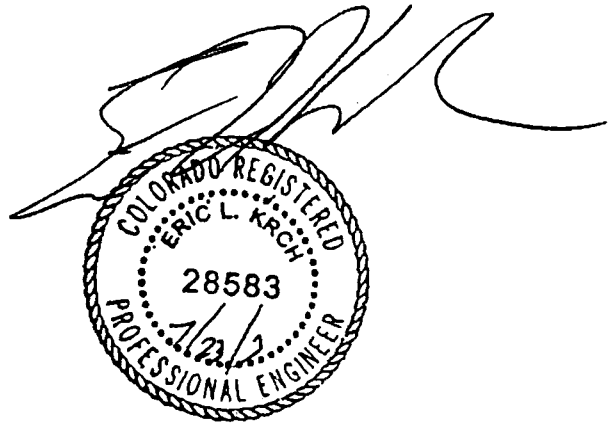
ONSITE
WASTEWATER ASSESSMENT
IDARADO PROJECT
SAN MIGUEL COUNTY, CO
JULY 22, 2003



Overview

Idarado, with its proposed development of 37 residential lots, will meet or exceed County and State individual sewage disposal system (ISDS) requirements. Please note the abbreviations onsite wastewater system (OWS) and ISDS will be used interchangeably throughout this report, except where referring to regulations, which are ISDS regulations. Idarado has established a standard that the OWS used by each residence will not degrade water quality associated with individual wells or the regional drinking water supply, and to that end, Idarado is requiring that all OWS be engineered, regardless of a homesite's ability to support a conventional OWS. In addition, Idarado has required that treatment of effluent be such that the resulting discharge will meet State and Federal groundwater standards. Following is a report of the field-testing performed and recommended treatment technologies to achieve Idarado's wastewater treatment objectives.

Introduction

This report and supporting fieldwork was prepared at the request of Idarado and covers the Idarado Project consisting of thirty-seven residential lots, located in areas commonly known as Liberty Bell, Pandora, and Bridal Veil, each located between the Town of Telluride and the Pandora Mill site on the north side of the San Miguel River. Idarado has made application to San Miguel County for cluster development/subdivision exemption approval. The cluster lots will range in size between 2.0 and 12.0 acres in size. The home site portions of the lots are situated within the confines of the valley floor of the San Miguel River Canyon.

Idarado has also filed a plan for thirty-seven lots, utilizing thirty-five acres each. The building envelopes established for each of those thirty-five acre lots are the same building envelopes established in the Idarado Cluster Development/Subdivision Exemption Plan. Consequently, the findings, recommendations, and conclusions contained in this report apply to the lots created by both the Idarado Cluster Development/Subdivision Exemption and by the Idarado Thirty-Five Acre Plan.

The purpose of this study is to ascertain whether onsite wastewater systems (OWS) consistent with San Miguel County and State of Colorado ISDS guidelines can be utilized on these homesites without causing degradation to local groundwater and the San Miguel River water quality.

In order to accomplish this task, Idarado commissioned full-scale OWS testing of each homesite envelope. The enclosed map presents the configuration of the lots and home sites.

Geologic Setting

The home sites are located in the upper San Miguel River Canyon. This glacially carved canyon presents the classic "U" shape associated with ice scouring activities. The surficial deposits of canyon bottom and lower side slopes are composed of a composite of river alluvium, side canyon alluvium, colluvial debris, and glacial lateral moraine remnants. The base of the near vertical canyon walls start out as sedimentary deposits of the Cutler and Dolores formations, which are capped by multiple igneous formations creating the rugged ridges and summits for which the region is famous. This steep topography, indicative of young mountains, provides a strongly energized erosive environment, which continues to feed the canyon bottoms with rock debris and sediments via dry and wet weathering processes.

Thus, the home sites are situated predominantly upon the glacial moraines supplemented with recent colluvial accumulations and alluvial deposition where Owl Creek, Royer Gulch, and the San Miguel River cross the project. The depth of this debris varies considerably throughout the project area, but is generally in excess of twenty (20) feet in depth throughout the project area.

Regional and Localized Considerations

The project is located within the confines of the Town of Telluride's source water and wellhead protection boundary. To date, the Town of Mountain Village has not filed a formal wellhead protection boundary for its water supplies. Regardless, this report demonstrates that OWS will not cause a degradation of the groundwater or surface waters for either Town source and wellhead protection areas. It should be noted that the current location where the Town of Telluride extracts its supply of drinking water is not located in the same tributary drainage basins as the Idarado Project.

Each of the homes for this project will be limited to 1999 gallons per day (gpd) of average daily effluent generation as defined by the State of Colorado, thus not requiring OWS permitting from the Sate of Colorado. Only San Miguel County will be required to review an application of the OWS.

The impacts associated with OWS adjoining homesites with shallow groundwater wells in the Royer Creek and the old Pandora site should not be an issue because of the up gradients location of these domestic wells, and the use of Code Plus OWS treatment (as described below) will provide the necessary protection to their wells as well as the regional drinking water supply.

Field Methods

OWS siting was undertaken to meet all setback requirements identified in the ISDS guidelines and San Miguel County land use regulations. Attention was paid to avoidance of riparian and wetland areas (Owl Creek, Royer Gulch, and the San Miguel

River) and their respective 100-foot buffer zones for all OWS sites. By placing the OWS outside of the wetland and/or riparian buffers, the sites are also protected from associated floodplain impacts. Other siting considerations associated with the identification of a suitable OWS site were avoiding steep topography (>30-percent slopes), 100-foot minimum separation from wells (existing and proposed), and avoiding tailing and mining remediation sites of Idarado. All of these considerations were utilized and followed in siting the OWS.

Each OWS drain field test site, as shown on the location map, is fifty by fifty feet (2500 square feet). This size of OWS disposal field site was chosen to allow for the initial drain field development as well as a future replacement area. Replacement drain field areas are not clearly required by the ISDS guidelines; nonetheless, such areas should be part of any prudent OWS site assessment.

It is understood that the shape and/or location of a subsurface drain field site may vary based upon field and/or design considerations of the OWS or because of design issues relating to actual home design and placement, but with the understanding that each drain field site shall always encompass at least 2500 square feet.

Testing of each drain field site consisted of the excavation of a profile pit near the center of the evaluation site to a depth of no less than 8 feet. These pits were used to ascertain the underlying geologic stratigraphy. In no pit was ground water or bedrock, which are key indicators of the need for engineered OWS, encountered. Although, L-1 to L-5 and P-21 were observed to be moist to wet, this indicates that their termination was likely nearing groundwater. This is not an issue as the groundwater level falls below the separation requirement of the ISDS guidelines (i.e. there must be a 4-foot vertical separation of suitable soil between the low point on a subsurface discharge system and the seasonal high groundwater). **Appendix "A"** has the logs of the profile pits.

Once the profile pits were logged, a determination of the appropriate placement depth for each drain field was made. Percolation test pits were then excavated to this level. Hand dug percolation holes, which penetrated the soil horizon to be tested, were then completed. Each site had three percolation holes, which straddled the profile pit site in a fashion consistent with surface topography, typical drain field configuration, and minimizing damage to surrounding vegetation.

Percolation testing was then completed to Buckhorn Geotech and local agency standards for the three holes and the results were logged along with testing observation notes. In some cases, irregularities in the percolation test results indicated that a retest was appropriate. These sites where retested to ascertain if the initial percolation rates were accurate or an anomaly. The summary sheet in **Appendix "B"** presents field test results as well as those of the retests.

Field Results

The soils in the project area were predominated with sandy silts. The rock content varied from none to very rocky (up to 70 percent). The encountered rocks were generated from sandstone or igneous formations. Large boulders of sandstone were not uncommon in the profile pits and occasionally in the percolation holes. This soil type tends to yield good percolation rates (10 to 40-mpi are typical). Field results were spread over a wider margin (<5 to 160-mpi) which is attributable to the rocky component in the soil matrix and the infrequent clay soil layer. Rock content can create zones with high voids resulting in rapid absorption pathways as well as when aligned in tight layers poor absorption pathways.

Overall averaged rates of absorption occurred within the expected range of 5 to 60 minutes per inch (mpi). Ten sites had an average rate of less than 5-mpi (P-4, P-5, P-6, P-8, P-17, P-19, P-21, BV-2, BV-4, and P-23) and three had rates in excess of 60-mpi (L-6, L-8, and BV-3). These thirteen lots fall outside of the percolation range where a non-engineered/conventional OWS could be used. The range of 5 to 60-mpi indicates sites where, coupled with adequate groundwater and bedrock clearance, conventional OWS can be employed.

In overview, thirteen homesites would require engineered OWS to meet adopted ISDS guidelines, while the remainder could use conventional OWS, but will use engineered OWS regardless. **Appendix "C"** presents the results of each percolation test and retest. **Appendix "B"** presents a summary of percolation testing.

Treatment Methods

Idarado is committed to using engineered OWS and principally sought our guidance concerning the manner in which to develop the reliable best practices form of OWS, from the perspective of water quality protection, design, construction, and operation and maintenance. Idarado also openly stated that the method and use of OWS for wastewater treatment is important to the development and, as such, locally adopted ISDS guidelines should not constrain the evaluation process. This heightened standard of evaluation and care can be considered a "Code Plus" approach to OWS.

Homes to be built in the Idarado Project will employ advanced (secondary) wastewater treatment technology providing an OWS that exceeds the performance of conventional OWS required by the ISDS guidelines. Advanced wastewater treatment for the purposes of this report consists of the addition of secondary and tertiary treatment processes not used on conventional OWS. Its discharged effluent would meet or exceed State of Colorado surface water discharge standards prior to subsurface discharge for all home sites. This advanced wastewater treatment technology will include for stages of treatment consisting of primary, secondary, and tertiary treatment as well as a disinfection treatment.

Primary Treatment – Primary treatment will be done using septic tanks. The tanks will be sized consistent with the bedroom count of each home. Two compartment tanks will be employed with access manholes to each compartment to improve maintenance access and allow ease of observation. A vent and carbon filtered vented lid will be installed on the first compartment to facilitate the release of ammonia gas and control the resulting odor. An effluent filter will be added to the pump basin for the recirculation filter. A net reduction of 75 percent of organic matter will be achieved by this septic tank configuration.

Secondary Treatment – Secondary treatment will be done using recirculation of the effluent through textile media. This recirculation method returns filtered effluent to the first compartment of the septic tank, which acts as a renitrification/reaction vessel. A vault with synthetic textile media is installed on top of the septic tank and measured cycled doses of septic tank effluent are introduced to the media. As a minimum, eighty (80) percent of each cycled dose is returned to the first compartment of the septic tank via a proportioning return assembly, thus providing no less than five cycles per unit volume of effluent through the textile media. Resulting effluent qualities for recirculation filters treating domestic strength wastewater yield the following typical values:

- TSS 2 to 15 mg/l
- BOD_5 0 to 5 mg/l
- Total Coliform 200 MPN/100ml
- COD 20 mg/l
- pH 6.9 to 8.0
- TN 10.5 to 17.0 mg/l
- TKN 3.1 to 6.5 mg/l
- $NO_3 + NO2$ 7.4 to 10.4 mg/l
- TP 6.3 to 8.1 mg/l
- Oil & Grease 0 to 12 mg/l

While the discharge from the secondary system is to the ground it is important to note as a comparison that the quality of effluent does meet the surface water discharge permit requirements issued by the State of Colorado as required for Camp Ilium and Blue Jay Lodge wastewater treatment plants.

In addition to the primary and secondary treatment stages, the OWS system to be used in the Idarado Project shall include the following:

Ultraviolet (UV) Disinfection – Bacteria and viral constituents of the wastewater effluent will be treated by Ultraviolet (UV) light exposure to compensate for the varied soil filtration of a conventional OWS. A UV unit will be placed downstream of the proportioning return assembly. All effluent will be exposed to the UV unit and then gravity fed to a second pump basin for delivery to pressure dosed trenches. This process will use UV lamps with a 4-log removal capacity at the service life of the UV lamp. The UV unit will be placed in a manhole for ease of maintenance. This is consistent with EPA standards for surface drinking water treatment. This level of effluent treatment is not required by ISDS guidelines for subsurface discharging OWS.

Tertiary Treatment – Pressure dosed gravelless discharge trenches will be the final aspect of the advanced treatment process. Dosed gravelless disposal trenches will be used in lieu of the conventional disposal bed/trench. The value of this technology allows the creation of an aerobic cycle in the soil between effluent doses (anaerobic cycle). The process reduces organic mat buildup at the soil interface, which maintains the designed permeability of the soil interface and thus results in longevity of the system performance. Another benefit of this technology is soil microbe consumption of organic matter, bacteria, and viruses.

For sites where the percolation rates are less than 5-mpi, replacement soil will be required to a minimum depth of 4 feet below the discharge level plus the topsoil horizon. The use of ASTM C-33 Sand (concrete sand) is recommended for its absorption consistency and availability. For sites where the percolation rate exceeds 60-mpi the secondary treatment components employed, along with engineering consideration of drain field area, can be accommodated.

Note: The use of drip irrigation subsurface disposal could be used for these homesites, but is commonly used where soils have very high clay content and absorb effluent poorly. Drip irrigation emitters require large area dispersal and utilize evapotranspiration, which is essential for long-lived OWS in clay soils.

The resultant combined effectiveness of this three-stage treatment system, with the addition of the UV disinfection process, will be an effluent that meets groundwater standards prior to discharge into the underlying soils. This standard exceeds the ISDS guidelines and parameters required for most wastewater sewage treatment facilities, which is consistent with the initial goals established by Idarado.

Management Methods

Secondary wastewater treatment methods result in a moderately complex installation and operational issue. Such systems extend beyond the skills of a conventional OWS installation contractor. They require skilled electricians, plumbers, and treatment equipment installers as well as an exaction contractor to ensure a properly functioning system.

Therefore, Idarado will require that each OWS be designed by a qualified engineering consultant, reviewed by Idarado and the homeowners association (HOA) for compliance with these standards, and that consultant will provide inspection services during the construction of the OWS. A completion certification will be provided to the County, Idarado, and the HOA upon OWS completion. Idarado will develop a list of pre-qualified installation contractors who have experience installing the planned OWS.

To insure proper care, maintenance, and operation of each OWS, OWS operation and management of all OWS within the Idarado development will be provided by a contracted management firm. This firm will provide routine inspection of all installed OWS; provide cleaning, repair, and maintenance of all OWS components; and keep

written records of all services provided and make annual reports to the HOA. To aid the management firm in monitoring the OWS, a telemetry panel will be added to each site, which will allow direct monitoring of the OWS components function and provide failure notification via a pager call out. The telemetry panels will allow timely response to failures and problems before they result in loss of treatment efficiency.

Septic tanks will require periodic cleaning in order to maintain treatment function. As mentioned, Idarado will limit the homes to less than 2000 gallons per daily of average effluent generation, which, fully occupied would typically require septic tank pumping every 3 to 5 years. Flow meters will be installed on each OWS to verify compliance with this standard. With two months of anticipated occupancy, cleaning cycles could conceivably reduce to 10 to 15-year periods. The OWS management firm will be responsible for annual sludge and scum depth evaluation for all septic tanks to determine realistic cleaning cycles

Conclusion

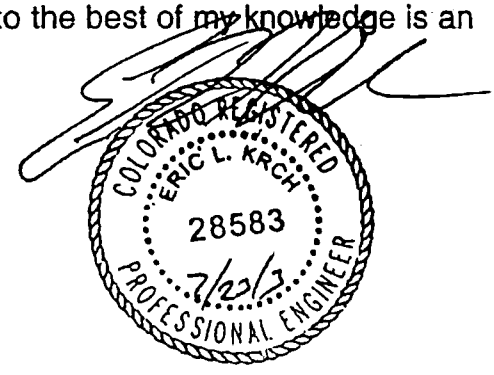
Following the identified treatment and management recommendations will result in the outstanding protection of surface and ground water proximate to the project area mandated by County and State laws. The proposed treatment methods will result in effluent quality substantially exceeding that required for home sites, which could legally support conventional OWS.

Thus, the proposed development of 37 lots can support OWS, which will discharge a very high quality effluent meeting local, and State of Colorado guidelines for ISDS, and provide long-term reliability for all parties concerned.

Engineer's Certifications

I, Eric L. Krch, PE, Colorado Engineering Registrant #28583, have prepared this report and directly supervised all activities associated with its preparation. This report is prepared following the best engineering practices and to the best of my knowledge is an accurate portrayal of the conditions reported.

Signed:



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