish actuarial flood insurance rates and to assist communities in efforts to promote sound flood plain management. The proposed

sewer district is not within a designated floodway or flood plain. The planning area is Zone C (area of minimal flooding). This includes the areas of Gilchrist and West Crescent.

The areas adjacent to the river are in Zone A within the 100 year flood plain, but these areas are outside of the project planning area. See FEMA FIRM map 410109-0175B in the Appendix.

Wetlands

A search of the U.S. Fish and Wildlife Service National Wetland mapping online database revealed that there are no regulated wetlands within the boundaries of the District. There are freshwater emergent mapped wetlands within the high water lines of the little Deschutes River. No ground disruption is planned in this area. Refer to the US Fish and Wildlife National Wetlands Map in the Appendix for the referenced Geographic Information Systems (GIS) mapping, which was the basis for this determination. Based upon general field observations made during the geotechnical site investigation, no unmapped regulated wetlands were identified within the proposed planning area. Test holes at the proposed wastewater facility site indicate that redox features are not present in the top 24 inches of soil (not much anaerobic activity). Also the site had no evidence of hydrophytic plant life. It should be noted that The National Wetland Inventory (NWI) program is a U. S. Fish and Wildlife Service wetland mapping program. NWI maps provide a basic level of information regarding location, type and size of wetlands for the entire United States. The NWI data includes attributed information on wetland system, sub-system, class, water-regime, and special modifiers indicating the general length of time water may be expected to exist in a wetland. Other special modifiers include water chemistry, soils, and manmade features and disturbances. There are limitations to using NWI maps, as the mapping data are incomplete. The data are also limited by the accuracy of the aerial photography interpretation and mapping. Frequently wetland areas are missed by interpreters and not mapped as wetlands, and sometimes non-wetland areas are identified as wetlands on the maps. Due to these inconsistencies a wetland delineation of the project areas will need to be completed after selection of the preferred project alternative.

Historical and Cultural Resources

The planning area has a very high probability for cultural resources based on known historical use of the area and previous experience evaluating the potential for cultural resources for similar projects in the area. A cultural resource study was conducted on-site and in cooperation with the State Historic Preservation Office in August 1982 (1983 Wastewater Facilities Plan). No impacts on historical and archeological sites were found for the wastewater project proposed at that time.

A Cultural Resources Technical Report will need to be completed for the selected alternative. Pipe corridors will need to be adjusted to minimize potential effects on cultural resources. Areas that have been previously disturbed will be favored in selection of pipe corridors. Inadvertent discovery procedures and guidelines will need to be developed for construction activities, in conjunction with the State Historic Preservation Office. The cultural study will also include input from local Tribes.

Flora and Fauna

The Little Deschutes River Sub-basin supports a variety of resident and migratory wildlife species, including songbirds, waterfowl, reptiles, amphibians and mammals. There are no known endangered species listed within the project area. Due to the nature of the environmental sensitive areas and potential for listed threated species to be present within the planned project areas, an assessment of the wildlife will need to be completed after selection of the preferred project alternative.

The low fertile volcanic soils in the upland areas generally limit native vegetation to conifers such as Lodge Pole and Ponderosa Pines, interspersed with Antelope Bitterbrush and Needle Grasses. No federally listed threatened or endangered plant species are known within the Little Deschutes watershed. There are plant species listed as species of concern with the US Fish and Wildlife Service, and species listed as threatened and candidates for listing by Oregon Department of Agriculture.

Water System

The majority of the planning area receives water service from the Crescent Water Association Water System (PWS ID#00244). The existing water system has 1.8 cubic foot per second (cfs) water rights and delivers water to 315 services from two separate wells, Well #2 and Well #3. The system also has a backup, Well #1, which is listed inactive except for emergency purposes. Infrastructure can currently deliver up to 120,000 gallons per day (GPD) at 700 gallons per minute (GPM) with a residual pressure of 75 pounds per square inch (psi). Static pressure in the planning area is in the range of 70 to 80 psi. The water system serves residents in both Gilchrist and West Crescent, outside of the District's boundary. The majority of homes in the planning area utilize the water system. There are only 3 to 4 domestic use wells located within the planning area.

Well logs for area wells were obtained from the Oregon Water Resources Department website (apps.wrd.state.or.us/apps/gw/well_log) and are noted on the map included as Exhibit F in the Appendix. Copies of the well logs are also included in Exhibit F. The public water supply wells for the Crescent Water District are shown on the Exhibit F map as Wells 1 and 2 located on the east half of Section 30 and Well 3 located in the NE ¼, NE ¼ of Section 1 directly west of the proposed treatment facility. All drinking water in the community is supplied by the Crescent Water District and protecting the chemical quality of the water derived from these wells is of the utmost importance.

There are two different water-bearing units or aquifers near Crescent; a shallow alluvial aquifer that is underlain by and separated from a series of basaltic lava flows, cinder deposits, and related volcanic rocks. The shallower aquifer is apparently hydraulically connected to the Deschutes River and water levels in it are within a few feet of the land surface. In comparison, water levels in the District wells tapping the deeper basalt aquifer are approximately 265 feet below land surface, such that there is as much as 200 feet of unsaturated geologic material separating the shallow alluvial aquifer from the deeper basalt aquifer.

Groundwater flow in the basalt aquifer is to the northeast generally following the course of the River (USGS Water-Resources Investigation Report 02-4015). This report also indicates the reach of the River near Crescent loses approximately 15 cubic feet per

second which contributes to the high groundwater table at the center of Crescent, along with this being a local topographic low. A mill pond impounds the River for the mill operations located in Section 19 and it probably contributes to the high groundwater table beneath the community.

Given a northeasterly groundwater flow in the basalt aquifer, Wells 1 and 2 are directly down-gradient of the locally contaminated shallow aquifer. If there is currently significant downward migration of water from the shallow alluvial deposits through 200 feet or more of unsaturated geologic materials (a number or volcanic flows, etc.) then elevated concentrations of nitrates in the shallow aquifer beneath Crescent would have been expected to already have been detected in these wells. However, at this point in time there is no evidence of nitrate degrading the chemical quality of the water in the deeper basalt aquifer indicating there is no easy path for the migration of the contaminated shallow water to the deeper basalt aquifer, although the potential may exist.

From the available data, Wells 1 and 2 are down-gradient from the known nitrate contamination in the shallow aquifer beneath the community. Consequently, it appears there is more of a risk for them to be affected than for Well 3 to be contaminated by the effluent from a properly operated treatment facility located slightly down-gradient of it. The proposed treatment ponds will be lined and the principal risk to Well 3 would be from irrigation using the effluent. However, the risk is very low for a well-managed facility with adequate irrigation area. Typically, irrigation with effluent results in nitrogen application rates of 10 to 50 pounds per acre per season, which is used up by the plants. These application rates are minimal compared to typical fertilizer application on farm land of 100 to 300 pounds per acre.

Risk of contamination is low for Well 3; however, moving the well would remove any risk and help with the stigma attached to a well near the treatment facilities.

If the District chooses to remove all risk of associated with Well 3, it could be moved further west to Highway 97 or across the highway, where the northeast groundwater gradient would further diminish contamination potential. The financial impact of moving the well would be to increase project costs by approximately $100,000.

Replacing Well 3 might be justified in any event because its construction details are a little sketchy and the casing diameter limits the size of pumps and therefore, the output from the well. There are three well logs for the well. The first log (KLAM 458) indicates the well was originally drilled to a depth of 285 feet. 12-inch diameter casing was installed to a depth of 138 feet and a sanitary seal placed to a depth of 20 feet. An 8-inch diameter liner was reportedly installed to a depth of 285 feet, with perforations from 165 to 175 feet; however, these perforations are approximately 90 feet above the static water level. The log also states that “loose strata [were] cemented off” from 140 to 260 feet but there is insufficient information provided to evaluate the effectiveness of these cementing procedures to act as an annular seal. The second log (KLAM 10261) relates to an attempt to perforate the 8-inch diameter casing from 275 to 285 feet. During the course of the work, it was determined the casing previously reported to have been installed to a depth of 285 feet was installed to a depth of 250 feet and no additional work was performed at that time. The third log (KLAM 10536) reports deepening the

well to a depth of 296 feet and installing a 6-inch diameter liner from a depth of 236 feet to 296 feet, perforated from 266 to 296. The 6-inch diameter liner limits the output of pumps that can be installed in the well.

Utilities and Fire & Life Safety

Other utilities within the planning area include telephone service by CenturyLink, electrical service by Mid-State Electric, natural gas provided through Cascade Natural Gas, and garbage service provide by Wilderness Garbage Service from La Pine. The Klamath County Sheriff Office provides police protection and Crescent Volunteer Fire District provides fire and emergency services. Highway 97 runs directly through Crescent and the nearest airport is Roberts Field located 120 miles north in Redmond, Oregon.

Other Environmental Issues

The environmental review will also need to consider removal of forest lands from forest use, the rezoning of the proposed facility property, and the access easement from the US Forest Service. These issues are currently being explored by the District and the results will be incorporated into the environmental review.

2.3 Growth and Population

Future projected growth and population along with estimated sewage flow and waste loads are estimated to provide a basis for design of the collection system and treatment capacity necessary to accommodate existing development and future growth over the next 20 years.

Current population and flow estimates in the planning area include consideration of West Crescent and Gilchrist since these areas will need to address their wastewater treatment facilities due to aging infrastructure and potential contamination of the Little Deschutes River Basin. The District understands that it may be financially necessary to connect additional users outside the current District boundary in order to finance and pay for the project.

Current Population

Residential population and income demographics are available for incorporated communities conducted by the US Census Bureau. Since Crescent is a rural unincorporated community there is little accurate growth and population data, so the data needs to be estimated using available County wide information. Historical water system information can be used to predict future growth and user trends in the sewer system. The Crescent Water Association currently provides water to 315 service connections both within the District and outside the District to the West Crescent Area. The current census data indicates the population averages 2.5 people per household. Using this per unit or service connection with the water district statistics equates to 790 people. Gilchrist has its own water system and supplies water to 210 residences. This puts the population of the surrounding area at approximately 1,000 people which includes Crescent, West Crescent, and Gilchrist.

Growth Rate

Based on historical census data and population forecasts as prepared by the Office of Economic Analysis, Oregon Department of Administrative Services Economic Analysis, Department of Administrative Services, State of Oregon, the growth rate in communities in Klamath County averages 0.42% per year and Deschutes County averages 2.0% per year from 1980 to 2050. The growth rates for sizing the Crescent Sanitary District's facilities will be current population, plus a 20 year forecast based on projected census data. Ultimate build-out population is the population that would result if all land within the District boundary is developed.

The ultimate build-out (UBO) is a moving target and difficult to predict when build-out will occur, therefore ultimate build out is not used for the population projection since growth in the rural areas is projected to be below build out levels by the Department of Administrative Services. However, UBO does allow some comparisons and consideration for collection system sizing.

A planning growth rate of 3% per year was assumed in the 1999 Facilities Study and update. The reasoning behind this growth rate is that the existence of a community sewer would create a 3% growth rate. According to the 1999 and 2007 facility plan update there are potential developments being planned that could allow a 3% growth rate to be reached and exceeded with a community sewage system. Even if the developments are established the likelihood that they will build-out is doubtful. This has been seen throughout the Central Oregon recreational properties real estate market.

The growth rate will most likely resemble the growth rate established for Deschutes County over the next 20 years which was forecast to be 2.0%, since the area is more connected to the Bend/La Pine area than to Klamath Falls. Once a new community sewer system is installed in the planning area some expansion will probably occur as property previously denied due to septic issues becomes available for development.

Many small communities in eastern Oregon have seen a decline in population over the past 25 years due to loss of timber related jobs and other factors. AES has spent 30 years working with small communities, and our experience is that population has remained relatively flat. This has been illustrated by the declining enrollment numbers in rural schools. However, some type of reasonable projection must be made for 20 year and 40 year planning periods. If funding for the project utilizes any USDA Rural Development funds a 40 year planning period is required.

Population forecasts for Klamath County to 2050 as noted by the Department of Administrative Services results in a growth rate of 0.42% per year for Kamath County. The Klamath County Planning Department has not developed any projections for the planning area; however, they felt 0.42% was low. Since the planning area is a unique, partially developed area comparing it to County wide percentages is not accurate since growth will most likely be concentrated in developed areas. A 0.42% growth rate is only 87 more people in the planning area in a 20 year period or 182 in a 40 year period. Sizing a system of this magnitude for such a small amount would be a mistake and result in very little cost savings. A growth rate of 2% results in a population of 1,500 in the 20 year period and 2,200 in the 40 year period. A growth rate of 2% will be used in this report to support further analysis. This growth rate is reasonable, will ensure

adequate facility capacity, and will result in a more realistic facility according to the best population forecasts available.

Equivalent Dwelling Units (EDU)

An EDU, also known as an equivalent residential unit (ERU), is the average wastewater flow received by the proposed treatment facility for one single family residential housing unit and referred to as the level of wastewater service provided to a typical rural residential dwelling. EDU are the basis for computing system development charges (SDC) and sewerage rates. They are also useful for planning purposes since EDU give an indication of the impacts of nonresidential development. OBDD-IFA requires a wastewater flow of 7,500 gallons per month, whereas ODEQ and USDA-RD is based on actual usage and recommends a design flow rate of 150 gallons per day per capita. Assuming 2.5 capita per household this equates to 11,250 gallons per month a 50% difference from the 7,500 gallon criteria.

Table 2.2 below summarizes the Equivalent Dwelling Units (EDU) that are within the District's boundary from data derived from the Crescent Water Association. Table 2.2 summarizes the current system users and flow rates and number of EDU for Residential, Commercial, Industrial, and Public usage using the criteria discussed in this section. Since there has been relatively minor growth within the area over the last 8 years, information provided in the 1999/2007 Facilities Plans is still relatively valid and is summarized below with minor modifications based on current design criteria.

Table 2.2 Equivalent Dwelling Units Summary Table

Type of User	# of Users (Hookups)	Usage (gallons/year)	Usage per User(gallons/year)	EDU'S (RD)[1]	EDU'S (IFA)[2]
Residential*	**211**	**19,340,534**	**91,661**	**143**	**215**
Commercial	**23**	**4,527,232**	**16,403**	**34**	**50**
Industrial	**5**	**1,902,658**	**380,532**	**14**	**21**
Public	**2**	**761,063**	**380,532**	**6**	**9**
Totals	**241**	**26,531,487**	**869,127**	**197**	**295**

**The Residential data includes both permanent and seasonal homes. The number of permanent versus seasonal residential users is not readily available at this time. This information will be determined during the income study.*

Water usage is not always directly related to waste flow as industrial users may use water for log watering, dust control or other uses that do not enter the waste stream. The same is true for some commercial and public users. However, it is a basis for determining rates and other charges.

Ultimate Build-Out (UBO)

Ultimate build-out is an estimate of the amount and location of potential development for an area. Performing a build-out analysis identifies the holding capacity of the land. The build-out calculation provides the supply of development for forecasting future land use growth. Build-out applies land use or zoning assumptions about density to the available land area. The build-out calculations deduct land due to physical constraints to development (e.g. sensitive natural resources), potential infrastructure dedications (e.g. streets, public open space, or storm water management structures), and practical design considerations (e.g. lot layout inefficiencies). Ultimate build-out (UBO) estimates are used for sizing sewer collection piping. Buried sewer lines are generally assumed to have a life expectancy of 50 years. It is disruptive and expensive to dig up undersized lines for replacement with larger pipes; therefore, buried sewer lines and other infrastructure are typically sized for ultimate build-out. Build-out calculations multiply the land area by density factors. Residential density is most often expressed as residential dwelling units per acre. The UBO population and EDU are computed based on land use zoning.

The Klamath County Comprehensive Plan currently restricts partitioning land less than two acres in the area. After a public sewer is constructed in Crescent, it is possible that the residential zoning will be rezoned to allow for smaller lot sizes since septic systems will no longer be installed. This will allow for more density of lots and potential higher growth. Installation of a community sewer system will also open the door to the potential for recreation resort properties that have been in planning for many years, but tabled due to the absence of a sewer system.

The timing and magnitude of development on these larger properties within the area is difficult to estimate. If estimates are too conservative, the final alternative may be more costly and capacity will never be utilized. However, if not enough capacity is planned for, costly upgrades may be required before the collection system has met the useful life of the facility.

The larger private parcels of land within the Crescent area have had the same level of use for decades and may remain for future decades as well. However, as development pressure increases for more recreational properties in the area it may spur more growth. Because of these factors the timing for reaching build-out conditions is difficult to predict in the Crescent area. Using the forecast growth rates puts build-out at least 50 years into the future. The 1999/2007 Facilities Plans' assumptions for forecasted growth, build-out, and EDU are reasonable and are summarized in the tables below, with minor revisions.

Table 2.3 Ultimate Build-Out

Crescent

Zoning	District Area(AC)	EDU per AC	Total EDU	Residential Population
RI	374	4.35	1,627	4,068
RUC-C	74	5.6	414	-
RUC-I	12	34.4	413	-
F	50	0	0	0-
Total	**510**	**0**	**2,454**	**4,068**

Based on 4.35 EDU per Acre with 1 EDU=2.50 capita.

West Crescent

Zoning	District Area(AC)	EDU per AC	Total EDU	Residential Population
RI	358	4.35	1,557	3,893
RUC-C	0	5.6	0	-
I	16	37	592	-
F	0	0	0	0-
Total	**374**	**0**	**2,149**	**3,893**

Gilchrist

Zoning	District Area(AC)	EDU per AC	Total EDU	Residential Population
RI	89	4.35	387	968
RUC-C	0	5.6	0	-
I	19	37	413	0
F	0	0	0	0
Total	**510**	**-**	**800**	**968**

This results in a build-out population of 8,929 at build-out of the areas based on available land area.

2.4 Reasonable Growth

The planning area includes the Crescent Sanitary District, West Crescent (currently outside the District boundary, but inside the water district boundary), and Gilchrist. There has also been some planning for destination resorts in the West Crescent area pending sewer system installation. Table 2.4 below summarizes the necessary growth capacity for the system based on the current census statics for 20 year and 40 year planning periods. Any new private development would pay for the additional capacity through connection fees and/or system development charges that will need to be established by the District. New development would also be responsible for the installation of collection system main lines and connection to the District's system.

Table 2.4 Growth and EDU Summary

Parameter	Crescent District	West Crescent	Gilchrist	Totals
Current Population	535	254	210	999
20 Year Projected Population at 2% Growth	803	381	316	1,500
40 Year Projected Population at 2% Growth	1,178	559	463	2,200
Current EDU - IFA Basis	295	156	138	589
20 Yr Projected EDU – IFA Basis	438	232	206	876
40 Yr Projected EDU – IFA Basis	651	344	305	1,300
Current EDU – RD Basis	197	103	91	391
20 Yr Projected EDU – RD Basis	293	153	135	581
40 Yr Projected EDU – RD Basis	435	227	201	863
Build-Out Population	4,068	3,893	968	8,929
Build-Out EDU	2,454	2,149	800	5,403

Does not include the potential destination resort properties estimated at 592 EDU, Population 1,504. EDU based on population of 2.5 per household.

The above results show a large difference between projected population and build-out figures. The possibility of a destination resort is not included in these estimates as a development of that magnitude would have resources to help the District modify the treatment system if required. Including the destination resort at this time would place a large burden on the existing users.

The projected design flows, based on 11,250 gallons per month and 7,500 gallons per month, are noted below, shown in Gallons per Day (GPD).

20 year population growth:

876 EDU @ 7,500 gallons per month equals 219,000 GPD, IFA Basis
581 EDU @11,250 gallons per month equals 218,000 GPD, RD basis

40 year population growth:

1,300 EDU @ 7,500 gallons per month equals 325,000 GPD, IFA basis
863 EDU @ 11,250 gallons per month equals 323,600 GPD, RD basis

Build-Out:

5,403 EDU @ 7,500 gallons per month equals 1,300,000 GPD, IFA Basis
5,403 EDU @ 11,250 gallons per month equals 2,000,000 GPD, RD Basis

This is a huge gap in projected data in comparison with the build out figures. However, build-out data is unrealistic unless some major change or large development is made.

Based on current trends and past experience the population projection of 2% is reasonable and will result in a more affordable project to service the needs of the area.

Since a combination of agency funding including IFA and USDA RD will most likely be required to construct the project, the 40 year projected flows of 325,000 GPD are recommended. This will allow compliance with all agency requirements, encompass the entire planning area of Crescent, West Crescent, and Gilchrist, and ensure adequate treatment facilities for the future.

If West Crescent and/or Gilchrist were omitted from the treatment system capacity calculations, the cost savings would be minimal when compared to the overall project. Since much of the treatment system will have the same fixed costs for power, pumps, piping, land acquisition, fencing, etc., the only savings realized in the construction would be the pond construction itself. (Treatment ponds are further discussed later in this report).

For example, if West Crescent flows are dropped the results would be 227 EDU'S at 2.5 persons per EDU resulting in 567.5 people. As a rule of thumb a treatment pond will handle roughly 294 people per acre, so the savings in lagoon construction is about 2 acres. Reducing the lagoon size by 2 acres will save only in earthwork and liner costs, about $140,000 or 6% of the treatment facility costs as noted later in this report.

For this reason the larger flow is recommended for planning at this time. This will result in an adequate facility and prevent overloading issues in the future, which is a common problem for small communities.

2.5 Community Involvement

The current District Board Members have been very proactive at involving the community and other stakeholders in the project planning. On April 9, 2014, the District, along with ODEQ and AES held a Town Hall meeting to discuss questions and concerns that the community may have regarding the District's future direction. At this meeting current plans for the development of the system and financing were discussed.

Other public meetings were also held as the facility plan was developed. Additional meetings with agencies and funding agencies have been held since January 1, 2015 to discuss how best to move ahead with the project. It is important at this time to keep the project moving as it has been on the table and discussed for many years. The current Board Members are also part of the community, and want to do what is best for the local community.

This includes, but is not limited to, economic growth and stability for the area as well as protection of the local cultural and environmental resources. The Board Members, led by the current President, Cher Dolan, have let the community know that their concerns are important and will be integrated into this current plan. ODEQ has also held numerous public education meetings within the area to educate the community about how on-site septic systems are affecting the local environment and drinking water resources.

3.0 EXISTING FACILITIES

3.1 Existing Facilities

The Crescent Sanitary District area does not have a centralized sewage collection system. Existing development within this area currently utilizes individual on-site sewage disposal systems. The condition of each individual system is unknown. What is known is that the existing drain fields are creating a potential health hazard due to the elevated levels of nitrogen present in the groundwater table. Some of the commercial properties (for example, gas stations) use portable toilets during the tourism season to alleviate the strain on the system. The high groundwater and highly permeable sandy soil conditions create very poor conditions for installation of new on-site sewage systems or repair of existing systems. A groundwater sampling report was prepared by Geotechnical Resources, Inc. (GRI) in 1999. The results found that nitrate levels range from Non Detected to 13 mg/L, which exceeds EPA set safe drinking water standards of 10 mg/L. A copy of the study is included in the Appendix as Exhibit E.

The community of Gilchrist on the north boundary of the District has a centralized sewer system which serves a population of 230 people. The collection system was installed prior to 1970 and consists mainly of vitrified clay pipe. The sewage is discharged into a sewage treatment plant that was constructed in 1972 and includes three one acre facultative lagoon cells, and a drain field consisting of approximately 4,200 lineal feet of disposal trench. The average flow measured from 2012 to 2013 was 12,788 gallons per day (GPD) (permitted flow is 60,000 GPD).

The treatment plant is located adjacent to the Little Deschutes River on tax lot 101 in the Southwest Quarter of Section 17 and the Southwest Quarter of Section 18, Township 24 South, Range 9 East, of the Willamette Meridian. The system is permitted with WPCF Permit #102198 with ODEQ. In 2006 the ODEQ amended the WPCF permit requiring that the Gilchrist system be monitored for water quality specifically for nitrate contamination and heavy metals to the groundwater. Gilchrist Sewer Company has contracted with EGR & Associates, LLC to sample, test, and report the results to the ODEQ. The most recent 2012-2013 assessment noted 14 instances of levels exceeding EPA's maximum level of 10 parts per million (ppm) nitrates in the groundwater monitoring wells. Copies of the ground water monitoring reports are on file at the Bend ODEQ office for examination. The ODEQ is currently in a pending mode as regards the situation in Gilchrist. The Gilchrist Sewer Company continues to perform groundwater monitoring according to their permit, but their current MAO has expired. ODEQ will not move forward with a re-negotiated MAO until they know if Gilchrist will be connecting to the proposed Crescent project. ODEQ is aware, from the monitoring results, that there are high nitrate values entering the groundwater between the drain field and the river. If Gilchrist does not connect to the Crescent system, or the Crescent system is not constructed, ODEQ will re-negotiate the MAO and Gilchrist will be required to perform an engineering study and reduce the nitrate levels. For funding purposes, ODEQ currently considers the Gilchrist system to be in violating of their groundwater rules. An email from ODEQ is included in the Appendix as Exhibit M.

The community of West Crescent also does not have centralized sewerage facilities and the residential properties are served with on-site septic systems. West Crescent has

high ground water, shallow aquifers, and very permeable pumice sandy soils. The housing density in the West Crescent area is located closer to the riparian Little Deschutes River Basin's sensitive wetland areas. The concern is that nitrogen released from on-site septic systems may not only contaminate groundwater that supplies drinking water, it may also make its way into the surface water, where nitrogen is known to decrease dissolved oxygen and have an adverse affect on pH levels in the river. This can cause increased algae plumes that remove oxygen needed by plants, fish, and animals to sustain a healthy eco-system.

3.2 Wastewater Generation

Future projected sewage flow and wastewater loads are estimated to provide a basis for design of collection system and treatment capacity necessary to accommodate existing development and future growth over the next 20 to 40 years. The planning area has been broken down into sub areas to better define and estimate population and growth characteristics. The sub areas are designated as Crescent Sanitary District, West Crescent, and Gilchrist.

The District has discussed at length the best approach for their community and the surrounding communities. At this time the District Board wants to evaluate the feasibility of developing a collection system for the Crescent Sanitary District, the West Crescent area, and include the Gilchrist area by constructing a connection line and associated pumps to accept the Gilchrist sewerage. The existing Gilchrist collection system would still be utilized and would receive no upgrades. This would allow the treatment facility at Gilchrist to be abandoned.

The Gilchrist area would need to be annexed into the Crescent Sanitary District or organized as a separate public utility district. The funding options available for the project do not allow costs associated with private entities, and it is not feasible for the District to pay the costs associated with the Gilchrist connection line. If Gilchrist was not annexed into the District, alternative funding (commercial loan, etc.) would need to be obtained. The West Crescent area would also need to be annexed into the District boundary. The potential annexation process is discussed further on Page 65.

The assumptions and methodology used to develop the system design criteria was established in the District's Facilities Plan and is summarized in Table 3.1.

Table 3.1 Wastewater Treatment System Design Criteria

Parameter	Crescent District	West Crescent	Gilchrist	Totals
40 yr. EDU'S	**651**	**344**	**305**	**1,300**
Daily Flow (GPD)	**163,000**	**86,000**	**76,000**	**325,000**
BOD_5 (pounds per day)	**277**	**146**	**130**	**553**
Daily Design Flow (GPM)	**113**	**60**	**53**	**226**
Peak Design Flow (GPM) 1.5 factor	**170**	**90**	**80**	**339**

BOD - Biochemical Oxygen Demand is the amount of oxygen needed for waste decomposition.

ODEQ & RD recommend a minimum average flow per capita of 150 GPD, and OBDD-IFA recommends a minimum flow rate per EDU of 7,500 gallons which is equivalent to 250 GPD per EDU.

3.3 Financial Information

The service area for the proposed project will be the current Crescent Sanitary District, West Crescent, and Gilchrist. This will be the area used when completing the income study required for funding approval.

Since there are currently no physical facilities installed for sewer collection and disposal, there is no formal rate structure at this time for the District. The lots within the District boundary are currently taxed through the Klamath County Assessor with a tax levy. 2012-2013 tax revenue for the District was $15,266. This works out to $4.42/EDU per month. A copy of the District's current budget is included in the Appendix.

Project Financing:
The District has been meeting with the Regional Solutions Team to determine how best to finance the project. Most likely the financing will be a combination of several sources.

Oregon Business Development Department – Infrastructure Finance Authority (OBDD-IFA)

Currently the District is exploring Community Development Block Grant (CDBG) funding through OBDD-IFA. Federal CDBG program rules limit program assistance to activities that are necessary to benefit current resident in a primarily permanent residential area. The program also requires meeting the federal objective of serving low and moderate income (LMI) persons. This means the service area of the system must serve an area that is comprised of over 51% LMI permanent residents both currently and in the future. Income levels in the Crescent area may not meet this requirement. "Low income" means income equal to or less than 50 percent of the area median (adjusted by family size). "Moderate income" means income equal to or less than 80 percent of the area median (adjusted by family size). Applicable income limits are determined by the United States Department of Housing and Urban Development (HUD) on an annual basis for all Oregon counties and metropolitan statistical areas. Because the Crescent area is unincorporated there is no current data available to determine the median income in the area. In order for the District to be able to apply for CDBG funding an income study will be required by the funding agencies to determine the community's income level. The maximum grant available through the program is $3,000,000.

OBDD-IFA also offers low interest loan options, through the Water/Wastewater Financing Program. The loan program funds the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act. In order to be eligible for funding a system must have received, or is likely to receive, a Notice of Non-Compliance by the appropriate regulatory agency. The maximum loan term is 25 years and the maximum loan is $10 million. Grants of up to $750,000 may be awarded based upon a financial review and must be matched 1:1 with a loan from the program. The annual interest rate for these loans is 3.96%. A median household income survey is also required for this program, to determine what the required affordability rate is and any potential for grant assistance.

U.S. Department of Agriculture–Rural Development (RD)
RD offers affordable funding to develop essential community facilities in rural areas. They offer direct loans options with terms up to 40 years at an annual interest rate of 3.25%. Grant assistance is also provided on a graduated scale with smaller communities with the lowest median household income being eligible for projects with a higher proportion of grant funds. An income study of the project area would determine how much of the project would be eligible for grant assistance.

Oregon Department of Environmental Quality (ODEQ)
ODEQ provides water/wastewater funding options through the Clean Water State Revolving Fund. The Fund provides low-cost loans to public agencies for the planning, design or construction of various projects that prevent or mitigate water pollution. ODEQ partners with Oregon communities to implement projects that attain and maintain water quality standards, and are necessary to protect recreation, fish habitat, boating, irrigation, drinking water and other beneficial uses. A wastewater treatment facility is an eligible project under this program. These loans are offered for 20 years and the current annual interest rate offered is 2.12%. As with the other funding agencies, reduced interest rates may be available depending on the income levels in the project area.

4.0 NEED FOR PROJECT

4.1 Health, Sanitation, Environment
In 2013 the South Deschutes/North Klamath Groundwater Protection Project Steering Committee findings for the region where summarized as follows:

“The area’s shallow, unprotected groundwater and pumice-based sandy soils mean that water soluble substances put on or in the ground will likely end up in the groundwater. While fertilizers, pesticides and livestock manure can contribute contaminants to the groundwater, most groundwater contamination comes from individual on-site septic systems. All types of on-site systems in the region – standard septic, sand filter and ATT systems --discharge contaminants into the ground. Over time, many of these contaminants drain through the sandy, porous soil and reach the groundwater, which can be as low as two feet below the ground surface in some areas. Compounding the risk is the fact that there are about 14,000 properties in the area with over 75% of the properties in neighborhoods having parcels of 2 acre or less in size. Add in the fact that there is minimal precipitation in the area to dilute contaminants and the problem becomes clear: too many septic systems are discharging to porous soil and over time there will be increasing contamination of the shallow vulnerable aquifers that many people are using as their drinking water supply.”

The committee identified on-site sewage disposal as a potential public health risk in the area and required property owners to either upgrade non-compliant on-site sewage disposal systems or connect to a centralized sewer system when it becomes available.

A study conducted by U.S. Geological Survey and published under **Fact Sheet 2007–3103 December 2007** in the Deschutes County's La Pine area which has similar conditions as Crescent stated the following:

"Large areas of the shallow aquifer will have nitrate concentrations above 10 ppm, and more nitrates will be carried into streams by groundwater.

If residential development proceeds as planned and no efforts are made to reduce the rates of nitrate loading from septic systems, loading is projected to increase 52 percent above 2005 rates. Computer model simulations of this future scenario show that:

1. Peak nitrate concentrations will exceed 10 ppm over large areas of the shallow aquifer. On average drinking water in those areas will be composed of at least 22 percent septic system effluent.
2. The highest nitrate concentrations will be near the water table, but many wells that draw water from the upper 50 feet of the aquifer will be at risk for nitrate contamination.
3. It will take decades for peak concentrations to occur and decades for concentrations to subside if nitrate loading is reduced.
4. Increasing amounts of nitrate from septic systems will be carried into the Deschutes and Little Deschutes Rivers by groundwater.

The computer model integrates the current understanding of nitrogen geochemistry, hydrology, and geology of the aquifer underlying the La Pine area. The model was tested by simulating past ground-water levels, ground-water travel times, ground-water discharge to streams, and ground-water-quality conditions and then comparing the model results with measurements made in the study area. The simulated conditions, including past ground-water nitrate concentrations, matched measured conditions within acceptable limits. These results indicate that the model has sufficient accuracy to be a valid tool for evaluating the potential effects of septic systems on future ground-water quality."

4.2 Aging Infrastructure

Many of the septic systems in the Crescent and West Crescent areas were installed decades ago when there was little or no regulatory oversight addressing system siting criteria, design, installation, and maintenance. The poor condition of the on-site sewage disposal systems in the Crescent area and the effect on public health and the environment has been an on-going concern. According to ODEQ, during the late spring and early summer roadside ditches in the area have sewage contaminated water in them. Water supply meter boxes have been tested in the past by water system operators with positive results for fecal coliform. People have complained for a number of years about a sewer smell lingering throughout the area. The rapidly draining soils in the area allow waste water to move directly from leaking septic tanks and existing drain fields. So even though a system may be impacting the shallow ground water the owners may not notice as there are no backups.

The groundwater monitoring that was conducted within the District in 1998 found that nitrate levels exceeded EPA drinking water standards set at 10mg/l. This data should be updated with new ground water monitoring, if the District moves forward with a new

central system. This will isolate contaminate areas, determine if cleanup is a necessary part of the construction project, and establish new baseline data for determining the central system impact on reducing the nitrate contamination.

No future development will be possible in this area using conventional standard type septic systems. It is very probable that constraints in place in southern Deschutes County will be applied to this area requiring systems to be replaced with advanced treatment systems that provide nitrogen reduction. These types of septic systems would cost individual homeowners around $22,000. This amount of instantaneous cost would be unattainable to most of the residents.

The Gilchrist gravity sewer piping network was installed prior to 1970 and was constructed of vitrified clay pipe that has a useful service life of approximately 50 years. The collection system is approaching the end of its useful life and there are no funds or assets in place to replace this infrastructure. Also, the sewerage treatment plant that is located adjacent to the Little Deschutes River is being monitored for groundwater quality and nitrate levels exceeding EPA drinking water standards set a 10mg/l. ODEQ is aware, from the monitoring results, that there are high nitrate values entering the groundwater between the drain field and the river. ODEQ is monitoring the situation and may require Gilchrist to perform an engineering study and reduce the nitrate levels, depending on the outcome of the proposed Crescent project. At this time, for funding purposes, ODEQ considers the Gilchrist system to be in violation of groundwater rules. Please refer to Exhibit M in the Appendix.

The proposed project will collect the Gilchrist sewerage using the existing collection system, which will not receive any upgrades. The sewerage will then be transported to the Crescent Sanitary District via a new collection line and associated pumps. The existing Gilchrist treatment plant will be abandoned.

Many of the properties in the West Crescent area are located in riparian areas of the Little Deschutes River. Although there is currently no scientific documentation, there are concerns that due to the permeable soil conditions and rapid infiltration qualities present, the Little Deschutes River may be subjected to septic effluent infiltration that would affect river pH, temperatures, dissolved oxygen, and nutrient rates,. This could have a detrimental effect on the river's ecosystem. The section of the Little Deschutes River running through the area is not designated wild and scenic, but sections of the Upper Little Deschutes River and tributary streams are protected under the Federal Wild and Scenic Rivers Act (Act). (See Section 2.2 of this report under Environmental Resources).

4.3 Summary

This project is necessary to protect public health due to sanitation issues and environmental concerns caused by release of contamination from on-site septic systems. The project is necessary to protect the water quality, maintain the rural character of the area, recognize private property rights of existing lot owners, and to accommodate anticipated growth. The key concerns are as follows:

Groundwater Quality: The area's highly permeable, rapidly draining soils and high water table with relatively cold water temperatures are not suitable for large numbers of septic systems. Nitrates, a by-product of septic systems and an indicator of human pathogens, are poorly retained in the fast draining soils and do not easily attenuate with the cool water temperatures.

Requiring all residents and businesses to upgrade to nitrogen reducing systems would be cost prohibitive. Installing a central system will protect the local environment and provide for additional growth which will further spread the burden of paying for the system. Property values will increase and lots and parcels will be saleable and developable.

Riparian and Wetland Habitat: Many of the lots and subdivisions are in sensitive areas near the Little Deschutes River, impacting riparian and wetland habitats that are important for fish and wildlife habitat and water quality.

5.0 ALTERNATIVES CONSIDERED

There are many different ways to collect, treat, and dispose of wastewater. This section of the report will examine the different types of sewer system alternatives available to provide a solution to protect groundwater in the District. The alternatives which were discussed with the District Board Members are as follows: No Action-continue with current on-site systems; Decentralized Cluster Systems; Vacuum Collection System; Low Pressure System with Grinder Pumps; Lower Pressure System with Septic Tank Effluent Pump (STEP) or Septic Tank Effluent Gravity (STEG); Conventional Centralized System.

No Action-(On-Site Systems)

Currently all wastewater treatment in Crescent is provided by on-site (septic tanks) systems. Septic tanks are designed for rural areas with lot sizes of one acre or more. All types of on-site systems that exist within the District; standard septic, sand filter, and ATT (alternative treatment technologies) systems, discharge contaminants into the ground. Over time, many of these contaminants drain through the sandy, porous soil and reach the groundwater, which can be as low as two feet below the ground surface in some areas. Due to soil and groundwater conditions, and population density, these systems are contributing to excessively high nitrogen concentrations in the area, as demonstrated by groundwater testing (report included in Appendix E). Continued usage of on-site systems will lead to increased nitrate levels in the groundwater as well as other harmful heavy metals and pharmaceuticals. Groundwater nitrates can be a pre-cursor/warning of pharmaceuticals, personal care products, and harmful household contaminates not eliminated by sewage disposal systems. Nitrates and other harmful chemicals accumulate in the groundwater over a long period of time, and it can take a correspondingly long time for nitrate levels to decrease after the source of contamination has been eliminated. Based on the potential negative environmental impacts resulting from the "no action" concept, this alternative is not considered practical, and therefore, is not retained for further evaluation.

Decentralized Cluster Systems

This alternative would involve the construction of several smaller decentralized wastewater treatment facilities to serve a small grouping or "cluster" of residential users. The type of treatment selected for each cluster can vary significantly from more conventional soil-based treatment to the construction of aerobic tanks, sand filters, peat filters, or constructed wetlands depending upon site conditions. From both a surface and groundwater perspective, these systems (if properly sited, installed, and maintained) can provide a high degree of treatment. However, clustered treatment systems have the following disadvantages:

- Close proximity of cluster treatment facilities to residential users
- Development plans should be prepared and followed closely
- Restricting future development within the service area
- Separate treatment facility required to serve each residential cluster
- Requires disposal of effluent into seepage trenches or other similar dispersal
- Permitting and operator training required for systems over 2500 GPD

Most of the modern cluster systems use alternative treatment technologies to remove nitrogen and other harmful chemicals. Most systems are expensive to maintain and cannot remove all of the harmful constituents that are dispersed into underground disposal arrangements. The soils and high groundwater in the area do no lend themselves well to these types of treatment technologies. These systems have been demonstrated and studied in the La Pine area with some success in the right soil conditions, but not in porous, high permeable, high groundwater conditions. Continued usage of on-site systems, or development of cluster systems, are not acceptable long term options, since evidence of groundwater contamination has been documented, and continued usage of septic tanks and drain fields will lead to increased nitrate concentrations in the groundwater. Based on the potential negative environmental impacts resulting from the "Decentralized Cluster System" concept, this alternative is not considered practical, and therefore, is not retained for further evaluation.

5.1 Collection System Alternatives

When on-site systems are not acceptable, wastewater must be collected for treatment at a centralized location. Collection systems can be divided into two categories, conventional and alternative. Conventional collection transports raw wastewater, primarily by gravity, through relatively large diameter (generally 8-inch diameter and greater) pipelines. Alternative systems primarily consist of three classes: septic tank effluent pumping (STEP/STEG), grinder pumps, and vacuum sewers. Crescent's population could be served by either conventional or alternative systems.

Centralized Effluent (STEP/STEG) Sewer Collection System

Effluent sewers are also known as STEP (Septic Tank Effluent Pumping) or STEG (Septic Tank Effluent Gravity) systems. With STEP sewers, a pump station equipment package is supplied by an independent material supplier. With an effluent sewer, raw sewage flows from the house or business to a watertight underground tank. Only the filtered liquid portion is discharged (by either pump or gravity) to shallow, small-diameter collection lines that follow the contour of the land. Solids remain in the underground

tank, for passive, natural treatment, and need be pumped approximately every 7 to 10 years. Collection system installation time is reduced compared to conventional sewers. Inexpensive, small diameter collection lines are shallowly buried, just below the frost line, reducing material and excavation costs. Because only liquid is being pumped, system designers do not need to worry about minimum velocity of the effluent. Each customer uses a separate tank. Since most of the solids are removed in the septic tank, sewer clogging typically is less of a problem. Small diameter (typically 3 inch to 6 inch) pipes can be installed at shallow depths, and may generally follow the contour of the land. In most cases cleanouts can be installed rather than manholes. The smaller diameter piping and elimination of manholes can decrease costs, depending on density of development. These savings are often offset by the cost of septic tank installation. In some instances, it is possible to gravity flow out of the septic tank, eliminating the requirement for pumping. This type of system can be referred to as septic tank effluent gravity (STEG) or small diameter gravity sewer (SDGS). One of the benefits of

Figure 5.1 Effluent Sewer Collection System

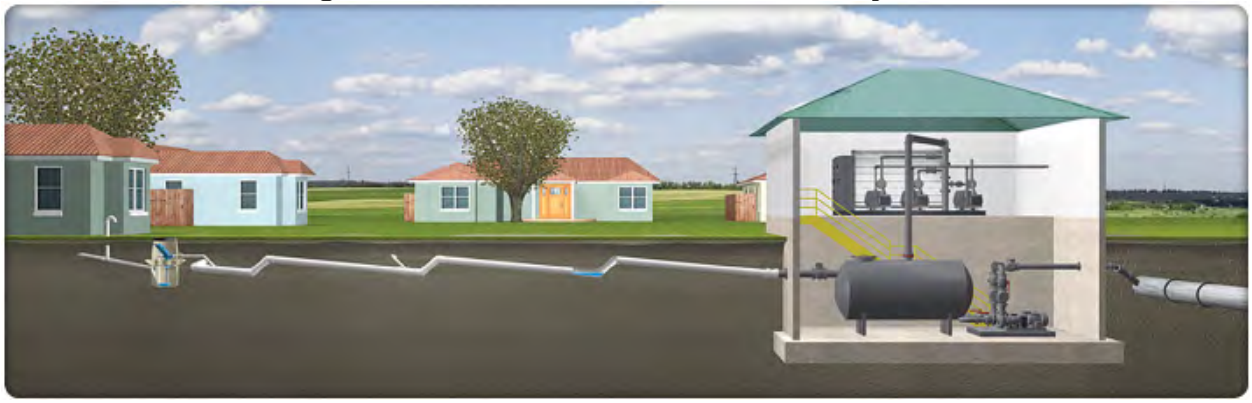
STEP/STEG is the solids remain in the septic tank and reduce the BOD and TSS values to the treatment plant. This type of collection system does help expand sewer collection systems easier than conventional gravity systems, but there are the issues of installation oversight, operations, and ongoing maintenance that conventional systems don't exhibit. Down sides to this collection system are the septic tanks need to be pumped and the pump systems require higher levels of maintenance and replacement costs for pumps and parts. Additional electricity is required to run the pump inside the pump tanks. This cost would be paid directly by the user. Agencies would require the District to maintain and be responsible for equipment maintenance and tank pumping, since the permit would be with the District and not the individual users. New construction costs would be placed on the developer to install the system so the District would need an inspection program in place or work with the Klamath County Building Department to make sure additional systems are installed correctly. The topography in Crescent is well suited for gravity flow and a combination STEP/STEG system. The nearby community of La Pine has experimented with the effluent system and the

maintenance costs have exceeded estimates for pump replacement and tank pumping frequency. Also it has not eliminated the nitrogen contamination problem as well as other constituents that wastewater carries. The Engineer's opinion of the probable capital costs for this collection system is $4,670,600, and the operations and maintenance costs are $30,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

Vacuum Sewer Collection System

In vacuum sewer systems, no septic tanks or grinder pumps are used. Instead wastewater gravity flows from each customer, or group of customers, to a valve station vault. From the valve vaults, wastewater then flows by vacuum through special valves into small diameter pipes and then to a central vacuum station. Wastewater is then pumped by conventional means to another collection system or treatment site. The vacuum system allows the use of small diameter pipes without the need for septic tanks or pumps. The figure below illustrates the typical vacuum system components.

Figure 5.2 Vacuum Sewer Collection System



A vacuum system works just like any other sewer system. Traditional gravity lines carry wastewater from the source to a vacuum valve air pit. When 10 gallons of wastewater collects in the sump, the vacuum valve opens and differential pressure propels the contents into the vacuum main line. Wastewater travels at 15 to 18 feet per second in the vacuum main to the vacuum station. The vacuum main is laid in a saw tooth fashion to ensure adequate vacuum levels at the end of each line. At the vacuum station, vacuum pumps cycle on and off as needed to maintain a constant level of vacuum on the entire system. Wastewater enters the collection tank and when the tank fills to a predetermined level, sewage pumps transfer the contents to the treatment plant via a force main.

Vacuum sewage is also aerobic and mixes easily with conventional sewage. A disadvantage is that specially trained personnel must be on call 24 hours a day 7 days a week. Potential problems include valve vault pits that have been frozen with up to 18 inches of solid ice, valves frozen closed, and controllers for the valves freezing open or closed or being unseated by ice. In addition to freezing caused by water in the pits, valves can freeze due to the constant stream of freezing ambient air being pulled in through "candy cane" vents. Both the City of Bend and Oregon Water Wonderland Sanitary District have experience with vacuum systems and can attest to the high

maintenance needs of these systems. The operators are on call 24/7 to maintain the system when problems arise, which is fairly frequently according to staff. Parts and repairs are also frequent and expensive due to the technology not being widely used in the area. Advantages are smaller pipe diameters, shallower bury depths, reduced water consumption since less water is needed to flush toilets, less concern about slope of installation (simplifies construction in flat areas), and less concern about contamination due to exfiltration of wastewater out of pipes. The main disadvantage is the additional operation and maintenance required to continuously maintain a vacuum throughout the system. The Engineer's opinion of the probable capital costs for this collection system is $4,863,800, and the operations and maintenance costs are $40,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

Low Pressure (Grinder Pump) Sewer Collection Systems

The low pressure sewer system generally consists of individual grinder pumps and low pressure sewer collection mains. Wastewater flows by gravity from buildings to individual or shared grinder pump vaults located on private property. Solids in the raw wastewater are ground up and pumped from the sump through a service line (typically 1-1/4-inch diameter) to a small diameter pressure main (pipe diameters ranging from 1-1/2 to 6 inch). Low pressure sewer collection systems utilizing individual and shared grinder pumps have been utilized by municipal sewage systems for the past 50 years. Low pressure collection systems are typically arranged as zone networks without loops. Depending on topography, size of the system and planned rate of build-out, appurtenances may include valve boxes, flushing arrangements, air release valves at significant high points, and check valves and full-ported stops at the junction of each house connection with the low pressure sewer main. The figure below shows the general arrangement of a low pressure sewer system.

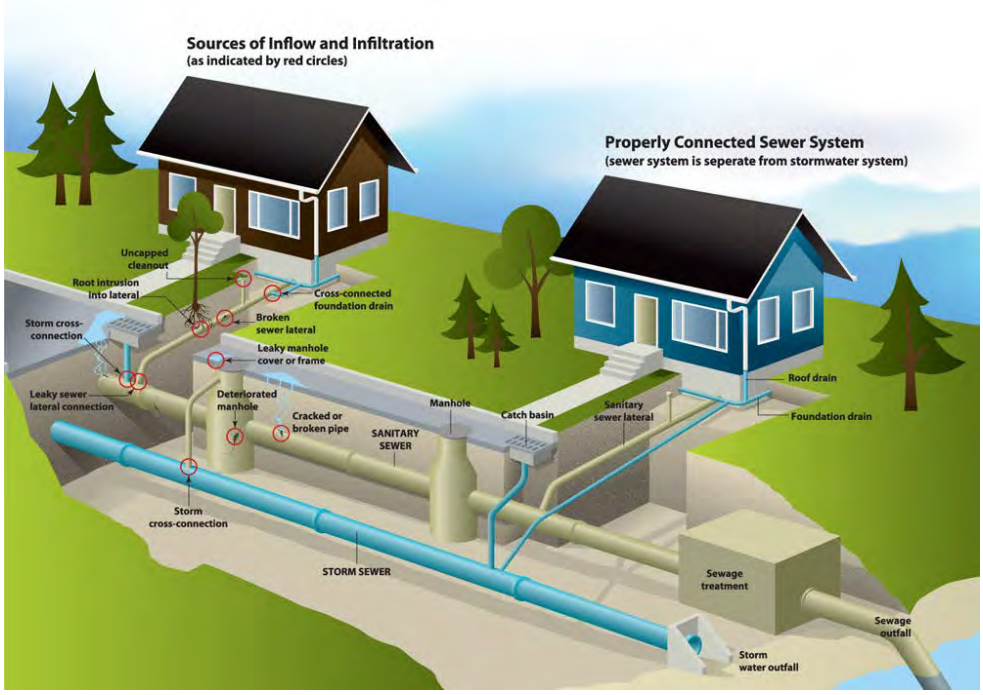
Figure 5.3 Low Pressure Sewer Collection System

Grinder pump systems do not use a septic tank to store solids, but grind up these solids and pump them into the sewer. These pumps can be plugged or damaged by certain waste products, such as rags or cat litter. Generally, each individual customer has their own grinder pump. This helps discourage customers from disposal of improper materials that may interfere with pump operation. The system may require more sewer line cleaning and customer education. The grinder pumps themselves may require more maintenance than a STEP pump system. Power outages can also wreck havoc on low pressure pumping systems if the individual pump vault overflows due to power outage. When power resumes there can be a surge on the electric and pumping system. There usually is no emergency power backup on each individual pumping unit. This type of collection system could introduce high maintenance, safety, and health concerns. The Engineer's opinion of the probable capital costs for this collection system is $4,526,600, and the operations and maintenance costs are $35,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

Conventional Gravity Sewer Collection System

A conventional gravity sewer collection system is a network of pipes laid at specified slopes to transport raw wastewater by gravity without the use of any mechanical means through relatively large diameter (generally 8-inch diameter and greater) pipelines. Conventional gravity sewers do not require on-site pretreatment or storage of the wastewater. Because the waste is not treated before it is discharged, the sewer must be designed to maintain self-cleansing velocity (i.e. a flow that will not allow particles to accumulate). A minimum self-cleansing velocity of 2 feet per second (fps) needs to be maintained to keep solids from settling in gravity lines. A constant downhill gradient must be guaranteed along the length of the sewer to maintain self-cleaning flows. When a downhill grade cannot be maintained, a pump station must be installed. Primary sewers are laid beneath roads, and must be laid at depths of 4.5 to 10 feet to maintain positive slope and to avoid damages caused by traffic loads. Access manholes are placed at set intervals along the sewer, at pipe intersections and at changes in pipeline direction (vertically and horizontally). The primary network requires rigorous engineering design to ensure that a self-cleansing velocity is maintained, that manholes are placed as required and that the sewer line can support the traffic weight.

Figure 5.4 Conventional Gravity Sewer Collection System



ODEQ has established minimum slopes for gravity lines to maintain 2 feet per second cleansing velocity. Minimum line sizes of 8 inch and 4 inch for gravity and pressure line respectively, have also been established by ODEQ. A preliminary gravity sewer collection system has been provided in the District's existing facility plan. Ultimate build-out was used to size the gravity lines since they have a design life of 50 years and it is very disruptive to remove sewer lines. Flows were distributed throughout the District boundary based on zoning and area served. Initial assessment of the topography and soil conditions in the Crescent area would allow for good conditions for the installation of a conventional gravity system. Conventional gravity systems work well in cold weather climates due the depth of burial. Conventional gravity systems also have no mechanical parts so once installed maintenance is usually limited to line flushing and manhole cleaning annually or as required if there is a blockage. Conventional systems do have higher initial capital installation costs and can cause more disruption due to the construction required to bury the lines deeper than alternative systems. This technology provides a high level of hygiene and comfort for the user at the point of use and also the system operator. Most sewer system operators would recommend a gravity system over other conventional systems as far as maintenance goes. The Engineer's opinion of the probable capital costs for this collection system is $4,659,800, and the operations and maintenance costs are $25,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

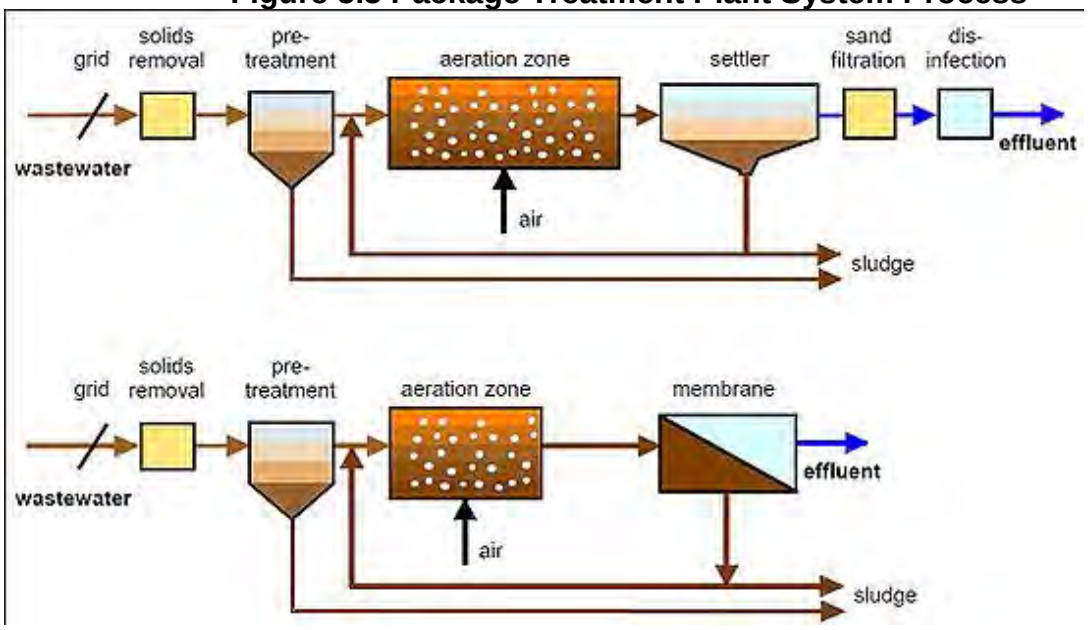
5.2 Treatment System Alternatives

Package Treatment Plant

There are a number of commercially available packaged treatment plants on the market today which use varying types of technologies to treat wastewater. These systems do a fair job of removing BOD (biochemical oxygen demand) levels of the wastewater to arrive at acceptable limits set by state and local regulations. Most package plants are based on a biological treatment process with sludge by product. All sewage would be conveyed to a packaged treatment system, followed by surface discharge to a stream.

The treatment system would include primary, secondary and, potentially, tertiary treatment depending upon the receiving water body. Due to nature of the environment of the Little Deschutes Basin it is unlikely that an NPDES permit would be issued by the ODEQ. The packaged plants require a higher degree of maintenance and expertise to run than other tertiary treatment methods such as lagoons and ponds, or land irrigation. A secondary treatment pond and subsurface absorption or irrigation would be required to dispose of the final effluent byproduct. Sludge would also have to be handled and disposed on an as-needed basis. The figure below illustrates the basic flow characteristic of a packaged biological treatment plant operation.

Figure 5.5 Package Treatment Plant System Process



The use of hazardous chemicals will require highly trained operators and may also require a hazard mitigation plan and will be a greater threat to the environment than other alternatives.

The pre-treatment process alternatives would be operator intensive, require frequent process and chemical adjustments, and result in relatively high operating costs due to chemical addition. Effluent filter or membrane options are capable of achieving quality suitable for reclaimed water. Disadvantages of the advanced treatment of effluent alternative include the costs for pretreatment prior to final filtration. High chemical costs

for polymer and flocculent can be expected. Process reliability continues to be subject to seasonal changes of temperature and algal concentrations. It may also be a necessity to pre-treat final filters with chlorine. Ammonia removal with air stripping significantly increases operational complexity. Air stripping requires chemical addition to elevate the pH, which translates into significant operations and maintenance concerns. Solids handling processes are required for solids from pre-treatment processes and filter backwashes. The resulting treatment system would be highly operator intensive.

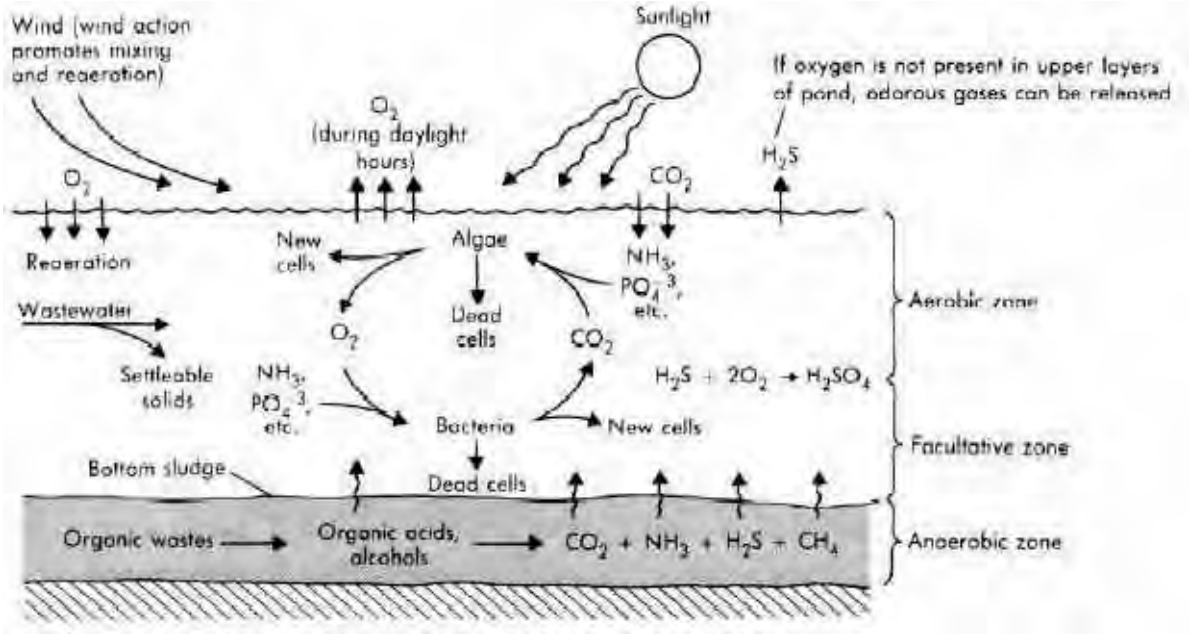
The Engineer's opinion of the probable capital costs for this treatment system is $4,011,000, and the operations and maintenance costs are $80,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

Facultative Ponds

A facultative pond system along with storage and land application of the effluent is a common and an acceptable way to dispose of municipal wastewater without discharging into public waters.

Facultative waste stabilization ponds, sometimes referred to as lagoons, are frequently used to treat municipal and industrial wastewater. The technology associated with facultative lagoons has been in widespread use in the United States for at least 90 years, with more than 7,000 facultative lagoons in operation today. These earthen lagoons are usually 4 to 8 feet in depth and can be mechanically mixed or aerated for increased capacity. The layer of water near the surface contains dissolved oxygen due to atmospheric re-aeration and algal respiration, a condition that supports aerobic and facultative organisms. The bottom layer of the lagoon includes sludge deposits and supports anaerobic organisms. The intermediate anoxic layer, termed the facultative zone, ranges from aerobic near the top to anaerobic at the bottom.

Figure 5.6 Facultative Pond System Process

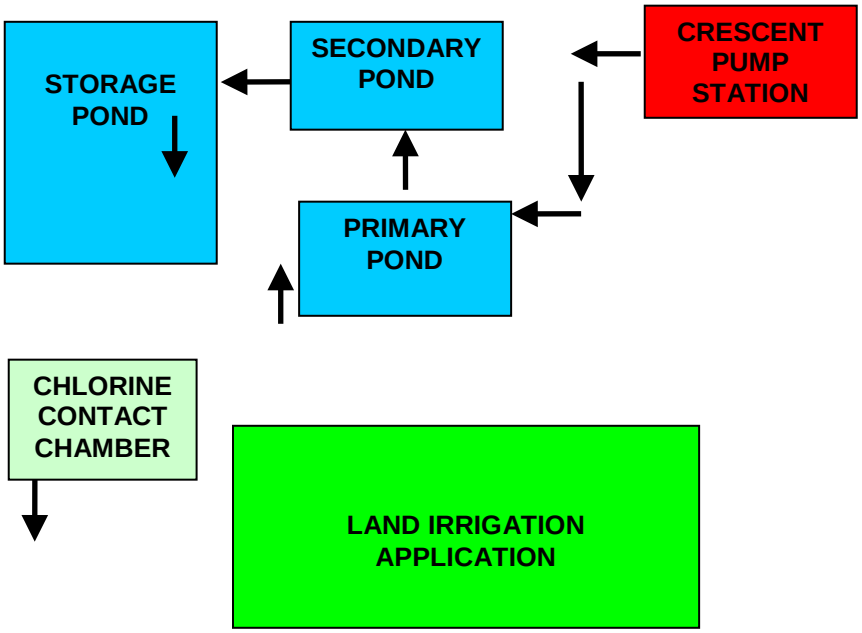


These layers may persist for long periods due to temperature-induced variations in the water density. Inversions can occur in the spring and fall when the surface water layer may have a higher density than lower layers due to temperature fluctuations. This higher density water sinks during these unstable periods, creates turbidity, and can produce objectionable odors, especially if there has been ice cover. However this period is generally short and can be helped by not under sizing the lagoon.

The presence of algae in the aerobic and facultative zones is essential to the successful performance of facultative ponds. In sunlight, the algal cells utilize CO_2 from the water and release O_2 produced from photosynthesis. On warm, sunny days, the oxygen concentration in the surface water can exceed saturation levels. Conversely, oxygen levels are decreased at night. In addition, the pH of the near surface water can exceed 10 due to the intense use of CO_2 by algae, creating conditions favorable for ammonia removal via volatilization. This photosynthetic activity occurs on a diurnal basis, causing both oxygen and pH levels to shift from a maximum in daylight hours to a minimum at night. The oxygen, produced by algae and surface re-aeration, is used by aerobic and facultative bacteria to stabilize organic material in the upper layer of water. Anaerobic fermentation is the dominant activity in the bottom layer in the lagoon. In cold climates, oxygenation and fermentation reaction rates are significantly reduced during the winter and early spring and effluent quality may be reduced to the equivalent of primary effluent when an ice cover persists on the water surface. As a result, many states in the northern United States and Canada prohibit discharge from facultative lagoons during the winter. Although the facultative lagoon concept is land intensive, especially in northern climates, it offers a reliable and easy-to-operate process that is attractive to small, rural communities.

Inflow coming in from the District's collection system will pump into the primary pond and then be directed to the secondary pond, and then to the storage pond for future land use application. Prior to irrigation the water will feed from the storage pond to a chlorine contact chamber to kill bacteria. The storage facility will have adequate storage to store the effluent until land application is possible during the growing season.

Figure 5.7 Diagram of Facultative Pond Treatment Facility



An irrigation pumping facility will be constructed after the chlorine contact chamber. This will be a simple structure of a concrete pad and a centrifugal pump that will be primed by the operator and then directed to the sprinkler system. The pump would be on a timer so the operator can set the irrigation applications for the required duration, and the pump will shut off to allow the sprinklers to be drained for movement.

Advantages of the facultative pond and storage alternative include low operating costs and less reliance on mechanical equipment and power. The District system operator will have the knowledge for this type of system, and will be required to have certification to operate the facility.

The District may encounter some public concern due to the potential for mosquito breeding, odors and a treatment site in the general sense. However with good operation and maintenance lagoons operate very well. There are many treatment lagoons throughout eastern Oregon and they are a cost effective and environmental sound treatment where land is available. Many lagoons in eastern Oregon are much closer to “Town” than this proposed lagoon site.

The Engineer’s opinion of the probable capital costs for this treatment system is $3,093,800, and the operations and maintenance costs are $51,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

6.0 SELECTION OF ALTERNATIVE

Selection of an alternative depends on many factors, including the net present worth cost analysis, operation and maintenance, community interests, and long-term interests.

Operations and maintenance (O&M) costs for all of the alternatives are considered in determining the recommended project. For planning purposes, only alternative-dependant costs for maintenance, operations, chemicals, and utilities were compared.

A net present worth cost analysis will compare the present cost of the project alternatives. The net present worth analysis requires the conversion of all cash flows to the present. As such, it requires the consideration of the time value of money and all future cash flows (costs or profits) are discounted back to the present. In other words, the net present worth is a summation of all present day costs (cost of implementing the project) and future costs (i.e. operation and maintenance costs) or profits (salvage value) over the analysis period. The analysis period for these project alternatives is 30 years. To find the present worth of a project an interest rate is needed to discount future cash flows. The most appropriate value to use for this interest rate is the rate of return from investments.

The real discount rate found in Appendix C of OMB Circular No. A-94 was used to determine the present worth of the uniform series of operations and maintenance estimated for the feasible alternatives. The wastewater treatment improvements were considered to have useful lives longer than thirty years. The real discount rate selected by OMB for discounting real value for investments maturing in 30-years or more is 3.9%. The economic lifetimes of the alternatives were assumed to be equivalent. Therefore, salvage value was estimated to be zero dollars at the end of the life cycle. The following table shows how the alternatives ranked based on the lowest Capital Cost and the lowest O&M life cycle Present Worth.

Table 6.1 Comparison of Alternative Life Cycle O&M and Capital Costs

Alternative	Capital Cost	Construction Cost Estimate	Non-Construction	Annual O&M	O&M Present Worth	Total Present Worth
Collection Systems						
Gravity	**$4,659,800**	**$3,841,500**	**$818,300**	**$25,000**	**$502,269**	**$5,162,069**
Pressure	**$4,526,600**	**$3,730,500**	**$796,100**	**$35,000**	**$703,177**	**$5,229,777**
STEP/STEG	**$4,670,600**	**$3,850,500**	**$820,100**	**$30,000**	**$602,723**	**$5,273,323**
Vacuum	**$4,863,800**	**$4,011,500**	**$852,300**	**$40,000**	**$803,631**	**$5,667,431**
Treatment Systems						
Facultative Pond	**$3,093,800**	**$2,486,500**	**$607,300**	**$51,000**	**$1,024,629**	**$4,118,429**
Package Plant	**$4,011,000**	**$3,142,500**	**$868,500**	**$80,000**	**$1,607,261**	**$5,618,261**

Costs used for comparison of alternatives include Crescent Sanitary District and the Gilchrist connection, where applicable.

6.1 Non-Monetary Factors Considered

Operation & Maintenance

Rural Oregon communities like Crescent need to consider the simplest, most effective operator friendly systems. These types of systems are ones that have been in use for years in small communities in Oregon and have a good environmental and treatment track record with ODEQ. A good O&M system is one that current operators in the area are familiar with and a local operator can become certified to operate.

Community Interests

Factors influencing community interests include providing a facility that will last for a long period of time (e.g., 40 year time frame) and is cost effective to build and operate.

Long Term Interests

Long term interests are to provide a distribution system that meets current standards, provides for existing demands and some future growth, and meets regulatory requirements.

6.2 Evaluation of Alternatives

A public meeting was held by the District on July 9, 2014 at the Crescent Community Center to present and discuss the alternatives to the public. Alternatives were discussed and ranked as listed in Table 6.2 below based on Cost, Operations and Maintenance, Community Interest and Long Term interest.

A ranking of the viable alternatives for both the economic and non-economic factors is provided below. The table includes the scores for the collection system alternatives and the treatment system alternatives. The final project will be a combination of the best collection treatment alternative and the best treatment system alternative. The best alternative was scored a 1; second best a 2; and third best a 3, and so on. Equivalent factors received equal rankings. A summary of the ranking is shown in Table 6.2.

Table 6.2 Evaluation of Alternatives

#	Alternative	Cost Analysis	O&M	Community Interest	Long Term Interest	SCORE
	Collection Systems					
1	STEP/STEG	2	2	2	1	7
2	**Gravity**	**1**	**1**	**1**	**2**	**5**
3	Pressure	2	3	4	4	13
4	Vacuum	4	4	3	3	14
	Treatment Systems					
1	**Facultative Pond**	**2**	**1**	**1**	**1**	**5**
2	Package Plant	1	2	2	2	7

After reviewing and discussing the alternates fully for these criteria, the Board Members unanimously decided to pursue a Conventional Gravity System for collection (Collection System Alternative #2 in the above table) with Facultative Treatment Lagoons for treatment (Treatment System Alternative #1 in the above table). The Board also decided to explore the possibility of constructing the system to serve the current

Crescent District, Gilchrist, and West Crescent, knowing that including these areas will help to reduce resources and keep rates reasonable for all users in the area. Cost estimates have been prepared for three options, Crescent Only, Crescent and Gilchrist, and Crescent, Gilchrist, and West Crescent. The financial analysis section will include information on all of these options.

The Gilchrist area would need to be annexed into the Crescent Sanitary District, or Gilchrist would need to be organized into a public district in order to make the project financially feasible. The various grant and loan funding options discussed in this report will not pay for any costs that are associated with private entities. It is not financially feasible for the Crescent District to cover the cost of the Gilchrist connection, estimated at $450,000, unless an alternative funding source was obtained. The issues associated with potential annexation are discussed further on Page 65. The Gilchrist collection system would continue to be used and would not receive any upgrades. A new collection pipe and associated pumps would be constructed to transport the sewerage from the Gilchrist system to the District treatment system.

The West Crescent area currently has no sewer system or district, and would also need to be annexed into the Crescent District boundary. The potential issues associated with this annexation are also discussed on Page 65.

7.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

7.1 Project Design

Collection System

A collection system proposed for this project shall be 8” minimum sewer main lines within the rights of way of the streets and existing roadways. The sizes of these main lines will be designed using population growth and peak flow from surges during morning and evening. These lines collect sewer from 4” lateral lines connecting to homes and businesses to collect and combine the sewer to one location where it can be pumped to the lagoons. Throughout the system, there are also a series of manholes and cleanouts for maintenance and inspection capabilities. These manholes also serve as collection points and changes in direction for the sewer to travel as this system is operated as a gravity structure. The collection system will also entail the need for crossing Highway 97 in a few locations to capture sewer on both sides of the road. This will involve construction boring so traffic on the highway is not interrupted. The collection system components will be the same for both the Crescent and West Crescent areas. This collection system is also sized to take on additional sewer flows from population growth within the project area.

Pump Station

Duplex pumps shall be provided for both pump stations in Gilchrist and Crescent. Duplex systems ensure if a pump goes out of service, the remaining pump will be capable of handling the design peak hourly flow. The effective volumes of the wet wells shall be based on design average flow and a filling time not to exceed 30 minutes. An alarm system shall be installed at both the pumping stations. These alarms shall be activated in cases of power failure, pump failure, unauthorized entry, or any cause of pump station malfunction. The pump stations shall be telemetered to the operator and

be outfitted with an auto dialer that will alert staff 24 hours a day, 7 days per week. Audio visual alarms shall also be installed at the pump stations with a battery back-up power supply. Also, both pump stations shall be equipped with a portable generator outlet for back-up power during extended power outages.

From current data gathered by Gilchrist, a determination was made for 40 year growth with a peak design flow of 80 GPM. The pumping station for Gilchrist that will be delivering the effluent will be designed for this flow. A duplex pumping station shall ensure the handling of the full daily peak flow. Each pump shall be designed for an approximate maximum pumping rate of 100 GPM at 50 feet of Total Dynamic Head. The wet well will be sized to purge a 15 minute volume which is 1,215 gallons. The pumps will alternate and pump 15 minutes per cycle which will purge the force main volume every 15 minutes (25 minutes maximum is required per ODEQ).

The wet well will be 8 feet in diameter by 4 feet deep. With the gravity sewer invert 12 feet deep; this will place the bottom of the wet well 17 feet deep from existing ground surface.

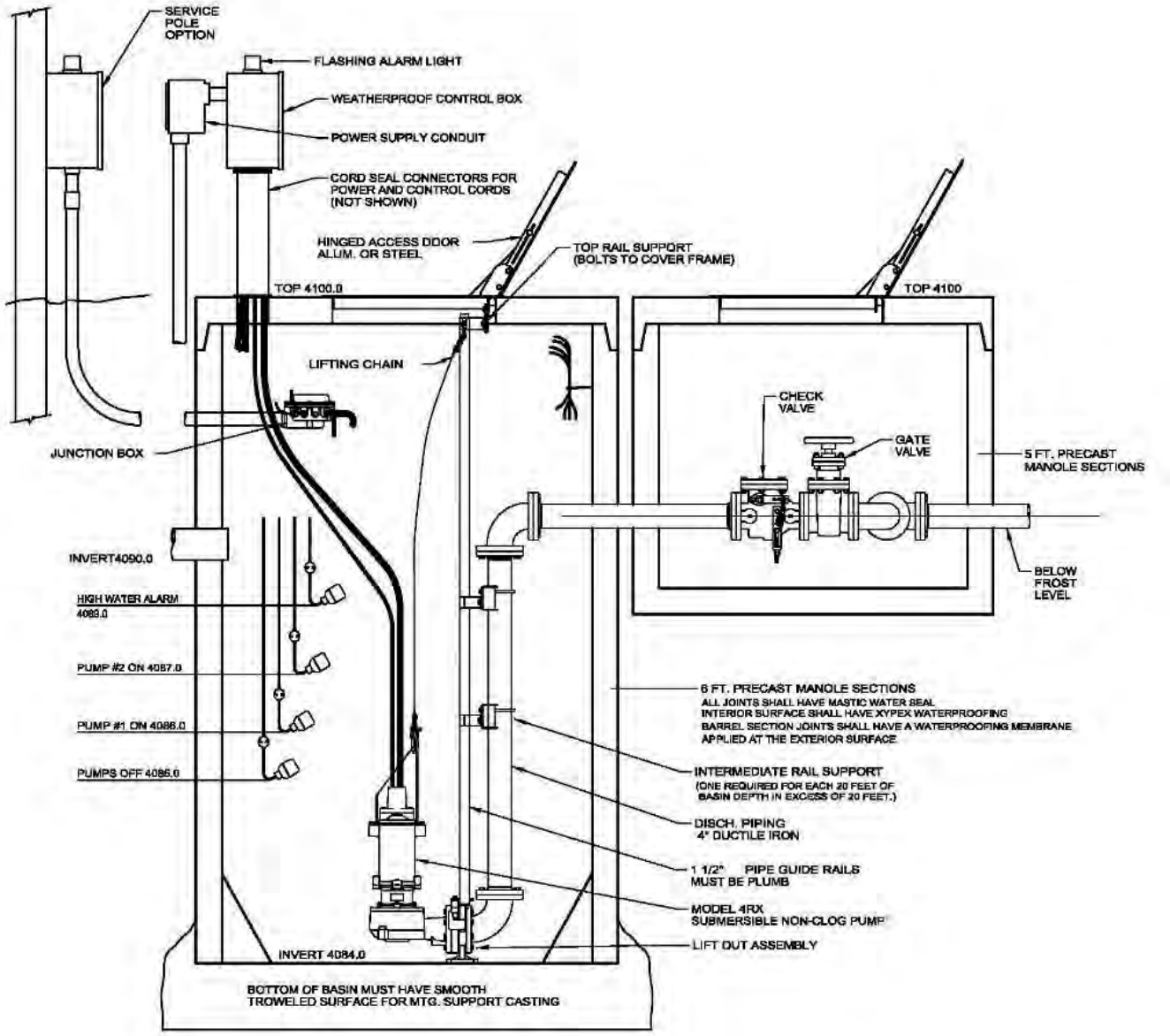
For the rest of the area, a calculation of 40 year growth was determined for a peak design flow of 260 GPM. However, this pump station will also need to include the sewer from Gilchrist at 80 GPM resulting in a station design of 340 GPM.

A duplex pumping station shall ensure the handling of the full daily peak flow. Each pump shall be designed for an approximate maximum pumping rate of 340 GPM at 60 feet of Total Dynamic Head with a 65% efficiency rating. The wet well will be sized to purge the volume and force main volume every 25 minutes (25 minutes maximum is required per ODEQ).

The schematic drawing shown in Figure 7.1 on the next page depicts the proposed sewer pump stations.

Electrical systems and components (e.g., motors, lights, cables, conduits, switch boxes, control circuits, etc.) in the wet wells (enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present) shall comply with the National Electrical Code requirements for Class I Group D, Division 1 locations. In addition, equipment located in the wet well shall be suitable for use under corrosive conditions. Each flexible cable shall be provided with a watertight seal and separate strain relief. A fused disconnect switch located aboveground shall be provided for the main power feed for all pumping stations. When such equipment is exposed to weather, it shall meet the requirements of weatherproof equipment NEMA 3R or 4. Lightning and surge protection systems should be considered. A 110 volt power receptacle to facilitate maintenance shall be provided inside the control panel for lift stations. Ground fault interruption protection shall be provided for all outdoor outlets.

Figure 7.1 Schematic of Proposed Pump Station



Force Main

A PVC C900 Class 200 (equivalent to water pressure pipe) force main which will run south along the East Right of way of Highway 97 then turn toward the proposed property and head east to the proposed lagoon sites for a total approximate force main length of 11,000 lineal feet. The discharge vault will be outfitted with a waste water flow meter. Force main design and sizing will maintain an acceptable cleansing velocity (minimum 2.0 ft/sec).

Gilchrist Connection

A pump station and connection line will be constructed to transport the sewerage from the existing Gilchrist collection system to the new treatment facility. The existing Gilchrist treatment facility will be abandoned. This will most likely consists of simply halting transportation of sewerage to the Gilchrist lagoons. Water levels in the lagoons will eventually drop, and accumulated sludge could be removed at that time. There will be significant environmental benefits to simply halting use of the Gilchrist treatment facility, even if formal abandonment is not completed for several years. The District will need to work with ODEQ to determine abandonment procedures. Formal abandonment could cost as much as $500,000. This cost is not included in the financial analysis for this report, as it is felt that formal abandonment of the Gilchrist treatment facility could be postponed until a much later time.

Treatment Components

The proposed treatment will be facultative lagoons, storage pond, treatment, and land application of the reclaimed water as was discussed earlier. There will be no discharge. The system will require permitting through the Oregon Department of Environmental Quality in accordance with OAR 340-071-0162.

Lagoons

Effluent from the pumping station will be pumped into a two cell lined lagoon treatment system. Cell A covers an area of 7.5 acres with an operating depth of 4 feet; Cell B covers an area of 7.5 acres also with an operating depth of 4 feet. The ponds have a freeboard amount of 2 feet to the top of the dikes. The table below summarizes the lagoon physical properties.

Table 7.1 - Lagoon Capacity

Lagoon	Area acres	Depth (ft)	Max Volume (mg)
Cell A	7.5	4	9.8
Cell B	7.5	4	9.8

All sewerage is pumped from the pump station to Cell A (North Lagoon). Sewerage can be directed to either Lagoon Cells A or B at the inlet valve box which will be located near the mid-point of the lagoon cell separation dike. However, unless a problem is apparent with Lagoon Cell A, sewerage should always be directed toward Lagoon Cell A to allow for maximum detention times for the waste.

The facultative ponds or lagoons treat sewerage through natural degradation of the waste in three zones. At the surface of the ponds an area will exist where aerobic

bacteria and algae will exist in a symbiotic relationship, below that will be an intermediate zone where decomposition of organic waste is carried out by facultative bacteria, and at the bottom of the ponds an anaerobic area will exist where accumulated solids are decomposed by anaerobic bacteria.

There are two separate lagoons to ensure the waste has adequate detention time as it moves through the system. An overflow structure will be located on the dike between the two treatment lagoons to allow the waste to flow through the system while keeping the cells at optimum level. This structure is an overflow pipe type outlet with an anti-vortex device to allow clear flow. Slide valves are installed at the bottom of the lagoons to allow lagoon levels to be dropped if necessary.

Wastewater will flow between the two lagoons automatically through the cross-flow structure. However, visual daily checks are required to ensure the cross-flow structure is functioning properly.

In case of an emergency or if one lagoon is taken out of service for maintenance, inflow can be redirected to the operational cell by shutting the slide valves at bottom of the overflow structure and draining one cell through the outlet structure.

The outlet structure located at each lagoon will be equipped with a sliding V-notch weir that can be adjusted to limit or increase the flow out of each cell and into the chlorinator.

With the waste loads determined, the sludge build-up should not be a problem and the lagoons can run for approximately 20 years before cleanup of the cells is necessary. However, the sludge depth should be monitored annually to track any build-up that will occur. Bio-solids (sludge) samples should also be taken throughout each lagoon.

The lagoons should remain full at all times. They should not be dried up for any reason unless approved by the Engineer. Drying up a cell could compromise the existing geo-textile lining and seal on the lagoon walls resulting in a groundwater impact problem.

Effluent Total Suspended Solids (TSS) will vary seasonally (especially in cold climates) between 50 and 150 mg/L or more and contain 10 to 100 mg/L of algae cells. BOD removal efficiency will vary seasonally between 70 and 95 percent. Odors may be an intermittent problem during spring in cold climates where lagoon surfaces have frozen over.

Maintaining the water elevations at design levels minimizes odor problems and keeps the system working properly. However in late winter or early spring if the surface has been covered with ice for a long period, odors can develop until oxygen is replaced in the upper levels of the ponds. But due to the large sizing of the lagoons and the relatively small waste load from the District, odors are not expected to be a problem.

Severe winter conditions may freeze over the surface so no surface flow is possible and the overflow structure may not work properly. At this point the control valves at the base of the overflow structure may be used for flow routing. Generally, wastewater flows are lower during the winter.

Chlorination Facility

The outlet from either lagoon cell discharges directly into the chlorination contact chamber. The contact chamber is below grade and will provide 2 hours of contact time at design flows (28,000 gallons). The chlorinator will be located in a block building next to the contact chamber. Chlorine injection is via liquid chlorine solution. The contact chamber is connected straight to the pump station, which pumps the chlorinated effluent to the storage pond. The chlorinator building will be equipped with ventilation.

A chlorine chlorate injection system controller will control the amount of chlorine introduced into the chamber. This controller can be manually adjusted as needed to calibrate the needed chlorine levels.

The liquid chlorine chlorate flows through a ½" pipe to the contact chamber where it is injected. The chamber consists of 80 feet of 96" diameter pipe laid 24" below grade. The amount of chlorine fed into the chamber will need to be monitored daily. Approximately 5 mg/L of chlorine will be added into the influent; this dose provides sufficient E. coli bacteria reduction as per normal operating levels. This should be checked by samples from the effluent leaving the contact chamber.

Water Balance

A water balance using projected 40 year flows was prepared for the system. Parameters for the water balance include average precipitation rates from recorded history, evapotranspiration rates from the Oregon State University experiment station near Bend, Oregon, and pan evaporation rates for the area. Irrigation was assumed to use normal irrigation rates and occur during the normal irrigation season for the area.

Figure 7.2 – Water Balance

Pond Sizing

Primary Pond	7.5	Acres based on population BOD loading
Secondary Pond	7.5	Acres based on back-up need
Storage Pond	20	Acres based on preliminary assumption

Month	Sewerage flow MGD	Monthly precipitation (inches)	Monthly Evaporation Rate(inches)	Total Sewerage Amount MG
January	0.325	4.35	-	14.01
February	0.325	3.14	-	12.86
March	0.325	2.28	-	12.05
April	0.325	1.19	4.25	6.97
May	0.325	1.21	6.14	5.19
June	0.325	1.06	6.69	4.53
July	0.325	0.54	8.66	2.16
August	0.325	0.63	7.91	2.96
September	0.325	0.69	5.42	5.38
October	0.325	1.65	-	11.45
November	0.325	3.61	-	13.31
December	0.325	4.86	-	14.50
			Total	105.39 MG

Note: Average days per month used 30.4 (365/12)

Storage Requirements

Month	Total Sewerage Amount MG	Irrigation Amount MG	Cumaltive Storage MG	
October	11.45	2.1	9.34	
November	13.31	0	22.65	
December	14.5	0	37.2	
January	14.01	0	51.16	
February	12.86	0	64.03	
March	12.05	0	76.08	
April	6.97	0	83.05	Max
May	5.19	16.1	72.13	
June	4.53	22.2	54.46	
July	2.16	29.6	27.00	
August	2.96	22.2	7.75	
September	5.38	13.1	0.00	

Irrigation Needs for Crop Survival

Month	Monthly precipitation (inches)	ET Rate Inches *	Leach %	Efficiency	Irrigation Need Inches
January	4.35	0.69			-
February	3.14	1.13			-
March	2.28	2.65			-
April	1.19	3.65			-
May	1.21	5.49	1.00	1.00	4.28
June	1.06	6.96	1.00	1.00	5.90
July	0.54	8.41	1.00	1.00	7.87
August	0.63	6.53	1.00	1.00	5.90
September	0.69	4.18	1.00	1.00	3.49
October	1.65	2.21	1.00	1.00	0.56
November	3.61	0.99			-
December	4.86	0.57			-
			Total inches Required		28.00

*Bend, Oregon ET rates used

Irrigation Area Required

Total Water MG	Gallons per Sq. Ft.	Acres Required
105.39	17.5	138.62

Storage

The water balance analysis indicates that maximum storage capacity of 83 million gallons (MG) is required to store effluent until it can be land applied.

The storage pond holds the effluent to be used for irrigation during the summer through the winter months. The pond is to be constructed with earth embankments sloped at 3 to 1, and a HDPE liner to prevent leakage. The storage pond will be approximately 20 acres with a storage depth of 12 feet. The two treatment lagoons are approximately 7.5 acres each. Total storage capacity is approximately 83 MG. The storage pond is filled with treated effluent by pumping from the chlorinator chamber pump station via a force main pipe located near the southwest corner of the pond.

Irrigation

The irrigation pumps station will be located at the southwest corner and the southeast corner of the storage pond and will draw or suction treated effluent directly from the storage pond. The irrigation pumps will be a 70 horsepower horizontal suction centrifugal pump directly coupled to the motor. The pumps have a design capacity of 500 GPM at a total head of 150 feet. A control panel with timer will be mounted next to the pump.

Irrigation using reclaimed water from the wastewater treatment system will follow the guidelines in Oregon Administrative Rules 340-55-015 as a Level D effluent.

Two 80-acre irrigation areas, east and south of the storage pond provide the crop growing area for irrigation using the effluent. The land may be leased to private individuals to grow fodder crops.

The period of irrigation using reclaimed water from the treatment system will generally be between May and October of each year when plants are growing and soil conditions can accept the irrigation water**.** Wastewater should not be applied to land that is frozen, snow covered or saturated.

The irrigation system for the land will be provided by a series of wheel-line type sprinkler systems. The wheel-lines are moveable via a gasoline engine mover. The sprinklers are attached at 40-foot intervals and provide approximately 7.5 gallons per minute of water application per sprinkler. After each move the line is connected to the main supply line via a rubber hose and valve connection. Irrigation water is pumped to the wheel-lines via 6” buried PVC mainline.

Water from the storage pond will be applied at a rate approximately of 200 to 250 gallons per minute per wheel line sprinkler unit. Sprinklers will be set to result in a total water application of 2” to 3” per irrigation to remain within agronomic rates.

The total amount of water applied over the whole growing season should not exceed 30” or 2.5 acre-feet. This amount will equal plant requirements for an average growing season. Therefore, applying water at agriculture rates in the growing season should provide adequate protection for groundwater impacts.

Irrigation water should be applied when the soil moisture begins to get near the wilting point of the soil. Irrigation should stop when the soil reaches field capacity or maximum water retention. These two limits can be determined in the field. General evaporation and transpiration of the crop needs to equal the total water applied for the season to prevent infiltration of excess water into the groundwater aquifer.

The sprinklers will be timed so they shut off and drain prior to being moved. This will also reduce the water contact to the operator. Operators will require training in safe operations around recycled water. As a minimum rubber boots and gloves should be worn and rinsed off after use. Clean water will be provided at the chlorinator building.

The irrigation land will be fenced and locked with proper signage. No general public contact will be allowed. A minimum 70 foot buffer zone will provided to the east and

west boundaries of the irrigation land to insure no over-spray reach the adjoining land properties. As an added precautionary measure, an automatic control will be installed to shut the irrigation pumps down when wind speeds exceed 20 mph.

At the end of the irrigation season pumps, valves, and sprinkle lines are to be drained to prevent ice damage. Wheel lines should be anchored to protect from wind damage. Wheel-line mover engines can be winterized by covering and adding fuel stabilizer to the gasoline.

In general, grass type crops should be grown as they use large amounts of water and have a high nutrient uptake of nitrogen and other nutrients. Other fodder crops can be grown, but they should be compatible with the soil and nutrients available and consistent with OAR 340-055. Grazing should only be considered in late fall and then in compliance with a Level D effluent.

Preliminary schematics showing the proposed system are included as Exhibit J in the Appendix.

Easements

In addition to the access and utility easement required for the treatment area property, the District will need to obtain easements for the new public collection lines and pump stations. Locating and obtaining the necessary easements will be accomplished during the project design and permitting phase.

7.2 Financial Analysis

A preliminary financial analysis has been prepared to determine loan payment amounts and projected sewer rate fees. The financial analysis was prepared for the recommended service area alternatives of Crescent Only, Crescent and Gilchrist, and Crescent, Gilchrist, and West Crescent.

Crescent District Only

Revenues

The tax revenue for the Crescent area is approximately $17,500 per year.

Costs

System operation and maintenance costs will remain the same, $77,000 annually.

Total capital costs are $7,213,600. A detailed estimate of these costs is provided in the Appendix. The available funding options do not allow costs that are associated with private entities or private property. Therefore, the lateral lines on private property will not be eligible, resulting in an eligible capital cost of $6,867,100. The District will need to obtain alternate funding, such as commercial loan funding, for the $346,500 in ineligible lateral line costs. All users must be connected by the end of the construction period.

Three funding options were examined and based on eligible capital costs of $6,867,100, the annual loan payment amounts are:

OBDD-IFA Loan - $472,140.50
USDA-RD Loan - $333,526.45
ODEQ Loan – $458,256.67

The costs for abandonment of the existing on-site septic systems in the Crescent area are also not included. Individual homeowners and businesses will be responsible for abandoning their septic systems according to the provisions of Oregon Administrative Rule 340-071-0185. The homeowners will also be responsible for the costs to connect to the system. All users must connect to the system before construction is complete. The District should consider adding these costs to the project and the users could pay back this amount in the rates over a reasonable time period. This cost could be large for some users ($5,000) and will need to be spread out over a period of time.

Projected Sewer Rates

The Crescent area has a total of 295 EDU for OBDD-IFA funding options and 197 EDU for USDA-RD and ODEQ options. The resulting monthly sewer rate per EDU for each option is:

OBDD-IFA Loan - $140.46
USDA-RD Loan - $155.97
ODEQ Loan - $204.89

Figure 7.2 shows the financial analysis for the Crescent Only option. Also shown is the mix of loan and grant funds that would be required to keep monthly sewer rates at $60 per EDU, for all three loan options.

Figure 7.3 Financial Analysis – Crescent Only

	OBDD-IFA Loan (25 years at 3.96%)	USDA-RD Loan (40 years at 3.25%)	Oregon DEQ Loan (20 Years at 2.12%)
Total Project Capital Cost	$ 7,213,600.00	$ 7,213,600.00	$ 7,213,600.00
Eligible Project Costs*	**$ 6,867,100.00**	**$ 6,867,100.00**	**$ 6,867,100.00**
Grant Amount	$ -	$ -	$ -
Loan Amount	$ 6,867,100.00	$ 6,867,100.00	$ 6,867,100.00
Annual Loan Payment	**$437,720.03**	**$309,211.37**	**$424,848.37**
Annual Operating Expenses			
Operater	$ 45,000.00	$ 45,000.00	$ 45,000.00
Power (pumps, etc.)	$ 7,000.00	$ 7,000.00	$ 7,000.00
Maintenance	$ 10,000.00	$ 10,000.00	$ 10,000.00
Billing/ Administrative	$ 15,000.00	$ 15,000.00	$ 15,000.00
Total Operating Expenses	***$ 77,000.00***	***$ 77,000.00***	***$ 77,000.00***
Revenue			
Property Taxes	$ 17,500.00	$ 17,500.00	$ 17,500.00
Resulting Rate/EDU			
Current EDU	295	197	197
Monthly Sewer Rate/EDU	**$ 140.46**	**$ 155.97**	**$ 204.89**
To Keep Rate at $60.00/EDU			
Payment Amount	$ 152,900.00	$ 82,340.00	$ 82,340.00
Loan Amount	$ 2,398,746.97	$ 1,828,642.39	$ 1,330,914.86
Grant Needed	$ 4,468,353.03	$ 5,038,457.61	$ 5,536,185.14

*** Portion of lateral lines on private property deducted - approximately 70% of total lateral line cost**

Crescent and Gilchrist

Revenues

The District is currently collecting approximately $17,500 per year in taxes assessed through Klamath County. This is at a rate of $1.032 per $1,000 assessed value. If the Gilchrist area will be annexed into the District, Gilchrist will have roughly the same value of taxable real property. Therefore, a base budget of $35,000 per year of tax revenue is assumed for the proposed District area. If annexation does not occur this amount would need to be included in Gilchrist's rates.

Costs

Once the system is installed the District will be responsible for operation and maintenance costs, billing, and additional administrative costs associated with system operation. Total annual operation and maintenance costs are projected to be $78,000.

Total capital costs for the project are estimated at $7,753,600. A detailed estimate of these costs is provided in the Appendix. The available funding options do not allow costs that are associated with private entities or private property. The financial analysis assumes that the Gilchrist area will be annexed into the Crescent Sanitary District boundary, making the Gilchrist connection costs eligible for inclusion in the grant and/or loan funding. However, the portion of the lateral service lines that are located on private property will still be ineligible for agency funding. This amount is estimated to be $346,500, approximately 70% of the lateral line costs. The District will need to obtain alternate funding, such as commercial loan funding, for these costs. All users must be connected by the end of the construction period.

The total capital costs eligible to receive funding are $7,407,100. The same three funding options were examined, OBDD-IFA loan funding for 25 years at 3.96%, USDA-RD funding for 40 years at 3.25%, and ODEQ Clean Water Revolving Loan funding for 20 years at 2.12%.

Based on the eligible capital costs of $7,407,100 the annual loan payment amounts are:

OBDD-IFA Loan - $472,140.50
USDA-RD Loan - $333,526.45
ODEQ Loan – $458,256.67

The costs for abandonment of the existing on-site septic systems and connecting to the system in the Crescent area are not included. Individual homeowners and businesses will be responsible for abandoning their septic systems according to the provisions of Oregon Administrative Rule 340-071-0185. The homeowners will also be responsible for connecting to the system. All users must connect to the system before construction is complete. The District should consider adding these costs to the project and the users could pay back this amount in the rates over a reasonable time period. This cost could be large for some users ($5,000) and will need to be spread out over a period of time.

Projected Sewer Rates

The Crescent and Gilchrist areas have a total of 433 EDU for OBDD-IFA funding options and 288 EDU for USDA-RD and ODEQ options. The resulting monthly sewer rate per EDU for each option is:

OBDD-IFA Loan - $99.14
USDA-RD Loan - $108.95
ODEQ Loan - $145.04

Figure 7.3 shows the financial analysis for the Crescent and Gilchrist option. Also shown is the mix of loan and grant funds that would be required to keep monthly sewer rates at $60 per EDU, for all three loan options.

Figure 7.4 Financial Analysis – Crescent and Gilchrist Service Area

	OBDD-IFA Loan (25 years at 3.96%)	USDA-RD Loan (40 years at 3.25%)	Oregon DEQ Loan (20 Years at 2.12%)
Total Project Capital Cost	$ 7,753,600.00	$ 7,753,600.00	$ 7,753,600.00
Eligible Project Costs*	**$ 7,407,100.00**	**$ 7,407,100.00**	**$ 7,407,100.00**
Annual Loan Payment	**$472,140.50**	**$333,526.45**	**$458,256.67**
Annual Operating Expenses			
Operater	$ 45,000.00	$ 45,000.00	$ 45,000.00
Power (pumps, etc.)	$ 7,000.00	$ 7,000.00	$ 7,000.00
Maintenance	$ 11,000.00	$ 11,000.00	$ 11,000.00
Billing/ Administrative	$ 15,000.00	$ 15,000.00	$ 15,000.00
Total Operating Expenses	***$ 78,000.00***	***$ 78,000.00***	***$ 78,000.00***
Revenue			
Property Taxes	$ 35,000.00	$ 35,000.00	$ 35,000.00
Resulting Rate/EDU			
Current EDU	433	288	288
Monthly Sewer Rate/EDU	**$ 99.14**	**$ 108.95**	**$ 145.04**
To Keep Rate at $60.00/EDU			
Payment Amount	$ 268,760.00	$ 164,360.00	$ 164,360.00
Loan Amount	$ 4,216,397.88	$ 3,650,178.09	$ 2,656,657.35
Grant Needed	$ 3,190,702.12	$ 3,756,921.91	$ 4,750,442.65

*** Portion of lateral lines on private property deducted - approximately 70% of total lateral line cost**

Crescent, Gilchrist, and West Crescent

Revenues

The District is currently collecting approximately $17,500 per year in taxes assessed through Klamath County. This is at a rate of $1.032 per $1,000 assessed value. If the Gilchrist and West Crescent areas are annexed into the District, they have roughly the same value of taxable real property. Therefore, a base budget of $52,500 per year of tax revenue is assumed for the proposed District area.

Costs

Once the system is installed the District will be responsible for operation and maintenance costs, billing, and additional administrative costs associated with system operation. Total annual operation and maintenance costs for all three areas are projected to be $79,000.

Total capital costs for the project are estimated at $9,296,416. A detailed estimate of these costs is provided in the Appendix. The available funding options do not allow costs that are associated with private entities or private property. The financial analysis assumes that the Gilchrist and West Crescent areas will be annexed into the Crescent Sanitary District boundary, making the Gilchrist connection costs and West Crescent collection system costs eligible for inclusion in the grant and/or loan funding. However, the portion of the lateral service lines that are located on private property will be still be ineligible for agency funding. This amount is estimated to be $504,000, approximately 70% of the lateral line costs. The District will need to obtain alternate funding, such as commercial loan funding, for these costs. All users must be connected by the end of the construction period.

The total capital costs eligible to receive funding are $8,792,416. The same three funding options were examined, OBDD-IFA loan funding for 25 years at 3.96%, USDA-RD funding for 40 years at 3.25%, and ODEQ Clean Water Revolving Loan funding for 20 years at 2.12%.

Based on the eligible capital costs of $8,792,416 the annual loan payment amounts are:

OBDD-IFA Loan - $560,442.77
USDA-RD Loan - $395,904.38
ODEQ Loan – $543,962.32

The costs for abandonment of the existing on-site septic systems in the Crescent and West Crescent areas, and connection costs are not included as previously noted. Individual homeowners and businesses will be responsible for abandoning their septic systems according to the provisions of Oregon Administrative Rule 340-071-0185. The homeowners will also be responsible for connecting to the system. All users must connect to the system before construction is complete. The District should consider adding these costs to the project and the users could pay back this amount in the rates over a reasonable time period. This cost could be large for some users ($5,000) and will need to be spread out over a period of time.

Projected Sewer Rates

The Crescent, Gilchrist, and West Crescent areas have a total of 589 EDU for OBDD-IFA funding options and 391 EDU for USDA-RD and ODEQ options. The resulting monthly sewer rate per EDU for each option is:

OBDD-IFA Loan - $83.04
USDA-RD Loan - $90.03
ODEQ Loan - $121.58

Figure 7.4 shows the financial analysis for the Crescent, Gilchrist, and West Crescent option. Also shown is the mix of loan and grant funds that would be required to keep monthly sewer rates at $60 per EDU, for all three loan options.

Figure 7.5 Financial Analysis – Crescent, Gilchrist, & West Crescent Service Area

	OBDD-IFA Loan (25 years at 3.96%)	USDA-RD Loan (40 years at 3.25%)	Oregon DEQ Loan (20 Years at 2.12%)
Total Project Capital Cost	$ 9,296,416.00	$ 9,296,416.00	$ 9,296,416.00
Eligible Project Costs*	**$ 8,792,416.00**	**$ 8,792,416.00**	**$ 8,792,416.00**
Annual Loan Payment	**$560,442.77**	**$395,904.38**	**$543,962.32**
Annual Operating Expenses			
Operater	$ 45,000.00	$ 45,000.00	$ 45,000.00
Power (pumps, etc.)	$ 7,000.00	$ 7,000.00	$ 7,000.00
Maintenance	$ 12,000.00	$ 12,000.00	$ 12,000.00
Billing/ Administrative	$ 15,000.00	$ 15,000.00	$ 15,000.00
Total Operating Expenses	***$ 79,000.00***	***$ 79,000.00***	***$ 79,000.00***
Revenue			
Property Taxes	$ 52,500.00	$ 52,500.00	$ 52,500.00
Resulting Rate/EDU			
Current EDU	589	391	391
Monthly Sewer Rate/EDU	**$ 83.04**	**$ 90.03**	**$ 121.58**
To Keep Rate at $60.00/EDU			
Payment Amount	$ 397,580.00	$ 255,020.00	$ 255,020.00
Loan Amount	$ 6,237,369.66	$ 5,663,594.64	$ 4,122,053.77
Grant Needed	$ 2,555,046.34	$ 3,128,821.36	$ 4,670,362.23

*** Portion of lateral lines on private property deducted - approximately 70% of total lateral line cost**

Cost Comparison with Homeowner Installed Alternate Treatment System

If the District does not construct the wastewater facility, it is likely that homeowners would eventually be required to install alternate treatment systems to reduce nitrate levels. These systems cost approximately $22,000 per home. At the lowest proposed sewer rate of $83.04 per month (Crescent, Gilchrist, West Crescent area, OBDD-IFA option) it would take 22 years of sewer system payments to equal the cost of the alternate treatment system.

Income Study

The District will need to perform an income study to analyze income levels in the proposed service area. This will determine if the District is eligible for grants and/or principle forgiveness from funding agencies. For example, USDA will consider grants up to 45% of eligible project development for areas with median household income between $52,855 and $42,284.

System Ownership

It is recommended that the entire proposed system be owned and operated by the Crescent Sanitary District. If the Gilchrist area and/or the West Crescent area were added to the project, this would include the existing collection system in Gilchrist, the new Gilchrist connection, and the new collection system in West Crescent. This would require annexing the Gilchrist area and the West Crescent area into the District. Annexation of the West Crescent and Gilchrist areas would need to be accomplished early in the project, prior to funding agency approval.

District ownership of the entire system would make it easier to obtain funding for all the areas involved in the project. However, there are several hurdles involved with annexing the Gilchrist and West Crescent areas. The District will not annex the Gilchrist system until the District is absolved of all responsibility for replacement of the existing collection system and decommissioning of the existing treatment facility. Since successful negotiations between the District and Gilchrist must occur prior to annexation, it may take 1 to 2 years to accomplish the annexation. Annexation of the West Crescent area would require a vote of the residents and at this time it appears the current residents are unlikely to approve an annexation. This annexation might not occur within the next 5 to 10 years.

The District cannot contract directly with all of the funding agencies for loan and grant funds. An intergovernmental agreement would need to be established between Klamath County and the District, making Klamath County the applicant for all grant and loan agreements for IFA programs. At this time, the District has not formally discussed this option with Klamath County.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The need for wastewater system improvements for the Crescent Sanitary District area has been established for some time, and is becoming critical. The project is necessary to protect public health due to sanitation issues and environmental concerns caused by release of contamination due to on-site septic systems. As the on-site septic systems age, there is the potential for increased nitrate contamination. Requiring all residents and businesses to update to nitrogen reducing systems would be cost prohibitive.

Installing a central system will protect our environment and provide for additional growth which will further spread the burden of paying for the system. Property values will increase and lots and parcels will be saleable.

The recommended alternative is to construct the system for all three areas, Crescent, West Crescent, and Gilchrist. Although this option has the highest capital cost, it would spread the costs over a larger number of users, helping to reduce user rates. However, this option would be dependent on successfully annexing the Gilchrist and West Crescent areas into the District. Successful annexation of these areas may be difficult to accomplish within the foreseeable future, as discussed in the System Ownership section on the previous page.

There is the possibility of completing the project in phases. A phased approach can increase costs, since certain costs, (engineering, permitting, administrative) would be required at each phase. However, this approach could allow more time to negotiate annexation agreements to incorporate the Gilchrist and West Crescent areas. The project could be completed in the following phases:

Phase I – Complete the collection system for the Crescent area as well as the treatment facility. The treatment facility could be constructed with the capacity to serve only the Crescent area. However, it is recommended that the treatment facility be constructed with the capacity to service all areas that are expected to be incorporated into the system during Phase I. Constructing the facility with the capacity for Crescent only and then trying to enlarge it when Gilchrist and West Crescent are included would significantly raise project costs.

Phase II – Annex the Gilchrist area and complete the connection line (and enlarge treatment facility if adequate capacity was not included in Phase I). This would be dependent on negotiating an annexation agreement between the District and Gilchrist. If an annexation agreement could not be negotiated, the District would have the option of not annexing the Gilchrist area and simply accepting their sewerage for treatment. This option would require obtaining alternate funding to construct the connection line between the two districts, as IFA and USDA RD do not allow costs associated with private systems.

Phase III – Annex the West Crescent area and complete the collection system (and enlarge treatment facility if adequate capacity was not included in Phase I and/or II). This would be dependent on negotiating an annexation agreement between the District and the West Crescent Residents. As noted in the System Ownership section, the preliminary indication is the current residents would not approve annexation. This could potentially postpone implementation of this phase for as many as 5 to 10 years.

It should be noted that completing the project in phases would most likely raise the total project cost. Also, a large portion of the project would need to be completed during Phase I (even if the treatment system was constructed to serve Crescent only) and it might be difficult for the District to cover loan costs with only the Crescent area users connected to the system.

The phased approach to the project will be more feasible if a large percentage of the project can be funded with grants.

The phased approach could go on for years without completion, which would not solve the issues facing Gilchrist and the other groundwater issues in the area. If a phased approach is considered it is recommended that it be implemented according to the following timeline:

Phase I – completed 2017-2018
Phase II – Gilchrist connection completed 2018-2019
Phase III – West Crescent completed 2020

Successful annexation of Gilchrist and West Crescent will be a major factor in determining which phases of the project are completed as well as the overall project timeline.

Schedule

The District will be coordinating with permitting and funding agencies throughout the development of the project. The District has already begun the land use permitting process, and needs to begin the income study as soon as possible. USDA funding applications require a certain amount of environmental review to be performed prior to application submission, so this task should also begin as soon as possible. A proposed project schedule is shown below. These dates are dependent upon agency review and approval.

Income Study	May 2015 – August 2015
Land Use Permitting Issues	April 2015 – August 2015
Environmental & Cultural Review	May 2015 – August 2015
Funding Applications	September 2015 – December 2015
Engineering Design	March 2016 – July 2016
Permitting	May 2016 – July 2016
Construction	October 2016 – December 2017

* If incorporating the Gilchrist and West Crescent areas, completion of annexation agreements may be included in the schedule, prior to final funding agency approval. If annexation was approved by the parties, the process of completing the annexation agreements could take between 5 and 6 months.

APPENDIX

EXHIBIT A

FEMA FIRM Flood Map

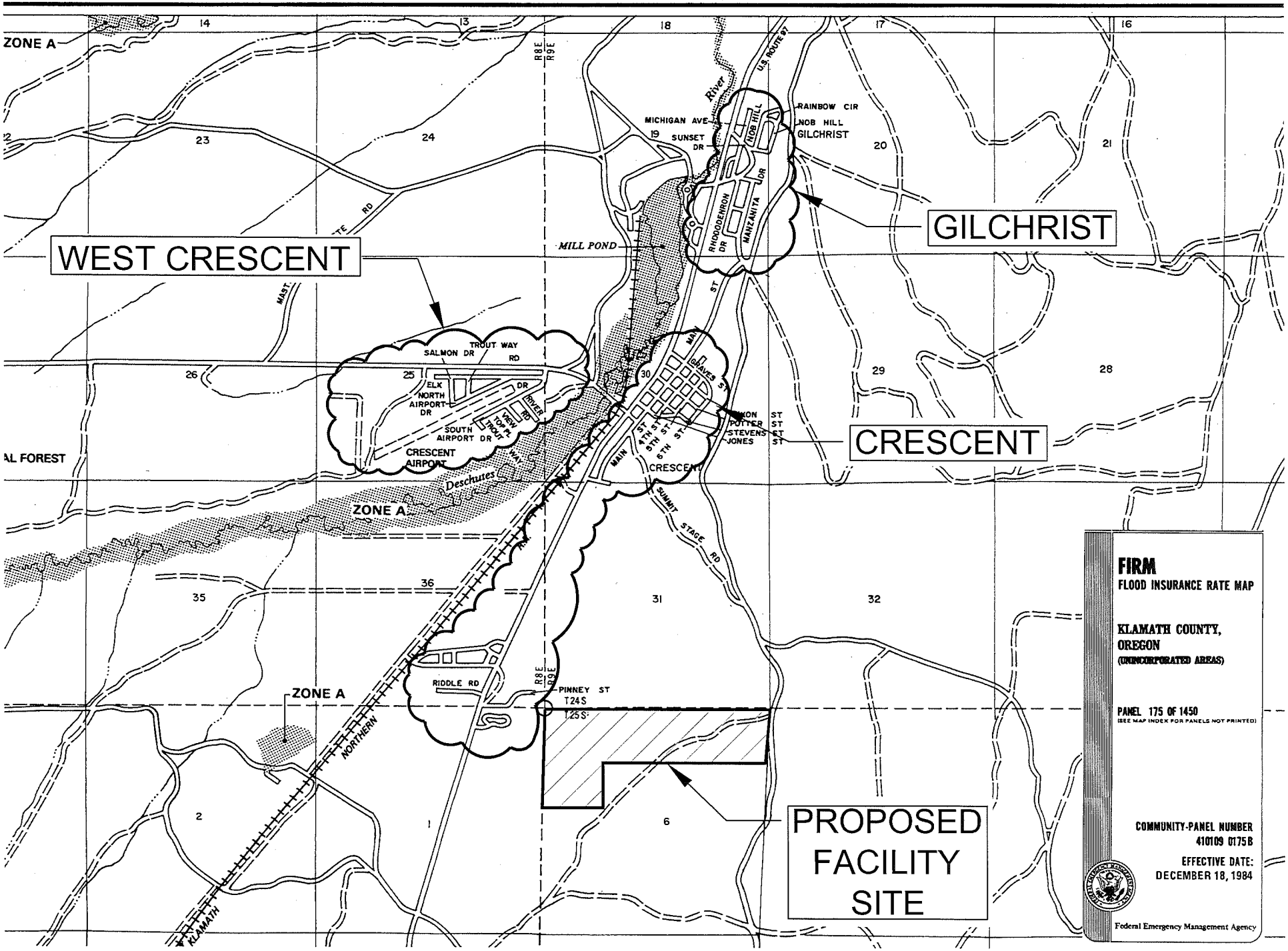
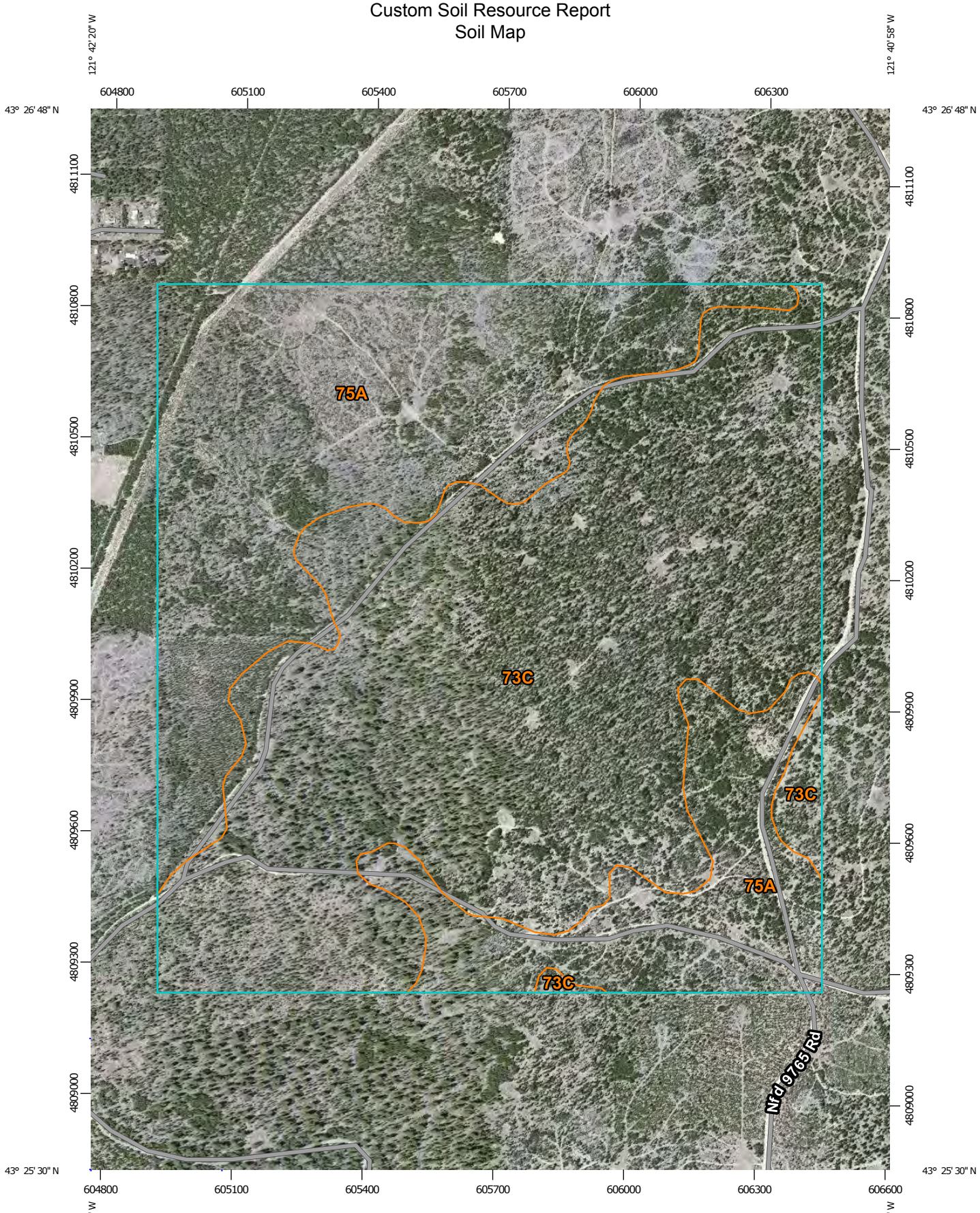

WEST CRESCENT
GILCHRIST
CRESCENT
PROPOSED FACILITY SITE
ZONE A
ZONE A
ZONE A
MILL POND
Deschutes River
CRESCENT AIRPORT
SUMMIT STAGE RD
RIDDLE RD
PINNEY ST
T24S
T25S
R8E
R9E
MICHIGAN AVE
SUNSET DR
RAINBOW CIR
KNOB HILL
GILCHRIST
MAIN ST
U.S. ROUTE 97
NORTHERN
KLAMATH
FIRM
FLOOD INSURANCE RATE MAP
KLAMATH COUNTY, OREGON
(UNINCORPORATED AREAS)
PANEL 175 OF 1450
(SEE MAP INDEX FOR PANELS NOT PRINTED)
COMMUNITY-PANEL NUMBER
410109 0175 B
EFFECTIVE DATE:
DECEMBER 18, 1984
Federal Emergency Management Agency

EXHIBIT B

USDA-SCS Classification and Soils Report

Custom Soil Resource Report
Soil Map



Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties

73C—Lapine gravelly loamy coarse sand, 0 to 15 percent slopes

Map Unit Setting

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 40 to 44 degrees F
Frost-free period: 20 to 50 days

Map Unit Composition

Lapine and similar soils: 90 percent
Minor components: 3 percent

Description of Lapine

Setting

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and gravel-sized pumice derived from dacite

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6s
Hydrologic Soil Group: A

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 8 inches: Gravelly loamy coarse sand
8 to 25 inches: Extremely gravelly loamy coarse sand
25 to 38 inches: Very gravelly coarse sand
38 to 61 inches: Gravelly coarse sand

Minor Components

Cryaquolls

Percent of map unit: 3 percent
Landform: Terraces

75A—Lapine gravelly loamy coarse sand, low, 0 to 3 percent slopes

Map Unit Setting

Elevation: 4,200 to 4,500 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 40 to 44 degrees F
Frost-free period: 10 to 30 days

Map Unit Composition

Lapine, low, and similar soils: 90 percent
Minor components: 5 percent

Description of Lapine, Low

Setting

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and gravel-sized pumice derived from dacite

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6s
Hydrologic Soil Group: A

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 8 inches: Gravelly loamy coarse sand
8 to 25 inches: Extremely gravelly loamy coarse sand
25 to 38 inches: Very gravelly coarse sand
38 to 61 inches: Gravelly coarse sand

Minor Components

Cryaquolls

Percent of map unit: 5 percent
Landform: Terraces

EXHIBIT C

Proposed Treatment Facility Location

Proposed Treatment Facility Location

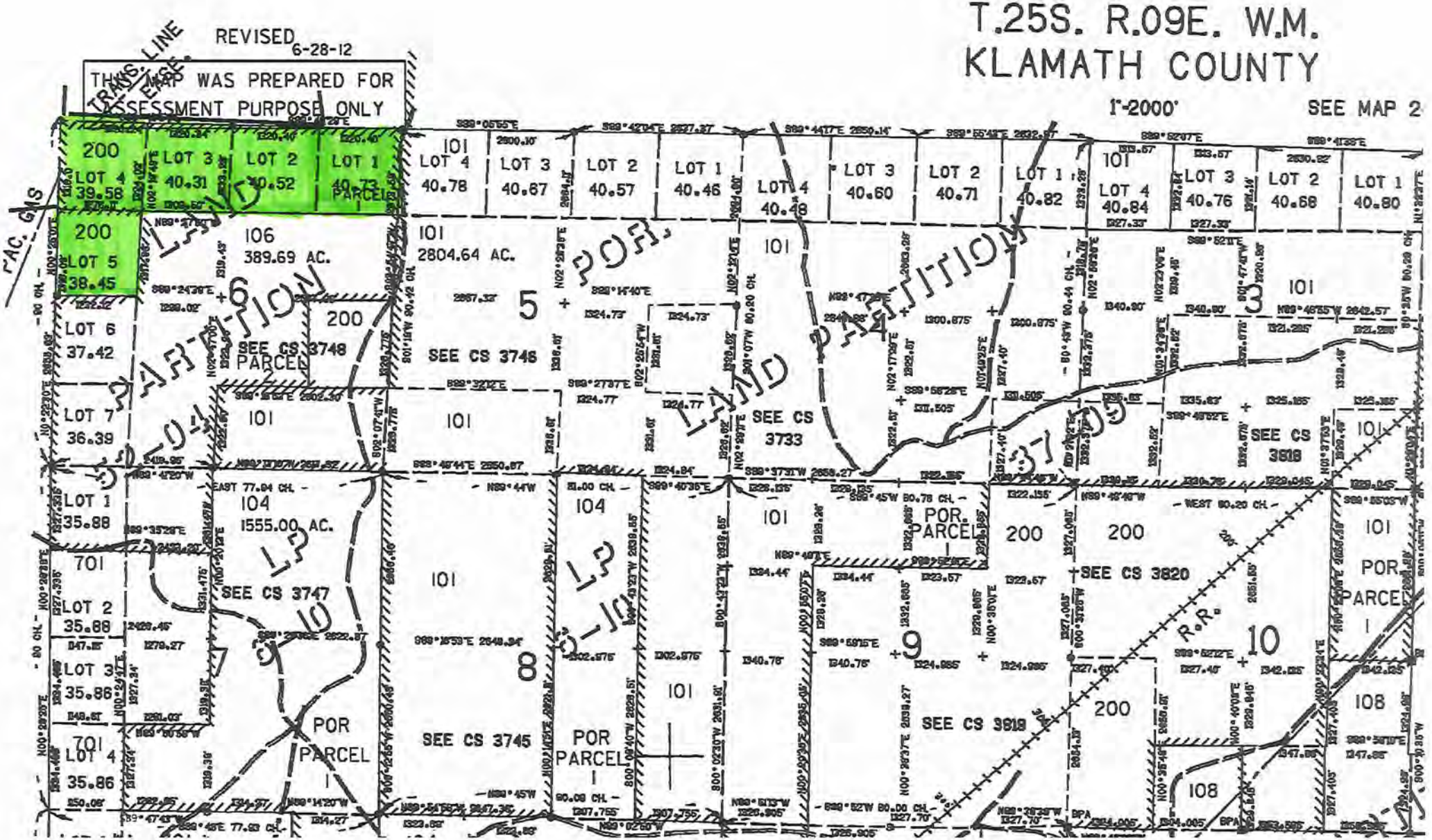


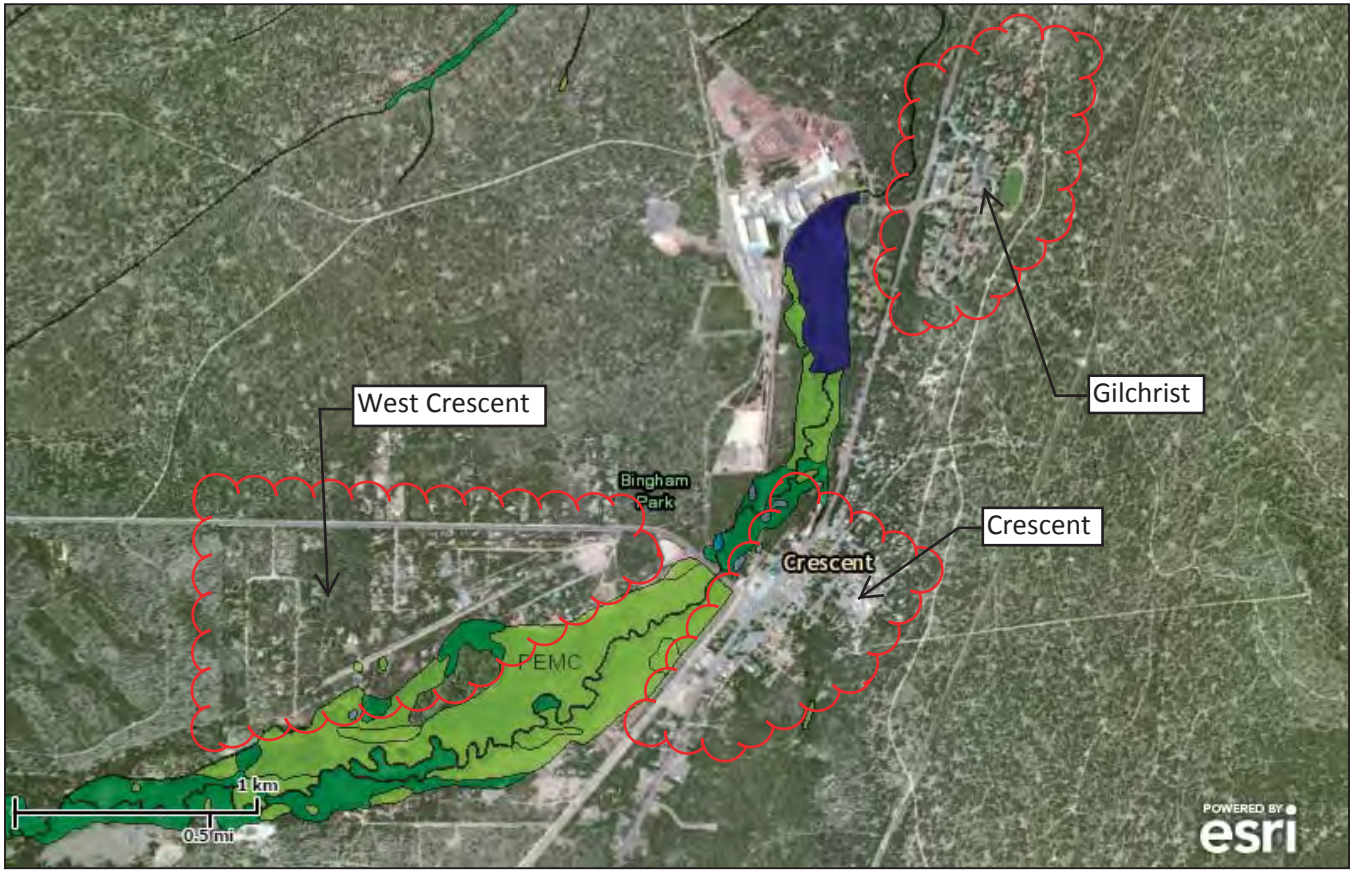
EXHIBIT D

USFW Wetlands Inventory Maps

U.S. Fish and Wildlife Service
National Wetlands Inventory

Crescent Sanitary District

Nov 5, 2014



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

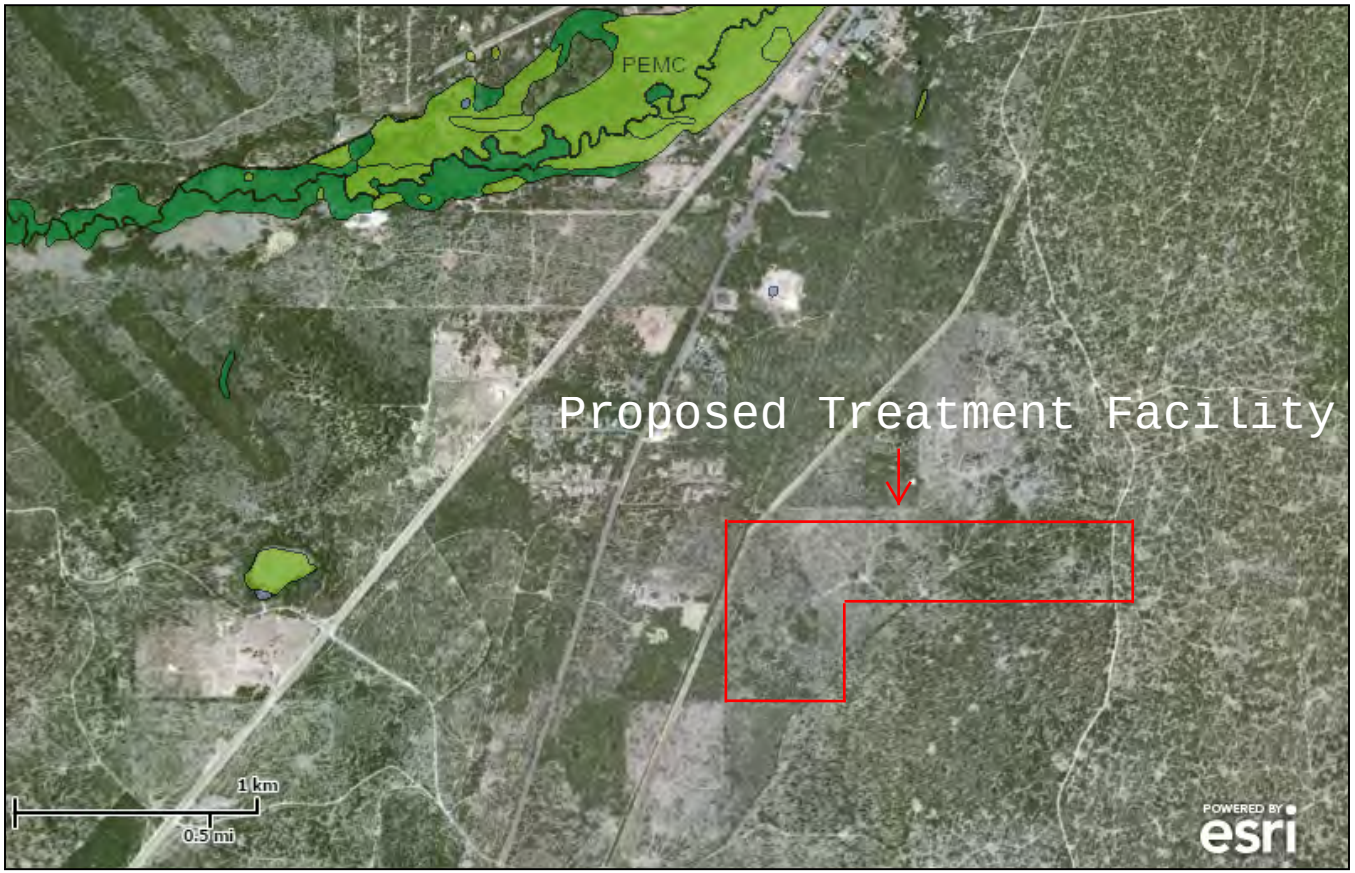
User Remarks:

U.S. Fish and Wildlife Service

National Wetlands Inventory

Crescent Sanitary District

Nov 5, 2014



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

EXHIBIT E

Crescent Sanitary District
Groundwater Nitrate Study

Geotechnical Resources Incorporated

Consulting Engineers, Geologists, and Environmental Scientists

November 24, 1998

2853_FINRPT

HGE, Inc.
375 Park Avenue
Coos Bay, OR 97420

Attention: Tim McGuire

SUBJECT: GROUNDWATER NITRATE+NITRITE SAMPLING, CRESCENT SANITARY DISTRICT, CRESCENT, OREGON

At your request, Geotechnical Resources, Inc. (GRI) has prepared this groundwater nitrate+nitrite sampling report for the Crescent Sanitary District in Crescent, Oregon. The general location of the site is shown on the Vicinity Map, Figure 1. The purpose of the work was to assist HGE, Inc. in their evaluation of the potential effect of local domestic sewage systems on shallow groundwater quality. Our work was conducted in general accordance with our proposal to HGE, Inc., dated September 8, 1998. This report describes the work accomplished and summarizes the findings of the groundwater testing.

Project Description

Crescent is located in Klamath County in southern Oregon, between the towns of Bend and Klamath Falls. The Crescent Sanitary District includes the community of Crescent and a relatively narrow corridor south of Crescent along State Highway 97. A wastewater treatment study for the Crescent Sanitary District was conducted by Robert E. Meyer Consultants of Beaverton, Oregon, in 1982. As part of the study, four shallow wells were installed in the sanitary district and sampled for nitrate, nitrite, and coliform. Analytical results showed low levels (<5 mg/L) of nitrates in all four wells. Nitrites were not detected, and coliform was detected in only one of the wells.

The 1982 study indicates the general sanitary district area is mantled with up to 7 ft of unconsolidated coarse pumiceous soils, underlain by relatively impermeable, organic-rich marsh deposits or basalt rock. In general, the shallow groundwater table at the site ranges from about 3 ft below the ground surface during the wet winter months to about 6 ft below the ground surface during the drier summer months and appears to be perched on the underlying marsh deposits or basalt rock.

As shown on Figure 2, the elevation of the project area ranges from about 4,500 ft in the eastern portion of the site, to about 4,460 ft in the western portion of the site near the Little Deschutes River. Topographically higher portions of the project area are underlain by basalt rock at the ground surface. The hydrogeological discharge for shallow groundwater in the project area is likely the Little Deschutes River, located west of the town center (Figure 2).

9725 SW Beaverton Hillsdale Hwy
Suite 140
Beaverton, Oregon 97005-3364
Phone (503) 641-3478 FAX (503) 641-8031
e-mail gri@teleport.com

Table 1 summarizes the soil/rock conditions and groundwater analytical data collected. A copy of the laboratory data report is provided in Appendix A.

METHODS

On November 18, 1998, a GRI geologist experienced in the collection of environmental samples met with a representative from HGE, Inc., and Dave Crider with the Crescent Water District. Sixteeen sample locations, designated P-1 through P-16, were field reviewed and located throughout Crescent. The samples were collected from Geoprobe™ borings made at the approximate locations shown on Figure 2. The Geoprobe™ borings were made by Cascade Drilling, Inc. of Portland, Oregon. Groundwater samples were collected using a 4-ft-long, stainless steel, wire-strapped screen point attached to Geoprobe Envirorod™ (1.5-in.-O.D., 1.0-in.-I.D.) sealed with Teflon O-rings. Heavy-duty water-tight drill rods were used to advance the water sampler to the desired depth, and the screen was then opened by pulling back the probe. Prior to sampling, a small-diameter rod was sent down the hole to open the screen and ensure that the screen was still at the desired depth after pulling back the probe. A peristaltic pump mounted on the Cascade truck was used to draw water through the screen into new disposable polyethylene tubing. New tubing was used for each sample point. The Geoprobe Envirorod™ water sampler was cleaned between sample locations with a clean water rinse.

Insufficient water for sampling was encountered at three locations (P-1, P-12, and P-14). Adequate water for sample collection was obtained at the remaining 13 locations. Field work was completed the evening of November 18, 1998. The water samples were collected and placed in laboratory-prepared plastic bottles and delivered under chain of custody to Oregon Analytical Laboratory, in Beaverton, Oregon. The samples were analyzed for nitrate+nitrite by EPA method 300. A copy of the laboratory data report is provided in Appendix A.

RESULTS

The field and laboratory results are summarized on Table 1. A contour map of the nitrate+nitrite concentrations (in mg/l) is provided on Figure 2.

Table 1

Summary of Field and Laboratory Results

Location	Subsurface Conditions	Groundwater Encountered	Sample Interval	Nitrate+ Nitrite, mg/l
P-1	0 to 9 ft soil; refusal on basalt rock at 9 ft	no	no sample	–
P-2	0 to 11 ft soil; refusal on basalt/cobbles at 11 ft	yes, good recharge	7 to 11 ft	6.5
P-3	0 to 12 ft soil; refusal on basalt at 12 ft	yes, good recharge	8 to 12 ft	0.11

Table 1 (continued)

Summary of Field and Laboratory Results

Location	Subsurface Conditions	Groundwater Encountered	Sample Interval	Nitrate+ Nitrite, mg/l
P-4	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, slow recharge	5 to 9 ft	13
P-5	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	6.6
P-6	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	1.8
P-7	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, good recharge	5 to 9 ft	3.6
P-8	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	0.06
P-9	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, good recharge	5 to 9 ft	0.01
P-10	0 to 8 ft soil; refusal on basalt at 8 ft	yes, good recharge	4 to 8 ft	0.02
P-11	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	1.9
P-12	0 to 9 ft soil; refusal on basalt rock at 9 ft	no	no sample	--
P-13	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, good recharge	5 to 9 ft	0.03
P-14	0 to 9 ft soil; refusal on basalt rock at 9 ft	no	no sample	--
P-15	0 to 8 ft soil; probe stopped at 8 ft	yes, good recharge	4 to 8 ft	0.08
P-16	0 to 8 ft soil; probe stopped at 8 ft	yes, good recharge	4 to 8 ft	1.1

DISCUSSION

The data indicate that nitrate+nitrite concentrations in shallow groundwater range between non-detect (detection limit of the analysis = 0.05 mg/l) to 13 mg/l. The highest nitrate+nitrite concentration (13 mg/l) was found at location P-4, in the topographically higher east-central portion of Crescent, see Figure 2. Lower concentrations were generally found to the west and south of the town center. Sample point P-15, located in the southeastern portion of the project area, was taken at a location away and upgradient from obvious potential sources of nitrates and had a nitrate+nitrite concentration of 0.08 mg/l. Water was not encountered in sample points P-1, P-12, and P-14, where basalt rock was encountered in the probes above the shallow groundwater table.

LIMITATIONS

This report has been prepared to assist the client with documenting the groundwater conditions at the sample locations. The scope of work was limited to the specific project, location, and activities described herein. In the performance of an assessment of this type, specific information is obtained at

specific locations at specific times. Since site activities and regulations beyond our control could change at any time after the completion of this report, our observations and findings can be considered valid only as of the date of this report. Land use, on- and off-site conditions, regulatory considerations, or other factors may change over time. The information presented in this report is based on our evaluation of the information obtained thorough the procedures described in this report. No other warranty or representation, either expressed or implied, is included or intended in this report.

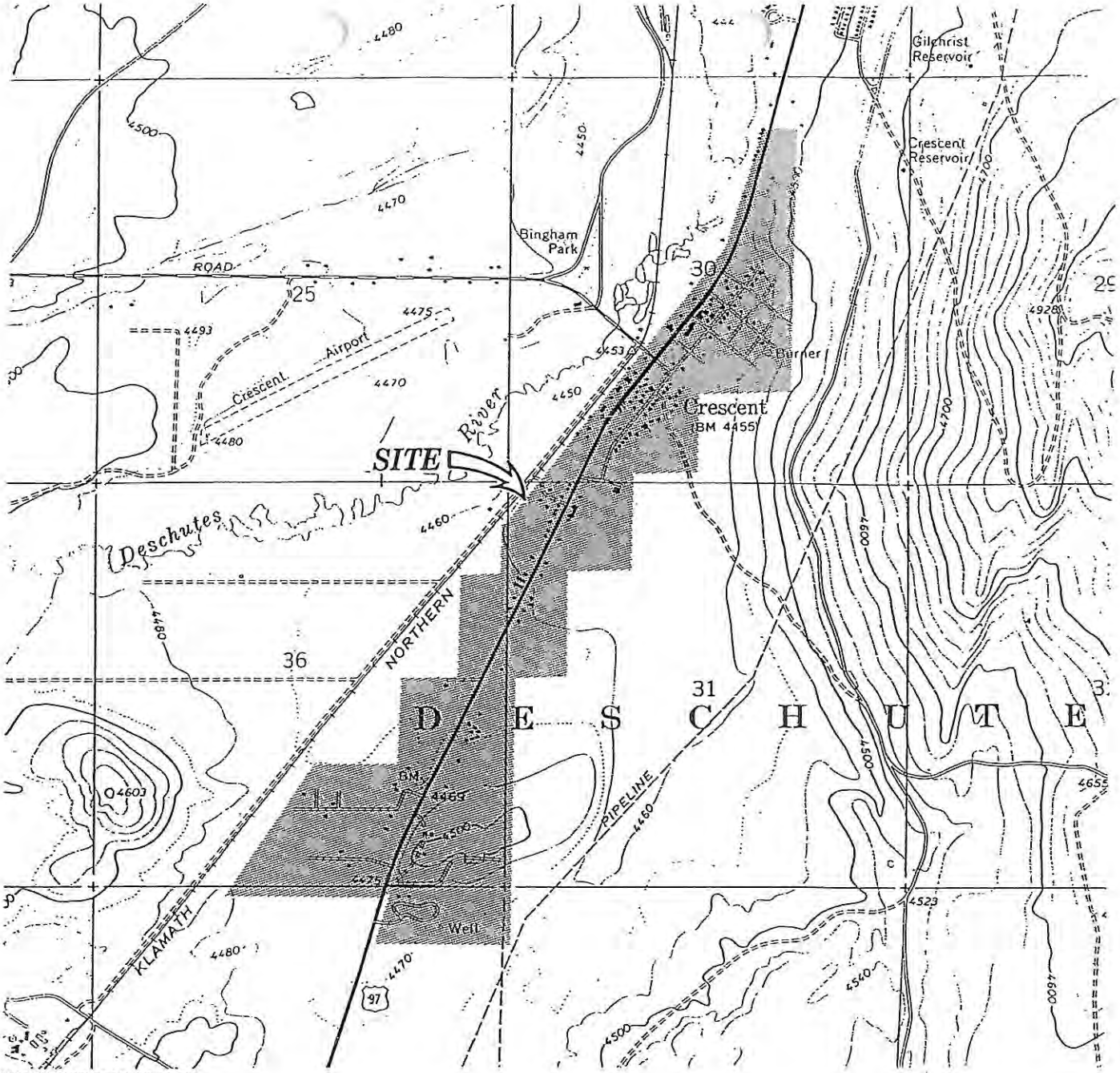
We appreciate the opportunity to be of continued service to HGE, Inc. Please contact the undersigned if you have any questions regarding this report.

Sincerely,

GEOTECHNICAL RESOURCES, INC.

H. Stanley Kelsay, P.E.
Principal

George A. Freitag, C.E.G.
Environmental Services Manager



USGS TOPOGRAPHIC MAP
CRESCENT, OREG. (2da) QUAD (1967)

North

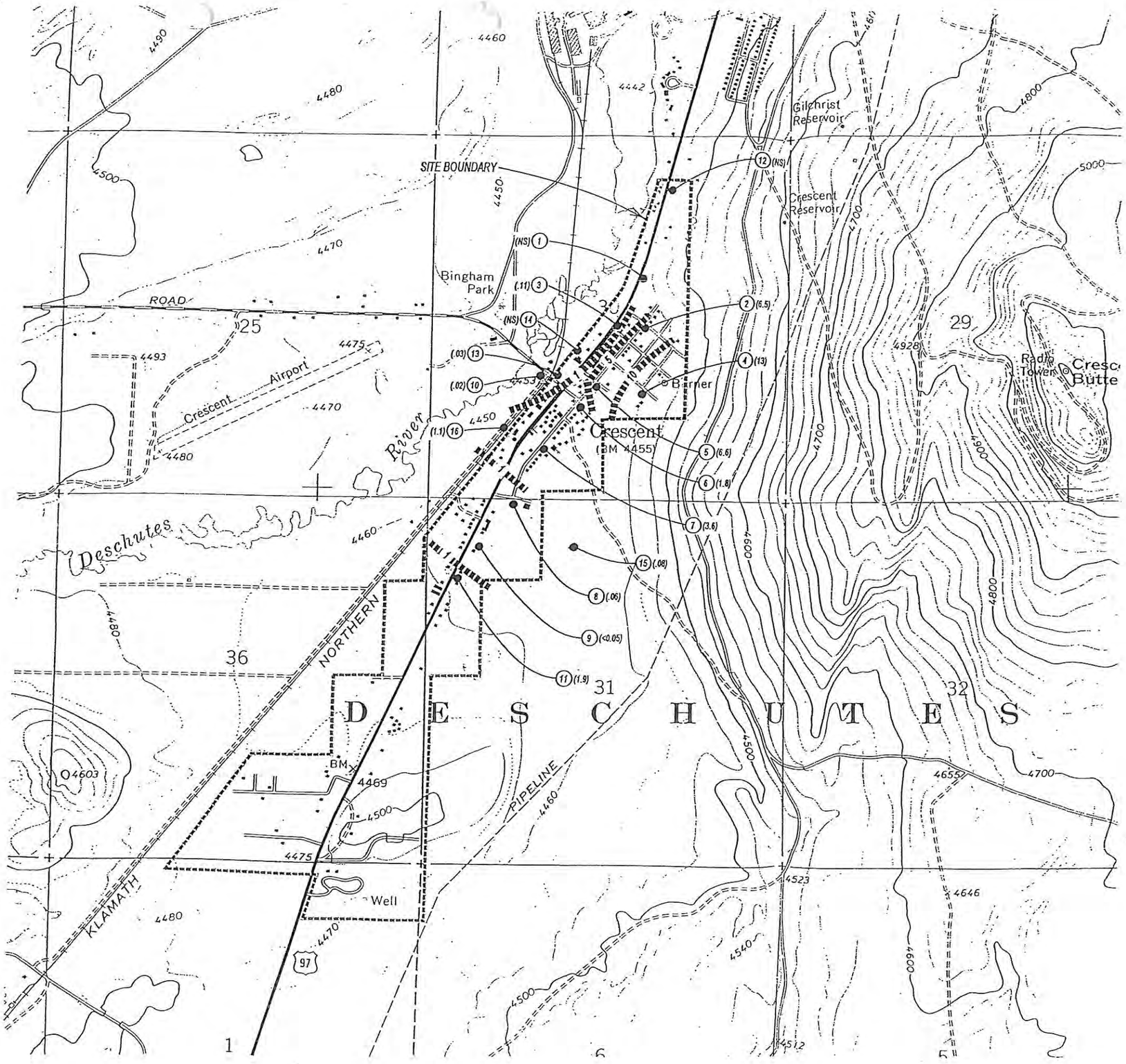
0 1/2 1 MILE

GRI

HGE, INC.
CRESCENT NITRATE STUDY

VICINITY MAP

NOV. 1998 JOB NO. 2853 FIG. 1



● (1) (6.6) SAMPLE LOCATION NUMBER WITH NITRATE+NITRITE CONCENTRATION (mg/l)

(NS) NO SAMPLE

10 INTERPRETED CONTOUR LINE OF EQUAL NITRATE+NITRITE CONCENTRATION (mg/l)

SITE PLAN FROM USGS TOPOGRAPHIC MAP (CRESCENT, OREG.), DATED 1967

North

0 1,500 3,000 FT

GRI

HGE, INC.
CRESCENT NITRATE STUDY

SITE PLAN

NOV. 1998 JOB NO. 2853 FIG. 2

OAL Oregon Analytical Laboratory
14855 S.W. Scholls Ferry Rd. Beaverton, Oregon 97007 (503) 590-5300 FAX (503) 590-1404

CHAIN OF CUSTODY RECORD
LABORATORY ANALYSIS REQUEST

Sampling: ☐ Grab ☐ Comp
OAL hrs. ______
ISCO ______
Page 1 of 2
Site Visit ☐

Client Information
Company: GRI
Contact: GEORGE FREITAG
Address: 9725 SW BEAVERTON HILLSDALE HWY SUITE 140 BEAVERTON
Phone #: 503 644 8034 Fax #: 641 3478

Billing Information
Company: SAME
Contact: ______
Address: ______
Phone #: ______ Fax #: ______

Project Information
Project Name: CRESCENT
Project #: 2853
P.O. #: ______
Comments: ______

Sampler's Name: GEORGE FREITAG
Signature: [signature]
Quote #: ______
NOTE: If quote number is not referenced, standard pricing will be applied.
Provide Fax Results ☒ Yes ☐ No

Remarks: FAX PHONE

	Sample Identification	Date	Time	FOR LAB USE ONLY OAL Login #	# of Containers	Soil	Water	Other (Note in Remarks)	Volatiles 624/8260/8240 8010/8020	Semivolatiles 625/8270 PAH/SIM PAH 8310	Organochlorine 608/8080/8081 PCB Pesticide	NWTPH-HCID Quantify? ☐ Yes ☐ No	NWTPH Quantification G D 418.1M	BTEX 602/8020 ☐ MTBE ☐ Naphthalene	TPH 418.1 Oil & Grease 413.1/1664 ☐ Total ☐ SGT	Metals ☐ Total ☐ TCLP ☐ Dissolved As Ba Cd Cr Pb Hg Se Ag Other		NITRATE + NITRITE			Turnaround
1	P-2	11/18	200	L8939-1	1		1											X			O
2	P-3	11	220	-2	1		1											X			
3	P-5	11	250	-3	1		1											X			
4	P-4	11	300	-4	1		1											X			
5	P-6	11	400	-5	1		1											X			
6	P-7	11	420	-6	1		1											X			
7	P-15	11	445	-7	1		1											X			
8	P-8	11	500	-8	1		1											X			
9	P-~~8~~ 11	11	545	-9	1		1											X			

[N] Normal – 10 working days
[S] Special – 5 working days
[R] Rush – 24-72 hrs.
(O) Other – PRELIMINARY RESULTS BY TUESDAY 11/24 NOON (OR SOONER) PER D. GRIFFITHS

Remarks

Relinquished		Relinquished		Relinquished	
Signature: [signature]	Date: 11/18/98	Signature:	Date:	Signature:	Date:
Print Name: GEORGE FREITAG	Time: 1300	Print Name:	Time:	Print Name:	Time:
Company: GRI		Company:		Company:	
Received		**Received**		**Received**	
Signature: [signature]	Date: 11/18/98	Signature:	Date:	Signature:	Date:
Print Name: TEYENT GOSSO	Time: 13:05	Print Name:	Time:	Print Name:	Time:
Company: OAL		Company:		Company:	

☒ Courier ☐ UPS ☐ FedEx ☐ Other
Received @ 8 °C
Appropriate Containers ☐ Yes ☐ No
______ 4oz./8oz. Jars
______ VOA Vials
9 Plastic Bottles 500 mL A
______ Glass Bottles
______ Other ______

OAL

L8939

Client: *Geotechnical Resources, Inc.*
Contact: *George Freitag*

Project: *2853*
Crescent

Inorganics

Sample ID / Analyte	Matrix	Result	Reporting Limit	Units (ppm)	Date Analyzed	Method	Comment	Analyst	Lab Number
P-9	*Water*				Sampled: *11/18/98*				*L8939-10*
Nitrate + Nitrite as N		ND	0.01	mg/L	11/20/98	EPA 353.2	K1	NM	
P-16	*Water*				Sampled: *11/18/98*				*L8939-11*
Nitrate + Nitrite as N		1.1	0.10	mg/L	11/20/98	EPA 353.2	D,K1	NM	
P-10	*Water*				Sampled: *11/18/98*				*L8939-12*
Nitrate + Nitrite as N		0.02	0.01	mg/L	11/20/98	EPA 353.2	K1	NM	
P-13	*Water*				Sampled: *11/18/98*				*L8939-13*
Nitrate + Nitrite as N		0.03	0.01	mg/L	11/20/98	EPA 353.2	K1	NM	

OAL

L8939

Sample Summary

Sample ID	Lab #	Description	Sampled	Received
P-2	L8939-1	water	11/18/98 14:00	11/19/98
P-3	L8939-2	water	11/18/98 14:20	11/19/98
P-5	L8939-3	water	11/18/98 14:50	11/19/98
P-4	L8939-4	water	11/18/98 15:00	11/19/98
P-6	L8939-5	water	11/18/98 16:00	11/19/98
P-7	L8939-6	water	11/18/98 16:20	11/19/98
P-15	L8939-7	water	11/18/98 16:45	11/19/98
P-8	L8939-8	water	11/18/98 17:00	11/19/98
P-11	L8939-9	water	11/18/98 17:45	11/19/98
P-9	L8939-10	water	11/18/98 17:50	11/19/98
P-16	L8939-11	water	11/18/98 18:10	11/19/98
P-10	L8939-12	water	11/18/98 18:25	11/19/98
P-13	L8939-13	water	11/18/98 18:45	11/19/98

Definition of Terms

D	Reported value is based on a dilution.
K1	Batch matrix spike recovery outside laboratory QC limits due to suspected matrix interference.
ND	Analytical result was below the reporting limit.

Analysts

Initials	Analyst	Title
NM	Nick Miller	Technician

Method Summary

Analysis	Method
Nitrate + Nitrite as N	EPA 353.2

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Scholls Ferry Road, Beaverton, OR 97007

OAL

L8939

November 23, 1998

George Freitag
Geotechnical Resources, Inc.
9725 SW Beaverton-Hillsdale Hwy.
Suite 140
Beaverton, OR 97005

Phone: (503) 641-3478
FAX: (503) 644-8034

Re: Laboratory Sample Analysis

Project: 2853
Crescent
Project Manager: George Freitag

Dear George Freitag:

On Thursday, November 19, 1998, OAL received thirteen (13) water samples for analysis. The samples were analyzed utilizing EPA, ASTM, or equivalent methodology.

Should you have any questions concerning the results in this report, please contact us at (503) 590-5300. Refer to OAL login number L8939.

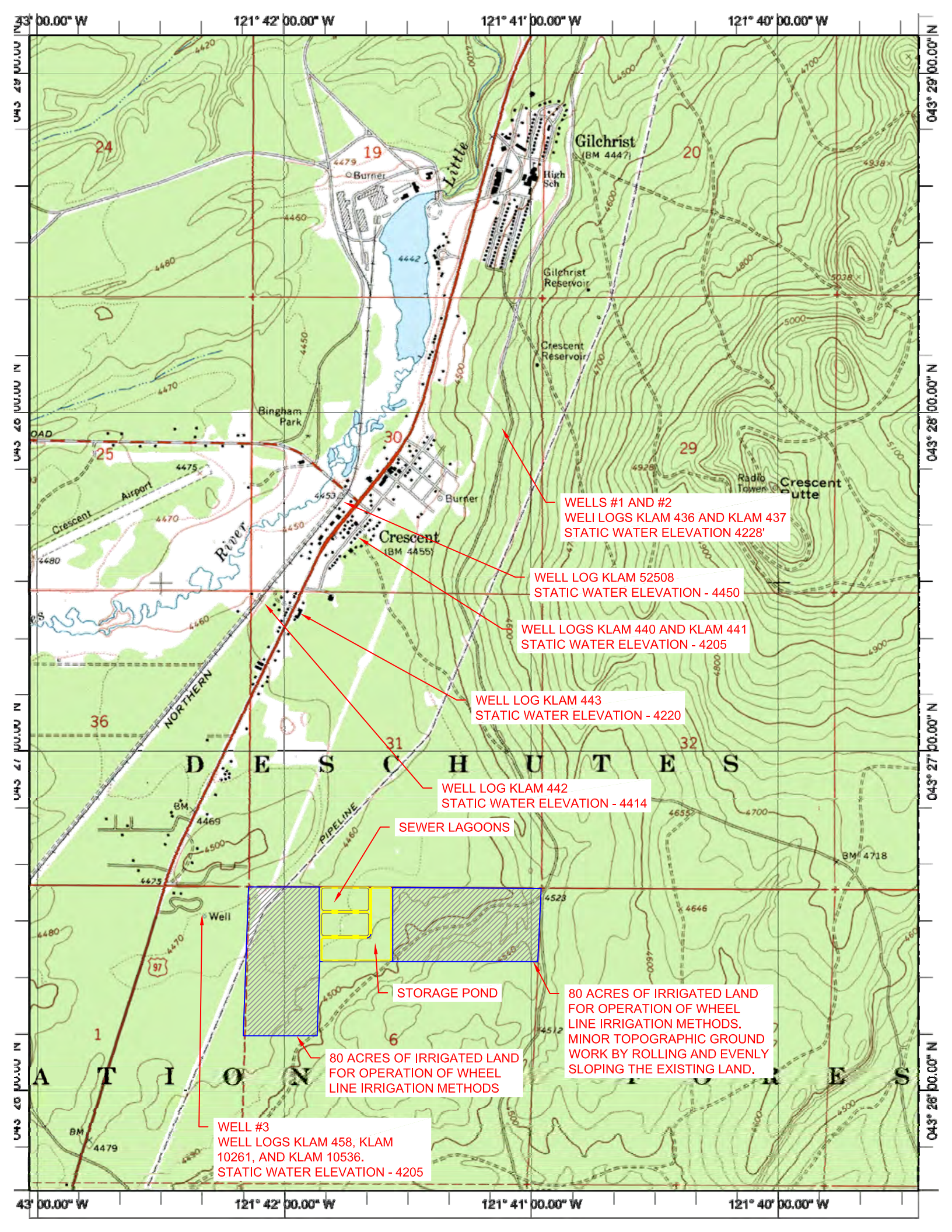
Sincerely,

Deborah Griffiths
Project Manager

Suzanne LeMay
QA/QC Officer

EXHIBIT F

Crescent Water Well Locations and Well Logs


WELLS #1 AND #2
WELI LOGS KLAM 436 AND KLAM 437
STATIC WATER ELEVATION 4228'
WELL LOG KLAM 52508
STATIC WATER ELEVATION - 4450
WELL LOGS KLAM 440 AND KLAM 441
STATIC WATER ELEVATION - 4205
WELL LOG KLAM 443
STATIC WATER ELEVATION - 4220
WELL LOG KLAM 442
STATIC WATER ELEVATION - 4414
SEWER LAGOONS
STORAGE POND
80 ACRES OF IRRIGATED LAND FOR OPERATION OF WHEEL LINE IRRIGATION METHODS.
MINOR TOPOGRAPHIC GROUND WORK BY ROLLING AND EVENLY SLOPING THE EXISTING LAND.
80 ACRES OF IRRIGATED LAND FOR OPERATION OF WHEEL LINE IRRIGATION METHODS
WELL #3
WELL LOGS KLAM 458, KLAM 10261, AND KLAM 10536.
STATIC WATER ELEVATION - 4205
Gilchrist
(BM 4447)
Crescent
(BM 4455)
Gilchrist Reservoir
Crescent Reservoir
Bingham Park
Burner
Little
Crescent Airport
River
NORTHERN
PIPELINE
Well
Crescent Butte
BM 4718
D E S C H U T E S
A T I O N
43° 00.00" W
121° 42' 00.00" W
121° 41' 00.00" W
121° 40' 00.00" W
043° 29' 00.00" N
043° 28' 00.00" N
043° 27' 00.00" N
043° 26' 00.00" N

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
JUL 17 1967
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

KLAM 436

State Well No. 24/9-30

State Permit No. .....

(1) OWNER:
Name CRESCENT WATER ASSOC.
Address P.O. BOX 123 CRESCENT ORE

(2) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(4) PROPOSED USE (check):
Domestic [ ] Industrial [ ] Municipal [X]
Irrigation [ ] Test Well [ ] Other [ ]

CASING INSTALLED:
Threaded [ ] Welded [X]
10" Diam. from 0 ft. to 110 ft. Gage .250
..." Diam. from ..... ft. to ..... ft. Gage .....
..." Diam. from ..... ft. to ..... ft. Gage .....

PERFORATIONS:
Perforated? [ ] Yes [X] No
Type of perforator used
Size of perforations ..... in. by ..... in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

(7) SCREENS:
Well screen installed? [ ] Yes [X] No
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.

(8) WATER LEVEL: Completed well.
Static level 312 ft. below land surface Date 5/15/67
Artesian pressure ..... lbs. per square inch Date

(9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? [X] Yes [ ] No If yes, by whom? Klamath Falls Pumps
Yield: 350 gal./min. with no ft. drawdown after 24 hrs.
" " " "
" " " "
Bailer test 20 gal./min. with no ft. drawdown after 4 hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water 43 Was a chemical analysis made? [X] Yes [ ] No

(10) CONSTRUCTION:
Well seal—Material used BENTIONITE & CEMENT
Depth of seal 43 ft.
Diameter of well bore to bottom of seal 14 in.
Were any loose strata cemented off? [X] Yes [ ] No Depth 120 to 140
Was a drive shoe used? [X] Yes [ ] No
Did any strata contain unusable water? [ ] Yes [X] No
Type of water? ..... depth of strata .....
Method of sealing strata off .....
Was well gravel packed? [ ] Yes [X] No Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

(11) LOCATION OF WELL:
County KLAMOTH Driller's well number .....
¼ ¼ Section 30 T. 24S R. 9 E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG:
Diameter of well below casing 10 in.
Depth drilled 334 ft. Depth of completed well 334 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Volcanic ash & pumice	0	6	
Grey Basalt Boulders	6	11	
Black lindeys	11	16	
Red Cinders & Broken Rock	16	43	
Grey Basalt Rock	43	120	
Broken grey Rock	120	140	
Grey Basalt Rock	140	280	
Brown Rocky	280	312	
Brown Rock with Crevices	312	326	
Black Cinder Rock	326	334	

Work started 11/14 1966 Completed 6/10 1967
Date well drilling machine moved off of well 6/14 1967

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] KENNETH MATHERS Date 7/11, 1967
(Drilling Machine Operator)

Drilling Machine Operator's License No. 245

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME MATHERS & SON
(Person, firm or corporation) (Type or print)

Address Rt 2 Box 28R BEND OREGON

[Signed] Kenneth Mathers
(Water Well Contractor)

Contractor's License No. 361 Date 7/11, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

KLAM 437

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
MAY 27 1976
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 24S/9E-30
State Permit No.

(1) OWNER:
Name: Crescent Water Association
Address: P. O. Box 123
Crescent, Oregon 97845

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☒
12 " Diam. from +1 ft. to 113 ft. Gage .250
10 " Diam. from 0 ft. to 202 ft. Gage .250
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Interstate
Yield: 420 gal./min. with 0 ft. drawdown after 24 hrs.
" " " "
" " " "
Bailer test 28 gal./min. with 0 ft. drawdown after 1 hrs.
Artesian flow -- g.p.m. --
Temperature of water 54° Depth artesian flow encountered -- ft.

(9) CONSTRUCTION:
Well seal—Material used Portland Cement
Well sealed from land surface to 76 ft.
Diameter of well bore to bottom of seal 16 in.
Diameter of well bore below seal 15 in. to 113'-12" to 365'
Number of sacks of cement used in well seal 186 sacks
Number of sacks of bentonite used in well seal 2 sacks
Brand name of bentonite National
Number of pounds of bentonite per 100 gallons of water 133 lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Klamath Driller's well number 758 (22-CP)
¼ ¼ Section 30 T. 24S R. 9E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 335 ft.
Static level 335 ft. below land surface. Date 4/27/76
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 12
Depth drilled 365 ft. Depth of completed well 365 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Pumice	0	7	
Hard Boulders	7	18	
Red cinders-large brkn.lava rock	18	50	
Hard basalt-badly fractured	50	69	
Basalt boulders-Loose grey cinders	69	77	
Hard basalt-badly fractured	77	98	
Basalt boulders-Grey lava ash	98	111	
Hard basalt	111	124	
Red cinders	124	143	
Hard basalt - badly fractured	143	150	
Broken grey lava rock	150	196	
Hard black basalt	196	295	
Brown lava rock	295	317	
Hard black basalt	317	335	
Grey lava rock	335	363	
Loose grey cinders	363	365	

Work started 3/15 19 74 Completed 4/27 1976
Date well drilling machine moved off of well 4/28/ 19 76

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] (Drilling Machine Operator) Date 5/25, 19 76
Drilling Machine Operator's License No. 717

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name (Person, firm or corporation) (Type or print)
Address P. O. Box 46 - Springfield, Oregon 97477
[Signed] (Water Well Contractor)
Contractor's License No. 126 Date 5/25, 19 76

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45056-119

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM 10, OREGON, within 30 days from the date of well completion.

RECEIVED
DEC 27 1963
STATE ENGINEER

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

KLAM 440

State Well No. 24/9-30P(11)

State Permit No. .....

(1) OWNER:
Name U. S. Department of Interior
Address Forest Service
Bend, Oregon

(2) LOCATION OF WELL:
County Klamath Driller's well number

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner
Crescent Ranger Station

(3) TYPE OF WORK (check):
New Well ☐ Deepening ☒ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐
8" Diam. from 0 ft. to 176 ft. Gage .277
6" Diam. from 167 ft. to 267 ft. Gage .280
..." Diam. from ... ft. to ... ft. Gage ...

(7) PERFORATIONS:
Perforated? ☒ Yes ☐ No
Type of perforator used Torch
Size of perforations 1/8 in. by 6 in.
120 perforations from 252 ft. to 267 ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name ...
Type ... Model No. ...
Diam. ... Slot size ... Set from ... ft. to ... ft.
Diam. ... Slot size ... Set from ... ft. to ... ft.

(9) CONSTRUCTION:
Well seal—Material used in seal ...
Depth of seal ... ft. Was a packer used? No
Diameter of well bore to bottom of seal ... in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth ...
Was a drive shoe used? ☐ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel: ...
Gravel placed from ... ft. to ... ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 250 ft. below land surface Date 11/26/63
Artesian pressure ... lbs. per square inch Date ...

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller
Yield: ~~XX~~ 71 gal./min. with 8 ft. drawdown after 8 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☒ Yes ☐ No

(12) WELL LOG:
Diameter of well below casing 6"
Depth drilled 297 ft. Depth of completed well 297 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Previously Drilled	0	267
Hard Grey Basalt	267	271
Water Bearing Grey Rock	271	284
Very hard grey rock	284	292
Grey basalt & Crevice	292	297

Work started 11/11 1963. Completed 12/19 1963
Date well drilling machine moved off of well 12/19 1963

(13) PUMP:
Manufacturer's Name ...
Type: ... H.P. ...

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME A. M. Jannsen Drilling Co.
(Person, firm or corporation) (Type or print)
Address 21075 S. W. T. V. Hwy., Aloha, Oregon

Drilling Machine Operator's License No. 236

[Signed] Edward M. Jannsen
(Water Well Contractor)

Contractor's License No. 79 Date 12/23/63, 19...

(USE ADDITIONAL SHEETS IF NECESSARY)

RECEIVED KLAM 441
DEC 17 1959
STATE ENGINEER
SALEM, OREGON

KLAM 441

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

State Well No. 24/9-30P

State Permit No. .....

(1) OWNER:
Name U. S. Department of Interior
Address Forest Service
Bend, Oregon

(2) LOCATION OF WELL:
County Klamath Owner's number, if any—
¼ ¼ Section 30 T. 24S R. 9E W.M.
Bearing and distance from section or subdivision corner A distance of 175' west and 46' north from the S. E. corner of N½ NW¼ SE¼ SW¼ Section 30.

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☒
~~Blank~~ " Diam. from ..... ft. to ..... ft. Gage .....
8" Diam. from 0 ft. to 176 ft. Gage .277
6" Diam. from 167 ft. to 267 ft. Gage .280

(7) PERFORATIONS:
Perforated? ☒ Yes ☐ No
Type of perforator used Torch
SIZE of perforations 1/8 in. by 6 in.
8 perforations per foot
..... perforations from ..... ft. to ..... ft.
..... perforations from 252 ft. to 267 ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

(8) SCREENS:
Well screen installed ☐ Yes ☒ No
Manufacturer's Name .....
Type ..... Model No. .....
..... Slot size ..... Set from ..... ft. to ..... ft.
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes ☒ No Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.
Was a surface seal provided? ☐ Yes ☐ No To what depth? ..... ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS: Corrected 22/Feb/63
Static level ~~248~~ 246 ft. below land surface Date 9-19-59
Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] ..... Date ....., 19.....
(Owner)

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom?
Yield DEC 18 8 A.M. 1959 gal./min. with 117 ft. drawdown after 8 hrs.
" " " " " "
" 50 GPM " " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG:
Diameter of well 8 inches.
Depth drilled 267 ft. Depth of completed well 267 ft.
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
pumice stone	0	15
cemented gravel	15	25
loose gravel	25	29
pumice sand & loose gravel	29	60
pumice sand	60	85
soft lava rock	85	100
hard grey basalt	100	118
very hard grey rock	118	134
cinders	134	145
loose cinders	145	155
hard brown rock	155	168
cinders	168	180
hard grey rock	180	196
caving cinders	196	206
hard pan	206	222
grey lava	222	232
lava	232	245
water bearing rock	245	267

Work started 9-15-59 19 . Completed 9-19-59 19

(13) PUMP:
Manufacturer's Name .....
Type: ..... H.P. .....

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME A. M. Jannsen Drilling Company
(Person, firm, or corporation) (Type or print)
Address 21075 S. W. Tualatin Highway, Aloha, Oregon

Driller's well number .....
[Signed] Edward M. Jannsen
Edward M. Jannsen, Partner
License No. 79 Date 12-9-59, 19.....

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE OF OREGON

WATER WELL REPORT
(as required by ORS 537.765)

RECEIVED AUG - 5 1986 WATER RESOURCES DEPT SALEM, OREGON

PLEASE TYPE or PRINT IN INK

KLAM 442

24s/9E-31bb

(for official use only)

(1) OWNER:

Name Charles Bishop

Address Po Box 86

City Crescent State OR 97733

(2) TYPE OF WORK (check):

New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Air [ ] Driven [ ]
Rotary Mud [ ] Dug [ ]
Cable [X] Bored [ ]

(4) PROPOSED USE (check):

Domestic [ ] Industrial [ ] Municipal [ ]
Irrigation [X] Thermal: [ ] Withdrawal [ ] Reinjection [ ]
Other: Piezometric [ ] Grounding [ ] Test [ ]

(5) CASING INSTALLED:

Steel [X] Threaded [ ] Plastic [ ] Welded [X]

6 " Diam. from 0 ft. to 30 ft. Gauge .025

" Diam. from ft. to ft. Gauge

LINER INSTALLED:

Steel [ ] Threaded [ ] Plastic [X] Welded [X]

5 " Diam. from 4 ft. to 66 ft. Gauge .025

(6) PERFORATIONS:

Perforated? [X] Yes [ ] No

Size of perforations .018 in. by 2½ in.

960 perforations from 46 ft. to 66 ft.

perforations from ft. to ft.

perforations from ft. to ft.

(7) SCREENS:

Well screen installed? [X] Yes [ ] No

Manufacturer's Name Simpson plastic Home made

Type Sawcut Model No.

Diam. 5" Slot Size .018 Set from 46 ft. to 66 ft.

Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? [ ] Yes [X] No If yes, by whom? Driller

Yield: gal./min. with ft. drawdown after hrs.

" " " "

Air test gal./min. with drill stem at ft. hrs.

Bailer test 6 gal./min. with 9 ft. drawdown after 1 hrs.

Artesian flow g.p.m.

Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Special standards: Yes [ ] No [X]

Well seal—Material used Cement

Well sealed from land surface to 18 ft.

Diameter of well bore to bottom of seal 10 in.

Diameter of well bore below seal 6 in.

Amount of sealing material 6½ sacks [X] pounds [ ]

How was cement grout placed? Pressure Grout

Was pump installed? No Type HP Depth ft.

Was a drive shoe used? [ ] Yes [X] No Plugs Size: location ft.

Did any strata contain unusable water? [ ] Yes [X] No

Type of Water? depth of strata

Method of sealing strata off

Was well gravel packed? [ ] Yes [ ] No Size of gravel:

Gravel placed from ft. to ft.

(10) LOCATION OF WELL by legal description:

County Klamath NW¼ NW¼ of Section 31 of

Township 24S (Township is North or South), Range 9E (Range is East or West), WM.

Tax Lot 4600 Lot — Block — Subdivision Klamath No. RR. Rd

MAILING ADDRESS OF WELL (or nearest address) No St. Addresses

(11) WATER LEVEL of COMPLETED WELL:

Depth at which water was first found 50 ft.

Static level 46 ft. below land surface. Date 7-23-86

Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing

Depth drilled 66 ft. Depth of completed well 66 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Top Soil	0	1	
Pumice	1	7	
Small Gravel - Sand	7	16	
Br. Clay - Sand	16	18	
Large Gravel - Sand	18	20	
Br. Clay - Sand	20	50	
Course Sand	50	60	46
Fine Sand	60	66	

Date work started 7-21-86 /completed 7-25-86

Date well drilling machine moved off of well 7-23 1986

(unbonded) Water Well Constructor Certification (if applicable):

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Date , 19

(bonded) Water Well Constructor Certification:

Bond EK545-527 (number) Issued by: American States Ins. Co. (Surety Company Name)

On behalf of Ronald N. Downes RND Well Drilling (type or print name of Water Well Constructor)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief:

(Signed) Ronald N. Downes (Water Well Constructor)

(Dated) 7-28-86

NOTICE TO WATER WELL CONSTRUCTOR
The original and first copy of this report are to be filed with the

WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date of well completion.

SP*46866-690

RECEIVED
JUN 22 1960
STATE ENGINEER
SALEM, OREGON

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

KLAM 443

WATER WELL REPORT
STATE OF OREGON

KLAM 443

State Well No. 24/9-31

State Permit No.

(1) OWNER:
Name Parsonage First Baptist Church
Address Box 57 Klamath Crescent Oregon

(2) LOCATION OF WELL:
County Owner's number, if any—
¼ ¼ Section 31 T. 24S E W.M.
Bearing and distance from section or subdivision corner
Lot 208

(3) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐
6 " Diam. from ft. to 15 ft. Gage .1875
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☐ Yes ☑ No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed ☐ Yes ☑ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes ☑ No Size of gravel:
Gravel placed from ft. to ft.
Was a surface seal provided? ☑ Yes ☐ No To what depth? 15 ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 245 ft. below land surface Date
Artesian pressure lbs. per square inch Date

Log Accepted by:
[Signed] First Baptist Church (Owner) Date June 20, 1960
by Wm. H. Cash Jr.

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Baller test 8 gal./min. with no ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☑ No

(12) WELL LOG:
Diameter of well 6 inches.
Depth drilled 260 ft. Depth of completed well 260 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
White Pumice	0	12
Black Hard Pan	12	15
Blue Lava Rock	15	233
Red Lava Rock	233	260

Work started 19 . Completed June 1 1960

(13) PUMP:
Manufacturer's Name
Type: H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Mathews & Son (Person, firm, or corporation) (Type or print)
Address RT 1 Box 509
Driller's well number
[Signed] Kenneth Mathews (Well Driller)
License No. 262 Date June 15, 1960

(USE ADDITIONAL SHEETS IF NECESSARY)

KLAM 52508

RECEIVED

OCT 1 1 2000

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-3
Name Crescent Water Assoc.
Address P.O. Box 247
City Crescent State OR Zip 97733

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☒ Push Probe ☐ Other

(4) TYPE OF HOLE:
☐ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☒ Other Casad temp.

(5) USE OF HOLE: groundwater Sample

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 8 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2"	0	8				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	1"	0	3		☐	☒	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:	1"	3	8		☐	☒	☐	☐
					☐	☐	☐	☐

Slot size 0.010

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☒ Yes ☐ No
By whom? North Creek Analytical
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: Removed temporary PVC casing after sampling

(9) LOCATION OF HOLE by legal description:
County Klamath Latitude 43° 27.741' Longitude 121° 41.823'
Township 24 N or (S) Range 9 (E) or W. WM.
Section 31 NE 1/4 NE 1/4
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) South side of Crescent Cutoff at Intersection of 97

Map with location identified must be attached

(10) STATIC WATER LEVEL:
3.5 ft. below land surface. Date 8/24/00
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
light brown silt w/ gravel and organics	0	1	
Grayish brown med. Sand	1	3.65	
dark grayish brown silt w/ clay	6.5	8	

Date Started 8/24/00 Date Completed 8/24/00

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
granular bentonite	0	8	4 sack

Date started 8/25/00 Date Completed 8/25/00

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

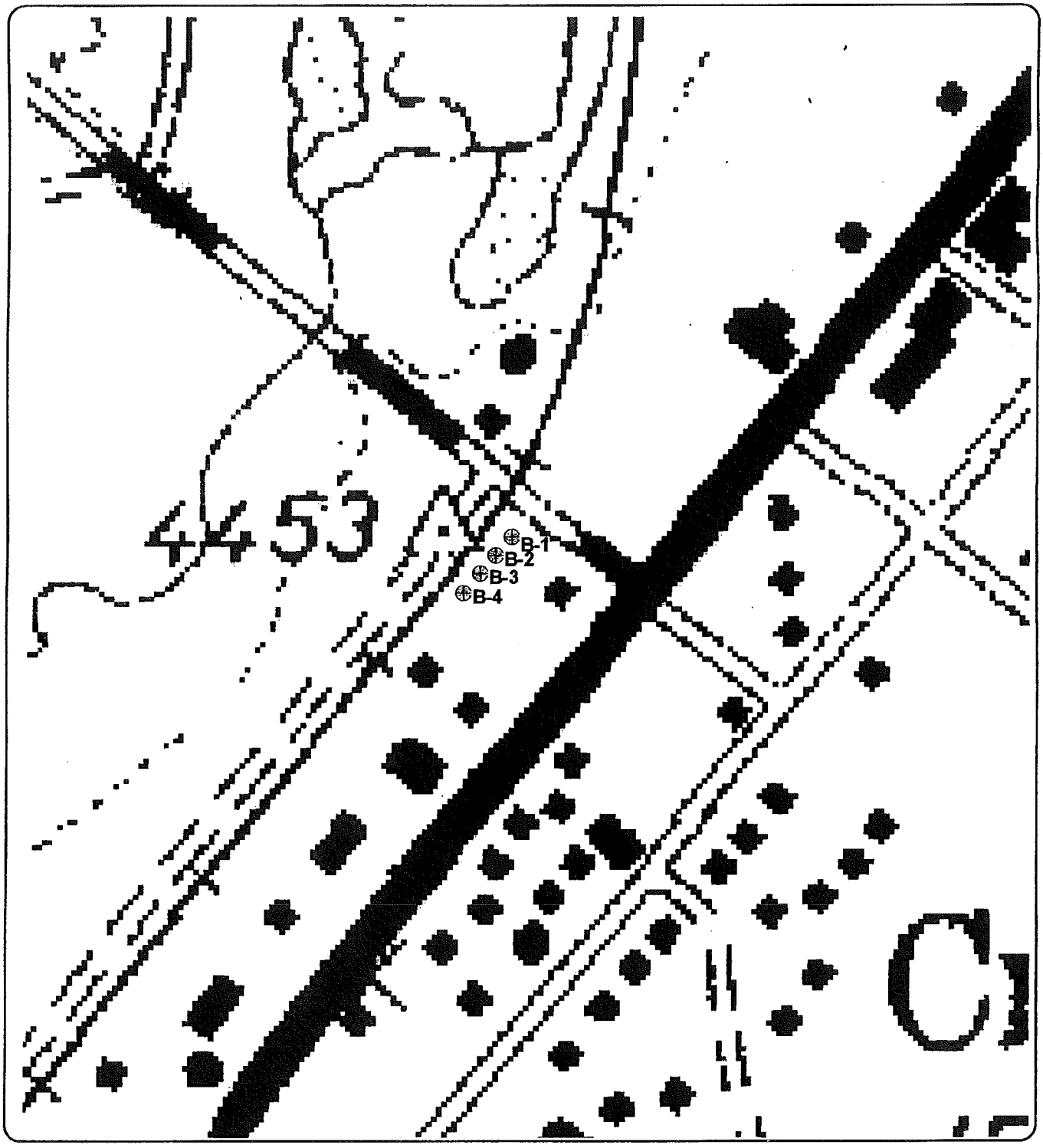
I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number UNWC 103833
Signed ____ Date 10/6/00
Affiliation DEQ

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

KLAM 52508



50 0 50 Feet

N

Boring completed on August 25, 2001

Crescent Boring Locations
Crescent Area-Wide Groundwater Study

DEQ
State of Oregon
Department of
Environmental
Quality

OBSERVATION WELL

RECEIVED
APR 18 1966
STATE ENGINEER
SALEM, OREGON

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

KLAM 458

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 25/8-1 aa

State Permit No. .....

(1) OWNER:
Name U S National Forest
Address Crescent City

(2) LOCATION OF WELL:
County Klamath Driller's well number
NE¼ NE¼ Section 1 T. 25S R. 8 E W.M.
Bearing and distance from section or subdivision corner
600 ft east of Hyway

(3) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☑
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐
12" Diam. from 0 ft. to 138 ft. Gage ¼
8" Diam. from 0 ft. to 285 ft. Gage ¼
..." Diam. from ... ft. to ... ft. Gage ...

(7) PERFORATIONS:
Perforated? ☑ Yes ☐ No
Type of perforator used
Size of perforations in. by in.
... perforations from ... ft. to ... ft.
... perforations from 165 ft. to 175 ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☑ No
Manufacturer's Name ...
Type ... Model No. ...
Diam. ... Slot size ... Set from ... ft. to ... ft.
Diam. ... Slot size ... Set from ... ft. to ... ft.

(9) CONSTRUCTION:
Well seal—Material used in seal Cement
Depth of seal 20 ft. Was a packer used? No
Diameter of well bore to bottom of seal 16 in.
Were any loose strata cemented off? ☑ Yes ☐ No Depth 140 to 260
Was a drive shoe used? ☐ Yes ☑ No
Was well gravel packed? ☐ Yes ☑ No Size of gravel: ...
Gravel placed from ... ft. to ... ft.
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? ... depth of strata ...
Method of sealing strata off

(10) WATER LEVELS:
Static level 262 ft. below land surface Date
Artesian pressure ... lbs. per square inch Date

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☑ Yes ☐ No If yes, by whom?
Yield: 50 gal./min. with ½ ft. drawdown after 8 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water ? Was a chemical analysis made? ☐ Yes ☑ No

(12) WELL LOG:
Diameter of well below casing ...
Depth drilled ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifiers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Top Light Pumice	0	18
Black Sand	18	130
Rock	130	190
Boulder	190	250
Basalt Black	250	760
~~Water~~		
Water gravel	760	285

Work started 3 / 1 / 19 65 Completed 6 / 1 / 19 65
Date well drilling machine moved off of well 19

(13) PUMP:
Manufacturer's Name ...
Type: ... H.P. ...

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Gordon Sours
(Person, firm or corporation) (Type or print)
Address Christmas Valley Calif.

Drilling Machine Operator's License No. 136

[Signed] G. Sours
(Water Well Contractor)

Contractor's License No. 305 Date July 1, 19 65

(USE ADDITIONAL SHEETS IF NECESSARY)

17

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

Klam 10261

AUG 27 1991

WATER RESOURCES DEPT.
SALEM, OREGON

35S/8E/1 aa

(START CARD) # 32731

(1) OWNER:

Well Number:

Name U.S. Nat. Forest Serv. - Crescent Water Assoc

Address P.O. Box 247

City Crescent State Ore. Zip 97733

(2) TYPE OF WORK:

☐ New Well ☐ Deepen ☒ Recondition ☐ Abandon

(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Other Pump Truck

(4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☒ Depth of Completed Well 280 ft.

Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
8	+1	250				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☐ Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	8"	+1'	250	+250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County Klamath Latitude Longitude

Township 25 N or S Range 8 E or W. WM.

Section 1 NE ¼ NE ¼

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:

262 ft. below land surface. Date 8-2-91

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground elevation

Material	From	To	SWL
THE ORGINAL WELL LOG SHOWS THE WELL WAS DRILLED TO 285' AND CASED TO THE BOTTOM WITH 8" X 250 WALL CASING. OUR PLANS WAS TO PERFERATE FROM 275' TO 285'. WE FOUND THE CASING ONLY WENT TO 250' WE DID NO PERFERATIONS.			

Date started 8-2-91 Completed 8-15-91

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number

Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 639

Signed Harold A. Olson Date 8-23-91

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

KLAM 105336

RECEIVED
AUG 12 1992
WATER RESOURCES DEPT.
SALEM, OREGON

255/8E/1aa

(START CARD) # 41563

(1) OWNER: Well Number
Name Des. National Forest
Address Crescent, Ode,
City State Zip

(2) TYPE OF WORK:
☐ New Well ☑ Deepen ☑ Recondition ☐ Abandon

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☐ Domestic ☑ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☐ No Depth of Completed Well 296 ft.
Explosives used ☐ Yes ☐ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
8	281	296				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	6"	166	236	296	160	☐	☑	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☑ Perforations Method Sawed
☑ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
266	296	120	36000	6		☐	☑
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☑ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
300	0		2 1 hr.

Temperature of Water Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Klamath Latitude Longitude
Township 25S N. or S. Range 8E E or W. WM.
Section 1 NE ¼ NE ¼
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address) Rosedale Res. Site

(10) STATIC WATER LEVEL:
265 ft. below land surface. Date 7-14-92
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 265

From	To	Estimated Flow Rate	SWL
281	296	300	265

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Red cinders	221	284	265
Fractured Basalt	284	296	

Date started 7-14-92 Completed 7-21-92

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 62
Signed Mike Foster Date 8-7-92

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 10/91

EXHIBIT G

Alternative Systems Cost Estimates

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Gravity Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$50,000.00	$50,000.00
2	Gilchrist Connection	L.S.	1	$450,000.00	$450,000.00
3	8" PVC Sewer Main	L.F.	28,000	$56.79	$1,590,000.00
4	4" PVC Sewer Laterals	L.F.	11,000	$45.00	$495,000.00
5	Force Main Line	L.F.	11,000	$35.00	$385,000.00
6	Pump Station Crescent	EA.	1	$75,000.00	$75,000.00
7	Service Connections	EA.	288	$1,500.00	$432,000.00
8	Standard 48" Manholes	EA.	50	$3,000.00	$150,000.00
9	Cleanouts	EA.	10	$500.00	$5,000.00
10	Highway Boring (8" sewer)	L.F.	50	$350.00	$17,500.00
11	Highway Boring (6" sewer)	L.F.	200	$300.00	$60,000.00
12	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
13	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
14	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
15	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
16	**Total Construction Costs**				**$3,841,500.00**
17	Construction Contingency at 10%				$384,150.00
18	Engineering and Construction Inspection at 10%				$384,150.00
19	Legal Fees				$5,000.00
20	Grant Administration				$10,000.00
21	Labor Standards Compliance				$10,000.00
22	Permits				$10,000.00
23	Environmental & Cultural Resources Site Study				$15,000.00
24	**Total Estimated Project Costs**				**$4,659,800.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Pressure Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	6" PVC Pressure Main	L.F.	4,000	$50.00	$200,000.00
3	4" PVC Pressure Main	L.F.	31,000	$40.00	$1,240,000.00
4	4" PVC Pressure Laterals	L.F.	11,000	$40.00	$440,000.00
5	Service Connections	EA.	288	$1,500.00	$432,000.00
6	Standard 48" Manholes	EA.	2	$3,000.00	$6,000.00
7	Cleanouts	EA.	40	$500.00	$20,000.00
8	Pressure Vault System	EA.	288	$3,500.00	$1,008,000.00
9	Highway Boring (6" line)	L.F.	100	$400.00	$40,000.00
10	Highway Boring (4" sewer)	L.F.	250	$350.00	$87,500.00
11	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
12	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
13	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
14	**Total Construction Costs**				**$3,730,500.00**
15	Construction Contingency at 10%				$373,050.00
16	Engineering and Construction Inspection at 10%				$373,050.00
17	Legal Fees				$10,000.00
18	Grant Administration				$10,000.00
19	Labor Standards Compliance				$10,000.00
20	Permits				$5,000.00
21	Environmental & Cultural Resources Site Study				$15,000.00
22	**Total Estimated Project Costs**				**$4,526,600.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Effluent Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	10" PVC Sewer Main	L.F.	1,000	$60.00	$60,000.00
3	8" PVC Sewer Main	L.F.	3,000	$55.00	$165,000.00
4	6" PVC Sewer Main	L.F.	5,000	$45.00	$225,000.00
4	4" PVC Sewer Main	L.F.	26,000	$40.00	$1,040,000.00
5	4" PVC Sewer Laterals	L.F.	11,000	$40.00	$440,000.00
5	Service Connections	EA.	288	$1,500.00	$432,000.00
6	Standard 48" Manholes	EA.	2	$3,000.00	$6,000.00
6	Cleanouts	EA.	40	$500.00	$20,000.00
6	STEG Tank System	EA.	258	$3,500.00	$903,000.00
7	STEP Tank System	EA.	30	$5,500.00	$165,000.00
7	Highway Boring (10" sewer)	L.F.	100	$500.00	$50,000.00
8	Highway Boring (4" sewer)	L.F.	250	$350.00	$87,500.00
8	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
9	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
9	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
10	**Total Construction Costs**				**$3,850,500.00**
10	Construction Contingency at 10%				$385,050.00
11	Engineering and Construction Inspection at 10%				$385,050.00
11	Legal Fees				$10,000.00
12	Grant Administration				$10,000.00
13	Labor Standards Compliance				$10,000.00
14	Permits				$5,000.00
15	Environmental & Cultural Resources Site Study				$15,000.00
16	**Total Estimated Project Costs**				**$4,670,600.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Vacuum Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	6" PVC Pressure Main	L.F.	4,000	$50.00	$200,000.00
3	4" PVC Pressure Main	L.F.	31,000	$40.00	$1,240,000.00
4	4" PVC Pressure Laterals	L.F.	11,000	$40.00	$440,000.00
5	Service Connections	EA.	288	$1,500.00	$432,000.00
6	Standard 48" Manholes	EA.	2	$3,000.00	$6,000.00
7	Cleanouts	EA.	40	$500.00	$20,000.00
8	Vacuum Vault System	EA.	288	$3,000.00	$864,000.00
	Vacuum Equipment Building	L.S.	1	$425,000.00	$425,000.00
9	Highway Boring (6" line)	L.F.	100	$400.00	$40,000.00
10	Highway Boring (4" sewer)	L.F.	250	$350.00	$87,500.00
11	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
12	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
13	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
14	**Total Construction Costs**				**$4,011,500.00**
15	Construction Contingency at 10%				$401,150.00
16	Engineering and Construction Inspection at 10%				$401,150.00
17	Legal Fees				$10,000.00
18	Grant Administration				$10,000.00
19	Labor Standards Compliance				$10,000.00
20	Permits				$5,000.00
21	Environmental & Cultural Resources Site Study				$15,000.00
22	**Total Estimated Project Costs**				**$4,863,800.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Facultative Ponds
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.

Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Dike Construction	C.Y.	150,000	$5.00	$750,000.00
2	60 Mil HDPE Liner	S.F.	1,700,000	$0.75	$1,275,000.00
3	3/4"-0" Tops of Dike and Access Roads	C.Y.	2,000	$25.00	$50,000.00
4	Bank Seeding Dike Slopes	acre	5	$500.00	$2,500.00
5	Chlorine Contact Chamber & Equipment	L.S.	1	$50,000.00	$50,000.00
6	Site Pump Stations	EA.	2	$10,000.00	$20,000.00
7	Inlet and Outlet Structures	EA.	5	$8,000.00	$40,000.00
8	Pond Structure Piping	L.S.	1	$10,000.00	$10,000.00
9	Flow Meters	EA.	2	$1,500.00	$3,000.00
10	Dike Fencing	L.F.	5,000	$15.00	$75,000.00
11	Site Building	L.S.	1	$15,000.00	$15,000.00
12	Power To Site	L.S.	1	$30,000.00	$30,000.00
13	Irrigation Equipment and Piping	L.S.	1	$100,000.00	$100,000.00
14	Telemetry and Controls	L.S.	1	$10,000.00	$10,000.00
15	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
16	Erosion Control	L.S.	1	$40,000.00	$40,000.00
17	**Total Construction Costs**				**$2,486,500.00**
18	Construction Contingency at 10%				$248,650.00
19	Engineering Design and Inspection at 10%				$248,650.00
20	Legal Fees				$5,000.00
21	Grant Administration				$10,000.00
22	Labor Standards Compliance				$10,000.00
23	Land Acquisition				$50,000.00
24	WPCF and Reclaimed Water Permits				$20,000.00
25	Environmental & Cultural Resources Site Study				$15,000.00
26	**Total Estimated Project Costs**				**$3,093,800.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Package Plant
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	120,000 gal. Package Treatment System	EA.	1	$500,000.00	$500,000.00
3	40,000 gal. Flow Equalization System	EA.	1	$150,000.00	$150,000.00
4	Integral Sludge Digester	EA.	1	$75,000.00	$75,000.00
5	90,000 gpd Rapid Sand Tertiary Filter	EA.	2	$150,000.00	$300,000.00
6	Dike Rip-Rap	C.Y.	4,000	$10.00	$40,000.00
7	Storage Pond Construction	C.Y.	60,000	$7.25	$435,000.00
8	60 Mil HDPE Liner	S.F.	500,000	$0.75	$375,000.00
9	3/4"-0" Tops of Dike and Access Roads	C.Y.	3,000	$20.00	$60,000.00
10	Bank Seeding Dike Slopes	acre	2	$1,500.00	$3,000.00
11	Site Pump Station	EA.	2	$20,000.00	$40,000.00
12	Inlet and Outlet Structures	EA.	2	$8,000.00	$16,000.00
13	Flow Meters	EA.	2	$10,000.00	$20,000.00
14	Site Piping	L.S.	1	$30,000.00	$30,000.00
15	Dike Fencing	L.F.	4,000	$15.00	$60,000.00
16	Site Building	L.S.	1	$45,000.00	$45,000.00
17	Lab Office Equipment	L.S.	1	$15,000.00	$15,000.00
18	Power To Site	L.S.	1	$30,000.00	$30,000.00
19	Force Main	L.F.	10,500	$35.00	$367,500.00
20	Water Service to Site	L.F.	1,000	$20.00	$20,000.00
21	Transfer Pump Station	EA.	1	$135,000.00	$135,000.00
22	Irrigation Equipment and Piping	L.S.	1	$150,000.00	$150,000.00
23	Telemetry and Controls	L.S.	1	$45,000.00	$45,000.00
24	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
25	Erosion Control	L.S.	1	$40,000.00	$40,000.00
26	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
27	**Total Construction Costs**				**$3,142,500.00**
28	Construction Contingency at 10%				$314,250.00
29	Engineering Design and Inspection at 10%				$314,250.00
30	Legal Fees				$5,000.00
31	Grant Administration				$10,000.00
32	Labor Standards Compliance				$10,000.00
33	WPCF and Reclaimed Water Permits				$20,000.00
34	Land Acquisition				$150,000.00
35	Geotechnical Study				$15,000.00
36	Groundwater Study				$15,000.00
37	Environmental & Cultural Resources Site Study				$15,000.00
38	**Total Estimated Project Costs**				**$4,011,000.00**

EXHIBIT H

Proposed Project Cost Estimates

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Crescent
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.

Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$50,000.00	$50,000.00
2	Dike Construction	C.Y.	150,000	$5.00	$750,000.00
3	60 Mil HDPE Liner	S.F.	1,700,000	$0.75	$1,275,000.00
4	3/4"-0" Tops of Dike and Access Roads	C.Y.	2,000	$25.00	$50,000.00
5	Bank Seeding Dike Slopes	acre	5	$500.00	$2,500.00
6	Chlorine Contact Chamber & Equipment	L.S.	1	$50,000.00	$50,000.00
7	Pond Site Pump Stations	EA.	2	$10,000.00	$20,000.00
8	Inlet and Outlet Structures	EA.	5	$8,000.00	$40,000.00
9	Pond Structure Piping	L.S.	1	$10,000.00	$10,000.00
10	Flow Meters	EA.	2	$1,500.00	$3,000.00
11	Dike Fencing	L.F.	5,000	$15.00	$75,000.00
12	Site Building	L.S.	1	$15,000.00	$15,000.00
13	Power To Site	L.S.	1	$30,000.00	$30,000.00
14	Force Main Line	L.F.	11,000	$35.00	$385,000.00
15	Pump Station Crescent	EA.	1	$75,000.00	$75,000.00
16	Irrigation Equipment and Piping	L.S.	1	$100,000.00	$100,000.00
17	Telemetry and Controls	L.S.	1	$10,000.00	$10,000.00
18	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
19	Erosion Control	L.S.	1	$40,000.00	$40,000.00
20	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
21	8" PVC Sewer Main	L.F.	28,000	$56.79	$1,590,000.00
22	4" PVC Sewer Laterals	L.F.	11,000	$45.00	$495,000.00
23	Service Connections	EA.	288	$1,500.00	$432,000.00
24	Standard 48" Manholes	EA.	50	$3,000.00	$150,000.00
25	Cleanouts	EA.	10	$500.00	$5,000.00
26	Highway Boring (8" sewer)	L.F.	50	$350.00	$17,500.00
27	Highway Boring (6" sewer)	L.F.	200	$300.00	$60,000.00
28	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
29	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
30	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
31	**Total Construction Costs**				**$5,878,000.00**
32	Construction Contingency at 10%				$587,800.00
33	Engineering Design and Inspection at 10%				$587,800.00
34	Legal Fees				$10,000.00
35	Grant Administration				$20,000.00
36	Labor Standards Compliance				$20,000.00
37	Land Acquisition				$50,000.00
38	Permits				$30,000.00
39	Environmental & Cultural Resources Site Study				$30,000.00
40	**Total Estimated Project Costs**				**$7,213,600.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Crescent and Gilchrist
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.

Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$50,000.00	$50,000.00
2	Dike Construction	C.Y.	150,000	$5.00	$750,000.00
3	60 Mil HDPE Liner	S.F.	1,700,000	$0.75	$1,275,000.00
4	3/4"-0" Tops of Dike and Access Roads	C.Y.	2,000	$25.00	$50,000.00
5	Bank Seeding Dike Slopes	acre	5	$500.00	$2,500.00
6	Chlorine Contact Chamber & Equipment	L.S.	1	$50,000.00	$50,000.00
7	Pond Site Pump Stations	EA.	2	$10,000.00	$20,000.00
8	Inlet and Outlet Structures	EA.	5	$8,000.00	$40,000.00
9	Pond Structure Piping	L.S.	1	$10,000.00	$10,000.00
10	Flow Meters	EA.	2	$1,500.00	$3,000.00
11	Dike Fencing	L.F.	5,000	$15.00	$75,000.00
12	Site Building	L.S.	1	$15,000.00	$15,000.00
13	Power To Site	L.S.	1	$30,000.00	$30,000.00
14	Force Main Line	L.F.	11,000	$35.00	$385,000.00
15	Pump Station Crescent	EA.	1	$75,000.00	$75,000.00
16	Irrigation Equipment and Piping	L.S.	1	$100,000.00	$100,000.00
17	Telemetry and Controls	L.S.	1	$10,000.00	$10,000.00
18	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
19	Erosion Control	L.S.	1	$40,000.00	$40,000.00
20	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
21	Gilchrist Connection	L.S.	1	$450,000.00	$450,000.00
22	8" PVC Sewer Main	L.F.	28,000	$56.79	$1,590,000.00
23	4" PVC Sewer Laterals	L.F.	11,000	$45.00	$495,000.00
24	Service Connections	EA.	288	$1,500.00	$432,000.00
25	Standard 48" Manholes	EA.	50	$3,000.00	$150,000.00
26	Cleanouts	EA.	10	$500.00	$5,000.00
27	Highway Boring (8" sewer)	L.F.	50	$350.00	$17,500.00
28	Highway Boring (6" sewer)	L.F.	200	$300.00	$60,000.00
29	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
30	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
31	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
32	**Total Construction Costs**				**$6,328,000.00**
33	Construction Contingency at 10%				$632,800.00
34	Engineering Design and Inspection at 10%				$632,800.00
35	Legal Fees				$10,000.00
36	Grant Administration				$20,000.00
37	Labor Standards Compliance				$20,000.00
38	Land Acquisition				$50,000.00
39	Permits				$30,000.00
40	Environmental & Cultural Resources Site Study				$30,000.00
41	**Total Estimated Project Costs**				**$7,753,600.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Crescent, Gilchrist and West Crescent
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.

Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$50,000.00	$50,000.00
2	Dike Construction	C.Y.	150,000	$5.00	$750,000.00
3	60 Mil HDPE Liner	S.F.	1,700,000	$0.75	$1,275,000.00
4	3/4"-0" Tops of Dike and Access Roads	C.Y.	2,000	$25.00	$50,000.00
5	Bank Seeding Dike Slopes	acre	5	$500.00	$2,500.00
6	Chlorine Contact Chamber & Equipment	L.S.	1	$50,000.00	$50,000.00
7	Pond Site Pump Stations	EA.	2	$10,000.00	$20,000.00
8	Inlet and Outlet Structures	EA.	5	$8,000.00	$40,000.00
9	Pond Structure Piping	L.S.	1	$10,000.00	$10,000.00
10	Flow Meters	EA.	2	$1,500.00	$3,000.00
11	Dike Fencing	L.F.	5,000	$15.00	$75,000.00
12	Site Building	L.S.	1	$15,000.00	$15,000.00
13	Power To Site	L.S.	1	$30,000.00	$30,000.00
14	Force Main Line	L.F.	11,000	$35.00	$385,000.00
15	Pump Station Crescent	EA.	1	$75,000.00	$75,000.00
16	Irrigation Equipment and Piping	L.S.	1	$100,000.00	$100,000.00
17	Telemetry and Controls	L.S.	1	$10,000.00	$10,000.00
18	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
19	Erosion Control	L.S.	1	$40,000.00	$40,000.00
20	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
21	Gilchrist Connection	L.S.	1	$450,000.00	$450,000.00
22	8" PVC Sewer Main	L.F.	42,000	$56.79	$2,385,180.00
23	4" PVC Sewer Laterals	L.F.	16,000	$45.00	$720,000.00
24	Service Connections	EA.	425	$1,500.00	$637,500.00
25	Standard 48" Manholes	EA.	70	$3,000.00	$210,000.00
26	Cleanouts	EA.	10	$500.00	$5,000.00
27	Highway Boring (8" sewer)	L.F.	50	$350.00	$17,500.00
28	Highway Boring (6" sewer)	L.F.	200	$300.00	$60,000.00
29	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
30	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
31	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
32	**Total Construction Costs**				**$7,613,680.00**
33	Construction Contingency at 10%				$761,368.00
34	Engineering Design and Inspection at 10%				$761,368.00
35	Legal Fees				$10,000.00
36	Grant Administration				$20,000.00
37	Labor Standards Compliance				$20,000.00
38	Land Acquisition				$50,000.00
39	Permits				$30,000.00
40	Environmental & Cultural Resources Site Study				$30,000.00
41	**Total Estimated Project Costs**				**$9,296,416.00**

EXHIBIT I

Crescent Sanitary District Budget

FORM LB-1 NOTICE OF BUDGET HEARING

A public meeting of the Crescent Sanitary District will be held on June 11, 2014, at 5:00 p.m. at Crescent Community Center in Crescent, Oregon. The purpose of this meeting is to discuss the budget for the fiscal year beginning July 1, 2014, as approved by the Crescent Sanitary District Budget Committee. A summary of the budget is presented below. A copy of the budget may be inspected or obtained at the Crescent Post Office, 136728 Main Street, Crescent, Oregon, between the hours of 10:00 a.m. and 3:00 p.m. This budget is for an annual budget period. This budget was prepared on a basis of accounting that is the same as the preceding year.

Contact: Cher Dolan Telephone: 541-480-3040 Email:

FINANCIAL SUMMARY - RESOURCES			
TOTAL OF ALL FUNDS	Actual Amount 2012-2013	Adopted Budget This Year 2013-2014	Approved Budget Next Year 2014-2015
Beginning Fund Balance/Net Working Capital	74,177	74,200	103,219
Fees, Licenses, Permits, Fines, Assessments & Other Service Charges	0	7,000,000	0
Federal, State and all Other Grants, Gifts, Allocations and Donations	0	0	935,000
Interfund Transfers / Internal Service Reimbursements	0	100,000	0
All Other Resources Except Current Year Property Taxes	0	2,401,500	824
Current Year Property Taxes Estimated to be Received	15,299	11,000	16,000
Total Resources	**89,476**	**9,586,700**	**1,055,043**

FINANCIAL SUMMARY - REQUIREMENTS BY OBJECT CLASSIFICATION			
Materials and Services	20,171	137,900	685,300
Capital Outlay	0	200,000	0
Interfund Transfers	0	100,000	0
Contingencies	0	807,000	0
Unappropriated Ending Balance and Reserved for Future Expenditure	69,305	8,341,800	369,743
Total Requirements	**89,476**	**9,586,700**	**1,055,043**

FINANCIAL SUMMARY - REQUIREMENTS AND FULL-TIME EQUIVALENT EMPLOYEES (FTE) BY ORGANIZATIONAL UNIT OR PROGRAM *			
Name of Organizational Unit or Program **FTE** for that unit or program			
Not Allocated to Organizational Unit or Program	89,476	9,586,700	1,055,043
FTE			
Total Requirements	**89,476**	**9,586,700**	**1,055,043**
Total FTE			

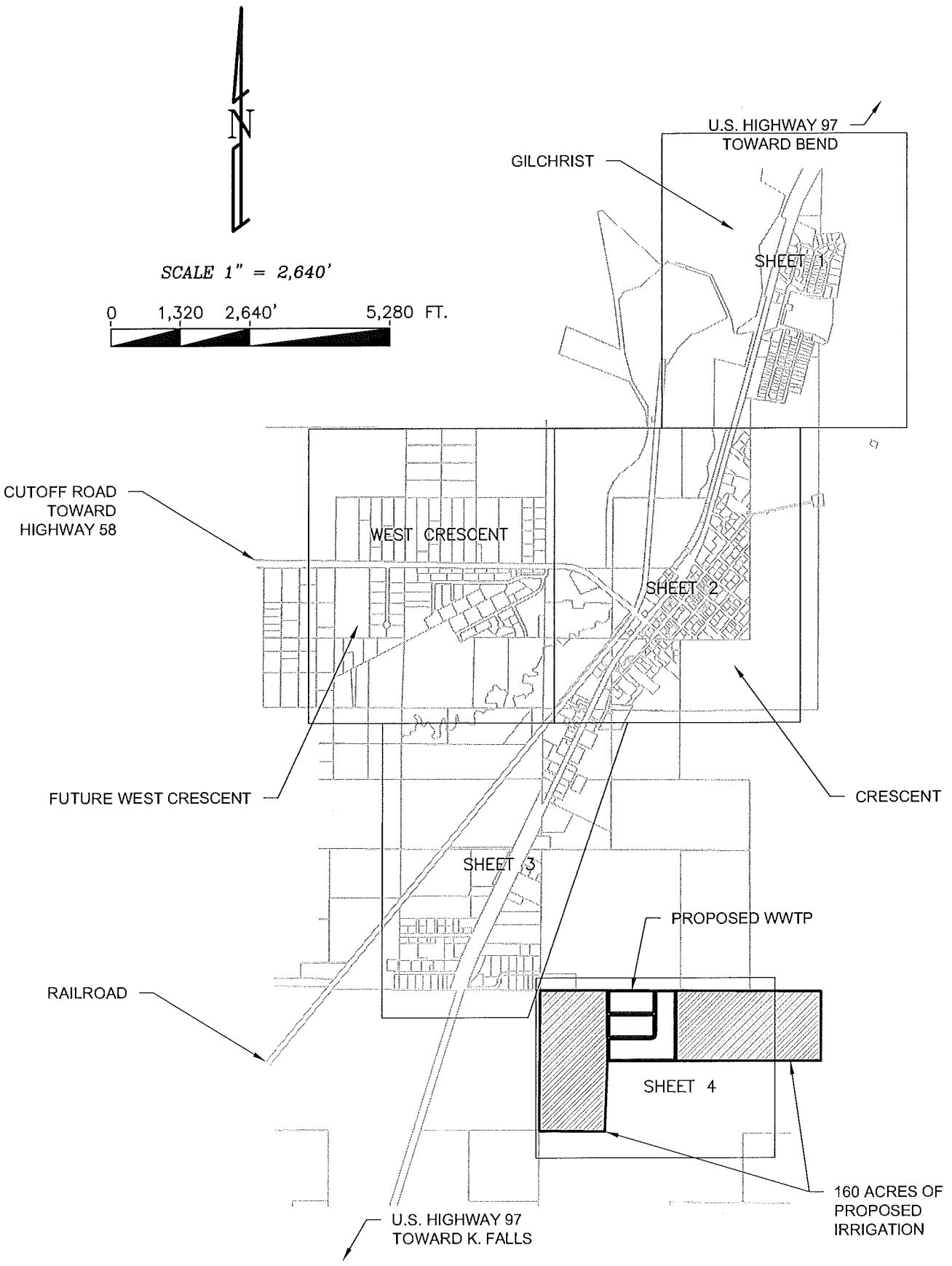
PROPERTY TAX LEVIES			
	Rate or Amount Imposed 2012-2013	Rate or Amount Imposed This Year 2013-2014	Rate or Amount Approved Next Year 2014-2015
Permanent Rate Levy (rate limit 1.0321 per $1,000)	1.0321	1.0321	1.0321
Local Option Levy			
Levy For General Obligation Bonds			

* If more space is needed to complete any section of this form, insert lines (rows) on this sheet. You may delete blank lines.

150-504-073-2 (Rev. 02-14)

EXHIBIT J

Preliminary System Schematics



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LAKEVIEW, OREGON 97630
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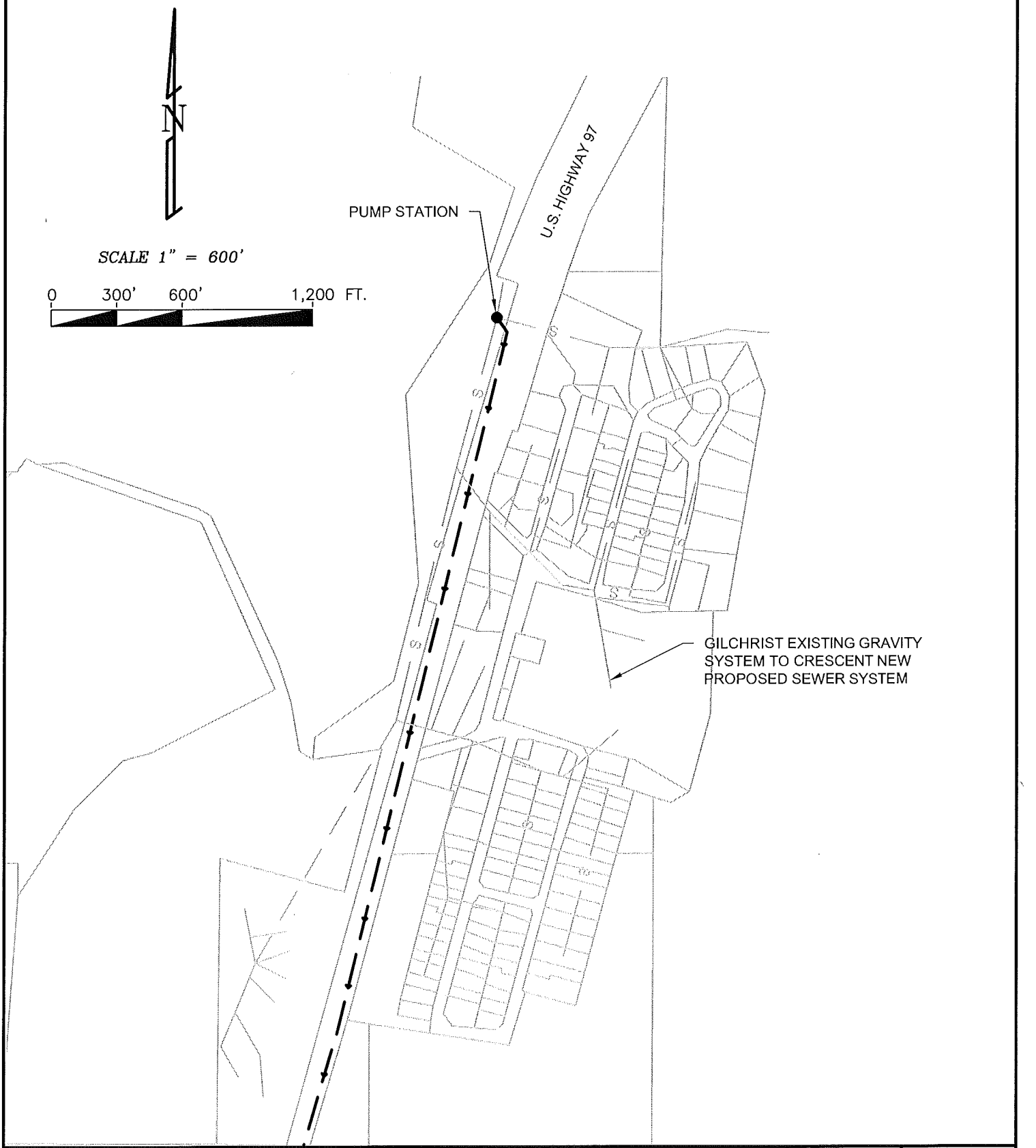
KEY MAP
CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

DATE : 10/10/2014	DRAWING NO. KEY
SCALE : 1"=2,640'	
APPROVED BY: DARRYL ANDERSON	



ANDERSON ENGINEERING AND SURVEYING, INC.
P.O. BOX 28 / 17681 HIGHWAY 395
LAKEVIEW, OREGON 97630
(541) 947-4407 FAX: 947-2321
www.andersonengineering.com

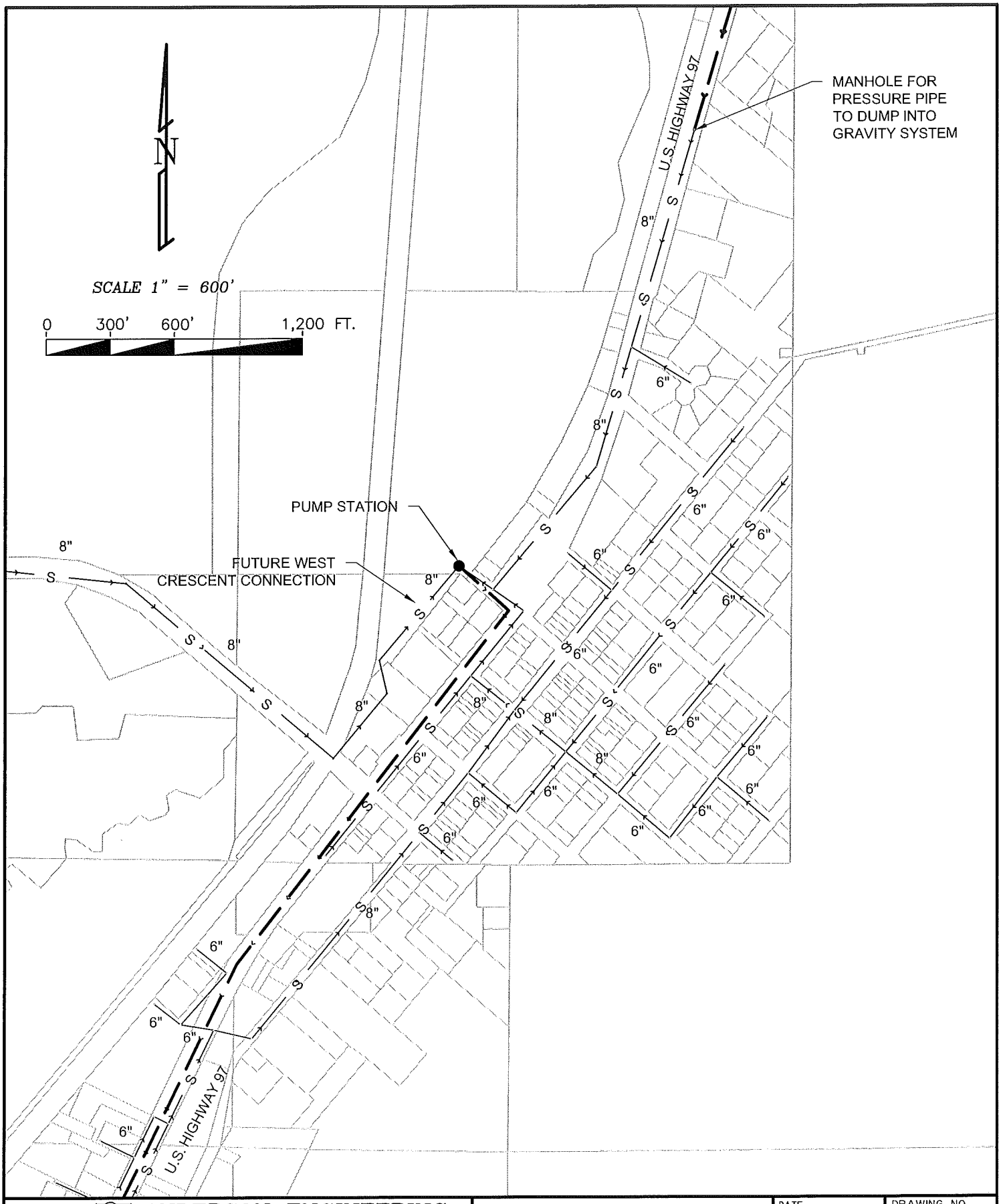
SHEET 1
CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

DATE : 10/10/2014

DRAWING NO. 1

SCALE : 1"=600'

APPROVED BY: DARRYL ANDERSON



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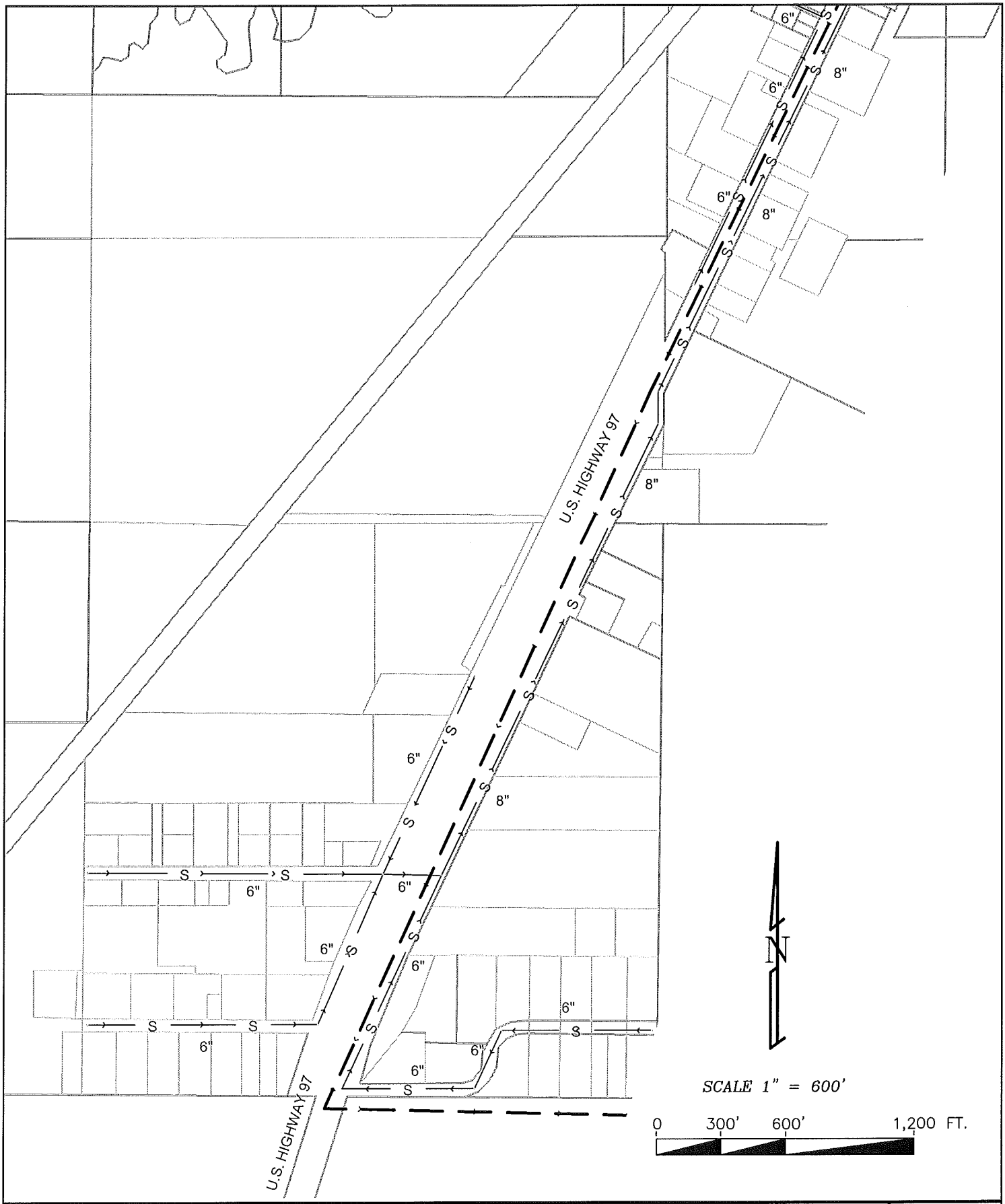
SHEET 2
CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

DATE : 10/10/2014

DRAWING NO. 2

SCALE : 1"=600'

APPROVED BY: DARRYL ANDERSON



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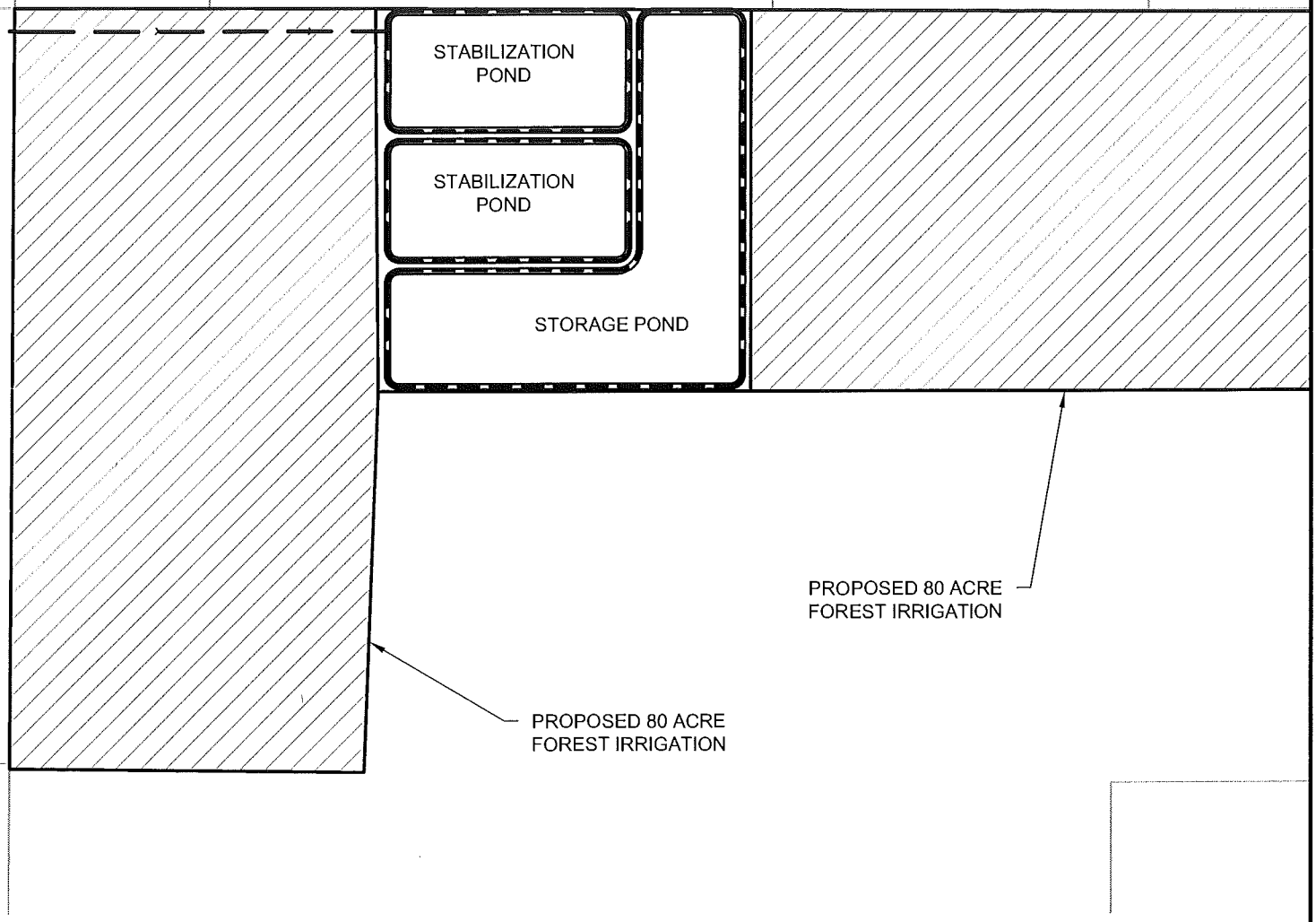
SHEET 3
CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

DATE : 10/10/2014	DRAWING NO. 3
SCALE : 1"=600'	
APPROVED BY: DARRYL ANDERSON	



SCALE 1" = 600'

0 300' 600' 1,200 FT.

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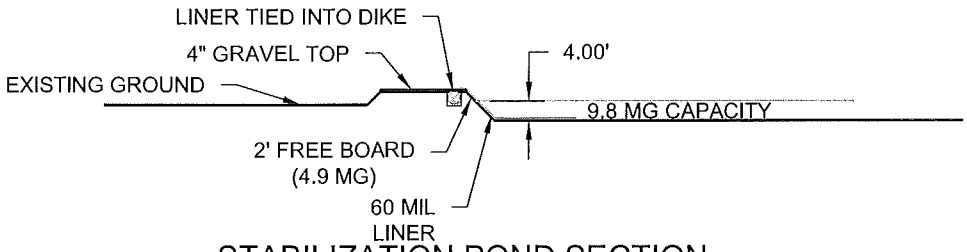
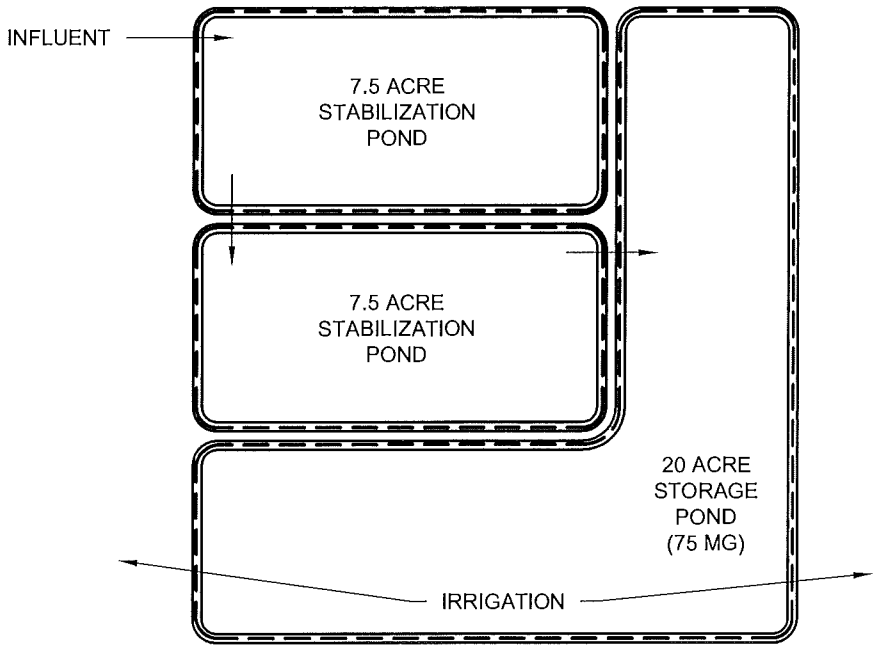
SHEET 4
CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

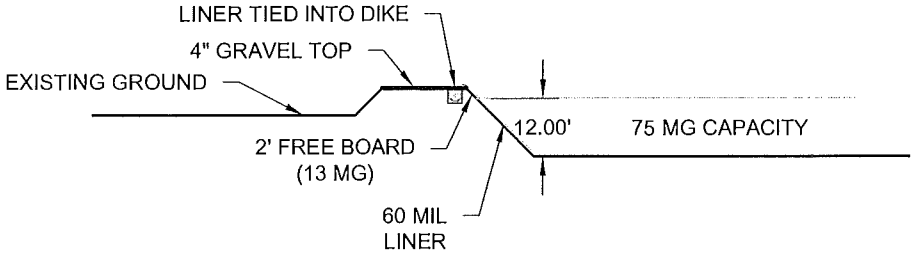
DATE : 10/10/2014
SCALE : 1"=600'
DRAWING NO. 4
APPROVED BY: DARRYL ANDERSON



STABILIZATION POND SECTION
SCALE: 1" = 40'



WWTP PLAN VIEW
SCALE: 1" = 400'



STORAGE POND SECTION
SCALE: 1" = 40'

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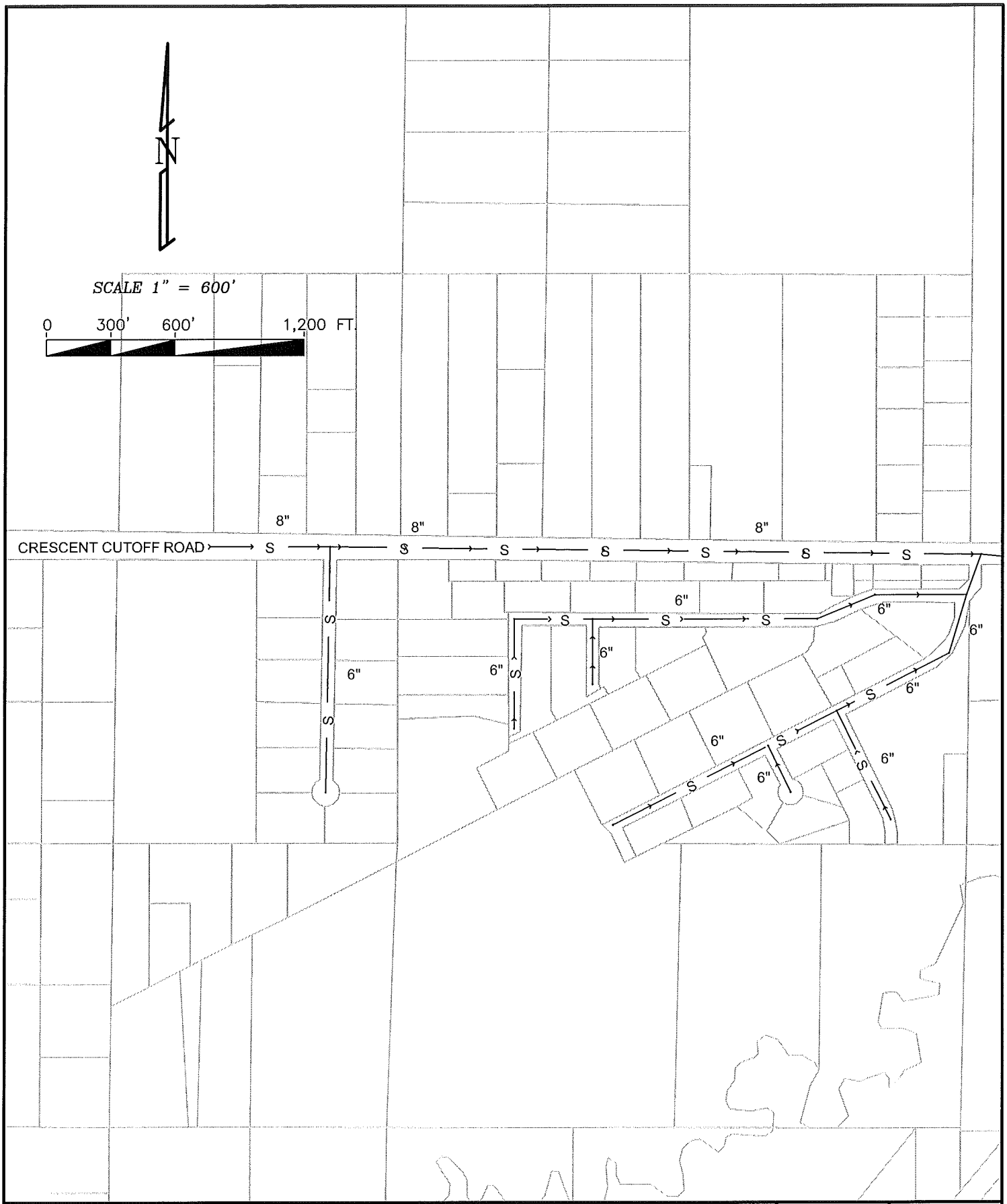
WWTP LAYOUT
CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

DATE : 10/10/2014
SCALE : AS NOTED
DRAWING NO. 5
APPROVED BY: DARRYL ANDERSON



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WEST CRESCENT CRESCENT WASTEWATER SYSTEM IMPROVEMENTS

DATE : 10/10/2014

SCALE : 1"=600'

DRAWING NO. 6

APPROVED BY: DARRYL ANDERSON

EXHIBIT K

Gilchrist WPCF Permit

MODIFICATION
WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
Eastern Region – Bend Office
2146 NE Fourth, Suite 104, Bend, OR 97701
Telephone: (541) 388-6146

Issued pursuant to ORS 468B.050

ISSUED TO:

Gilchrist Sewer Company, LLC
P.O. Box 637
Gilchrist, OR 97737

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Method of Disposal
Domestic Wastewater	001	Drainfield

FACILITY TYPE AND LOCATION:

Stabilization Lagoons without Aeration and Drainfield
Gilchrist, OR

Treatment System Class: N/A
Collection System Class: N/A

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub-Basin: 25C:Little Deschutes
Hydro Code: 25C-DELI 63
LLID: 1214536438546-65.7-N
County: Klamath

Nearest surface stream which would receive waste if it were to discharge: Little Deschutes at R.M. 65.7

Issued in response to Application No. 991954 received June 19, 1997.
This permit modification is issued based on the land use findings in the permit record.

Richard J. Nichols, Manager
Bend Water Quality Section
Eastern Region

Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge to waters of the state is prohibited, including discharge to an underground injection control system.

SCHEDULE A

Waste Disposal Limitations

1. The permittee is authorized to construct, operate, and maintain a sewage treatment and disposal system in accordance with the following conditions:

    a. Unless otherwise approved in writing by the Department, the maximum monthly average daily flow to the wastewater treatment system shall not exceed 0.060 MGD.

    b. No discharge to state waters is permitted. All overflow from the sewage lagoons shall be disposed in to drainfields so as to prevent:

        (1) Surface runoff or subsurface drainage through drainage tile;

        (2) The creation of odors, fly and mosquito breeding or other nuisance conditions; and

        (3) The overloading of land with nutrients or organics.

        (4) Prevent any adverse impact to groundwater quality.

2. The permittee shall, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

SCHEDULE B

1. **Minimum Monitoring and Reporting Requirements** (unless otherwise approved in writing by the Department).

The permittee shall monitor the operation and efficiency of all treatment and disposal facilities. Unless otherwise agreed to in writing by the Department of Environmental Quality, data collected, and submitted shall include but not necessarily be limited to the following parameters and minimum frequencies:

a. Influent to Lagoons:

Parameter	Minimum Frequency	Type of Sample
Flow-Influent	Daily	Measurement
BOD-Influent	Quarterly	24hr Composite
TSS-Influent	Quarterly	24hr Composite
Flow Meter Calibration	Annual	Verification
pH-Influent	Weekly	Grab

b. Treated Effluent to Drainfield:

Parameter	Minimum Frequency	Type of Sample
Total Flow (gal./day)	Daily	Measurement
Flow Meter Calibration	Annual	Verification
Total Kjeldahl-Nitrogen	Bi-Annually	Grab
Nitrite+Nitrate-Nitrogen	Bi-Annually	Grab
Perimeter Inspection of lagoon and drainfield	Daily	Observation

c. Groundwater Monitoring

(1) Groundwater Minimum Monitoring and Reporting Requirements (Note: based upon information provided by the permittee, if the Department concludes that operation of the drainfield disposal site will not adversely affect groundwater quality, the Department may reduce or eliminate groundwater quality monitoring.)

(a) Groundwater monitoring shall be conducted in accordance with the approved Groundwater Monitoring Plan titled Work Plan for Monitoring Well Installation and Groundwater Monitoring Plan, by EGR & Associates, Inc., dated March 2003.

(b) Groundwater monitoring shall be conducted in the following monitoring wells, and sampling procedures shall be in accordance with the approved Monitoring Plan:

Monitoring Well	Well Designation
#1	Background
#2	Detection
#3	Compliance

(c) Sampling procedures shall be in accordance with the approved Groundwater Monitoring Plan. At a minimum, the permittee shall monitor groundwater for the parameters at the frequencies as specified below. If the Department approved Groundwater Monitoring Plan requires additional sampling and analysis of other parameters, the permittee shall conduct the additional monitoring as required in the Groundwater Monitoring Plan.

Parameter	Minimum Frequency	Type of Sample
Fecal Coliform	Quarterly	Grab/Lab Analysis
Nitrate-Nitrogen	Quarterly	Grab/Lab Analysis
Water table elevation	Quarterly	Grab/Field Analysis
Sulfate	Quarterly	Grab/Lab Analysis
Chloride	Quarterly	Grab/Lab Analysis
Conductivity	Quarterly	Grab/Lab Analysis

(d) Reporting Requirements

(i) **Quarterly Reporting**: Analytical results of groundwater monitoring for the parameters listed above and for any other parameters identified in the approved Groundwater Monitoring Plan, shall be reported quarterly in a Department approved format. At a minimum, the report shall contain the quarterly reporting information identified in the approved Groundwater Monitoring Plan. Reports are due to the Department by the 30th day of the month following the sampling event.

(ii) **Annual Data Analysis and Reporting**: Unless otherwise approved in writing by the Department, an annual groundwater data analysis report shall be submitted to the Department by January 15, 2007 and each year thereafter. The annual report shall contain the annual data analysis and reporting information identified in the approved Groundwater Monitoring Plan.

2. Reporting Procedures

a. Monitoring results shall be reported on approved forms. Except for groundwater monitoring, the reporting period is the calendar month. Reports must be submitted to the Department's Eastern Region - Bend office by the 15th day of the following month.

3. Report Submittals

a. For any year in which biosolids are removed , a report shall be submitted to the Department by February 19 of the following year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-050-0035(6)(a)-(e).

SCHEDULE C

Compliance Schedules and Conditions

1. Six (6) months prior to the removal of accumulated solids from the lagoon, the permittee shall submit to the Department a biosolids management plan developed in accordance with Oregon Administrative Rule 340, Division 50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

2. Within one year of issuance of this permit modification, the permittee shall submit a written report which analyzes the hydro-geologic character of the groundwater system beneath the permittee's disposal system and determines the fate of nitrogen constituents in its effluent.

3. Immediately upon issuance of this permit modification, the permittee shall begin routine maintenance of the collection system. **Problem areas shall be identified and cleaned as needed and periodically inspected to prevent future spills and backups**. Maintenance activities shall include but are not limited to; routine inspections of the collection system; repairing areas where leaks and roots have been found, and replacing sections of the collection system where needed. **All spills to the ground surface from the main trunk line shall be reported to the Department within 24 hours**. The permittee's monthly discharge monitoring report shall include a section detailing those portions of the collection system that have been televised, repaired, or replaced, and other activities and improvements associated with the operation and maintenance of the collection system. It shall also list all building sewer repairs that the permittee has provided to homeowners.

4. The permittee is expected to meet the compliance dates that have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. The permittee shall, during all times of disposal, provide qualified personnel to ensure the continuous performance of the disposal system within the limitations of this permit.

2. Prior to constructing or modifying any wastewater control facilities, detailed plans and specifications shall be approved in writing by the Department. After approval of the plans, all construction shall be in strict conformance with the plans unless otherwise approved in writing by the Department

3. Prior to the removal of any accumulated sludges in the permittee's wastewater treatment system, the permittee shall prepare, submit to the Department, and receive approval of a biosolids management plan that complies with OAR 340-50. All sludge (biosolids or septage) shall be managed in accordance with the approved sludge (biosolids or septage) management plan. No substantial changes shall be made in sludge management activities which significantly differ from operations specified in an approved plan without the prior written approval of the Department. This permit may be modified to incorporate any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

4. The permittee shall notify the DEQ Bend office (541) 388-6146, in accordance with the response times noted in the General Conditions of this permit, of any malfunction so corrective action can be coordinated between the permittee and the Department.

5. Management and Maintenance of Groundwater Monitoring Wells

    a. The permittee shall protect and maintain each groundwater monitoring well so that samples collected are representative of actual conditions.

    b. All monitoring well abandonments, replacements, repairs, and installations must be conducted in accordance with the Water Resources Department Oregon Administrative Rules, Chapter 690, Division 240, and with the Department's guidance "Groundwater Monitoring Well Drilling, Construction, and Decommissioning", dated August 22, 1992. All monitoring well abandonments, replacements, repairs, and installations must be documented in a report prepared by an Oregon registered geologist.

    c. If a monitoring well becomes damaged or inoperable, the permittee shall notify the Department in writing within 14 days of when the permittee becomes aware of the circumstances. The written report shall describe: what problem has occurred, the remedial measures that have been or will be taken to correct the problem, and the measures taken to prevent the recurrence of damage or inoperation. The Department may require the replacement of inoperable monitoring wells.

    d. Prior to installation of new or replacement monitoring wells, the placement or design must be approved in writing by the Department. Well logs and a well completion report shall be submitted to the Department within 30 days of installation of the well. The report shall include a survey drawing showing the location of all monitoring wells, disposal sites, and water bodies.

    e. Prior to abandonment of existing wells deemed unsuitable for groundwater monitoring, an abandonment plan must be submitted to the Department for review and approval.

WPCF GENERAL CONDITIONS
(SCHEDULE F)

SECTION A. STANDARD CONDITIONS

1. Property Rights

Issuance of this permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property, any invasion of personal rights, or any infringement of federal, state, or local laws or regulations.

2. Liability

The Department of Environmental Quality or its officers, agents, or employees may not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities or systems because of this permit.

3. Permit Actions

After notice by the Department, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any term or condition of this permit, any applicable rule or statute, or any order of the Commission;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.

4. Transfer of Permit

This permit may not be transferred to a third party without prior written approval from the Department. The Department may approve transfers where the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of this permit and the rules of the Commission. A transfer application and filing fee must be submitted to the Department.

5. Permit Fees

The permittee must pay the fees required with this permit application and annually for permit compliance determination by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

At all times the permittee must maintain in good working order and properly operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to comply with the terms and conditions of this permit.

2. Standard Operation and Maintenance

All waste collection, control, treatment, and disposal facilities or systems must be operated in a manner consistent with the following:

a. At all times, all facilities or systems must be operated as efficiently as possible in a manner that will prevent discharges, health hazards, and nuisance conditions.

b. All screenings, grit, and sludge must be disposed of in a manner approved by the Department to prevent any pollutant from the materials from reaching waters of the state, creating a public health hazard, or causing a nuisance condition.

c. Bypassing untreated waste is generally prohibited. Bypassing may not occur without prior written permission from the Department except where unavoidable to prevent loss of life, personal injury, or severe property damage.

3. Noncompliance and Notification Procedures

If the permittee is unable to comply with conditions of this permit because of surfacing sewage; a breakdown of equipment, facilities or systems; an accident caused by human error or negligence; or any other cause such as an act of nature, the permittee must:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department's Regional office so that an investigation can be made to evaluate the impact and the corrective actions taken, and to determine any additional action that must be taken.

c. Within 5 days of the time the permittee becomes aware of the circumstances, the permittee must submit to the Department a detailed written report describing the breakdown, the actual quantity and quality of waste discharged, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or liability for failure to comply.

4. Wastewater System Personnel

The permittee must provide an adequate operating staff that is duly qualified to carry out the operation, maintenance, and monitoring requirements to assure continuous compliance with the conditions of this permit.

SECTION C. MONITORING AND RECORDS

1. Inspection and Entry

The permittee must at all reasonable times allow authorized representatives of the Department of Environmental Quality to:

a. Enter upon the permittee's premises where a waste source or disposal system is located or where any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy any records required by this permit;

c. Inspect any treatment or disposal system, practices, operations, monitoring equipment, or monitoring method regulated or required by this permit; or

d. Sample or monitor any substances or permit parameters at any location at reasonable times for the purpose of assuring permit compliance or as otherwise authorized by state law.

2. Averaging of Measurements

Calculations of averages of measurements required for all parameters except bacteria must use an arithmetic mean; bacteria must be averaged as specified in the permit.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures specified in the most recent edition of **Standard Methods for the Examination of Water and Wastewater**, unless other test procedures have been approved in writing by the Department and specified in this permit.

4. Retention of Records

The permittee must retain records of all monitoring and maintenance information, including all calibrations, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. The Department may extend this period at any time.

SECTION D. REPORTING REQUIREMENTS

1. Plan Submittal

Pursuant to Oregon Revised Statute 468B.055, unless specifically exempted by rule, construction, installation, or modification of disposal systems, treatment works, or sewerage systems may not commence until plans and specifications are submitted to and approved in writing by the Department. All construction, installation, or modification shall be in strict conformance with the Department's written approval of the plans.

2. Change in Discharge

Whenever a facility expansion, production increase, or process modification is expected to result in a change in the character of pollutants to be discharged or in a new or increased discharge that will exceed the conditions of this permit, a new application must be submitted together with the necessary reports, plans, and specifications for the proposed changes. A change may not be made until plans have been approved and a new permit or permit modification has been issued.

3. Signatory Requirements

All applications, reports, or information submitted to the Department must be signed and certified by the official applicant of record (owner) or authorized designee.

SECTION E. DEFINITIONS

1. BOD_5 means five-day biochemical oxygen demand.
2. *TSS* means total suspended solids.
3. *FC* means fecal coliform bacteria.
4. NH_3-*N* means Ammonia Nitrogen.
5. NO_3-*N* means Nitrate Nitrogen.
6. NO_2-*N* means Nitrite Nitrogen.
7. *TKN* means Total Kjeldahl Nitrogen.
8. *Cl* means Chloride.
9. *TN* means Total Nitrogen.

10. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
11. *Total residual chlorine* means combined chlorine forms plus free residual chlorine.
12. *mg/1* means milligrams per liter.
13. *ug/l* means micrograms per liter.
14. *kg* means kilograms.
15. *GPD* means gallons per day.
16. *MGD* means million gallons per day.
17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
18. *Composite sample* means a combination of samples collected, generally at equal intervals over a 24-hour period, and apportioned according to the volume of flow at the time of sampling.
19. *Week* means a calendar week of Sunday through Saturday.
20. *Month* means a calendar month.
21. *Quarter* means January through March, April through June, July through September, or October through December.

EXHIBIT L

Gilchrist MAO

Oregon
Theodore R. Kulongoski, Governor

Department of Environmental Quality
Eastern Region
700 SE Emigrant
Suite 330
Pendleton, OR 97801
(541) 276-4063 Voice/TTY
FAX (541) 278-0168

June 29, 2009

Gil Ernst
Gilchrist Sewer Company, LLC
P.O. Box 637
Gilchrist, OR 97737

RE: Mutual Agreement and Order
In the Matter of:
Gilchrist Sewer Company, LLC
No. WQ/D-ER-08-254
Klamath County

Dear Mr. Ernst:

A copy of the signed Mutual Agreement and Order (MAO) is enclosed. The Department's primary contact person for this MAO is:

Jayne West
DEQ, Bend Office
475 NE Bellevue, Suite 110
Bend, OR 97701

If you have any questions about the MAO, please call Jayne West at (541) 633-2028.

Sincerely,

Mitch Wolgamott
Administrator
Eastern Region

MW:bjd
Enc.
cc: Enforcement Section, DEQ
Jayne West, DEQ, Bend Office

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION

OF THE STATE OF OREGON

IN THE MATTER OF:	)	MUTUAL AGREEMENT
	)	AND ORDER
Gilchrist Sewer Company LLC,	)	NO. WQ/D-ER-08-254
Permittee	)	KLAMATH COUNTY
	)	

WHEREAS:

1. On January 17, 2006, the Department of Environmental Quality (Department or DEQ) issued Water Pollution Control Facilities (WPCF) Permit Number 102198 (Permit) to Gilchrist Sewer Company, LLC (Permittee). The Permit authorizes the Permittee to construct, install, modify or operate a wastewater collection, treatment, control and disposal system and dispose of treated wastewater into a drainfield in conformance with the requirements, limitations and conditions set forth in the Permit. The Permit expires on April 30, 2010.

2. The wastewater treatment facility consists of three lagoons and a drainfield for disposal. The plant was originally constructed in 1972, with no significant upgrades since that time. Given the shallow groundwater conditions in the area, the Department required the Permittee to install monitoring wells to determine if the lagoons and/or drainfield were impacting groundwater quality. On October 13 and 14, 2003, the Permittee installed three monitoring wells to monitor groundwater at the site. A forth monitoring well was installed in 2008 to gather background water quality data. Monitoring well sample results show that the Permittee's disposal system is causing elevated groundwater nitrates, often above the drinking water Maximum Contamination Level (MCL) of 10 mg/L. In addition, four quarters of data from background well #4 shows nitrates below 1 mg/L. These results confirm that the wastewater/drainfield disposal system is having an impact on groundwater at the site. The current drainfield as designed is no longer a viable disposal option and a new disposal method will need to be implemented. Impacts to groundwater are prohibited in accordance with OAR 340-44-0014(1). In a letter dated May 20, 2008, the Department gave the Permittee the option of

either conducting a Remedial Investigation and Feasibility Study (RIFS) or entering into an MAO to provide a schedule for coming into compliance with Oregon law.

3. During the time period the Permit has been in effect, Permittee has not met the above conditions in violation of Oregon Administrative Rule (OAR) 340-44-0014(1) and the Permit.

4. DEQ and the Permittee recognize that until Permittee completes the actions required by this Mutual Agreement and Order (MAO), Permittee will continue to violate the Permit and Oregon law.

5. The Department and Permittee recognize that the Environmental Quality Commission has the power to impose a civil penalty and to issue an abatement order for violations of Oregon law. Therefore, pursuant to ORS 183.415(5), the Department and Permittee wish to settle those past violations referred to in Paragraph 3 and to limit and resolve the future violations referred to in Paragraph 4 in advance by this MAO.

6. This MAO is not intended to limit, in any way, the Department's right to proceed against Permittee in any forum for any past or future violations not expressly settled herein.

NOW THEREFORE, it is stipulated and agreed that:

7. The Environmental Quality Commission shall issue a final order:

A. Requiring Permittee to comply with the following schedule:

(1) By April 1, 2010, submit an Engineering Evaluation Report (Report) to the Department for review and approval. The Report must evaluate alternative disposal options for the treated wastewater, propose a new preferred disposal method, and describe how the preferred disposal method will not contribute to elevated nitrates in the groundwater. The Engineering Evaluation must be conducted by a registered professional.

(2) Within one year following Department approval of the Report, the Permittee shall submit Plans and Specifications for upgrades identified in the Report for the preferred disposal option and which the Department has approved. If land application of treated effluent is chosen as the preferred disposal method, Permittee must submit a Recycled Water Use

Plan to the Department no less than 6 months prior to irrigation in accordance with OAR 340-55.

(3) Permittee shall complete the upgrades within one year following Department approval of Plans and Specifications.

B. Requiring Permittee, upon receipt of a written notice from the Department for any violations of this MAO, to pay a civil penalty of $250 for each day of each violation of the schedule of compliance set forth in Paragraph 7A.

8. If any event occurs that is beyond Permittee's reasonable control and that causes or may cause a delay or deviation in performance of the requirements of this MAO, Permittee shall immediately notify the Department verbally of the cause of delay or deviation and its anticipated duration, the measures that have been or will be taken to prevent or minimize the delay or deviation, and the timetable by which Permittee proposes to carry out such measures. Permittee shall confirm in writing this information within five (5) working days of the onset of the event. It is Permittee's responsibility in the written notification to demonstrate to the Department's satisfaction that the delay or deviation has been or will be caused by circumstances beyond the control and despite due diligence of Permittee. If Permittee so demonstrates, the Department shall extend times of performance of related activities under this MAO as appropriate. Circumstances or events beyond Permittee's control include, but are not limited to acts of nature, unforeseen strikes, work stoppages, fires, explosion, riot, sabotage, or war. Increased cost of performance or consultant's failure to provide timely reports may not be considered circumstances beyond Permittee's control.

9. Regarding the violations set forth in Paragraphs 3 and 4 above, which are expressly settled herein without penalty, Permittee and the Department hereby waive any and all of their rights to any and all notices, hearing, judicial review, and to service of a copy of the final MAO herein. The Department reserves the right to enforce this MAO through appropriate administrative and judicial proceedings.

10. The terms of this MAO may be amended by the mutual agreement of the Department

and Permittee.

11. The Department may amend the compliance schedule and conditions in this MAO upon finding that such modification is necessary because of changed circumstances or to protect public health and the environment. The Department shall provide Permittee a minimum of thirty (30) days written notice prior to issuing an Amended Order modifying any compliance schedules or conditions. If Permittee contests the Amended Order, the applicable procedures for conduct of contested cases in such matters shall apply.

12. This MAO shall be binding on the parties and their respective successors, agents, and assigns. The undersigned representative of each party certifies that he or she is fully authorized to execute and bind such party to this MAO. No change in ownership or corporate or partnership status relating to the facility shall in any way alter Permittee's obligations under this MAO, unless otherwise approved in writing by DEQ.

13. All reports, notices and other communications required under or relating to this MAO should be directed to Jayne West, DEQ Bend Regional Office, 475 NE Bellevue Dr., Suite 110, Bend, Oregon 97701, phone number 541-633-2028. The contact person for Permittee shall be Gil Ernst, Gilchrist Sewer Company, LLC, P.O. Box 637, Gilchrist, OR 97737, phone number 541-433-2610.

14. Permittee acknowledges that it has actual notice of the contents and requirements of the MAO and that failure to fulfill any of the requirements hereof would constitute a violation of this MAO and subject Permittee to payment of civil penalties pursuant to Paragraph 7B above.

15. Any stipulated civil penalty imposed pursuant to Paragraph 7B shall be due upon written demand. Stipulated civil penalties shall be paid by check or money order made payable to the "Oregon State Treasurer" and sent to: Business Office, Department of Environmental Quality, 811 S.W. Sixth Avenue, Portland, Oregon 97204. Within 21 days of receipt of a "Demand for Payment of Stipulated Civil Penalty" Notice from the Department, Permittee may request a hearing to contest the Demand Notice. At any such hearing, the issue shall be limited

to Permittee's compliance or non-compliance with this MAO. The amount of each stipulated civil penalty for each violation and/or day of violation is established in advance by this MAO and shall not be a contestable issue.

16. Providing Permittee has paid in full all stipulated civil penalties pursuant to Paragraph 15 above, this MAO shall terminate 60 days after Permittee demonstrates full compliance with the requirements of the schedule set forth in Paragraph 7A above.

PERMITTEE

June 26, 2009
Date

Gil Ernst, Gilchrist Sewer Company LLC
Managing Members

DEPARTMENT OF ENVIRONMENTAL QUALITY

29 JUN 09
Date

Mitch Wolgamott, Division Administrator

FINAL ORDER

IT IS SO ORDERED:

ENVIRONMENTAL QUALITY COMMISSION

29 Jun 09
Date

Mitch Wolgamott, Division Administrator
Department of Environmental Quality
Pursuant to OAR 340-011-0136(1)

EXHIBIT M

ODEQ Email
Correspondence Regarding
Gilchrist

Darryl Anderson

From: WEST Jayne <WEST.JAYNE@deq.state.or.us>
Sent: Wednesday, June 03, 2015 12:03 PM
To: Darryl Anderson; WEST Jayne (Jayne.WEST@state.or.us); BAGGETT Robert
Cc: charles lawrence (jylcyl04@gmail.com); Cher Dolan
Subject: RE: Cresent

Darryl-the situation with Gilchrist hasn't changed. There's a MAO out there that has expired and since we've been waiting to see how this project plays out we've just been in a pending mode with Gilchrist.

They continue to monitor according to their permit so in that regard they are in compliance. The problem is we know from monitoring well data that there are high nitrate values entering the groundwater between the drainfield and the river. We will not move forward until we know what direction the project is going to take. If Gilchrist hooks up to Crescent and decommissions their treatment system then problem solved. If they don't then the MAO will be re-negoiated for them to do an engineering study on the facility and reduce nitrate levels. So, for funding purposes Gilchrist is in violation of our groundwater rules.

I'll let Bob address the septic question.

Thanks.

From: Darryl Anderson [darryla@andersonengineering.com]
Sent: Tuesday, June 02, 2015 3:21 PM
To: WEST Jayne (Jayne.WEST@state.or.us); BAGGETT Robert
Cc: charles lawrence (jylcyl04@gmail.com); Cher Dolan
Subject: Cresent

Jayne / Bob

As we get closer to funding applications on the Crescent project, it would be helpful that we have some indication from DEQ on non-compliance. Can we have some documentation on number of failed septic systems (such as number of repair permit issued) and also on the non-compliance of Gilchrist. Let me know your thoughts. This is very important to try to get the project funded at a rate the District can afford.

Thanks

Darryl Anderson PE PLS
Anderson Engineering and Surveying Inc.
541-947-4407 Of.
541-219-0378 cell