HAPPY SCENES WATER SYSTEM
ENGINEERING REPORT

SUBMITTED:
October 2008

PREPARED FOR:
Happy Scenes Water System
1577 CR 500
Bayfield, CO 81122

PREPARED BY:
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Steven C Harris, P.E.

October 8, 2008

Colorado Department of Health and Environment
WATER QUALITY CONTROL DIVISION
Drinking Water Engineer
Christine Lukasik
222 S. 6th Street, RM #232
Grand Junction, CO 81501-2768

RE: Happy Scenes Water System PWSID # CO0234390
Engineering Design Report

Dear Ms. Lukasik;

Happy Scenes Water System is an existing water system in the northeast corner of La Plata County. The homeowners have developed a new source and wish to bring the existing system and new treatment works up to State specifications. They have contracted with Harris Water Engineering, Inc. (HWE) to design the treatment works and develop an Engineering Design Report.

The Design Report and all necessary CDPHE water system capacity planning documents are attached, except the Lead and Copper Assessment. The Certified Operator will be conducting the assessment and submitting by the end of October.

Please review the submittal at your earliest convenience, as the homeowners would like to complete the upgrades prior to this winter. I will be available to answer any questions you have about the design and offer my assistance with any additional requirements you may have. I appreciate the assistance you have offered to this point and look forward to our continued work on this project.

Please contact myself, or Steve Harris, with any questions, concerns or requirements.

Sincerely,

Amy Kraft, E.I.
(970) 259-1028

CERTIFICATION

I hereby certify that this Engineering Design Report for the construction of a new well and treatment facility located at 265 Trust Drive, were prepared under my supervision for Happy Scenes Water System during the summer of 2008.

_____

Steven C Harris
Colorado Registration No. 14303

HAPPY SCENES WATER SYSTEM
ENGINEERING DESIGN REPORT

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1.1
PLAN SUBMITTAL

1.0 Plan Submittal

1.1.1 Engineering Report

Engineering report attached in Section 1.2.

1.1.2 Plan Review

A completed "Plans Review" form and "100 Year Flood Plain Certification" attached.

1.1.3 Raw Water Chemical Analysis

Raw water chemical analyses for Well #1 is attached in Appendix B.

1.1.4 Raw Water Stability

Analysis of the stability of Well #1 was conducted. The lab analysis indicates that the raw water does not appear to be aggressive based on the testing results. The results are attached in Appendix B and summarized below.

	Well#1
Langelier Index	-0.08
TDS	182
pH	7.38
Alkalinity	182
Temperature	20ºC

1.1.5 Technical Specifications

Technical specifications are attached in Appendix C. Some of the equipment, including the well pump and the distribution pump, are not NSF 61 certified. CDPHE Design Criteria deviation requests are also included in Appendix C.

1.1.6 Blueprints and Drawings

Proposed blueprint drawings are attached in Appendix D.

1.1.7 Permits

The applicant has applied for all required permits. The only required permit is a Department of Water Resource Well Permit, which is attached in Appendix E.

1.1.8 Vulnerability Assessment

All required water quality sampling to complete a vulnerability assessment is attached in Appendix B. The results may be used as a baseline for future vulnerability assessments as required by the Department. The routine sampling requirements will be dictated by the Colorado Department of Health and Environment and submitted to the subdivision Board and/or certified operator.

1.2
ENGINEERING AND DESIGN REPORT

1.2 Project Scope

1.2.1 Service Area Definition

Water Service Area and Project Summary

The Happy Scenes Water System (system) serves potable water to the Happy Scenes Subdivision, located north of Vallecito Reservoir or about 20 miles north of the Town of Bayfield, in La Plata County, Colorado. Please see Appendix F for the Happy Scenes Water System Location Map. The area north of and around Vallecito Reservoir is a typical resort type area with a handful of restaurants, one small country grocery store, and many commercial resorts, ranging in type from small motels or individual rental cabins, to guest ranches. The remainder of the area is sectioned into multiple subdivisions. There is no central water supply. The majority of the subdivisions have their own wells and individually treat their own water. There is one central wastewater system that covers a portion of the valley; otherwise, all homes and businesses utilize individual septic disposal systems.

The secluded subdivision was first developed in the mid to late 1960s. Through time more land was subdivided and added to the Happy Scenes Water System. The areas are recognized by La Plata County as Happy Scenes #1, Happy Scenes #2, etc…to Happy Scenes #8. The majority of the homes were built in the late 1960s or early 1970s as small, one to two bedroom vacation cabins or secluded mountain retreats. Some of the more recently constructed homes are common three to four bedroom single family homes. A majority of the homes are currently still used as vacation homes, some occupied for a couple of months during the summer season and some only occupied over the Fourth of July holiday. Only 20 of the homes are inhabited year round, with 50 full time residents.

Although there is a paved county road bisecting the subdivision, the majority of the subdivision roads are unpaved, gravel roads.

Originally designed and constructed in the 1960s, the system's current water supply consists of two springs. The spring water surfaces, then flows into two separate collection boxes, equipped with above ground overflows that direct excess water to nearby streams, and piping that directs water to two separate pump houses. The water is chlorinated and then delivered to the system by the pumps, which independently pressurize the upper and lower levels of the subdivision.

At some point in time, the system obtained a Public Water System Identification Number, (PWSID CO-0234390), however the system has been operated as two individual systems. The subdivision (or subdivisions as explained above) had two different non-profit organizations governing the two systems. As two separate systems, the full time population appeared not to trigger oversight by the CDPHE

and the PWSID was believed to be inactive. Recently, however, new homeowners joined the board and became more interested in the quality and quantity of the drinking water. A microscopic particulate analysis of the spring water alerted the Board that the system's source water needed additional treatment. The Board consulted with Greg Brand, the CDPHE Division Engineer, who informed them that the system is recognized as one system, has a population requiring CDPHE oversight, and that the system must put in place the necessary improvements to deliver potable water treated to conformance with maximum contaminant levels.

The following design report discusses the development of a new raw water source, construction of a treatment facility, and installation of an underground finished water storage tank. The existing distribution system consists of 2-inch lines. Due to the costs to develop the new water source, construct the water treatment facility and purchase the storage tank, the system plans to wait 3 to 4 years before beginning to replace the existing distribution system with 6-inch pipe. That will allow time for the regular assessments to build back up the construction reserves. Please see Appendix H for the four-year projected budget. At the time of pipeline replacement, the system will follow all design criteria of the CDPHE Design Criteria, Appendix I, and will submit plans to either the local Division Engineer, who is currently Greg Brand, or to the Drinking Water Engineer in the Grand Junction Office, currently Christine Lukasik.

The general treatment process is raw water will be pumped from the well and enter the treatment facility. The water will be metered and a sampling tap will be provided for water quality testing. The water will then be sodium hypochlorinated and delivered to the 15,000 gallon storage tank for 4-log removal of viral contaminants. The water is then pumped from the tank to the distribution system. A sample tap will be provided on the treated water line after hypochlorination, before the storage tank, and also after the storage tank on the system entry line. The water will enter the storage tank through a spray bar. Please see the Spray Bar Detail and Cross Section drawing in Appendix D.

The System currently serves 62 taps and an estimated population of 160 people. The non-profit water system is made up of members who each have one tap and one vote. The elected Board of Directors has generally been responsible for managing and running the System. All System expenses are financed by assessments to the homeowners.

Water Demands

Happy Scenes Water System operates under an augmentation plan with the Pine River Irrigation District, see Appendix E. The Division of Water Resources (DWR) has recorded the system's water use since 1975. The data shows that the usage was fairly consistent over the last 10 years, except for the year 2000, when the system experienced a major leak. The system's average demand has been determined by averaging the use over the last 10 years, excluding 2000.

The records indicate an average annual demand of 7,494,573 gallons per year. The average day demand, therefore, is 20,533 gallons, or approximately 336 gallons per day per home for 62 homes.

The Happy Scenes Subdivision has 76 total lots, 68 of which are serviceable. The unserviceable lots are too small to be an individual lot as allowed by La Plata County land use and development codes. In these cases, the lot owner owns the adjoining lot or lots and has never officially joined the lots together and recorded a new plat. If sold individually, the lots are not developable, due to acreage constraints. Over the last 10 years, the system has served a maximum of 62 of the 76 lots, and is currently serving 59.

Please see Sections 1.3.1 and 1.3.4 for further discussion of the average and maximum water demands used in this design report.

Water System Operation Criteria

The water system can be operated manually or automatically, with controls that include an Auto/Manual switch, and an on/off switch for manual control. The tank water level will initialize automatic control of the well pump and treatment equipment. The operator will be certified at the proper level and will be responsible for the following activities, as listed in the Colorado Department of Public Health and Environment (CDPHE) New Water System Capacity Planning Manual:

- Control of all chemical control processes,
- Initiation or termination of individual water sources,
- Unit process control monitoring,
- Treatment equipment preventative maintenance,
- Other functions related to water quality, and
- Compliance monitoring.

The Homeowners retain primary responsibility for compliance reporting and record keeping, and distribution system and treatment equipment repair.

1.2.2 Existing Treatment Facilities

As explained above, the existing system chlorinates the spring water prior to distribution. However, the existing treatment facilities are not adequate, nor in the proper location, to be used with the new water source, storage and treatment equipment. The option of treating the existing spring water system was considered. However, capitol and operational costs of treating surface water, or groundwater under the influence of surface water, were prohibitive. Thus, the existing treatment equipment will be removed.

1.2.3 Source selection

Groundwater was selected as the raw water source for Happy Scenes as there is no domestic water provider in the vicinity that would have the capacity to take over the Happy Scenes System, and as surface water is generally more difficult to treat to potable standards. Most other homes in the area are served by individual wells.

1.2.4 Treatment Alternative

Primary treatment will be provided by sodium hypo-chlorination. Aeration will also be provided. Please see Section 1.3.12, Section 6 and Section 8 for further treatment design.

MIOX equipment to provide onsite electrolysis of salt to produce hypochlorite was considered. The monthly or yearly cost of chemicals could have been reduced, but the capital cost of the equipment was prohibitive. Electrolysis is generally used with much larger systems.

1.2.5 Implementation Plan and Schedule

As previously indicated, the Happy Scenes Subdivision has been in existence since the 1960s. This design report is for the approval of Well #1 as the new water source and to bring the Happy Scenes Water System into compliance with the CDPHE. Well #1 was drilled in the spring of 2008. The treatment building was constructed in May and June of 2008. The water storage tank order is "on-hold" pending approval of this application. The installation of the treatment works is also pending approval of this application. The homeowners hope to gain approval of the system improvements to complete construction of the treatment works, install the storage tank, and connect the well to the existing distribution system by the end of October 2008 prior to the winter of 2008-2009.

1.2.6 Wellhead Control Plans and Procedures

The following Wellhead Control Plan will protect the well structure and the Happy Scenes Water System groundwater supply.

The well is located on a 45 foot by 90 foot easement. The easement also contains the treatment building and underground treated water storage. No other uses are authorized for the easement. The adjoining land is categorized as residential. A narrow, winding dirt road, with a posted speed limit of 15 miles per hour, runs parallel to the easement. The road, Trust Drive, is used for access to approximately 8 residential lots, and is very lightly traveled. The clear zone for a road of this design and use is less than 10 feet. The wellhead is located outside of the 10 foot clear zone and does not require physical protection from cars traveling on Trust Drive. Two bollards will be placed on the front corners of the well pad.

As the subdivision already exists, the only construction near the well that will be necessary is the well connection to the treatment plant. Straw bales will be placed around the well during the pipeline construction to protect the well.

To ensure no contamination to the groundwater source through the well, the ground around the wellhead is graded away from the well, for a distance of at least 20 feet, so surface run-off from rain, etc…will drain away from the well. A concrete pad is also placed for wellhead protection. The well will be capped to prevent any liquids, materials or animals from entering the wells. Please see Section 2 for specific construction details.

Prior to the wells being connected to the system, the water will be tested for biological or viral contamination and will be disinfected and flushed.

1.2.7 Sources of Contamination

Sources of contamination within 250 feet of the well and 100 feet of the underground treated water storage tank have been identified.

Trust Drive could potentially be considered a source of contamination if a vehicle were carrying hazardous chemicals or if a vehicle wrecked and chemicals leaked from the engine, etc…however, the speed limit, the secluded, residential nature of the road, and the limited use of the road, make contamination of the well highly unlikely.

Individual septic disposal systems also exist in the area. The surrounding lots are already developed and some of the septic system locations are within the 250 foot and 100 foot distances.

Lot	Distance From Well & Tank (ft)
158	175
159	175
161 & 162 (joined)	150

Contamination from these systems is unlikely. The well is four hundred and thirty feet deep. The top 38 feet are grouted and the next 392 feet are drilled through granite. Any effluent from these systems would enter the shallow groundwater at 11 feet, or travel down gradient through the soil until dispersed, long before impacting the water-bearing zone of this well.

Please see Appendix F for the Potential Pollution Source Location map depicting locations of domestic or industrial water dischargers within 2.5 miles of the well.

1.2.8 Raw Water Quality Analysis

Chemical analysis for primary MCL parameters for Well #1 is attached in Appendix B. The Gross Alpha level is approaching the MCL. The initial test result indicated a level of 13.4 ± 3.3 pCi/L and the MCL is 15 pCi/L. If Gross Alpha exceeds 10 pCi/l, the sample will be analyzed for Radium-226. If the Radium-226 exceeds 3pCi/l, the sample will be analyzed for Radium-228. The Radium-226 plus Radium-228 results were lower than the MCL for Radium-

226+228. Uranium was also tested, and that result was also lower than the MCL for Uranium. The testing procedure and resulting levels, indicate that Radon may be a factor in the high Gross Alpha level. Well flushing and subsequent testing are expected to indicate lower Gross Alpha levels, however, the storage tank will be equipped with a spray bar and vent, to provide aeration to the water as it enters the tank. The treatment process is further discussed in Section 1.3.12 and Section 6.

As stated in the attached Operation and Maintenance Manual, the certified operator will conduct sampling, analysis and reporting as required by the CDPHE.

1.2.9 Turbidity

Happy Scenes water system utilizes groundwater sources, not surface water sources. Raw water turbidity is not a concern.

1.2.10 Standby Power and Fire Protection Flows

A generator will be provided to run the pumps from Well #1 and the storage tank, as well as the treatment works. The propane generator is stored in the treatment facility.

Due to the constrictions of the existing 2 inch distribution pipelines, the system is not designed to provide fire protection.

1.2.11 Chemical Additives or Materials

The chlorine to be used for initial system disinfection and source water disinfection, will be NSF approved and certified under ANSI Standard 60. All pumps, pipelines, storage tank and distribution system equipment and materials, will be NSF approved and certified under ANSI Standard 61.

1.3
DESIGN REQUIREMENTS

1.3.1 Design Constants, Engineering Assumptions and Variables

The Manning Equation and the Micro Hardy Cross were used for pipeline analysis. The assumption that pressurized pipe is full at all times, allows for this use.

Number of Taps:

Existing	62
Build-out	68

Water Usage:

Current

Average Demand:	7,500,000 gal/year	DWR Diversion Records
	20,500 gal/day	0.0205 MGD
	336 gal/day/home	62 taps
	43 gpm	(8 hours of use)
Max Day:	86 gpm	Max Day:Average Day = 2:1
Peak Hour:	108 gpm	Peak Hour:Average Day = 3.25:1
Well Production:	50 gpm	

Build-out

Average Demand:	22,850 gal/day	0.0229 MGD
	336 gal/day/home	68 taps
	48 gpm	(8 hours of use)
Max Day:	96 gpm	Max Day:Average Day = 2:1
Peak Hour:	156 gpm	Peak Hour:Average Day = 3.25:1
Well Production:	50 gpm	

As explained in Section 1.2.1, the well permit limits the number of lots served to 62. The following sections of the report will be primarily based on service to the 62 lots, but will also provide calculations or quantities to indicate adequate supply for 68 lots.

1.3.2 Reservoir Surface Area and Volume

The system does not utilize a reservoir.

1.3.3 Area of Watershed

Groundwater, not surface water, is used as the raw water source. There is no watershed associated with the groundwater source.

1.3.4 Estimated Average and Maximum Day Water Demands

Average Water Demand

Happy Scenes Water System has been in existence for many years, and operates under an augmentation plan with the Pine River Irrigation District, the Division of Water Resources (DWR) has recorded the system's water use since 1975. This analysis uses 9 out of the last 10 years of data to determine the average demand. A major leak was experienced in 2000. The records for that year are not included in the analysis.

The records indicate an average annual demand of 7,494,573 gallons per year. The average day demand, therefore, is 20,533 gallons, or approximately 336 gallons per day per home for 62 homes. To determine the average demand per minute, the average day demand was divided by 8 hours of use per day, resulting in a demand of 43 gpm.

Maximum Water Demand

The AWWA Water Distribution Handbook states the peak hour demand is commonly in the range of 2.5-4:1 of the average daily demand. The average day demand for the system is 43 gpm and the max day demand is 86 gpm. The ratio of 3.25:1 returns the peak hour demand of 108 gpm.

As explained in Section 1.3, the existing 2-inch pipeline will be utilized and upgraded as breaks occur, but currently the peak supply available will be limited by the physical capacity of the pipeline. The pipeline does not have the ability to deliver the peak hour demand, but does have the physical capacity to supply the average day demand and max day demand. As the pipeline is upgraded to 6-inch line, it will have the capacity to deliver the peak hour demand as calculated here.

1.3.5 Number of Proposed Services and Projected Population

The current number of service connections is 62. The well permit limits the number of connections served to 62. However, the subdivision has 68 total lots that could require a tap at some time in the future. Please see Section 1.2.1 for a discussion of Happy Scenes' population trends.

1.3.6 Prefiltration Design Characteristics

Groundwater is used as the water source, so there are no flash mix, flocculation or settling basin design characteristics.

1.3.7 Retention Times

The storage tank provides a two-thirds day of storage, with the usage records indicating an average demand of 336 gallons per day per home, or 20,500 gallons per day for the entire system. As explained in Section 1.2.1, the tank can provide water to the system in the case that the well pump fails, as water can be delivered to the tank for distribution to the system. 15,000 gallons is more than enough to provide a full day use if the use is restricted to household use only in an emergency, providing 242 gallons per home for 62 homes or 220 gallons per

home for 68 homes.

The pipeline allows for a 2.25 hour retention time at full build-out. This assumes the average demand of 43 gpm, a 9,000 foot 2-inch pipeline (estimated), and a pipeline volume of 5,875 gallons. The pipeline includes evacuation valves at each dead-end of the pipeline to allow the system to be flushed. The pipeline retention time is appropriate.

$$(9{,}000\,ft)\times(\pi)\times(.167\,ft)^2\times\left(\frac{7.48\,gal}{ft^3}\right)\cong 5{,}875\,gallons$$

1.3.8 Unit Loadings

The PULSAtron LB02 pump operates in a range of 0 to 6 gallons per day. Please see Section 6.1.3 for dosing calculations.

1.3.9 Proposed Filtration Rate and Filter Area

Groundwater is used as the water source. Treatment by filtration is not required.

1.3.10 Backwash Rate

Groundwater is used as the water source. Treatment by filtration is not required, therefore no backwash process is required.

1.3.11 Feeder Capacities and Ranges

Please see Section 6.1.3.

1.3.12 Treatment for Conformance to Maximum Contaminant Levels (MCL's)

The treatment process is designed to ensure conformance with MCL's and will be provided primarily by chlorination, as well as any additional treatment deemed necessary through supplementary water quality testing done prior to equipment installation. Tank aeration will be provided to rectify Gross Alpha levels, if further water quality results continue to indicate high levels of Gross Alpha caused by Radon being present in the water. Please see Section 8.3.24.

Disinfection will be provided by injecting sodium hypochlorite, certified under ANSI Standard 60, into the stream of flow from the well to the storage tank. Please see Sections 6 and 7 for further discussion of the disinfection process.

1.3.13 Proper Disinfection and Contact Time

Please see Sections 6 and 7 for discussion of the disinfection process.

1.3.14 Schematic Flow Diagrams and Hydraulic Profile

The Treatment Train drawing is attached in Appendix D and the hydraulic profiles are attached in Appendix G.

1.3.15 Piping Detail

The treated water piping detail is included in the Treatment Train drawing in the attached Appendix D.

1.3.16 Chemical Equipment Location and Point of Application

Chemical feeding equipment and the point of application can be found on the Treatment Train drawing in the attached Appendix D.

1.3.17 Proposed Chemicals for Addition

NSF approved, 12% chlorine will be the only chemical proposed to be added to the water system. The chlorine, to be used for initial system disinfection and source water disinfection, will be certified under ANSI Standard 60.

1.3.18 Storage and Safety Details for Chemical Handling

12% NSF approved chlorine, mixed with water to form sodium hypochlorite, will be used to disinfect the groundwater. The operator will be responsible for delivering the chlorine, and/or ordering it from the appropriate supplier. Univar USA in Farmington, New Mexico, or equivalent supplier, will be used. The chlorine will be delivered and stored in the treatment building in original 54-gallon containers, in the dedicated chlorine storage room with secondary containment. Please see Sections 3, 6 and 7, for further discussion of chemical handling.

1.3.19 Water Mains and Water Works Structures

All appurtenances, specific structures, equipment, water treatment plant waste disposal units, and points of discharge having any relationship to the plans for water mains and water works structures are addressed throughout report.

1.3.20 Sanitary Facility Locations

Please see Section 3 for discussion of locations of sanitary and other applicable facilities.

1.3.21 Locations, Dimensions and Elevations of all Proposed Plant Facilities

The subdivision lies partially on the side of a hill and partially on the Vallecito Creek valley floor. The homes are all at elevations between 7,850 feet and 7,770 feet.

The treatment building and storage tank are located in the center of the subdivision, at latitude 37º 27.581' and longitude 107º 33.386'. The building sits in a 4,050 square foot utility easement at an elevation of approximately 7,783 feet. Please see the Distribution System Layout in Appendix F. The treatment building is 14 feet by 20 feet, with a main treatment room and one additional room provided chlorine storage. Please see the Blueprints and the Utility Easement Site Plan in Appendix D.

Well #1 is located near the treatment building at the same elevation. Please see the Utility Easement Site Plan drawing in the attached Appendix D.

1.3.22 Locations of all Sampling Taps and Monitoring Equipment

Valves and sampling taps will be installed in the well water inlet to the treatment plant to test the raw water quality of the source before treatment. A valve and sample tap is included in the finished water pipeline to access and test the finished water supply before it exits the treatment building. Please see the Treatment Train drawing in the attached Appendix D.

The sampling taps are located throughout the system, at each dead-end. Please see the Distribution System Layout in the attached Appendix F.

The only in-house monitoring equipment will be a portable chlorine analyzer, which will be stored in the treatment building while not in use.

1.3.23 Assessment of Operation Under All Weather Conditions

The treatment equipment will be protected under all weather conditions by the treatment facility insulated structure. The treatment facility will be accessible during all weather conditions. The road to the treatment building will be plowed regularly, along with the subdivision roads.

As breaks necessitate and homeowner assessments allow, the existing 2-inch pipeline will be replaced with 6-inch pipe. The 6-inch pipe will be buried to a minimum depth of 4 feet to avoid freezing during winter months, as allowed by soil and groundwater conditions.

1.3.24 Guardrails and Walkways

Not Applicable

1.3.25 Location of Flow Meters

Flow meters are located throughout the treatment facility. Generally, a flow meter will be installed in the well inlet line, prior to sodium hypochlorite injection, to measure the flow of raw water from the well. Meters are also included in the finished water pipelines to meter the finished water delivered to the distribution system. As the system pipeline is upgraded, meters will be installed at the taps in the distribution system. Please see the Treatment Train drawing in the attached Appendix D.

1.3.26 Cross Connection Control Devices

Cross connection control in the treatment facility is discussed in Section 7.12.1. The Happy Scenes Water System provides potable water for both in-home and outside use, however, a number of the parcels have wells for outside landscape needs. As per the system's Rules and Regulations, the system will be protected from cross connection by restricting the wells to be for outside use and prohibiting the wells from being connected to the system in any way, including

the restriction from being attached to the potable water plumbing of any home. Cross connection is also restricted by the water system's Rules and Regulations.

1.3.27 Significant Deviations or Revisions

Any significant deviations from the approved plans involving the treatment process will be submitted to the CDPHE for approval. The revisions will be submitted in time for review and approval before construction begins.

2.0
GROUND WATER SOURCES

2.1.0 General Well Construction

The water source for the Happy Scenes Water System is groundwater from Well #1. Well #1 is permitted under Colorado Division of Water Resources Permit Number 66887-F and allowed up to 50 gpm, not to exceed 26.04 acre-feet (8,485,160 gallons) per year. The estimated average water demand equals 23 acre-feet per year. The well is located near the treatment facility, at latitude 37º 27.581' and longitude 107º 33.386'. The well pump will be a Franklin Electric 6-inch High Capacity FPS 4000 75FA7S6-PE, with a Franklin Electric 6-inch Sand Fighter 7.5 hp Submersible Motor. Neither the pump nor the motor are NSF 61 certified, however they are made with materials suitable for use in drinking water applications. Please see a deviation request for this configuration in Appendix C.

2.1.1 Construction Rules and Regulations

Well #1 was constructed in accordance with the latest edition of The Rules and Regulations of Colorado's State Board of Water Well and Pump Installation Contractors. The well is plain cased from the 2.5 feet above the ground surface to 12 feet (below). The well is perforated cased from 12 feet to 38 feet, however, the plain and perforated casings were grouted to 38 feet. The remaining depth of the well, from 38 feet to 430 feet is granite. Please see the Well Construction Report in Appendix E.

2.1.2 Waterways and Geological Formations

Well #1 is constructed about 100 feet away from D Creek, an intermittent or seasonal stream. The well is drilled through a granite formation from 38 feet to 430 feet deep. As indicated in Sections 1.2.6 and 2.1.8, the ground around the well is graded and a concrete pad has been installed to protect the integrity of the well. The construction of the well, as well as the geologic formation in which the well is drilled, prohibit the direct intrusion of surface water.

2.1.3 Microscopic Particulate Analysis

A microscopic particulate analysis of the well water will be conducted and provided if requested by the Colorado Department of Health and Environment; however, the analysis should not be required, as Well #1 is grouted to a depth of 38 feet and the well formation is granite from 38 feet to 430 feet.

2.1.4 100 Year Flood Plain

As evidenced by the attached 100 Year Flood Plain Certification in Appendix G, Well #1 was not constructed within the 100-year flood plain.

2.1.5 Well Caps and Seals

Well caps, with sanitary seals, will be installed in Well #1 to protect from surface contamination. The well cap will be Baker-Monitor Division #6WPSM, or equivalent. Specifications for the well cap are attached in Appendix C.

2.1.6 Sanitary Seals

The Well #1 well cap will be designed and installed such as to prevent liquids or solids, of any kind, from entering the well. The cap will include a watertight port for the electrical connection of the pitless adapter. MAASS Model 6JC1 1/4 Clamp-On Pitless Adapter, Part Number 928350. The same pitless adapter will also be used for the storage tank pump. Specifications for the pitless adapter can be found in the attached Appendix C.

2.1.7 Vents

The well caps come equipped with corrosion resistant screen to prevent insects or other possible contaminants from entering the wells.

2.1.8 Grade Enhancement

The ground around Well #1 has been graded to divert any surface run-off away from the wellhead for a distance of at least 20 feet. A minimum four-foot diameter pad will be constructed around the wellhead. The concrete pad will follow the diversion grade.

2.1.9 Well Contamination Sources

To ensure that no new contamination sources are created within 100 horizontal feet of Well #1, a utility easement has been placed around the well to denote the 100' zone of isolation. This restriction will be listed in the Happy Scenes Water System O&M Manual and Rules and Regulations. Please also see Sections 1.2.6 and 1.2.7 for additional wellhead protection plans.

2.1.10 Well Vaults

Not Applicable

2.2 Spring Construction

Not Applicable

2.3 Infiltration Galleries

Not Applicable

3.0
FACILITY LAYOUT

3.1 Location of Structures

As evidenced by the attached 100 Year Flood Plain Certification, none of the Happy Scenes water supply system components are designed to be or are constructed within the 100-year flood plain.

3.2 Plant Layout

3.2.1 Functional Aspects of the Plant Layout

The treatment facility will house the treatment system. The building will be wood frame construction on a concrete pad and will be 14 feet by 20 feet. The building has two separate rooms. The main room, an L-shaped room with approximately 225 square feet, will house the treatment train, portable generator, testing equipment, etc... The smaller storage room will house the 12% liquid chlorine, as well as the chlorine solution tank. The smaller storage room is at least 4.5 feet by 5.3 feet.

The treatment train consists of the chlorination equipment and all valves, taps and meters associated with its operation. The water will enter the facility from the well, the inlet line will be equipped with a Dole nickel plated, brass flow control valve, to regulate the flow to 50 gpm, a brass sampling spigot, a Neptune 2-inch flow meter, a Danfoss Flomatic check valve to prevent backflow, and the PULSAtron chlorine injection nozzle. A pressure gauge will be installed as the last component before the line exits the facility to the storage tank. The water will enter the storage tank through a spray bar, equipped with a valve to allow bypass of the spray bar. The water will be pumped back through the facility to the delivery lines. This line will be equipped with a pressure gauge, a transducer used to regulate the delivery pump, a main shut-off valve, a hose bib equipped with a pressure vacuum breaker, and a brass sampling spigot. Two Wellmate pressure tanks will be installed to help regulate the pressure of the system and the operation of the delivery pump. The water will exit the facility through three separate distribution lines. The three lines will be equipped with Neptune 2-inch flow meters and ball valves. The distribution Line #3 will also be equipped with a pressure reducing valve and a pressure gauge. Please see equipment specifications in Appendix C and the Treatment Train drawing in the attached Appendix D.

3.2.2 Provisions for Future Plant Expansion

The building is designed to have excess space, allowing for expansion of the treatment facilities. The treatment building provides a large, unused area. Please see the Treatment Facility Blueprints or Treatment Train, attached in Appendix D.

3.2.3 Provisions for Waste Treatment and Disposal Facilities

Waste created by the operation of the treatment building will be regular household waste and disposed of in an outside waste or recycling receptacle, which will be collected regularly by the waste management and/or recycling companies contracted by the Happy Scenes Subdivision homeowners.

3.2.4 Access Roads

The treatment facility and well are located near the center of the subdivision in a 45 foot by 90 foot utility easement. Access to the site is provided by Trust Drive, a narrow dirt road that serves approximately 8 residential lots in the subdivision. Trust Drive can be accessed from the north by Hope Lane or by the South by Ponderosa Boulevard. The subdivision roads are plowed by the homeowners for access to the lots, so year round access to the treatment facility will be provided.

3.2.5 Site Grading and Drainage

The foundation of the building sits about 6 inches above the natural grade and the finished grade will be sloped away from the building to the natural grade to prohibit runoff from damaging the building foundation. The ground around the treatment facility will be graded to direct any surface runoff into natural drainage depressions. Please see Appendix D for drawings of the foundation and grading, found in the drawings from Jay Lynch Architects, LLC.

3.2.6 Snow Removal

The gravel access to the treatment facility, or parking pad, will be graveled and plowed in the winter to allow access throughout the year. The treatment building doors will be kept clear of snow accumulation to ensure easy and continued access.

3.2.7 Walks and Driveways

A 15-foot wide, gravel driveway, or parking pad, will provide access to the treatment facility door. No other walks or driveways are necessary.

3.2.8 Utility Easements

The Happy Scenes subdivision incorporates easements for the existing water lines, general utilities, the water well, storage tank and treatment facility. Please see the Distribution System Layout attached in Appendix F. Easement agreements are also included in Appendix F.

3.2.9 Yard Piping

Not Applicable

3.2.10 Chemical Delivery

The operator will be responsible for the delivery of the 12% chlorine, either personally or under contract with the supplier. The chlorine will be stored in the treatment building in the original 55-gallon containers, with secondary containment.

3.2.11 Plant Security

The treatment building will be locked at all times for security and safety reasons. The operator will have a key. The water system secretary will keep an additional key so that the plant can be accessed for general and emergency purposes.

3.3 Building Layout

3.3.1 Ventilation

Although chlorine gas is not being utilized for disinfection, ventilation will be supplied in accordance with the Colorado Design Criteria for Potable Water Systems and manufacturer's recommendations.

3.3.2 Lighting

The Treatment Facility will be supplied 110V electrical capacity, lighting and electrical outlets. Lighting will be provided by an incandescent or fluorescent ceiling lighting fixture and the switch will be located beside the door.

3.3.3 Heating

The Treatment Facility will be properly insulated and heated to assure the water system plumbing does not freeze. Insulation will be installed to provide R30 in the ceiling and R19 in the walls. The heater will be an electrical, floorboard type heater, but will be mounted on the wall at least 18 inches above the floor to ensure it does not come in contact with any water. A portable propane heater will also be installed in the case of an electrical outage. The heater will be a Vanguard VP20BTB. Please see Appendix C for specifications.

3.3.4 Drainage

A floor drain and drainpipe were not included in the design of the treatment facility. A wet vac will be kept on site for small leaks. Major leaks will exit the facility under the walkthrough door.

3.3.5 Dehumidification Equipment

Not Necessary

3.3.6 Accessibility of Equipment

The treatment facilities are arranged to allow for easy access for the operation, servicing and removal of the treatment equipment.

3.3.7 Flexibility of Operation

The treatment facility is designed to provide flexible operation.

3.3.8 Operator Safety

The treatment system is very uncomplicated and the treatment facility is large enough to provide sufficient room for the operator to conduct testing and treatment activities. No specific designs to the treatment process or facility are required to ensure operator safety.

3.3.9 Convenience of Operation

The treatment facility is designed to provide convenient operation

3.3.10 Chemical Storage

The 12% liquid chlorine will be stored in a separate room in the treatment building in original containers, with secondary containment.

3.3.11 Sludge Disposal

Not Applicable

3.4 Electrical Controls

The electrical controls are located above grade. Please see the Treatment Train drawing in Appendix D.

3.5 Standby Power

Standby power will be provided so that well water may be treated and delivered to the storage tank and distribution system. Please see Section 1.2.10.

3.6 Shop Space and Storage

The treatment facility is designed to provide adequate shop space and storage to ensure the finished water is not contaminated. A work area, with bench and storage space for chlorine residual test equipment, test results forms, safety forms, equipment specifications and other organizational documents, will be provided in the building. Please see the Treatment Facility Blueprints in Appendix D.

3.7 Laboratory Equipment

3.7.1 Testing Equipment

The testing equipment provided will be compatible with utilizing groundwater as the raw water source. Chlorine residual testing equipment (HACH Pocket Colorimeter II Analysis System, Product #5870000) will be provided and stored in the treatment building.

3.7.2 Other Provisions

Sufficient bench space, ventilation, lighting and storage compartments will be provided.

3.8 Monitoring Equipment

3.8.1 Continuous Monitoring Turbidimeters

Not Applicable

3.8.2 Continuous Chlorine Monitoring and Recording

Not Applicable

3.8.3 Portable Chlorine Residual Testing Equipment

Portable chlorine residual testing equipment will be provided and stored in the treatment building. The equipment provided will be a HACH Pocket Colorimeter

II Analysis System, Product #5870000. Please see equipment specification in Appendix C. Please also see Section 6.1.17 for additional technical specifications.

3.8.4 Other Operational Equipment
No other operational equipment is required.

3.8.5 Laboratory Testing
Laboratory tests for the determination of MCL contaminants will be conducted in compliance with the Colorado Primary Drinking Water Regulations. Test result records will also be kept in the treatment building, as well as with the water system records, as held by the secretary.

3.9 Sample Taps
A sampling tap will be installed in the well water inlet to the treatment plant to test the raw water quality of the sources before treatment. A sample tap is included in the finished water pipeline to access and test the finished water supply before it exits the treatment building. The taps will not be petcock taps and will be suitable for the sampling needs, as required by the Colorado Design Criteria for Potable Water Systems.

3.10 Facility Water Supply
The facility water supply will be supplied by a tap, or hose bib, installed inside the treatment plant on the finished water system entry line.

3.11 Wall Castings
Extra wall castings will not be supplied, the building is not concrete.

3.12 Meters
Please see Section 1.3.25.

3.13 Piping Color Code and Arrows
The Happy Scenes treatment facility has very simple treatment and piping. There is only one inlet from one source. The water is hypochlorinated and sent to the storage tank. The water returns to the treatment building, is pressurized and exits the building through three distribution lines. There are no waste lines to confuse with treated water lines. Color-coded piping identification will not be used.

3.14 Disinfection
Well #1, the storage tank and all raw and treated water pipelines will be disinfected in accordance with AWWA Standards C654, C652 and C651.

NSF approved 12% chlorine will be used to disinfect the 15,000 gallon storage tank. An initial chlorine dose of 100 mg/L is expected to maintain a chlorine residual of over 50 mg/L during the 24-hour disinfection period. 12.5 gallons of

12% chlorine will be mixed with 14,985 gallons of water to produce the 100 ppm or 100 mg/L.

$$\frac{[(100mg/L)\times(0.015Mgal)]}{0.12} = 12.5gallons$$

Following AWWA C652, the tank will be filled and the solution will be held for a contact time of 24 hours. After the storage tank disinfection is complete, the 15,000 gallon tank will have a chlorine residual of 50 ppm or 50 mg/L.

To disinfect the mainline, according to AWWA C651, the pressurized pipeline will be injected with a continuous chlorine residual of 50 ppm or 50 mg/L from the storage tank and held for another 24 hours. After the facilities are flushed, the water will be tested for total coliform to ensure complete disinfection.

3.15 Manuals, Drawings and Parts Lists

All operation and maintenance manuals, parts lists and as-built drawings will be provided by the equipment suppliers and held both in the treatment building, as well as with the water system records, by the secretary.

3.16 Operator Instruction

The certified operator will develop the Startup and Normal Operating Procedures in compliance with the manufacturer's recommendations. The Startup and Normal Operating Procedures will be held both in the treatment building, as well as with the water system records, by the secretary.

3.17 Other Considerations

It is the responsibility of the legal representative to obtain all needed permits for discharges, wells, overflow, stream crossings, highway crossings, building, etc..., as well as any special requirements by other state and local regulatory agencies for items such as safety requirements, special designs for the disabled, fire protection, emergency power, plumbing and electrical codes, etc.

4.0
PREFILTRATION TREATMENT

4.0 General

The quality of the finished water will conform with MCLs as provided in the Colorado Primary Drinking Water Regulations.

4.1 Plant Reliability

The Happy Scenes treatment facility will be treating ground water, not surface water. This section is not applicable.

4.2 Presedimentation

Please see Section 4.1.

4.3 Coagulation (Chemical Addition and Rapid Mix)

Please see Section 4.1.

4.4 Flocculation

Please see Section 4.1.

4.5 Sedimentation

Please see Section 4.1.

5.0
FILTRATION

5.0 General

The Happy Scenes treatment facility will be treating groundwater, not surface water. This section is not applicable

6.0
DISINFECTION

6.1 Chlorination

6.1.1 Chlorination

The disinfection of the groundwater source will be accomplished by the use of sodium hypochlorite.

6.1.2 Positive Displacement Feeder

A positive displacement type hypochlorite feeder will be used.

6.1.3 Chlorinator Capacity

The chlorinator "capacity shall be such that a free chlorine residual of at least 2 milligrams per liter…can be attained in the water after a contact time of at least 30 minutes" at all times and demands of use, as required by the Colorado Design Criteria for Potable Water Systems.

The sodium hypochlorite solution will be made by mixing NSF approved 12.5% chlorine with water in an approved plastic 55 gallon drum. The solution will be mixed to a concentration of 2.88% by adding 10.5 gallons of 12.5% chlorine to 35 gallons of water.

$$\frac{[(10.5)\times(.12)]-[(10.5gal)\times(0.0288)]}{0.0288}=35gallons$$

In order to provide a dose of at least 2 mg/L, the pump will need to supply 5 gallons of the 2.88% solution a day, at the expected normal production of 50 gallons per minute.

$$\left(\frac{5gal}{day}\right)\times(.0288)\times\left(\frac{day}{0.072Mgal}\right)=2mg/L$$

The PULSAtron LB02 pump has the capacity to supply up to 6 gallons of solution a day. With this pump range, the pump will normally be operating at about the 80% range, supplying 5 gpd.

The pump range gives the operator great flexibility in controlling the residual chlorine in the system. The operator will monitor the chlorine residual at the entry point and at the end of the main and adjust the hypochlorinator pump to meet the residual chlorine concentration requirements. The operator may choose to install a PULSAtron LB03 pump with a range up to 12 gallons a day.

6.1.4 Back-Up Equipment

To provide protection of the water supply, standby equipment will be available to replace the hypochlorinator pump. A PULSAtron LB02, or equivalent will be used. Therefore, two PULSAtron LB02will be kept in the treatment building at

all times. One will be operating and the other will serve as backup. If at any time, the back-up pump is installed in the treatment system, an additional pump will be purchased to serve as backup.

6.1.5 Automatic Proportioning

An automatic proportioning chlorinator is not required as the rate of flow is a constant while the tank is filling.

6.1.6 Contact Time

Due consideration of the disinfectant contact time will be given in relation with the groundwater quality. Please see Section 6.1.10.

6.1.7 Chlorine Application for Surface Water

The source water for the system is groundwater. This section is not applicable

6.1.8 Chlorine Application for Groundwater

The disinfectant will not be injected directly into the well casing. Instead, it is injected into the treatment plant piping before the water enters the storage tank.

6.1.9 Tablet Type Chlorinators

The treatment system will not utilize a tablet type chlorinator.

6.1.10 Chlorine Contact Time

Chlorine contact time, or 4-log removal of viral contaminants, will be provided by a 15,000 gallon storage tank. The tank diameter is 10 feet and the length is 30 feet. The tank is an underground fiberglass tank. The determination of actual detention time for the storage tanks was calculated using the ratio between actual and theoretical detention times associated with the tank design. The ratio used for design is 0.3 or "Poor". A spray bar will be installed at the entry point to the tank, which will assist in mixing.

The maximum pumping capacity from the well is 50 gpm. 15,000 gallons provides a chlorine contact time of 90 minutes, which is more than sufficient to provide 4-log removal of viral contaminants from ground water.

$$(15{,}000\,gal)\times\left(\frac{\min}{50\,gal}\right)=(300\,\min)\times(0.3)=90\,\min$$

The 15,000 gallon tank provides 53 minutes of chlorine contact time at a maximum day demand pumping rate of 85 gpm and 42 minutes of chlorine contact time at the peak hour demand of 108 gpm. Considering the build-out scenario, the 15,000 gallon tank provides 29 minutes of chlorine contact time. Again, this is more than sufficient contact time to provide 4-log removal of viral contaminants from ground water.

6.1.11 Combined Residual Chlorination

The treatment system will not utilize combined residual chlorination. This section is not applicable.

6.1.12 Actual Detention Time

Please see Section 6.1.10 for chlorine contact detention times.

6.1.13 Minimum Residual Chlorine Concentration

The minimum residual chlorine concentration, after 30 minutes of detention time, shall not be less than 0.2 mg/L with a measurable chlorine residual at the end of the main line. The system is designed to provide at least 2.0 mg/L to the system so that chlorine residual at the end of the main is 0.2 mg/L, greater than a trace. As stated in section 6.1.3, the operator will monitor the chlorine residual at the entry point and at the sampling points throughout the system and adjust the hypochlorinator pump to meet the residual chlorine concentration requirements.

6.1.14 Combined Chlorine Residuals

Not Applicable

6.1.15 Water Characteristics Affecting Chlorine Residuals

The certified operator will adjust the disinfectant dosage in relation to the water characteristics.

6.1.16 Formation of THMs

The certified operator will adjust the disinfectant dosage to avoid the formation of THMs, although the formation of THMs in this system is improbable as little organic matter is found in groundwater.

6.1.17 Portable Chlorine Analyzer

The portable HACH chlorine analyzer, or the chlorine residual testing equipment, for testing the chlorine residual will be "capable of measuring residuals to the nearest 0.1 milligrams per liter in the range of 0 to 1.0 milligrams per liter and to the nearst 0.5 milligrams per liter between 1.0 milligrams per liter and 2.0 milligrams per liter," as required by the Colorado Design Criteria for Potable Water Systems. A HACH Pocket Colorimeter II Analysis System, Product #5870000, will be used.

6.1.18 Continuous Monitors and Recorders

Not Applicable

6.1.19 Chlorination Equipment Storage

The chlorine will be stored in a separate room in the treatment building in original containers, with secondary containment.

6.1.20 – 6.1.46 Chlorine Gas Specifications

The treatment system will utilize sodium hypochlorite. These sections are not applicable.

6.2 Ultraviolet

Not Applicable

6.3 Iodine

Not Applicable

6.4 Other Disinfecting Agents

Not Applicable

7.0
CHEMICAL APPLICATION

7.0 General

The only chemical to be used for water treatment or system disinfection will be sodium hypochlorite. Sodium hypochlorite is approved for this use by the Colorado Department of Health and Environment Water Quality Control Division.

7.1 Plans and Specifications

7.1.1 Description of Feed Equipment

The hypochlorinator will use PULSAtron Peristaltic Pump, Model LB02 or LB03, or equivalent as determined by the operator. The Model LB02 operates in a range up to 6 gallons per day. The Model LB03 operates in a range up to 12 gallons per day. Two pumps will be kept in the treatment building at all times. One will be operating and the other will serve as back-up. If at any time, the back-up pump is installed in the treatment system, an additional pump will be purchased to serve as back-up.

7.1.2 Location of Feeder, Piping Layout and Point of Application

As evidenced in the Happy Scenes Treatment Facility Plan View, the disinfectant feeder is located in the treatment building. The point of application is after the inlet from Well #1 and before the outlet to the storage tank. Please see the Treatment Train drawings in the attached Appendix D.

7.1.3 Storage

The chlorine will be stored in original containers, with secondary containment, in the chlorine storage room of the treatment building.

7.1.4 Chemical Specifications

The chlorine used to make the sodium hypochlorite solution will be NSF approved 12% chlorine.

7.1.5 Operating and Control Procedures

Please see Sections 6.1.3 and 6.1.13.

7.1.6 Testing Equipment and Procedures

The chlorine residual will be tested on a routine basis, a minimum of once per week, or as required by the CDPHE. The operator will use a HACH portable Pocket Colorimeter II Analysis System to test the entry point chlorine residual, as well as the sampling points throughout the system.

7.2 Chemical Application

Chemicals shall be applied to the water at such points and by such means according to the Colorado Design Criteria for Potable Water Systems requirements 7.2.1-7.2.6.

7.2.4 Satisfactory Mixing

To assure satisfactory mixing of chlorine with the raw water, the PULSAtron pump is equipped with an injection check valve and extension tip that will be trimmed as necessary to locate the tip directly in mid flow of the raw water supply line, as described in the equipment specification sheet attached in Appendix C.

7.3 Equipment Design

7.3.1 Feeder Range

The pump operates in the range up to 6 gallons per day. The pump will operate at 5 gallons per day if a 2.9% solution is to be injected into a stream of flow of 50 gallons per minute or 0.072 million gallons per day.

$$\left(\frac{5gal}{day}\right)\times(.0288)\times\left(\frac{day}{0.072Mgal}\right)=2mg/L$$

Chemicals shall be applied to the water at such points and by such means as to follow the Colorado Design Criteria for Potable Water Systems requirements 7.3.2-7.3.4.

7.4 Chemical Feeders

7.4.1 Duplicate Feeders

Two feeders will be provided.

7.4.2 Standby Unit

The second feeder will serve as a standby or back-up unit. If the back-up unit has to replace the feeder a new back-up unit will be purchased and stored at the site.

7.4.3 Duplicate Equipment

Standby power will be supplied by the generator. Duplicate equipment will be provided as necessary.

7.4.4 Independent Feeders

Only one chemical will be applied.

7.4.5 Dedicated Feeders

Spare parts, as recommended by the manufacturer, will be kept in the treatment building for the PULSAtron Pump.

7.5 Controls

7.5.1 Manual/Automatic Control

The treatment facility controls include an Auto/Manual switch, and an on/off switch for manual control. The automatic control will be directed by storage tank levels. When the tank draws down to a certain volume level, set by the operator, the Well #1 pump and the hypochlorinator will engage.

7.5.2 Chemical Feed Rates

Chemical feed rates will be proportioned to flow.

7.5.3 Flow Measurement

Water flow measurement will be provided by the meter on the inlet line from Well #1 to the hypochlorinator. Please see the Treatment Train drawing, in the attached Appendix D.

7.5.4 Chemical Measurement

The operator in charge will provide means for measuring the quantity of 12% chlorine used.

7.6 Weighing Scales

Not Applicable

7.7 Dry Chemical Feeders

Not Applicable

7.8 Positive Displacement Solution Pumps

As required, the sodium hypochlorite will be injected with a positive displacement type solution feed pump. Please see Sections 7.3.

7.9 Liquid Chemical Feeders – Siphon Control

The hypochlorinator chemical feeder will discharge at a point of positive pressure.

7.10 Cross Connection Control

7.10.1 Service Line

The solution tank and the service line are protected from cross connection because there are no direct plumbing connections between the solution barrel and the water system. To fill the solution tank, the operator will use a hose, connected to a spigot. The line serving the spigot will be equipped with a backflow prevention vavle. The solution tank filling procedure is such that the operator will stand at the solution tank, holding the hose, as the tank fills. After the tank is filled with the appropriate amount of water, the hose will be removed and turned off and then the chlorine will be added. The chlorinator pump will be turned off during the filling of the solution tank.

7.11 Chemical Feed Equipment Location

7.11.1 Dedicated Storage

It is unnecessary for the chemical feed equipment to be located in a separate room, as chlorine gas is not being used. However, the 12% chlorine will be stored in a dedicated room.

7.11.2 Location

As shown on the plan view of the treatment plant, the chemical feed equipment, or sodium hypochlorite solution tank, is located adjacent to the point of application. Please see the Treatment Train drawing, in the attached Appendix D.

7.11.3 Accessibility

The chemical feed equipment will be easily accessible for the operator.

7.12 Service Water Supply

7.12.1 Water Supply LIne

The water supply line will have adequate pressure to work with the PULSAtron Pump. Please see Section 9.4.1.

7.12.2 Water Supply Measurement

The water supply line is equipped with a flow meter, prior to hypochlorite injection. Please see the Treatment Train drawing in the attached Appendix D.

7.12.3 Water Supply Hardness

The raw water supply will be properly treated for hardness when necessary.

7.12.4 Water Supply Backflow Prevention

The treatment train includes backflow prevention valves located throughout the treatment process. Please see the Treatment Train drawing in the attached Appendix D.

7.13 Storage of Chemicals

The NSF approved 12% chlorine will be stored in compliance with the Colorado Design Criteria for Potable Water Systems Section 7.13. Please see Sections 3 and 6, as included herein, for further discussion of chemical handling.

7.13.1 Storage Space

Storage space adequate to store two 55-gallon drums is provided in the 5.3 foot by 4.5 foot chemical storage room. One 55-gallon drum supplies over 50 days of supply.

7.13.2 Chemical Handling

The certified operator will follow convenient and efficient chemical handling techniques.

7.13.3 Storage Conditions

Please see Section3, specifically Section 3.2.1.

7.13.4 Storage Volume

The 12% chlorine is not delivered or stored by truckload. This section is not applicable.

7.13.5 Storage Tanks and Pipelines

The 12% chlorine will be stored in original shipping containers and supplied to the hypochlorite tank by piping for specific use with chlorine.

7.13.6 Storage Containers

The 12% chlorine will be stored in original shipping containers, inside the chemical storage room of the treatment facility.

7.13.7 Storage Liquid Level

Storage drum liquid level detection will be provided by an ultrasonic drum level gauge or equivalent means as selected by the certified operator. The translucent Pulsafeeder tank is equipped with 5-gallon increment markings for liquid level detection.

7.13.8 Overflow Containment

Secondary containment is provided by either a two drum polyethylene low-profile containment deck or spill pallet.

7.13.9 Backflow Prevention

Please see Section 7.9.

7.14 Solution Tanks

7.14.1 Solution Strength

The certified operator will monitor the strength of the hypochlorite solution.

7.14.2 Solution Tank Maintenance

The operator will service the solution tank when the storage tank is full, or will provide an alternate, temporary container to house the hypochlorite solution, in the case of an emergency servicing.

7.14.3 Solution Tank Liquid Level

The solution tank will be an industrial grade translucent polyethylene Pulsafeeder 55 gallon tank (USA Bluebook Part #MC-42966), that allows the tank level to be visually determined. Please see equipment specifications in Appendix C.

7.14.4 Solution Tank Lid

The Pulsafeeder Tank has a heavy-duty lid specifically designed to support the pump.

7.14.5-7.14.7 Subsurface Solution Tank Location

The solution tank will be housed in the treatment facility. This section is not applicable.

7.14.8-7.14.10 Overflow Pipes

The solution tank is filled manually by the operator. Overflow pipes will not be provides. This section is not applicable.

7.14.11 Acid Storage

Acid will not be stored in the treatment facility. This section is not applicable.

7.14.12 Backflow Protection

The solution tank is protected against backflow in accordance with Sections 7.9 and 7.10.

7.14.13 Secondary Containment

Secondary containment is provided by either a polyethylene low-profile containment deck or spill pallet. Please see equipment specifications in Appendix C.

7.15 Day Tanks

A day tank is not required. This section is not applicable.

7.16 Feed Lines

7.16.1 Length

The hypochlorite feed line will be as short as possible.

7.16.2 Material

The feed line will be of durable, corrosion resistant material designed for use with chlorine solutions.

7.16.3 Accessibility

The entire length of the feed line will be accessible for cleaning or maintenance.

7.16.4 Freeze Protection

The feed line will be protected from freezing, as it is located inside the heated, insulated treatment facility.

7.16.5 Maintenance

The entire length of the feed line will be accessible for cleaning or maintenance.

7.16.6 Slope

Sodium hypochlorite will be utilized, not chlorine gas. This section is not applicable.

7.16.7 Color Coding

Due to the simplicity of the treatment train, the feed line will not be color coded.

7.16.8 Design

The feed line will be of a material designed for use with chlorine solutions, designed to prevent scale-forming and solids deposition.

7.17 Chemical Handling

7.17.1 Chemical Delivery & Displacement

The 55-gallon drums will be delivered by UNIVAR and placed by the delivery personnel. The secondary containment will be equipped with a flexible lip or removable ramp.

7.17.2 Chemical Storage Disposal

The empty 55-gallon drums will be collected by UNIVAR at the delivery of the new drums. The full and empty drums will be stored in the chemical storage room, with minimal impact to the treatment train and treated water storage.

7.17.3 Dry Chemical Handling

Dry chemicals will not be utilized. This section is not applicable.

7.17.4 Chemical Measurement

The certified operator will provide a means to measure the 12% chlorine in the preparation of the hypochlorite solution.

7.18 Housing

7.18.1 Floor Surface

Please see Section 3.3.4.

7.18.2 Venting

The chemical storage room will be vented to the outside. The vent will be provided through a 3 foot horizontal by 1 foot vertical window, framed into the outside wall. The window will be operated by a crank that will allow the operator to manually vent the room. The use of a window, instead of a vent will help prevent freezing problems. Windows are also installed throughout the Treatment Facility to allow manual ventilation.

7.19 Shipping Containers

7.19.1 Chemical Information

The chemical shipping containers will be fully labeled with the chemical name, purity and concentration.

7.19.2 Supplier Information

The chemical shipping containers will be fully labeled with the supplier name and address.

7.20 Specifications

As required by the Colorado Design Criteria for Potable Water Systems, "all chemicals shall meet AWWA specifications".

7.21 Acids

The system does not utilize acid. This section is not applicable.

7.22 Safety

7.22.1 Safety Protection Equipment

Safety protection equipment, if required by the National Institute for Occupational Safety and Health, will be made available in an obvious and convenient location for use by the operator.

7.22.2 Notification

The fire department shall be notified of the chemicals used or stored on site.

8.0
OTHER TREATMENT

8.1 Softening

Softening is not necessary and will not be provided.

8.2 Ion Exchange

Ion exchange is not necessary and will not be provided.

8.3 Aeration

Aeration will be provided to remove radon from the water.

8.3.1-8.3.8 Natural Draft Aeration

Not Applicable. Natural draft aeration will not be provided.

8.3.9-8.3.20 Forced or Induced Draft Aeration

Not Applicable. Forced or induced draft aeration will not be provided.

8.3.21-8.3.23 Typical Pressure Aeration

Not Applicable.

8.3.24 Other Aeration Methods

A spray bar installed inside the storage tank will provide the aeration necessary to treat for the possible Radon contamination and resulting high Gross Alpha levels. As indicated in Section 1.2.8, it is expected that flushing the well and subsequent water quality testing will result in lower Gross Alpha levels, however, a spray bar will be installed in the tank to provide treatment if necessary.

The spray bar will be 10 feet of 1¼ inch Schedule 80 PVC, with three rows of 1/8 inch orifices at 4,6 and 8 o'clock. The orifices will be spaced at 1 inch intervals.

8.3.25 Protection from Contamination

The spray bar will be protected as it is inside the tank.

8.3.26 Additional Treatment for Groundwater Supplies

The water will also be treated by chlorination.

8.3.27 Bypass

The tank inlet will be equipped with a bypass around the spray bar.

8.4 Iron and Manganese Control

Iron and Manganese control are not required and will not be provided.

8.5 Fluoridation

Fluoridation is not necessary and will not be provided.

8.6 Stabilization

The water is stable. Stabilization is not necessary and will not be provided.

8.7 Taste and Odor Control

Taste and odor control is not necessary and will not be provided.

8.8 Microscreening

Microscreening is not necessary and will not be provided.

8.9 Waste Disposal

No waste will be generated from these treatment processes.

9.0
PUMPING FACILITIES

9.0 General

9.0.1 Sanitary Protection

The pumping facility will be designed to maintain the sanitary quality of the pumped water.

9.0.2 100-Year Flood Plain

As evidenced by the Section 1.1.2, the treatment facility is not located within the 100-year flood plain.

9.1 Location

The underground water storage tank will serve as the pumping facility. The following sections, in this Section 9, will discuss only the pumps installed within the tank. The Treatment Facility is described in Section 3 – Facility Layout and the underground water storage tank is described in Appendix A – State of Colorado Design Criteria for Potable Water Systems Distribution and Storage.

9.2 Site Protection

9.2.1 Flood Elevation

Please see Section 1.1.2

9.2.2 Accessibility

Access to the storage tank pump will be provided by a MAASS Model 6JC1 1/4 Clamp-On Pitless Adapter, Part Number 928350.

9.2.3 Drainage

Please see the relevant sections in Section 3 and Appendix A.

9.2.4 Security

Please see Appendix A, Section 1.0.4

9.3 Pumping Stations

The underground storage tank is the only “pumping station.”

9.3.1 Operating Space

Please see the relevant sections in Section 3.

9.3.2 Durability

Please see Appendix A, Section 1.0.

9.3.3 Floor Elevation

Please see Section 3.2.5.

9.3.4 Underground Structure

The storage tank will be waterproofed according to AWWA's waterproofing criteria, such that no coatings will be applied to the storage tank that aren't NSF approved for contact with potable water. Please see Appendix A, Section 1.0.

9.3.5 Floor Drains
Please see Section 3.3.4.

9.3.6 Pump Drainage
Please see Section 9.4

9.3.7 Watertight
Please see Appendix A, Section 1.0.

9.3.8 Floor Slope
Please see Section 3.3.4.

9.3.9 Pump Protection - Contamination
The pumps are enclosed within the water storage tank and will be protected against contamination. Please see Appendix A.

9.3.10 Pump Protection - Humidification
The pumps are submersible pumps.

9.3.11 Lighting
Please see Section 3.3.2.

9.3.12 Facilities
Please see the relevant sections in Section 3

9.4 Pumps
Duplicate pumps will be provided and stored in the Treatment Facility for the supply pump (well pump) and the delivery pump (storage tank pump).

The delivery pump is a Grundfos 4-inch submersible pump Model 75S75-12, with a Franklin Electric 4-inch Sand Fighter 7.5 hp Submersible Motor. Neither the pump nor the motor are NSF 61 certified, however they are made with materials suitable for use in drinking water applications. Please see the pump specifications and a deviation request for this configuration in Appendix C.

9.4.1 Pump Capacity
The delivery pump is a stainless steel, variable frequency pump, as described above. The pump will be able to supply the average demand of 43 gpm against the maximum distribution system head of 206 feet. The pump will also be able to supply the max day demand of 86 gpm against the same head. Although the pump could also supply the peak hour demand of 108 gpm, the 2-inch pipeline will not carry the peak hour demand. When the pipe is replaced with 6-inch pipe,

the system head will be greatly reduced and the pump will then easily be able to also supply the peak hour demand. Please see the attached pump curves in Appendix C and the hydraulic profile in Appendix G.

Eventually, a second delivery pump will be installed in the underground storage tank, to provide redundancy to the system. The storage tank portals, the treatment facility water line layout, and the treatment facility electrical wiring are in place to support the addition of the second pump.

9.4.2 Pump Operation Environment

The pumps will be able to operate appropriately with the environmental constraints of the wells and storage tank. Please see Section 9.4 & 9.4.1

9.4.3 Parts

Applicable spare parts for each pump will be available.

9.5 Suction Lift

9.5.1 Prevention

Suction lift is avoided in this system. This section is not applicable.

9.6 Priming

The submersible pumps will not require priming.

9.7 Booster Pumps

Not Applicable

9.8 Automatic and Remote Controlled Stations

The well pump will be automatically controlled by a pump switch and a liquid level alarm installed in the storage tank. The pump switch will control the well pump by starting it when the tank reaches a certain low level and stopping it when the tank is full. A low liquid level alarm will also be installed to alert the operator, or homeowners, when the tank reaches a certain low level, as prescribed by the operator. The pump switch is a PumpMaster Plus Wide Angle Mechanical Pump Switch, Part Number SSFDB. The liquid level alarm is a SJE Rhombus Tank Alert 4XL. The alarm is installed with a mechanical float switch, not a mercury float sweet. Please see the attached Appendix C for further description of the liquid level alarm and the pump switch.

The delivery pump will be controlled by the pressure of the system. The system is equipped with a pressure transducer/transmitter valve and two Wellmate WM25WB pressure tanks. The pressure transmitter valve will regulate the delivery pressure of the system and will be set at the highest pressure demand. As demand is applied to the system, the pressure will decrease and the delivery pump will engage to meet the system demand. The pressure tanks will alleviate the start/stop operation of the pump by meeting small system demands. The pressure transmitter valve is a TURCK Part Number PT200PSIG-13-LI3-H1131, ID#

H6831460. An ABB ACS 550 Adjustable Speed AC Drive will be installed in the treatment facility to support this operation. The ABB AC Drive will also support the alternating operation of the two delivery pumps, once the second pump is put in place. Please see equipment specification sheets in Appendix C.

9.9 Valves

Backflow prevention valves, check valves, are installed on both the line from the well before entry to the storage tank, and the delivery pump discharge before any other treatment works. All valves will be AWWA approved and meet the criteria of the CDPHE. The valves are Danfoss Flomatic Model 80MDI Part Number 4084. Please see Appendix C for specifications. Please see the Treatment Train drawing in Appendix D for placement of the valves.

9.10 Piping

9.10.1 Friction Loss

The treatment facility pipe is designed to minimize friction loss. The pipe is 2-inch diameter.

9.10.2 Contamination

Cross connection restrictions will prevent contamination.

9.10.3 Joints

The piping will be designed with watertight joints.

9.10.4 Surge and Water Hammer

The piping will be designed to protect against surge or water hammer.

9.10.5 Similar Conditions

The system is designed so that both of the delivery pumps, after the second pump is installed at some point in the future, will have similar hydraulic and operating conditions.

9.11 Gauges and Meters

9.11.1 Pressure Gauge

The pump will be equipped with a standard pressure gauge on the discharge line.

9.11.2 Compound Gauge

Not applicable.

9.11.3 Recording Station

This system does not require a recording station.

9.11.4 Meter

Please see Section 9.11.5

9.11.5 Metering

A totalizing and recording meter will be installed on the water line after the pump, before system entry, to measure the flow of treated water.

9.12 Water Seals

The submersible pumps will be sealed by the manufacturer.

9.13 Controls

The pumps and accessories "shall be controlled in such a manner that they will operate at rated capacity without dangerous overload", as per the Colorado Design Criteria for Potable Water Systems. Please see Section 9.4.2.

9.14 Power

Please see Section 1.2.10.

9.15 Water Pre-Lubrication

Not Applicable.

Appendix A
DISTRIBUTION AND STORAGE

1.0 Water Storage General

All materials used in construction of the Happy Scenes Water System treatment and storage systems will meet the requirements of the Colorado Department of Health and Environment Water Quality Control Division, as recommended in Appendix I of the Design Criteria for Potable Water Systems and described in this Appendix A. All materials and construction standards shall follow applicable AWWA/NSF standards.

1.0.1 Sizing

The underground storage tank is 15,000 gallons, which provides a one day supply, assuming the maximum average daily in-house demand is 220 gallons per day per home at the maximum build-out of 68 homes or 242 gallons per day per home for the existing 62 taps. La Plata County's "minimum daily quantity requirement for in-house us is 195 gallons per day per dwelling", as per the County Code Section 82-186: Water Quantity and Quality Standards.

The tank will be 8 foot diameter by 46.75 feet long.

$$\pi \cdot \left(\frac{8 ft^2}{2}\right) \cdot (46.75 ft) \times \left(\frac{7.48 gal}{ft^3}\right) = 17{,}577 gallons$$

In the case of an emergency, water can be delivered to the tank to provide for the subdivisions needs.

1.0.2 Location of Ground-Level Reservoirs

This section is not applicable.

1.0.3 Protection

The underground tank, or finished water storage tank, is located on the Happy Scenes Water System utility easement. All access, pump and electrical, ports to the tank will be protected by manholes culverts with locking lids, that will protect the finished water supply from animals, birds, and insects.

1.0.4 Protection from Trespassers

The finished water supply will be protected trespassing, vandalism or sabotage. The manhole lid will be locking. Please see Section 1.0.3 and the Water Storage Tank drawings in Appendix D.

1.0.5 Drains

A drain is not installed in the storage tank. The location is extremely flat and there is no place to daylight a drain from the underground storage tank. If the tank needs to be drained, the operator will use a sump pump to evacuate the water.

1.0.6 Overflows

The 4-inch access pipe to the floats will also provide an overflow for the tank. The above ground end of the pipe will be inverted and screened with 24-mesh screen. The screen will be installed at the end of the pipe and also prior to the inversion. The 4-inch pipe will terminate 12 inches above the ground, lower than the 6-inch pump access pipe, to ensure that the water will exit the overflow before harming the electrical components of the pumps. Please see the Water Storage Tank Profile drawing in Appendix D.

1.0.6.a Elevated Tank Overflow

Not Applicable

1.0.6.b Ground-Level Tank Overflow

Not Applicable.

1.0.6.c Overflow Pipe

The overflow pipe will be 4 inch Schedule 40 PVC, sufficient to permit waste of water in excess of the filling rate.

1.0.6.d Overflow Pipe Protection

Twenty-four mesh non-corrodible screen will be installed at the end of the overflow pipe to protect the finished water supply from insects, birds and animals.

1.0.7 Access

The finished water storage tank is designed to provide convenient access to the interior for cleaning and maintenance. The tank is equipped with a 22 inch diameter manhole and an 8 foot NSF 61 certified fiberglass ladder (12 inches wide.)

1.0.7.a Manhole Elevation

The manhole culverts will be elevated at least 24 inches above the natural ground level. Please see the Water Storage Tank Profile drawing in Appendix D.

1.0.7.b Manhole Covers

The manholes will be fitted with a solid impervious watertight cover which overlaps the framed opening and extends down around the frame at least two inches. Please see the Water Storage Tank Cross Section drawings in Appendix D.

1.0.7.c Manhole Access

The manhole covers will be hinged at one side or easily removable by one person.

1.0.7.d Manhole Protection

The manhole covers will be equipped with a locking device.

1.0.7.e Manhole Access Hatches

The access hatches will be constructed of materials that are non-corrodible and non-biodegradable.

1.0.8 Vents

Vents are provided through the Baker Monitor caps on the 6-inch pump access pipes and also on the 4-inch overflow pipe. Please see the Water Storage Tank drawings in Appendix D.

1.0.8.a- 1.0.8.d Vent Protection

The vent will prevent the entrance of surface water and rainwater. The pipe will be capped with 24 mesh screen to exclude insects, birds and animals. The vent shall exclude insects and dust, as much as this function can be made compatible with effective venting. The vent will terminate in an inverted U with the opening at least 12 inches above the average annual snow depth and covered with 24 mesh non-corrodible screen.

1.0.9 Roof and Sidewall

All access ports, inlets, outlets and pump mountings are constructed of wound fiberglass and molded into place at the time of the tank construction.

1.0.9.a Metal or Concrete Tanks

Not Applicable

1.0.9.b Roof or Sidewall Openings

Any openings in the roof of the tank; access manholes, pump mountings, inlets, outlets, etc…, are molded as the tank is constructed and will prevent any contaminants from entering the tank.

1.0.9.c Related Equipment

All valves and related equipment will be installed outside of the storage structure.

1.0.9.d Superstructure

Not Applicable

1.0.9.e Local Building Codes

Not Applicable

1.0.9.f Wood Constructed Roof

Not Applicable

1.0.10 Drainage of Roof

Not Applicable

1.0.11 Safety

The safety of employees has been considered in the design of the storage tank. The storage tank will be marked with a placard indicating that it is a "confined space" and that all necessary precautions and regulations concerning confined spaces will be followed for entry. Therefore, Standard-29 Code of Federal Regulations (CFR) #1910.146 and applicable Appendices will be adhered to by all persons entering the tank for any necessary disinfection, or at any and all other times.

1.0.11.a Ladders

An NSF 61 approved, eight foot ladder will be provided inside each of the access manholes of the storage tank.

1.0.12 Freezing

The storage tank will be buried to a depth sufficient to prevent freezing.

1.0.13 Internal Catwalk

Not Applicable

1.0.14 Silt Stop

Not Applicable

1.0.15 Grading

The tank will be buried to a depth of five to six feet. The ground surface on and around the tank will be gently graded for a least twenty feet away from the tank to ensure run-off and snowmelt are directed away from the tank.

1.0.16 Painting and/or Cathodic Protection

The underground storage tank is equipped with an NSF 61 approved liner.

1.0.17 Disinfection

The finished water storage tank will be disinfected according to AWWA Standard C652, as explained in Section 3.14.

1.1 Plant Storage

Not Applicable

1.2 Pressure Tanks

Two Wellmate WM25WB pressure tanks are supplied to regulate the pressure of the system and protect against water hammer. They will not be utilized for water storage.

1.2.1 Location

The pressure tanks will be located in the treatment facility.

1.2.2 Sizing

This section is not applicable. The pressure tanks are not used for storage.

1.2.3 Piping

Bypass piping will be supplied to allow operation of the system while the tanks are out of service for maintenance or replacement.

1.2.4 Appurtenances

Not Applicable. See Section 1.2.

1.3 Distribution System Storage

1.3.1 Pressures

The underground water storage tank does not supply pressure for the distribution system. This section is not applicable.

1.3.2 Drainage

The underground water storage tank does not supply pressure for the distribution system. This section is not applicable.

1.3.3 Level Controls

Controls will be provided to maintain appropriate tank levels.

1.3.3.a Tank Level Pump Control

Please see the Design Report Section 9.8.

1.3.3.b Second or Subsequent Tanks

Not Applicable

1.3.3.c Overflow and Low-Level Warning Devices

An overflow and low-level warning light and alarm is provided on the outside of the treatment building to signal storage tank level problems. Please see the Design Report Section 9.8.

2.0 Distribution System

Please see Section 1.2.1 of the Engineering and Design Report.

APPENDIX H
ATTACHMENT 6
FINANCIAL PLAN

The Happy Scenes Water System (System) is a not for profit entity organized to manage and provide for system operation. The System is governed by a Board that is duly elected by the homeowners. The System contracts for legal, engineering, bookkeeping and operating expertise.

The System charges an annual assessment to all tap holders, regardless of water use. In recent years, the annual assessment was $350 per year. This assessment sufficiently covered the annual system operating and repair expenses, leaving $20,000 in reserves at the end of each year.

In 2008, the Pine River Irrigation District (water supplier through exchange agreement) changed its billing structure, the new water supply well was drilled, and plans and designs for the new treatment facility were initiated, with well drilling and partial construction of the treatment facility completed. The reserve accounts were used in full. The System applied for and was granted $75,000 in grants, with $25,000 from the Southwestern Water Conservancy District and $50,000 from the Colorado Water Conservation Board Water Supply Reserve Account via the Southwest Basin Roundtable. The new water supply and treatment expenses have greatly increased the annual operating budget. Also, the approved grants do not completely cover the construction expenses. Therefore, the annual assessments have been raised to $660 per year, or $55 per month. This new assessment also allows for the annual generation of reserve accounts.

The 2000 Census maintains La Plata County's average annual median household income (MHHI) was $40,159. The Colorado Department of Public Health and Environment's *New Water System Capacity Planning Manual* asserts that water rates should be no more than 1.5% of the MHHI. This would result in monthly water rates of $50 per month. The annual fee or $660, or $55 per month, is not excessive and is only 1.6% of the MHHI.

After the system has been constructed, costs confirmed, and the distribution system upgraded, the financial spreadsheet and annual assessments may change. Please see the attached spreadsheet.

The System undertakes a annual financial audit and discusses the budget at each meeting. Please see the System Bylaws attached to this Appendix H.

MANAGERIAL PLAN
OPERATION AND MAINTENANCE MANUAL

1. Description of Facilities

The treatment facility will house the treatment system. The building will be a wood frame construction on a concrete pad and will be 14 feet by 20 feet. The building has two separate rooms. The main room, an L-shaped room with approximately 225 square feet, will house the treatment train, portable generator, testing equipment, etc... The smaller storage room will house the 12% liquid chlorine, as well as the chlorine solution tank. The smaller storage room is at least 4.5 feet by 5.3 feet.

The treatment train consists of the chlorination equipment and all valves, taps and meters associated with its operation. The water will enter the facility from the well, the inlet line will be equipped with a Dole nickel plated, brass flow control valve, to regulate the flow to 50 gpm, a brass sampling spigot, a Neptune 2-inch flow meter, a Danfoss Flomatic check valve to prevent backflow, and the PULSAtron chlorine injection nozzle. A pressure gauge will be installed as the last component before the line exits the facility to the storage tank. The water will enter the storage tank through a spray bar, equipped with a valve to allow bypass of the spray bar. The water will be pumped back through the facility to the delivery lines. This line will be equipped with a pressure gauge, a transducer used to regulate the delivery pump, a main shut-off valve, a hose bib equipped with a pressure vacuum breaker, and a brass sampling spigot. Two Wellmate pressure tanks will be installed to help regulate the pressure of the system and the operation of the delivery pump. The water will exit the facility through three separate distribution lines. The three lines will be equipped with Neptune 2-inch flow meters and ball valves. The distribution Line #3 will also be equipped with a pressure reducing valve and a pressure gauge. Please see the Design Report for a full description of the facilities, the equipment specifications in Appendix C and the Treatment Train drawing in the attached Appendix D (of the Design Report).

2. System Contact Information

Physical Location of Plan:

265 Trust Dr, Bayfield, CO 81122

Operator In Responsible Charge Contact Information:

Fred Stephenson
109 Rio Vista Circle, Durango, CO 81301
970-247-4271
redfred@frontier.net

Administrative Contact Information:

Margie Miller
1577 CR 500, Bayfield, CO 81122
970-884-6080
margiekmiller@msn.com

Owner/Board Representation Contact Information:

Quentin Wray, President
185 Hope Road, Bayfield, CO 81122
970-884-2424

3. System Organizational Structure

The System consists of a Board, a secretary, an operator and the homeowners. The Board will contract with the operator and have ultimate responsibility for the System. As indicated in the CDPHE Capacity Planning Manual, the operator will be responsible for control of chemical application processes, initiation or termination of the water source, repair and preventative maintenance of treatment equipment and distribution system, compliance monitoring, reporting, and record keeping.

The Board, secretary and homeowner responsibilities are delineated in the System Rules and Regulations, Articles I and III, and Bylaws, Articles IV, V and VIII. The Rules and Regulations and Bylaws are attached to this Managerial Plan.

4. System Legal Basis and Easements

The Happy Scenes Water System is a non-profit corporation managed by the Board of Directors within the limits provided by Colorado Law, Articles of Incorporation and the adopted Bylaws.

The System has easements for the distribution system and the treatment facility. The easements for the treatment facility are attached to the Design Report in Appendix F.

The System leases water from the Pine River Irrigation District under yearly contract. The contract is attached to the Design Report in Appendix E.

5. Startup and Normal Operation Procedures

The certified operator will operate the system in compliance with the manufacturer's recommendations.

Start-up operations shall include, but not be limited to, the following:

- Manually engage the well pump.
- Ensure the hypochlorinator engages as the well pump engages and the stream of flow passes the injection point.
- Ensure the flow control valve is restricting the flow to 50 gpm.
- Check that the meter, on the supply line is accurately recording the flow.

- Set the shutoff float at a low volume and fill the tank before engaging the delivery pump to ensure the pump shutoff float operates properly.

- Manually engage the delivery pump.
- Check the pressure gauges and meters for proper operation.
- Check the main shutoff valves and the ball valves on the delivery lines.
- Check all sampling taps for proper operation.
- Check the lines, pressure tanks, and all valves and fittings for leaks.

- Set the system to automatic operation and ensure the low level float engages the well pump.
- Ensure the hypochlorinator engages as the well pump engages and the stream of flow passes the injection point.
- Check all gauges and meters.
- Apply demand to the system and ensure the delivery pump engages.

The facility will normally operate automatically, with the only equipment to start, shutdown and operate being the sodium hypochlorinator, the supply pump and the distribution pump. The Design Report Section 9.8 describes the process as, "The well pump will be automatically controlled by a pump switch and a liquid level alarm installed in the storage tank. The pump switch will control the well pump by starting it when the tank reaches a certain low level and stopping it when the tank is full. A low liquid level alarm will also be installed to alert the operator, or homeowners, when the tank reaches a certain low level, as prescribed by the operator. The pump switch is a PumpMaster Plus Wide Angle Mechanical Pump Switch, Part Number SSFDB. The liquid level alarm is a SJE Rhombus Tank Alert 4XL. The alarm is installed with a mechanical float switch, not a mercury float sweet. Please see the attached Appendix C for further description of the liquid level alarm and the pump switch.

The delivery pump will be controlled by the pressure of the system. The system is equipped with a pressure transducer/transmitter valve and two Wellmate WM25WB pressure tanks. The pressure transmitter valve will regulate the delivery pressure of the system and will be set at the highest pressure demand. As

demand is applied to the system, the pressure will decrease and the delivery pump will engage to meet the system demand. The pressure tanks will alleviate the start/stop operation of the pump by meeting small system demands. The pressure transmitter valve is a TURCK Part Number PT200PSIG-13-LI3-H1131, ID# H6831460. An ABB ACS 550 Adjustable Speed AC Drive will be installed in the treatment facility to support this operation. The ABB AC Drive will also support the alternating operation of the two delivery pumps, once the second pump is put in place. Please see equipment specification sheets in Appendix C."

The hypochlorinator will be set to engage when the well pump engages.

A log will be kept regularly, showing instantaneous and total flow amounts, operating pressures, chlorine residuals, water quality testing dates and results, at a minimum. Other information may be included on the log as determined appropriate by the certified operator.

6. Maintenance Program

The operator will periodically maintain the water system as necessary for the water usage. Besides keeping the treatment facility clean, the largest maintenance concern will be the hypochlorinator pump, which will be cleaned and maintained per manufacture's recommended technique and frequency. The supply and delivery pumps will also be maintained per manufacturers' recommendations. The pumps are submersible pumps that do not need to be primed, so maintenance activities should be minimal.

Leaks will be repaired as soon as possible and standing water will be mopped up. Window and doors will be kept in high operational capacity. Equipment packaging and other trash will be immediately removed from the site. The workbench and document center will be kept well organized, dry, and free of clutter.

7. Sampling and Analysis

The operator will conduct water quality sampling and analysis as required by the Colorado Department of Public Health and Environment Monitoring Schedule. At the least, the operator will conduct the following tests:

- VOC & SOC quarterly for the first two quarters and then once every three years.
- Lead and Copper quarterly for the first two quarters
- Chlorine Residual twice per week
- Bact. T monthly
- Nitrate/Nitrite quarterly for the first year and then once per year
- In-Organics once every three years
- TTHM HAA5 at least once with the new well
- MPA at least once with the new well

8. Staffing and Training

A certified operator with the necessary training and licensing will be hired. The system requires the operator to have Treatment Level D and Distribution Level One Certification. The operator will train members of the System Board as necessary for sampling, systems checks, or emergency management.

9. Potential Pollution or Contamination Sources

The System will restrict the storage of hazardous materials or waste within the Happy Scenes Subdivision land, as allowed by state and federal guidelines. Other potential contamination sources were identified and discussed in the Design Report Section 1.2.7. A map, included in the Design Report Appendix F, showing locations of domestic or industrial water dischargers within 2.5 miles of the well is attached to this Operation and Maintenance Manuel.

10. Safety Program

The only chemical to be used in water treatment is sodium hypochlorite. Protective clothing, including gloves and glasses should be worn at all times when handling the equipment used in chemical application, as well as the chemical storage drums. The window in the chemical storage room should be opened while the operator is in the room.

The storage tank is buried five to six feet underground. When it is necessary to access the tank, the outer fiberglass lid of the manhole should be completely removed and set aside. The ladder should be used for entry. The tank manhole lid should also be removed entirely from the manhole.

The storage tank will be marked with a placard indicating that it is a "confined space" and that all necessary precautions and regulations concerning confined spaces will be followed for entry. Therefore, Standard-29 Code of Federal Regulations (CFR) #1910.146 and applicable Appendices will be adhered to by all persons entering the tank for any necessary disinfection, or at any and all other times.

The Board is responsible for the safety training of the operator, as well as any other Board members or homeowners that have access to the treatment facility.

11. Unaccounted for Water

The distribution system has three main lines that exit the treatment facility. Each of these lines will be metered. This will assist in localizing any potential leaks.

Currently, the delivery lines to each home are not metered and the homeowners all have the same annual assessment for their water use. As explained in the Design Report, the System plans to eventually upgrade all of the 2-inch distribution lines to 6-inch. When this upgrade is made and each meter pit must be excavated to connect the 6-inch line, meters will then be installed to each home.

12. Emergency Management Plan

The water system and the system operator will develop an emergency management plan. Once it is complete, copies will be kept at the treatment plant and with the Association president.

13. Manufacturers Manuals

An original, clean, easy to read, copy of the manufacturers' manuals for the supply and delivery pumps, the chlorine injection pump, portable testing equipment, and the ABB Adjustable Speed Drive will be kept in the treatment plant. A copy of these manufacturers' manuals will be provided to the secretary of the water system nonprofit organization, as well.

11. Water System Policies

The water system policies are incorporated into the Rules and Regulations and will be updated as necessary by the water system nonprofit organization and the operator. A copy of the Water System Rules and Regulations will be attached to this O&M Manual and kept in the treatment plant, as well as with the secretary for the water system nonprofit organization. Water system policies include:

- Budget development and rate structure,
- Water system responsibilities,
- Customer responsibilities,
- Cross-connection control,
- Customer information or public education,
- Customer complaints, and
- Response and notification if water quality violations occur.

Attachments to the Managerial Plan

- Rules and Regulations
- Bylaws