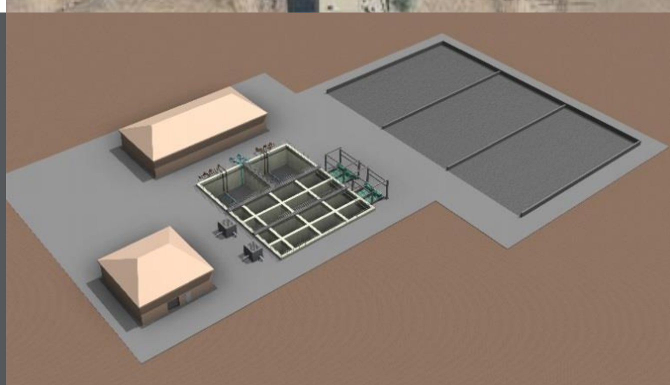

PRELIMINARY ENGINEERING REPORT

Quill Wastewater Treatment Facility

Santa Fe County, New Mexico

June 2017

ENGINEER'S CERTIFICATION

I, Edward A. DuBois Jr., certify that I am a licensed Professional Engineer registered in the State of New Mexico (PE #17615), and that this document was prepared by me or under my direction.

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NEW MEXICO
17615
LICENSED PROFESSIONAL ENGINEER

6/20/17

Edward A. DuBois, Jr., P.E.

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Abbreviations and Terminology

af	acre-feet
af/yr	acre-feet per year
BBER	Bureau of Business & Economic Research [UNM]
BOD	biochemical oxygen demand
City	City of Santa Fe
County	Santa Fe County
DIP	ductile iron pipe
DO	dissolved oxygen
EPA	Environmental Protection Agency
gal	gallon
gpd	gallons per day
gpm	gallons per minute
GPS	Geospatial & Population Studies [UNM]
GWQB	Groundwater Quality Bureau [NMED]
GWDP	Groundwater Discharge Permit
HDPE	high density polyethylene
HDR	HDR Engineering, Inc.
HMI	human machine interface
hp	horsepower
kW	kilowatt
kWh	kilowatt hour
LOT	limit of technology
LS	lift station
MBR	membrane bioreactor
MCC	motor control center
MF	microfiltration
MG	million gallons
mgd	millions of gallons per day
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System

O&M	Operations and Maintenance
OSE	Office of the State Engineer
PER	Preliminary Engineering Report
PNM	Penitentiary of New Mexico
PS	pump station
psi	pounds per square inch
PCCP	prestressed concrete cylinder pipe
PVC	polyvinyl chloride
RAS	return activated sludge
SBR	sequencing batch reactor
SCADA	supervisory control and data acquisition
sf	square feet
SFC	Santa Fe County
SWPPP	Stormwater Pollution Prevention Plan
State	State of New Mexico
TDH	total dynamic head
UF	ultrafiltration
VFD	variable frequency drive
WAS	waste activated sludge
WW	wastewater
WWTF	Wastewater Treatment Facility

When dealing with irrigation and land application, water quantities are generally expressed in terms of acre-feet, which can be defined as an area of 1 acre with a depth of 1 foot of water. In terms of the wastewater treatment facility, water quantities are generally expressed in terms of million gallons per day (mgd). When referencing pumping capacities, water quantities are provided in terms of gallons per minute (gpm). Some commonalities of terms need to be addressed for the ease of the reader such as:
Reclaimed Water = Reuse Water
Ground Water Discharge = Land Application or Irrigation
Tank = Basin
1 acre = 43,560 square feet
1 acre-foot = 325,850 gallons
1 mgd = 694 gpm

1)

Project Planning

1) Project Planning

Santa Fe County (County) owns and operates the Quill Wastewater Treatment Facility (WWTF), which treats domestic wastewater. The WWTF requires significant improvements to meet the National Pollutant Discharge Elimination System (NPDES) requirements, provide beneficial use of reclaimed wastewater with no setback/access limits, plan for future expansion, and meet anticipated limits for land application of biosolids.

The County has contracted HDR Engineering, Inc. (HDR) to prepare a Preliminary Engineering Report (PER) to evaluate alternatives to upgrade the existing Quill WWTF. The goals for the PER are to:

- Review regulatory requirements.
- Document and describe existing conditions at the facility.
- Analyze size and capacities of existing wastewater infrastructure and provide preliminary sizing for new infrastructure.
- Summarize and provide design criteria and estimates of probable construction costs for proposed facilities.
- Develop a phasing plan for constructing the new WWTF for the preferred alternative.

It is estimated the WWTF was originally built in the 1960s with additions such as the Operations Building built in 1989. The WWTF treats domestic wastewater from local residential neighborhoods and the nearby prison, Penitentiary of New Mexico (PNM). The WWTF's maximum treatment capacity is 280,000 gallons per day (gpd) and has the ability to discharge treated effluent by land-applying over 95 acres as permitted by the New Mexico Environment Department (NMED) Groundwater Discharge Permit (GWDP) DP-234. The current average daily flow is approximately 136,000 gpd.

The County does not currently possess a NPDES permit for the discharge of treated effluent to surface waters of the United States. It is assumed that a NPDES permit will be issued as a result of the proposed improvements in this PER, which will be similar to the City of Santa Fe's (City) Paseo Real WWTF permit limits, since both facilities eventually discharge to the Rio Grande.

HDR met with County staff and WWTF operators multiple times to discuss their needs and proposed improvements. The County intends to decommission the existing facility and construct a new WWTF to meet NPDES/GWDP requirements and is actively considering connection of additional service areas.

a. Location

Santa Fe County is located in north central New Mexico, which includes the City of Santa Fe. The Quill WWTF is approximately 1 mile south of the intersection of Interstate 25 and NM 599; directly west of NM 14 and located within the PNM property. A map showing the overall County wastewater collection system is provided in Appendix A. A vicinity map of Quill WWTF is shown in Figure 1.

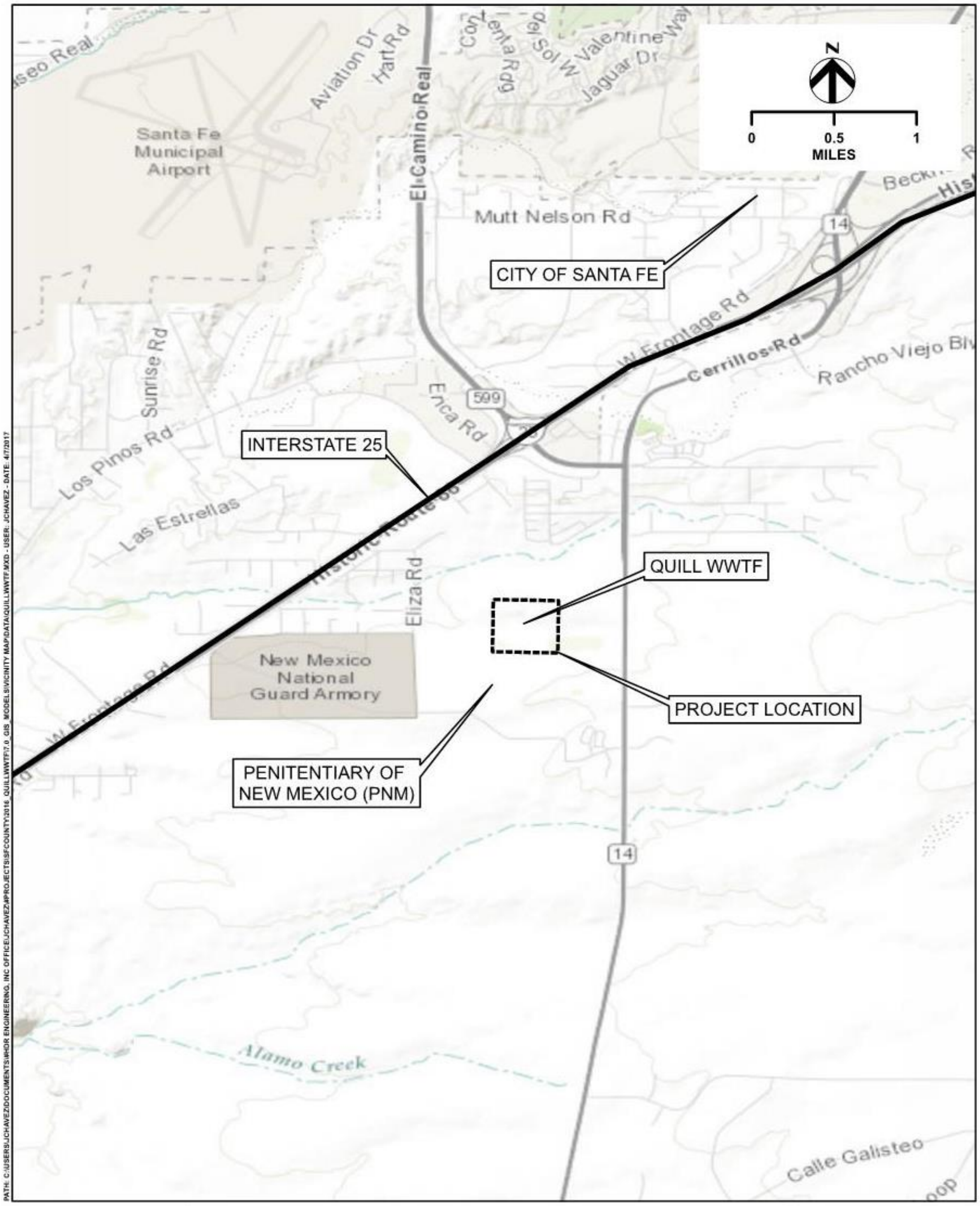

Figure 1: Vicinity Map for Quill WWTF

b. Environmental Resources Present

An Environmental Information Document (EID) has not been prepared for this project. If local funding is used, an EID will not be required. If federal funding is used, an Environmental Assessment (EA) following the National Environmental Policy Act (NEPA) process will be required.

It is assumed there are no known archaeological, cultural, or other historic resources identified at the existing WWTF due to its already disturbed state.

Biological resources are limited at the site since the area is disturbed and in use for the existing wastewater treatment plant and irrigation areas of reuse water.

See Section 2) for NPDES/GWDP requirements.

c. Population Trends

The planning period for this PER is 20 years, to the year 2037. The population growth for the area is developed for the 20-year period.

According to the 2010 US Census, the population of Santa Fe County was estimated to be 144,170. Table 1 summarizes the population trends for Santa Fe County.

Table 1: Population Trends

Year	1990	2000	2010	2015	2020	2030	2040
Santa Fe County Population	98,928	129,292	144,170	148,238	151,767	162,782	175,242
Cumulative County % Change	--	30.7	42.2	45	47.4	54.7	62.4

Note: Information interpreted from US Census (2015), UNM BBER, and UNM GPS

The University of New Mexico (UNM) Bureau of Business & Economic Research (BBER) and Geospatial & Population Studies (GPS) departments develop population projections throughout the state and estimates an approximate 62.4% increase in population for Santa Fe County from year 1990 to year 2040. This percentage increase projects a future population of 175,242 for Santa Fe County in year 2040. The City of Santa Fe is included in the population numbers.

Currently, contributing wastewater flows to the WWTF are approximately 136,000 gpd average daily flow with a maximum daily flow of 280,000 gpd. The main contributors are from the PNM, NM National Guard Complex via a private lift station, Valle Vista Subdivision via a lift station, Santa Fe County Business Park Development, and the New Mexico Film Studio.

There are several existing developed areas and undeveloped areas within the potential service area (SDA-1) that could be served by the Quill WWTF as shown in Figure 2. Much of the potential growth depends on the type of development and infill of those undeveloped areas. The City of Santa Fe is operated independently and is not associated with this PER.

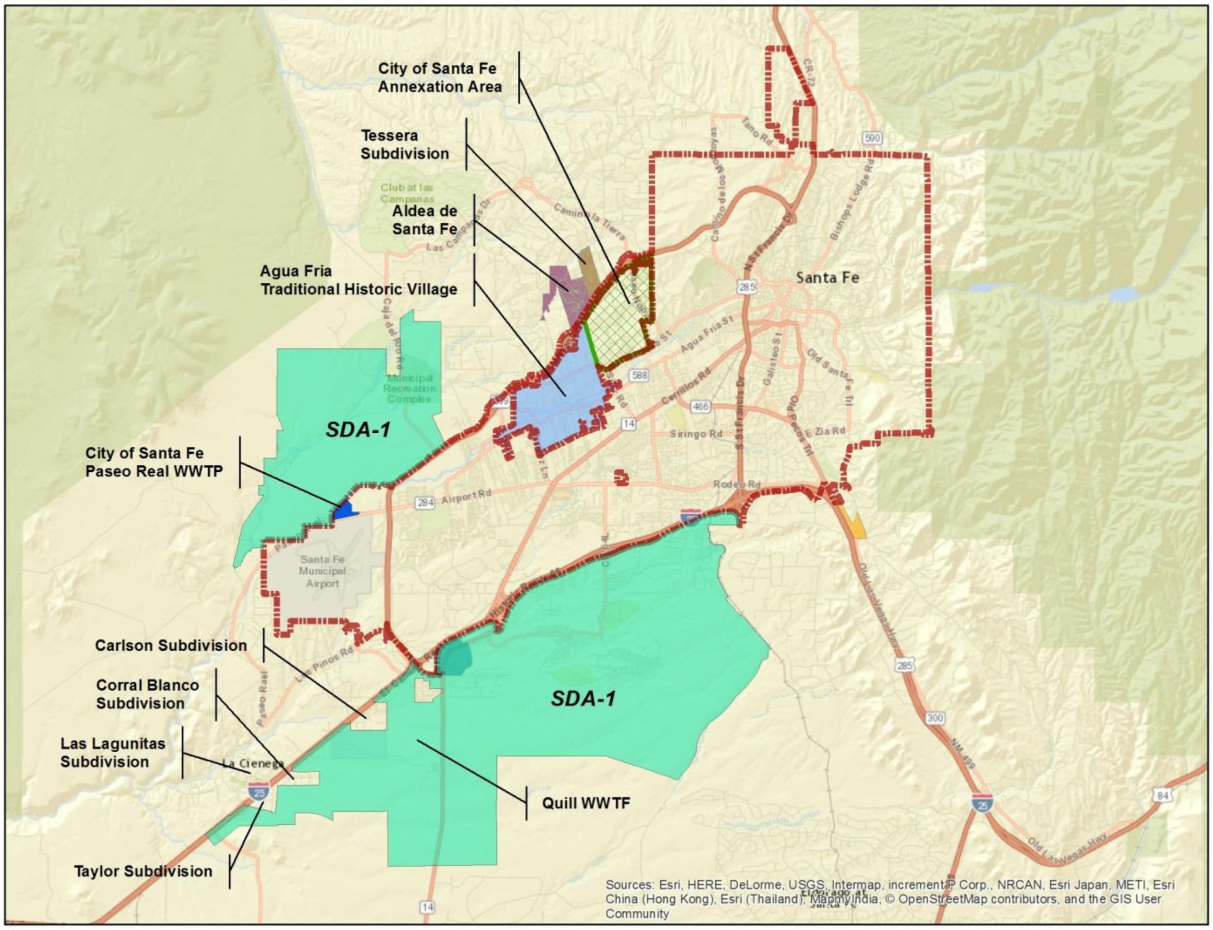

Figure 2: SFC Development Areas

Potential growth areas within in the County will be studied in a subsequent Wastewater Master Plan in 2017.

The existing Abajo lift station could be brought on-line to the Quill WWTF in the near future. The Abajo lift station has a capacity to pump 450 gpm [approx. 0.65 million gallons per day (mgd)] although the existing wastewater volume is much lower. A map showing the overall County wastewater collection system is provided in Appendix A.

Overall build out of the Quill WWTF has the potential to reach 2.0 mgd for the 20 year planning period based on discussions with County staff. As directed by County staff, a phased modular approach to for the new WWTF using 0.5 mgd as the standard increment was used. Evaluations were performed for both 0.5 mgd and 1.0 mgd treatment process options with the associated headworks and disinfection to be sized for both 1.0 and 2.0 mgd options. Based on discussions with County staff, a 0.5 mgd plant will be the basis of design with flexibility to expand to 1.0 mgd, which could potentially been seen in about 10 years.

With limited funding in today's economy, communities are trying to optimize capital and not over plan for potential growth.

d. Community Engagement

The Quill WWTF and utilities have been discussed at County meetings over the recent years. The intent of public involvement is to help the community develop an understanding for the need of the project and funding to meet these requirements.

2)

Existing Facilities

2) Existing Facilities

a. Location Map

The approximate Quill WWTF property boundary is shown in Figure 3. All major components of the system are located within this property boundary. All staff, visitors, and construction crews must enter through PNM's guarded entrance to gain access to the Quill WWTF.

b. History

The Quill WWTF was built more than 50 years ago to treat domestic wastewater from nearby collection systems, including PNM located nearby, with a maximum treatment capacity of 280,000 gpd.

The WWTF currently utilizes aerated lagoons and settling ponds for biological treatment and disinfection via chlorine. The treated effluent produced at the WWTF does not consistently meet GWDP standards.

Other recent improvements include:

- Constructed headworks and operations building – 1989
- Installed irrigation reuse pumps – 2014
- Replaced mechanical fine screen in the headworks building – 2015
- Modified the existing irrigation system to allow for the land application of reuse water during the winter – 2015

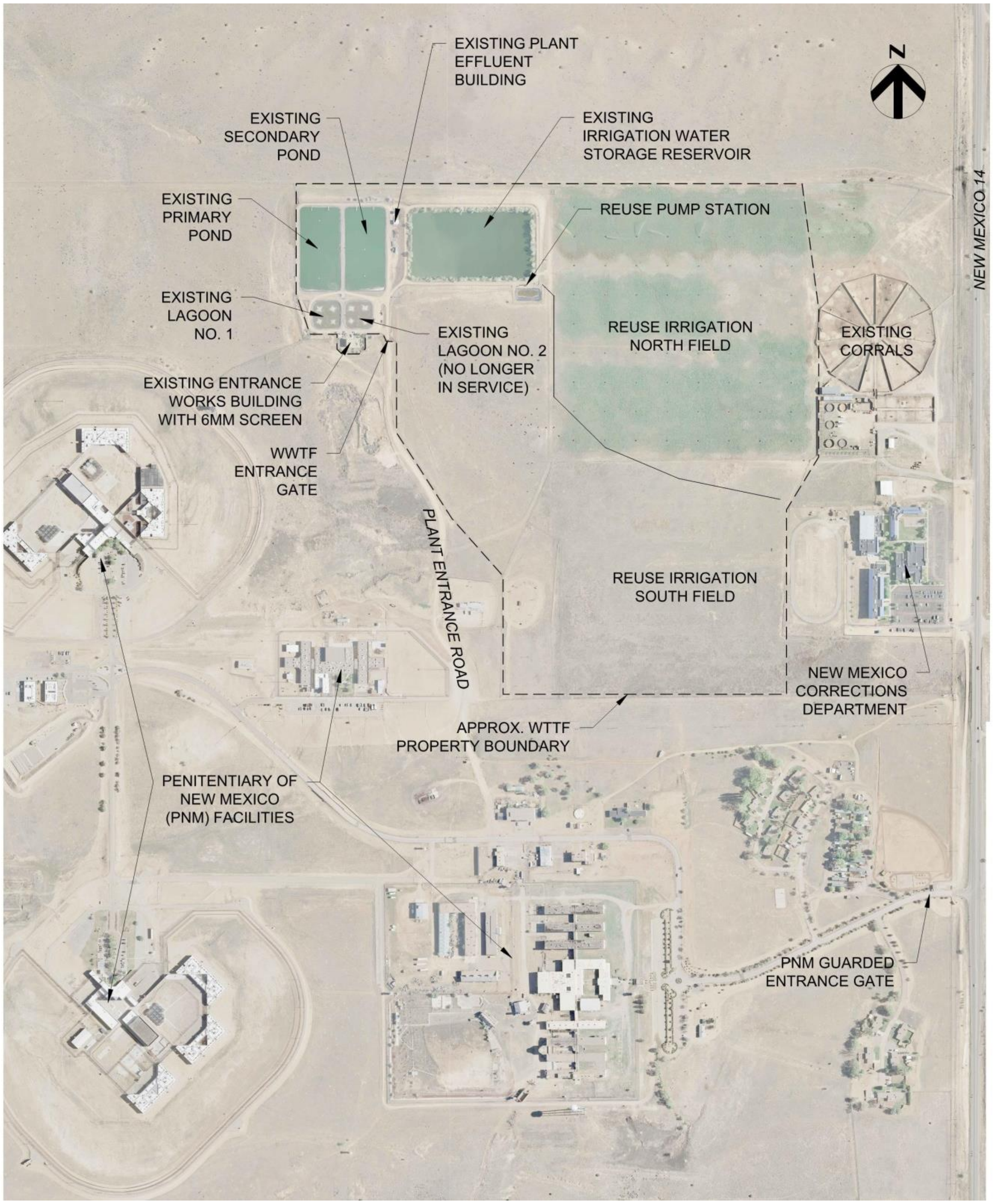

Figure 3: Quill WWTF Boundary and Entrance

c. Condition of Existing Facilities

The existing biological wastewater treatment process utilizes aerated lagoons and settling ponds, and is consistently unable to meet the NPDES requirements for Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS). In addition, the treatment process does not have the capability for nitrogen removal which is typically required for land application. The following tables were compiled from existing influent and effluent data taken at the Quill WWTF over the past three years. Phosphorous was not sampled over that period, but future testing will start in 2017. See Appendix B for influent and effluent flow data.

Table 2: Existing Influent Data

Limit	Units	Average	Maximum
Flow	mgd	0.136	0.289
BOD, Influent	mg / L	323	680
TSS, Influent	mg / L	215	620
Total Nitrogen, Influent	mg N / L	42	53
Total Phosphorus, Influent	mg P / L	--	--

Table 3: Existing Effluent Data and Existing GWDP Requirements

Limit	Units	Existing Effluent (30 Day Avg.)	Existing GWDP (30 Day Avg.)	Existing GWDP (Max.)
Fecal Coliform	org/100 mL	130	200	400
BOD, Effluent	mg / L	33.1	30	45
TSS, Effluent	mg / L	75.7	30	45
Total Nitrogen, Effluent	mg N / L	16.2	--	20
Total Phosphorus, Effluent	mg P / L	--	--	--
Turbidity, Effluent	mg P / L	Monitor Only	Monitor Only	Monitor Only

As shown in Table 3, the existing WWTF is unable to meet even NMED GWDP Class 2 limits. County operations has honorably tried to maintain the existing WWTF functionality, but due to its advanced age, deteriorating conditions, inadequate technology, and limited potential for upgrades and/or repairs is unable to do so.

The existing WWTF consists of an entrance works, recirculation pump station, aerated lagoons, settling ponds, exit works disinfection, effluent pump station, reuse storage pond, irrigation pump station, reuse irrigation system, and laboratory/operations building. The entrance works consists of both influent mechanical and manual bar screens, parshall flume and junction box. The exit works includes the chlorine contact basin and chlorine equipment building. A condition summary of the existing facilities is provided in the following table.

Table 4: Condition Summary

Component	Condition	Failure(s)
Entrance Works	Good	None
Recirculation Pump Station	Fair	None
Aerated Lagoons	Poor	Yes
Settling Ponds	Poor	Yes
Exit Works Disinfection – Chlorine Contact Basin, Chlorine Equipment Building	Fair	None
Effluent Pump Station	Fair	None
Reuse Storage Pond	Poor	Yes
Irrigation Pump Station	Good	None
Reuse Irrigation System	Good/Fair	None
Electrical / Controls / Instrumentation	Poor	Yes
Laboratory – Building, Operations	Good	None

No violations have occurred, but as stated earlier, the existing WWTF is unable to meet the Class 2 permit. Further information on the condition of existing WWTF components is described as follows.

Entrance Works

Known failures: None

Condition: Good

The existing entrance works building was built in the 1990s. The mechanical screen was replaced in 2015 with a 0.25 in (6 mm) Lakeside Raptor® Micro Strainer screen. This Lakeside mechanical screen and the influent bypass equipped with a manual bar screen are to remain in place and undisturbed for this project. This 6 mm screen is shown in The effluent leaving the entrance works enters the parshall flume. This parshall flume was installed in the 1990's and includes a head sensing ultrasonic flow meter and chart sensing. The junction box capturing the effluent leaving the entrance works is designed to split wastewater flow into both aerated lagoons. Current operations only direct wastewater into Lagoon No. 1 (west) since Lagoon No. 2 (east) is no longer in operation.

Figure 4: Existing 6 mm Lakeside Screen

Recirculation Pump Station

Known failures: None

Condition: Fair

The existing recirculation pump station was built in approx. year 1990. This pump station includes a junction and splitter box for controlling the amount of wastewater entering and leaving either the settling ponds or the aerated lagoons. The wastewater from both the setting ponds and aerated lagoons then recirculates back to this pump station to create a recycle process. This pump station includes two recirculation ponds. This pump station will be abandoned in place.

Aerated Lagoons

Known failures: Lagoon No. 2 (east) has been taken out of service due to a leak, which is believed to be caused by settling and damage to the liner.

Condition: Poor

There are two existing high-density polyethylene (HDPE) lined aerated lagoons, each of which are equipped with four 10 hp floating aerators. These aerated lagoons are shown in Figure 5. Both aerated lagoons have a 10 foot sidewater depth (SWD). These lagoons have a cell capacity of approx. 0.84 MG each and cover a surface area of approx. 0.4 acres each. Both aerated lagoons are currently serving as sludge storage, and have never been cleaned. It is unknown exactly how much sludge has settled in the lagoons, but the volume is estimated to be substantial. The sludge will need to be removed and disposed in the future. Lagoon No. 2 will be removed and regraded in all options. Lagoon No. 1 could be used as an overflow emergency storage basin for influent flows or removed and regraded as well. The HDPE liner may need to be replaced if the lagoon is reused as an overflow.

Figure 5: Existing Aerated Lagoon and Settling Ponds

Settling Ponds
Known failures: Both ponds are subject to substantial algae growth because they are shallow and the sunlight can penetrate to the bottom of the pond. Since there is no easy way to remove solids from these settling ponds, the solids tend to go septic and rise to the surface creating odors.

Condition: Poor

There are two existing HDPE lined settling ponds that have a 5 foot SWD. The purpose of these ponds is to settle out solids from the aerated lagoons. Each of the settling ponds is equipped with three 5 hp floating aerators. The settling ponds are shown in the distance in Figure 5. These ponds have a cell capacity of approx. 2.9 MG each and cover a surface area of approx. 2 acres each. These settling ponds are to be either abandoned in place or used for treated effluent storage for the new WWTF system selected for this project, but new HDPE liners would be required. Both settling ponds are currently serving as sludge storage, and have never been cleaned. It is unknown exactly how much sludge has settled in the ponds, but the volume is estimated to be substantial. The sludge will need to be removed and disposed in the future.

Exit Works
Known failures: None

Condition: Fair

Flow from the settling ponds is transferred to the chlorine contact basin where disinfection is accomplished with the use of a sodium hypochlorite tablet dispensing system. The treated effluent is then released back to the settling ponds or the reuse storage pond. A new chlorine equipment building was built in the 1990's and the disinfection equipment was replaced and the chlorine contact basin was renovated.

Effluent Pump Station
Known failures: None

Condition: Fair

The effluent pump station was renovated in the 1990's with a new effluent lift station including two Flygt submersible pumps. There is a transit time flow meter installed at this pump station.

Reuse Storage Pond
Known failures: The reuse pond has reached its storage capacity on several occasions throughout the years and spilled over to the northwest. The improvements to the winter reuse irrigation system have corrected the issue.

Condition: Fair

The existing storage pond has a cell capacity of approximately 20 MG of reclaimed water effluent. This effluent is then discharged or land applied on property owned by the Penitentiary of New Mexico (PNM) adjacent to the WWTF. This pond is clay-lined with concrete sidewalls and covers a surface area of approx. 5.5 acres. This storage pond could continue to be used as is, abandoned in place, or regraded and relined with HDPE pending funding.

Irrigation Pump Station
Known failures: None

Condition: Good

The irrigation pump station was renovated in 2014 with a new irrigation lift pump assembly. This pump station is shown in Figure 6.

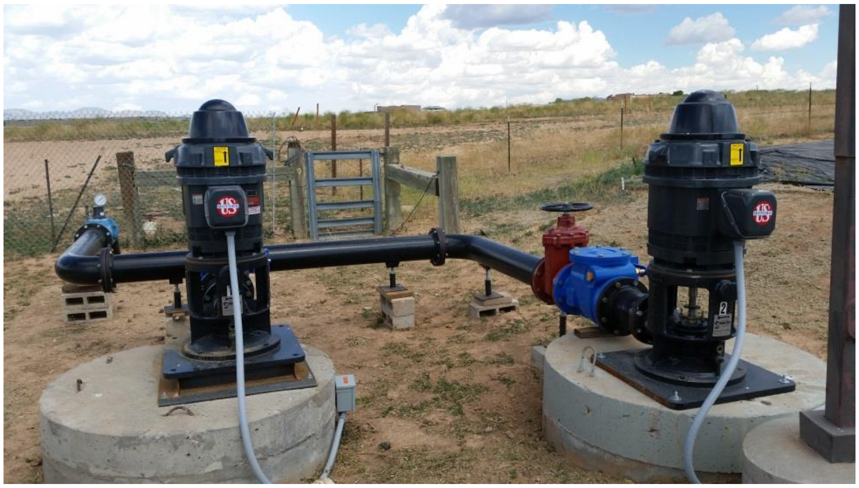

Figure 6: Existing Reuse Irrigation Pumps

Reuse Irrigation System

Known failures: None

Condition: Good/Fair

A portion of the reuse irrigation sprinkler system was improved in 2015 to allow for winter irrigation. The area irrigated with reuse effluent is split into two sections: north field and south field. The north field is approx. 57 acres of rangeland and the south field is approx. 38 acres of rangeland. The sprinkler system used for irrigation is shown in Figure 7. A reclaimed water, or reuse, study is planned to be conducted in the near future. Depending on the findings of the study and/or the WWTF system selected for this project, further improvements in the irrigation system may be required in the future.

Figure 7: Existing Irrigation Sprinkler System

Electrical / Controls / Instrumentation
Known failures and violations: None

Condition: Poor

All electrical, controls, and instrumentation equipment required or impacted by this project, including a backup generator, will be installed or replaced, respectively.

Laboratory – Building, Operations
Known failures and violations: None

Condition: Good

The existing laboratory building was built in the 1990's, and is shared with Operations and Entrance Works. Operators currently only perform limited testing, so the size of the existing operations and laboratory building is adequate for the existing facility. It is anticipated that additional in-house testing will be necessary with the new treatment process implementation for process control. This may require minor modifications including additional equipment.

d. Financial Status of any Existing Facilities

The County operates both water and sewer systems within in the County and funds the utilities through a variety of sources including utility bonds, loans, impact fees, utility revenues, and state and county grants. It is anticipated that this project will be funded through a utility bond. It is anticipated that the County will have approximately $8 million for construction not including engineering services. Information on costs, including Annual O&M, may be found in Section 6).

Rate Schedules
Table 5 shows fees and charges by calendar year set forth according to Santa Fe County Ordinance No. 2014-II.

Table 5: Sewer Rate Schedule

Calendar Year During Which Rates are Effective	Monthly Fixed Fee	Monthly Usage Charge (Per 1,000 Gallons Above Base Rate of 1,000 Gallons)
2015	$ 7.54	$ 4.50
2016	$ 7.73	$ 4.50
2017	$ 7.95	$ 4.69
2018	$ 8.18	$ 4.89
2019 and Each Calendar Year	$ 8.42	$ 5.10

Calendar Year During Which Rates are Effective	Monthly Fixed Fee	Monthly Usage Charge (Per 1,000 Gallons Above Base Rate of 1,000 Gallons)
Thereafter		

A future Rate Study and Cost of Service study will be included in the County's Wastewater Master Plan.

e. Water / Energy / Waste Audits

No audits of the existing Quill WWTF have been completed. However, the new facilities should optimize energy costs by using VFDs (variable frequency drives), energy efficient pumps, premium efficiency motors and other methods to ensure the County that this project is sustainable.

3)

Need for Project

3) Need for Project

As mentioned in previous sections, the existing Quill WWTF requires significant improvements to meet the GWDP/NPDES requirements and increase capacity for future growth. In addition, the County would like the new facility to provide beneficial use of reclaimed wastewater with no setback/access limits, prepare for future expansion, and meet anticipated limits for land application of solids.

a. Health, Sanitation, and Security

Land application or irrigation of land using reclaimed wastewater is considered groundwater discharge since the water can percolate down to the groundwater. The State regulates the use of reclaimed wastewater to ensure the protection of public health and the environment. The NMED Groundwater Quality Bureau (GWQB) is responsible for issuing land application GWDPs by class as shown in Table 6.

The County's current GWDP follows Class 2 quality standards; however, the County would like to meet Class 1A and anticipated future NPDES permit requirements. Table 7 summarizes the minimum water quality requirements for Class 1A reuse. Access and restrictions for Class 1A reuse is listed below in Table 8.

Table 6: Approved Uses for Reclaimed Wastewater by Class

Class of Reclaimed Wastewater	Approved Uses
Class 1A ***(Classification for Proposed Quill WWTF)***	All Class 1 uses. *No setback limit* to dwelling unit or occupied establishment
	Backfill around potable water pipes
	Irrigation of food crops [1]
Class 1B	Impoundments (recreational or ornamental)
	Irrigation of parks, school yards, golf courses [2]
	Irrigation of urban landscaping [2]
	Snow making
	Street cleaning
	Toilet flushing
	Backfill around non-potable piping
Class 2 ***(Classification for Existing Quill WWTF)***	Concrete mixing
	Dust control
	Irrigation of fodder, fiber, and seed crops for milk-producing animals
	Irrigation of roadway median landscapes
	Irrigation of sod farms

Class of Reclaimed Wastewater	Approved Uses
	Livestock watering
	Soil compaction
Class 3	Irrigation of fodder, fiber, and seed crops for non-milk-producing animals
	Irrigation of forest trees (silviculture)

[1]Irrigation of food crops should only be allowed for food crops when there is no contact between the edible portion of the crop and the wastewater. Spray irrigation is prohibited for food crops.

[2] If reclaimed wastewater is applied using spray irrigation, the setback limitation of Appendix C of this report) "Spray Irrigation" should be observed. (NMED GWQB)

Table 7: Class 1A Reclaimed Wastewater Effluent Requirements

Class of Reclaimed Wastewater	Wastewater Quality Parameter	Wastewater Quality Standards	
		30-Day Average	Maximum
Class 1A	BOD_5	10 mg/l	15 mg/l
	Turbidity	3 NTU	5 NTU
	Fecal Coliform	5 organisms per 100 ml	23 organisms per 100 ml
	TRC or UV Transmissivity	Monitor Only	Monitor Only

Note: Class 1B, 2, and 3 not shown; see Appendix C for complete table

Table 8: Class 1A Reclaimed Wastewater Access Restrictions and Setback Requirements

Class of Reclaimed Wastewater	Spray Irrigation	Flood / Surface Drip Irrigation
Class 1A	• No access control • No set-back to dwelling unit or occupied establishment	No access control

Note: Class 1B, 2, and 3 not shown; see Appendix C for complete table

The new WWTF will meet NMED Class 1A for effluent reuse with no setback limits and no access limits. The NMED classes are shown in Table 6. Any disposal/aquifer recharge during the winter season shall meet requirements of the acquired National Pollutant Discharge Elimination System (NPDES) permit.

Currently, the County does not use an NPDES permit for the Quill WWTF. The Environmental Protection Agency (EPA) and NMED are currently in discussions for the City of Santa Fe's (City) WWTF NPDES permit limits. The limits are much stricter than the City's current NDPES permit or the County's Valle Vista subdivision permit (NM0028614). It is assumed that any future County NPDES permit would have to meet similar requirements of the City's NDPES permit. Therefore, the following information is based on the current discussions about the City's proposed NPDES permit limits.

The limits are separated into two Tiers. Tier 1 level would be immediately implanted at the City WWTF (i.e. Paseo Real) while Tier 2 levels would be implemented sometime in the near future. The Tier 1 levels for the City's potential NPDES limits are that of 6.9 mg N/L total nitrogen and 3.1 mg P/L total phosphorus. Tier 2 levels have significantly stricter requirements. The Tier 2 levels of 3.0 mg N/L total nitrogen and 1.0 mg P/L total phosphorus are based on a combination of a logical step-wise reduction in limits from Tier 1 coupled with the limit of technology (LOT). It is well documented that LOT for total nitrogen limits is in the range of 3 to 4 mg N/L. Most of the existing plants located in areas with impaired waters, such as Chesapeake Bay, are typically required to meet a total nitrogen discharge limit of 3 mg N/L. The LOT for nitrogen was deemed a worst-case scenario for the City and used as the Tier 2 limit.

1. The 1.0 mg P/L total phosphorus (i.e. Tier 2) was selected for the following reasons:
2. It is a common discharge level that HDR sees nationally.
3. It is a reasonable step reduction from Tier 1 (3.1 mg P/L) to a more stringent level

The LOT for total phosphorus is approximately 0.02 mg P/L, which would result in a reduction of two orders of magnitude from the Tier 1 level of 3.1 mg P/L. The 0.02 mg P/L represents the amount of soluble non-reactive P in the stream. This amount will vary from plant to plant which is why the value was listed as approximately. A reduction of this magnitude is not considered practical or likely by regulatory agencies; therefore, 1.0 mg P/L total phosphorus will be used as a more likely next step in limits.

Using NPDES Tier 2 permit requirements will improve marketability of reuse water. A few possibilities include credit returns and selling reuse water potential customers such as to the City. Therefore, the proposed Quill WWTF shall be designed to meet the proposed Tier 2 limits based on the City's WWTF:

- 3.0 mg N/L total nitrogen
- 0.1 mg P/L total phosphorus

More detail on wastewater treatment regulations and requirements may be found in Section 3) and Appendix C.

Since the Total Nitrogen target is 3 mg N/L, some additional wastewater characterization should be completed prior to design. Specifically, testing on influent carbon characterization to identify the portion of influent load that is amenable to nutrient load reduction should be conducted. Given that limits for both biological P and N reduction, carbon becomes a scarce commodity.

If there is not sufficient carbon, external carbon would have to be provided. Given the plant size, Micro-C would be used at approximately $2.50/gal. In order to calculate demand, the testing would identify how much additional carbon is required for max month to size the facilities, followed by day to day for O&M.

In addition, supplementary testing on influent BOD/TSS should be completed prior to design. Due to the lack of frequency of the BOD/TSS influent data and their existing range of recorded values, if these values are found to be higher and more frequently, then the facilities might have to be made slightly larger.

b. Aging Infrastructure

The WWTF requires significant improvements to meet EPA's NPDES and NMED's GWDP requirements, provide beneficial use of reclaimed wastewater with no setback/access limits, plan for future expansion, and meet anticipated limits for land application of biosolids.

County operations has valiantly tried to maintain the existing WWTF functionality, but it is in urgent need of replacement, due to its advanced age, deteriorating conditions, inadequate technology, limited potential for upgrades and/or repairs, and inability to consistently meet existing NMED GWDP Class 2 limits.

Throughout NM and the US, communities have to meet lower standards to provide for the beneficial use of reclaimed water. A full-scale wastewater process replacement enables the County to meet NMED GWDP Class 1A limits and anticipated future EPA NPDES limits. Compliance with the NPDES permit as stated in the previous section will enable the County to discharge to surface water, for example to the Rio Grande in exchange for water rights and provides the treatment required for possible aquifer storage recovery (ASR).

The existing WWTF as stated in Section 2) will be decommissioned with the exception of the Operations Building, new mechanical fine screen, reuse storage pond, and reuse irrigation system.

c. Reasonable Growth

Estimating the projected wastewater flows for the new WWTF is not straightforward. For the entire planning area, the anticipated future flow rates may be as high as 2 mgd, which would include currently developed and undeveloped land. However, it is unlikely that the entire planning area will be connected and/or developed by the design year of this PER, which is 2037. Potential growth areas within in the County and number of new connections will be studied in a subsequent Wastewater Master Plan in 2017.

Therefore, after discussions with County staff, the average daily design flowrate for the Quill WWTF was determined to be 0.5 mgd for the main process, with the expectation that expansion to 1.0 mgd will occur within the design period. Headworks and UV will be sized for 1.0 or 2.0 mgd which is more appropriate.

However, as shown in Section 4), site plans were developed for both alternatives with an average daily flow of 0.5 mgd and 1.0 mgd, respectively.

4)

Alternatives Considered

4) Alternatives Considered

After discussions with County staff, two alternatives were ultimately considered for this project. The first alternative is a membrane bioreactor (MBR) system. The second alternative is a sequencing batch reactor (SBR) system. A “do nothing” alternative was not considered because the Quill WWTF is not consistently meeting the existing GWDP or future NPDES permit requirements and it is inconsistent with the County’s plan to use reclaimed wastewater for beneficial uses and land applied solids.

Each system was steady-state process modeled using HDR’s Envision model to confirm manufacturer’s recommendations. HDR’s approach to flows for the modeling included an Average Annual (0.5 mgd), Max Month (0.6 mgd), and a Peak Flow (1.0 mgd) with a 1.2 peaking factor.

4.1) Membrane Bioreactor (MBR)

a. Description

The MBR alternative includes new mechanical fine screening/grit, BNR, MBR, followed by UV disinfection.

The MBR is a variation of the activated sludge process and relies on membrane separation of solids. Secondary clarifiers in a conventional system are replaced by these membranes which are located at the end of the activated sludge basin to capture and return biomass to the beginning of the basin (i.e. return to the beginning of the activated sludge process). These membranes are mounted in modules that can be lowered into the bioreactor, and are subjected to a vacuum that draws water through the membrane while retaining solids in the basin. This process has the ability to sustain high sludge concentrations while providing a high quality effluent. A general concept of an MBR with a nitrification and partial denitrification configuration is shown in Figure 8.

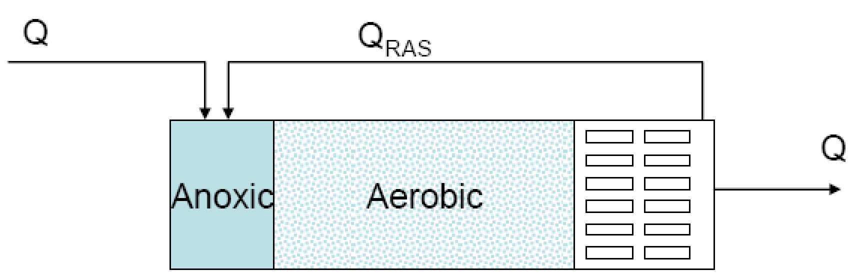

Figure 8: General MBR Configuration with Nitrification & Denitrification

The MBR process requires better wastewater pretreatment than conventional systems. A 1 mm or 2 mm fine screen will need to be added before the MBR with no opportunity to bypass or overflow this screen. This screen can be either a perforated plate or a drum. It is not unusual for a MBR system to have a two stage screening process; for example, a 6 mm screen followed by a 2 mm screen. Effective grit removal is also important as grit abrades to the membrane and reduces its effective life.

Following, the BNR/MBR process, UV disinfection would occur.

Solids handling is accomplished by aerobic digestion and concrete sludge drying beds that are composted by a paddle aerator. Class A sludge will be produced and may be hauled off to a landfill or used as compost on various parks, fields, etc.

A process schematic of the MBR system is shown in Figure 9.

Since there are several companies manufacturing the proprietary MBR system, the construction of the system can be competitively bid. These companies include, but are not limited to, Evoqua (formerly known as Siemens), GE, Huber, Kubota, and Mitsubishi. Manufacturer information is provided in Appendix D.

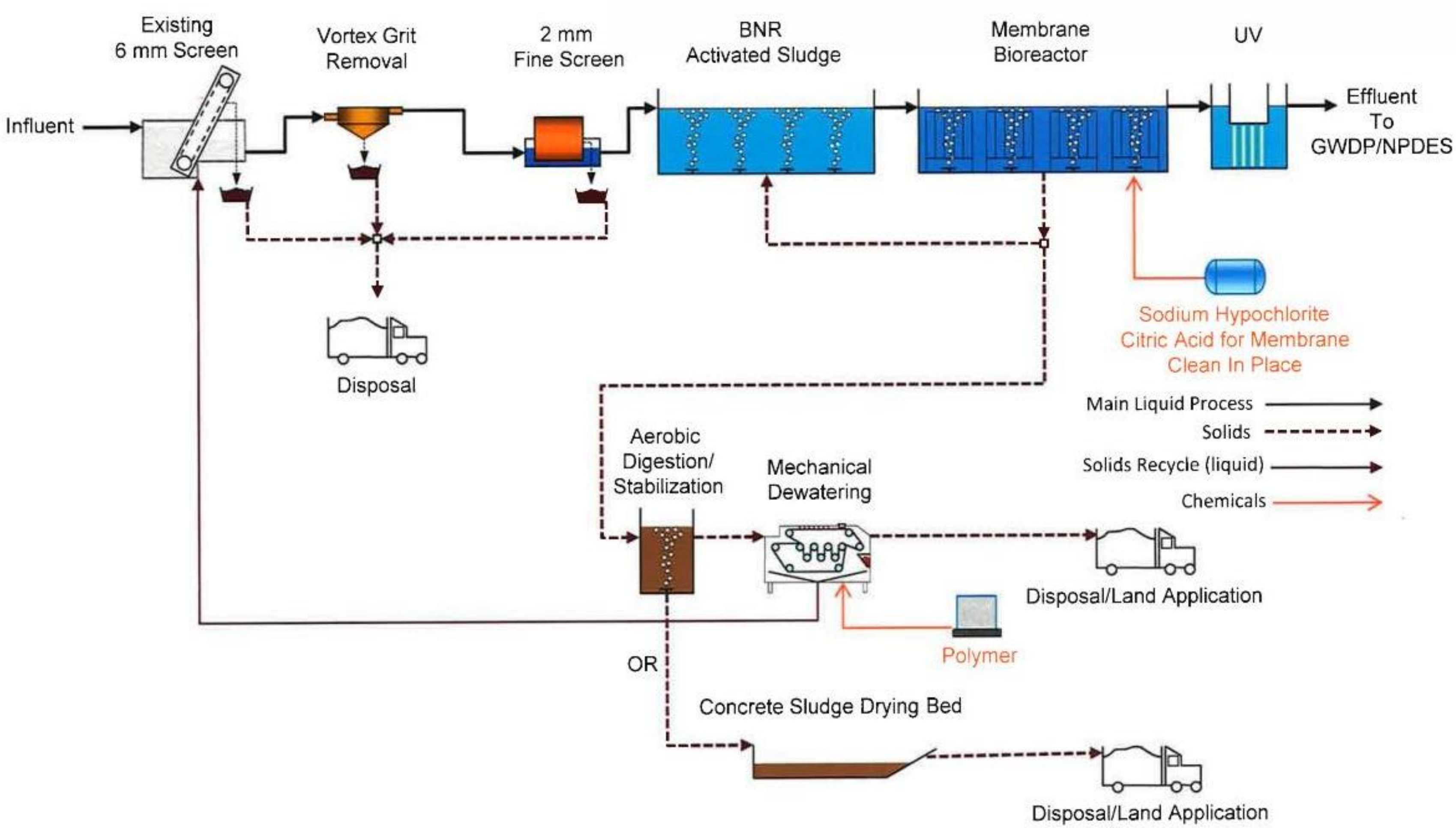

Figure 9: MBR Process Schematic

b. Design Criteria

The following listed information describes the design criteria for the MBR alternative:

- Meet all applicable NPDES Tier 2 permit requirements, including:
  - Effluent quality less than 3.0 mg N/L total nitrogen
  - Effluent quality less than 1.0 mg P/L total phosphorus
- Discharge from the WWTF by effluent reuse shall meet GWQB and NMED Class 1A permit requirements.

More detail on wastewater treatment regulations and requirements may be found in Section 3) and Appendix B.

c. Map

The proposed site plan of the preliminary MBR system implementation with both a 0.5 mgd and 1.0 mgd sizing for the County is shown in Figure 10 and Figure 11, respectively.

Major improvements include:

- New Fine Screen and Grit Building
- New Operations Building with blowers, RAS pumps, Sodium Hypochlorite/Citric Acid Equipment, and UV Disinfection
- Biological Basins and Aeration Equipment
- MBR Basin and Equipment
- Aerobic Digesters
- Concrete Sludge Drying Beds

Other items that could be additive alternates include:

- Aeration Lagoon No. 1 – remove and dispose including sludge removal
- Primary Settling Pond – remove and dispose including sludge removal
- Primary Settling Pond – regrade and reline for additional reuse storage
- Secondary Settling Pond – remove and dispose including sludge removal
- Secondary Settling Pond – regrade and reline for additional reuse storage

TO REPLACE SHEET

Figure 10: 0.5 mgd Design Flow MBR Proposed Location

TO REPLACE SHEET

Figure 11: 1.0 mgd Design Flow MBR Proposed Location

d. Environmental Impacts

It is not expected that there will be any environmental impacts with either of the proposed alternatives. All new construction will be within the existing property and specifically, areas which are already disturbed.

The site must be graded to prevent storm water runoff.

e. Land Requirements

The implementation of this treatment alternative will fit within the footprint of the existing WWTF property as indicated in the location layouts in both Figure 10 and Figure 11. All new structures will be constructed within existing property. Therefore, no additional land or easements are anticipated at this time.

f. Potential Construction Problems

The following is a list of potential construction problems that need to be considered for the MBR system:

- All staff, visitors, and construction crews must enter through PNM's guarded entrance to gain access to the Quill WWTF entrance gate. The WWTF site is large enough to accommodate construction staging and a contractor field office, so mobilization of construction equipment and materials is not anticipated to be problematic.
- The construction activities for this alternative would exceed 1 acre of ground disturbance, so a Stormwater Pollution Prevention Plan (SWPPP) will be required by the contractor.
- A geotechnical investigation will need to be performed prior to design.
- The preference to locate the MBR facility at the existing aerated lagoons location may create minor problems with the existing treatment operation.
- The nearby location of the PNM may require additional security and safety measures during construction.

g. Sustainability Considerations

I) Water and Energy Efficiency

The MBR allows for water and energy efficiency. This alternative addresses water efficiency by allowing for more effective reuse water which impacts water conservation in a positive manner. The new facilities will allow for more energy efficient design and practices. The MBR may use more electricity but the carbon footprint is significantly reduced due to compact size.

II) Green Infrastructure

The MBR alternative provides for the reuse of treated effluent for either NPDES or GWDP uses. This process aids in water conservation for the community. The site will be graded to not allow for stormwater runoff from the site.

I) Other Sustainability Considerations
The new facilities will optimize energy costs by using VFDs (variable frequency drives), energy efficient pumps, premium efficiency motors and other methods to ensure the County that this project is sustainable.

h. Cost Estimates

Estimates of probable construction costs for a new MBR facility are summarized in Table 9 and provided in Appendix E. Costs were obtained from the most updated cost estimating guides and from the most recent construction costs from similar projects. Equipment costs were obtained from various equipment manufacturers.

This cost estimate includes a 20% contingency, which will be refined as the design is completed. These costs may fluctuate due to bidding climate or when actual construction occurs.

Table 9: MBR WWTF – 0.5 mgd Design Flow – Cost Estimate

Component	MBR
Site Work, including Mobilization and Demobilization	$758,855
Existing Wastewater Ponds	$20,000
Fine Screen and Grit Building	$1,095,000
Operations Building	$989,100
Biological Basins	$440,000
MBR Basin	$1,712,000
Aerobic Digesters	$330,000
Sludge Drying Beds	$268,000
Permits, Bonds, Insurance, Start-up, Testing Allowance	$295,000
Subtotal	**$5,907,955**
Contingency @ 20%	$1,181,591
Total Estimated Construction Costs	**$7,089,546**
Engineering @ 10%	$708,955
Survey & Geotechnical	$10,000
Construction Observation Services @ 3%	$212,686

Component	MBR
Subtotal Total Estimated Costs	**$8,021,187**
NMGRT @ 7%	$561,483
TOTAL ESTIMATE OF PROBABLE COSTS	**$8,582,670**

Table 10: MBR WWTF – 1.0 mgd Design Flow – Cost Estimate

Component	MBR
Site Work, including Mobilization and Demobilization	$836,000
Existing Wastewater Ponds	$20,000
Fine Screen and Grit Building	$1,204,000
Operations Building	$1,048,500
Biological Basins	$800,000
MBR Basin	$2,179,500
Aerobic Digesters	$645,000
Sludge Drying Beds	$400,000
Permits, Bonds, Insurance, Start-up, Testing Allowance	$395,000
Subtotal	**$7,528,000**
Contingency @ 20%	$1,505,600
Total Estimated Construction Costs	**$9,033,600**
Engineering @ 10%	$903,360
Survey & Geotechnical	$10,000
Construction Observation Services @ 3%	$271,008
Subtotal Total Estimated Costs	**$10,217,968**
NMGRT @ 7%	$715,258
TOTAL ESTIMATE OF PROBABLE COSTS	**$10,933,226**

4.2) Sequencing Batch Reactor (SBR)

a. Description

The SBR alternative is an activated sludge process operated under non-steady state conditions (i.e. varies with time). A SBR can have multiple operation configurations:

- A fill-and-draw type of reactor system that involves single completely mixed reactors. The need for separate sedimentation tanks is not necessary since the mixed liquor remains in the reactors during all cycles.
- A true batch mode with aeration and sludge settlement both occurring in the same basin.

The preferred SBR configuration for the County is the true batch configuration. Therefore, the true batch configuration will be referred to as the SBR alternative moving forward.

The main difference between SBR and conventional continuous-flow, activated sludge systems is sequence parameters. The SBR basin carries out the functions of equalization, aeration and sedimentation in a time sequence rather than in the conventional space sequence of conventional continuous-flow systems. Additionally, the SBR system can be designed with the ability to treat a wide range of influent volumes whereas the conventional continuous system is based upon a fixed influent flowrate. Thus, there is flexibility associated with working in a time sequence.

The SBR system produces sludge with good settling properties, provided the influent wastewater is admitted into the aeration in a controlled manner. An appropriately designed SBR process is a unique combination of equipment and software. The software automated controls reduce the number of operators required to operate this system. The availability of computerized controls in recent years has made the SBR process more attractive.

As mentioned, the SBR system operates by automated cycles, including fill, react, settle, decant and idle. The duration, dissolved oxygen concentration, and mixing in these periods could be altered according to the needs of the specific treatment facility. Appropriate aeration and decanting is essential for the correct operation of the SBR system. The majority of the SBR aeration equipment consists of jet, fine and coarse bubble systems. In this alternative, solids handling is accomplished by aerobic digestion and/or concrete sludge drying beds that are composted by a paddle aerator. As discussed with the County, the disc filters for the SBR system are preferred to be sand filters. This alternative is well proven in the industry to produce reclaimed water quality effluent.

Following, the BNR/SBR process, flow will proceed to a sand filter before UV disinfection.

Solids handling is accomplished by aerobic digestion and concrete sludge drying beds that are composted by a paddle aerator. Class A sludge will be produced and may be hauled off to a landfill or used as compost on various parks, fields, etc.

A process schematic of the SBR system is shown in Figure 12.

Since there are several companies manufacturing the proprietary SBR system, the construction of the system can be competitively bid. These companies include, but are not limited to, Evoqua (formerly known as Siemens) and Xylem. More information on manufacturer details may be found in Appendix E.

b. Design Criteria

The following listed information describes the design criteria for the MBR alternative:

- Meet all applicable NPDES Tier 2 permit requirements, including:
  - Effluent quality less than 3.0 mg N/L total nitrogen
  - Effluent quality less than 1.0 mg P/L total phosphorus
- Discharge from the WWTF by effluent reuse shall meet GWQB and NMED Class 1A permit requirements.

More detail on wastewater treatment regulations and requirements may be found in Section 3) and Appendix C.

c. Map

The proposed site plan of the preliminary SBR system implementation with both a 0.5 mgd and 1.0 mgd sizing for the County is shown in Figure 13 and Figure 14, respectively.

- Major improvements include:
- New Grit Building
- New Operations Building with blowers
- SBR/Biological Basin and Equipment
- UV Building
- Effluent Filter
- Aerobic Digesters
- Concrete Sludge Drying Beds

Other items that could be additive alternates include:

- Aeration Lagoon No. 1 – remove and dispose including sludge removal
- Primary Settling Pond – remove and dispose including sludge removal
- Primary Settling Pond – regrade and reline for additional reuse storage
- Secondary Settling Pond – remove and dispose including sludge removal
- Secondary Settling Pond – regrade and reline for additional reuse storage

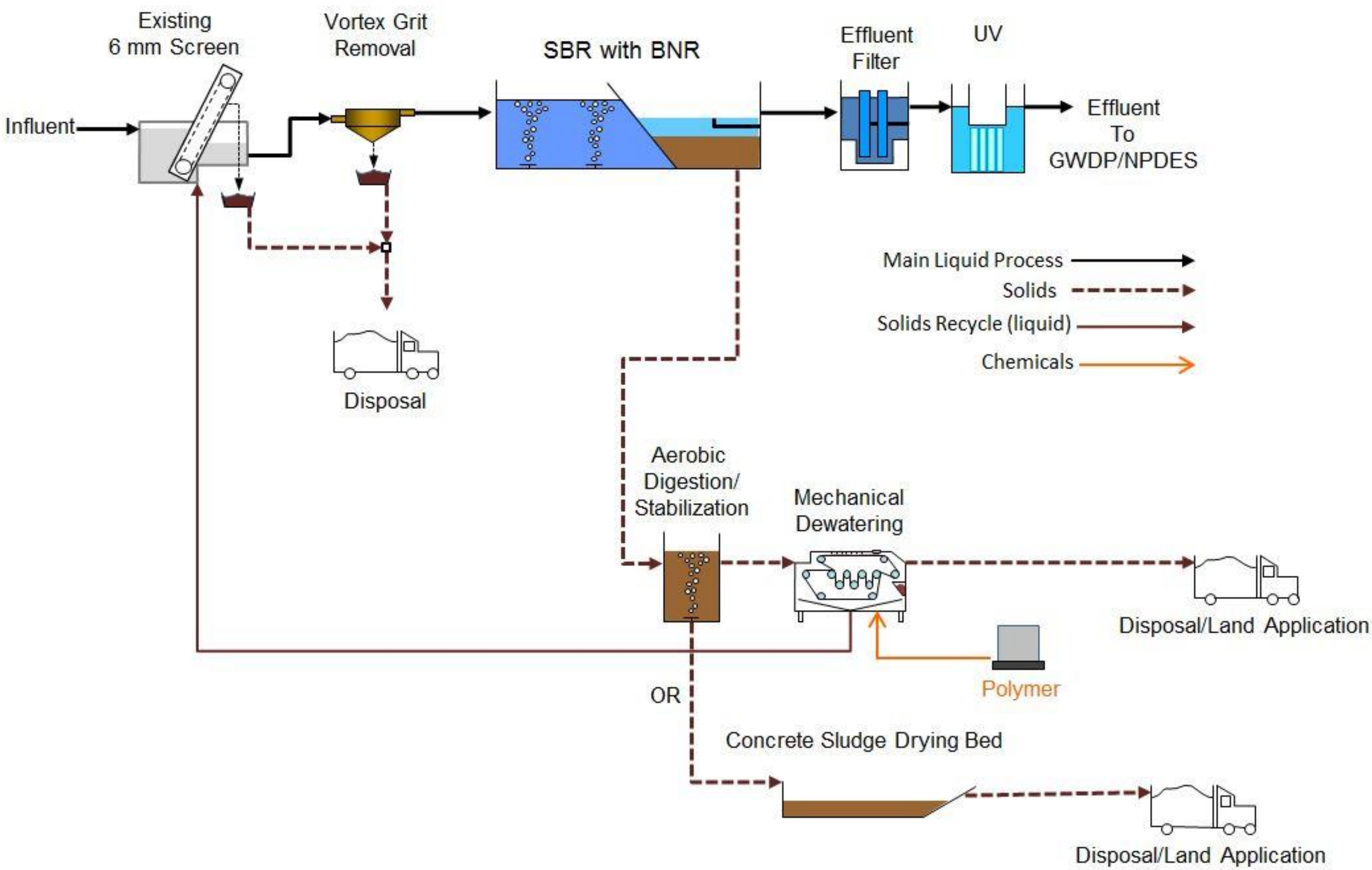

Figure 12: SBR Process Schematic

TO REPLACE SHEET

Figure 13: 0.5 mgd Design Flow SBR Proposed Location

TO REPLACE SHEET

Figure 14: 1.0 mgd Design Flow SBR Proposed Location

d. Environmental Impacts

It is not expected that there will be any environmental impacts with either of the proposed alternatives. All new construction will be within the existing property and specifically, areas which are already disturbed.

The site must be graded to prevent stormwater runoff.

e. Land Requirements

The implementation of this treatment alternative will fit within the footprint of the existing WWTF property as indicated in the schematic layout in Figure 12. All new structures will be constructed within existing property. Therefore, no additional land or easements are anticipated at this time.

f. Potential Construction Problems

The following is a list of potential construction problems that need to be considered for the SBR system:

- All staff, visitors, and construction crews must enter through PNM's guarded entrance to gain access to the Quill WWTF entrance gate. The WWTF site is large enough to accommodate construction staging and a contractor field office, so mobilization of construction equipment and materials is not anticipated to be problematic.
- The construction activities for this alternative would exceed 1 acre of ground disturbance, so a Stormwater Pollution Prevention Plan (SWPPP) will be required by the contractor.
- A geotechnical investigation will need to be performed during design.
- The preference to locate the SBR facility at the existing aerated lagoons location may create minor problems with the existing treatment operation.
- The nearby location of the PNM may require additional security and safety measures during construction.

g. Sustainability Considerations

I) Water and Energy Efficiency

The SBR allows for water and energy efficiency but less than the MBR alternative. The new facilities will allow for more energy efficient design and practices.

II) Green Infrastructure

The SBR alternative provides for the recycle and reuse of treated effluent for either NPDES or GWDP uses. This process aids in water conservation for the community. The site will be graded to not allow stormwater runoff from the site.

III) Other Sustainability Considerations

The new facilities will optimize energy costs by using VFDs (variable frequency drives), energy efficient pumps, premium efficiency motors and other methods to ensure the County that this project is sustainable.

h. Cost Estimates

Estimates of probable construction costs for a new SBR facility are in summarized in Table 11 and Table 12 and provided in Appendix E. Costs were obtained from the most updated cost estimating guides and from the most recent construction costs from similar projects. Equipment costs were obtained from various equipment manufacturers.

This cost estimate includes a 20% contingency, which will be refined as the design is completed. These costs may fluctuate due to bidding climate or when actual construction occurs.

Table 11: SBR WWTF – 0.5 mgd Design Flow – Cost Estimate

Component	SBR
Site Work, including Mobilization and Demobilization	$809,575
Existing Wastewater Ponds	$20,000
Grit Building	$561,000
Operations Building	$455,000
UV Building	$339,100
SBR / Biological Basins	$1,618,000
Effluent Filter	$242,500
Aerobic Digesters	$330,000
Sludge Drying Beds	$268,000
Permits, Bonds, Insurance, Start-up, Testing Allowance	$295,000
Subtotal	**$4,938,175**
Contingency @ 20%	$987,635
Total Estimated Construction Costs	**$5,925,810**
Engineering @ 10%	$592,581
Survey & Geotechnical	$10,000
Construction Observation Services @ 3%	$177,774
Subtotal Total Estimated Costs	**$6,706,165**

Component	SBR
NMGRT @ 7%	$469,432
TOTAL ESTIMATE OF PROBABLE COSTS	**$7,175,597**

Table 12: SBR WWTF – 1.0 mgd Design Flow – Cost Estimate

Component	SBR
Site Work, including Mobilization and Demobilization	$930,170
Existing Wastewater Ponds	$20,000
Grit Building	$586,000
Operations Building	$455,000
UV Building	$398,500
SBR / Biological Basins	$3,166,000
Effluent Filter	$475,000
Aerobic Digesters	$645,000
Sludge Drying Beds	$400,000
Permits, Bonds, Insurance, Start-up, Testing Allowance	$395,000
Subtotal	**$7,470,670**
Contingency @ 20%	$1,494,134
Total Estimated Construction Costs	**$8,964,804**
Engineering @ 10%	$896,480
Survey & Geotechnical	$10,000
Construction Observation Services @ 3%	$268,944
Subtotal Total Estimated Costs	**$10,140,229**
NMGRT @ 7%	$709,816
TOTAL ESTIMATE OF PROBABLE COSTS	**$10,850,045**

5)

Selection of an Alternative

5) Selection of an Alternative

As discussed in previous sections, the following treatment alternatives are considered:

- Membrane Bioreactor (MBR)
- Sequencing Batch Reactor (SBR)

A general comparison of the advantages and disadvantages of both alternatives was conducted, as shown in Table 13.

Table 13: Alternative Comparison

Alternative	Advantages	Disadvantages
MBR	• Technology is becoming more common in United States • Highest quality effluent more consistently • Provides redundancy • Proven simpler process with less concerns about filamentous activated sludge • No need for secondary clarifiers, therefore, requiring less area for process • Lower disinfection dose requirement due to low turbidity effluent • Cheaper for expansion/modularity	• Higher capital cost • Higher O&M cost: higher energy use and fouling control • Need additional fine screening equipment • Future membrane replacement
SBR	• No RAS system needed • Can operate in continuous-flow mode • Lower equipment costs	• Sludge wasting • Application of process kinetics • More complicated selection of key operating conditions, including the fraction of tank content removal • Higher concrete costs especially with expansion from 0.5 to 1.0 mgd • More difficult to operate consistently

A comparison of the specifics of each proposed Quill WWTF alternative was prepared and is shown in Table 14.

Table 14: Alternative Specifics Comparison

Parameter	MBR	SBR
Footprint	1.0 MGD - 2 Trains - BNR 30' x 82'; MBR 9' x 14'; 0.5 MGD - 1 Train but could use two for BNR	1.0 MGD - 2 Trains/4 basins each at SBR 50' x 50'; 0.5 MGD - 1 train/2 basins
Level of Treatment	Class 1A; MBR consistently delivers the highest quality effluent than other alternatives	Class 1A
BNR Performance Reliability	Best	Good
Capital Cost	Higher	Lower Equipment Costs; Higher concrete costs especially with expansion from 0.5 mgd to 1.0 mgd
O&M Costs	Higher; Replace membranes every 7/10 years (Approx. $425k)	Lower, but more difficult to operate
Equipment Costs (Process only)	1.0 MGD - $1,725,000; 0.5 MGD - $1,550,000 includes BNR for two trains; 0.5 MGD - $1,300,000 for one train	1.0 MGD - $1,260,000; 0.5 MGD - $630,000
Energy Costs	Highest	Lower
Ease of Operation	BNR is flexible; MBR is somewhat inflexible, but much more reliable	Automated; Flexible; More opportunity for operator error
Competition/ Vendors	Multiple Vendors	Multiple Vendors
Ease of Construction	More complex equipment	More concrete; less complicated
Screening	2 Fine Screens (1-2 mm); Grit Removal	Grit Removal
Effluent Filter	Not Required	Disc Filter (Tier 1); Sand Filter (Tier 2)
Chemical Needs/Usage	Required for cleaning; 1,000 gallons of sodium hypochlorite; 500 gallons a year of citric acid	Not Required

a. Life Cycle Cost Analysis

A summary of the estimate of probable construction costs for both alternatives is shown in Table 15.

Table 15: Alternative Cost Comparison

Phase	MBR	SBR
Total Estimated Project Cost (0.5 mgd) including Engineering Design and NMGRT	$ 8,582,670	$ 7,175,597
Total Estimated Project Cost (1.0 mgd) including Engineering Design and NMGRT	$ 10,933,226	$ 10,850,045

The MBR has a higher capital construction cost compared with the SBR at the 0.5 mgd design flow, however, as the plant expands to 1.0 mgd and beyond, both alternatives capital construction cost are essentially equal.

In order to compare the alternatives for a 20-year design period, a Net Present Worth analysis was performed, which includes engineering design, capital construction cost and annual operations & maintenance cost adjusted to present day dollars.

Table 16 summarizes the Present Worth (Life Cycle costs) for the alternatives.

Table 16: Alternative Present Worth Comparison

Parameter	MBR	SBR
Capital Costs (0.5 mgd) including Engineering Design and NMGRT	$ 8,582,670	$ 7,175,597
Average Annual O&M	$ 428,002	$ 308,439
O&M Present Worth (2.5% - Federal Discount Rate from OMB Circular A-94)	$ 7,514,007	$ 4,808,306
Present Value 20-yr Life Cycle Cost (0.5 mgd)	$ 16,096,677	$ 11,983,903

A detailed breakdown of the opinions of probable construction cost can be found in Appendix E.

b. Non-Monetary Factors

Matrix Rating System
A matrix rating system was compiled using typical criterion as shown in Table 17. This matrix compares both alternatives based on a weighted scoring system with a parameter weight percentage (i.e. ranking weight). Each parameter is scored on a scale of 1 through 10 or 1 through 5. This score is then adjusted to account for the ranking weight to provide final scores.

Table 17: Alternative Matrix Rating

Parameter	Ranking Weight	MBR	SBR
GWDP Regulatory Compliance	10	10	8
NPDES Regulatory Compliance	10	10	7
Technology/Experience/History	10	10	8
Competitive Bid	5	5	5
Site Efficiency, Land Issues, Constructability	5	5	3
Cost Consideration	10	8	10
O&M Cost	10	7	8
Expandability/Modularity	10	9	4
Operational Complexity	10	8	8
Reliability/Redundancy	5	5	3
Future NPDES Reg. Compliance	5	5	2
Owner Preference	10	8	6
Total:	**100**	**80.0**	**65.5**

After comparing the parameters for both alternatives, the matrix suggests the recommended alternative is the **membrane bioreactor (MBR)** system. Out of a maximum score of 100, the MBR system totaled a final score of 80.0 compared to the SBR system final score of 68.5. With further analysis between the alternatives in this Section 5), the recommended alternative will be discussed in Section 6).

6)

Proposed Project (Recommended Alternative)

6) Proposed Project (Recommended Alternative)

The recommended alternative is the MBR treatment system. The proposed system is to construct one MBR train with a 0.5 mgd process capacity with a modular design to expand to either 1.0 mgd in the near future and up to 2.0 mgd at ultimate capacity.

MBR was ultimately selected due to its delivery of a consistently higher quality effluent, better expansion/modularity, increased reliability, easier to operate consistently, smaller footprint, and owner preference.

The MBR enables the County to meet NMED GWDP Class 1A limits and anticipated future EPA NPDES limits. Compliance with the NPDES permit as stated earlier will enable the County to discharge to surface water, for example to the Rio Grande in exchange for water rights and provides the treatment required for possible aquifer storage recovery (ASR).

The MBR has a higher capital construction cost compared with the SBR at the 0.5 mgd design flow, however, as the plant expands to 1.0 mgd and beyond in the near future, both alternatives capital construction cost are essentially equal.

The MBR can achieve the lowest levels of treatment, in the likelihood that the EPA and NMED lower their requirements, by adding extra chemicals but without the capital costs for new facilities, since filtration is included with the MBR. The SBR would require a denitrification filter which would involve substantial capital costs.

a. Preliminary Project Design

The following information further describes the preliminary design of the proposed alternative. More information on the MBR system or the existing facilities can be found in Section 4.1) and Section 2), respectively. The MBR schematic shown in Figure 9 provides the sequence of equipment for treatment.

Fine screen and grit building

The preliminary treatment/headworks will add 2 (2 mm) fine screens before the MBR basins to provide full redundancy and no bypass or overflow. One of the fine screens will serve as a stand-by for maintenance and emergency purposes. The fine screens cannot be gravity fed, so a new influent lift station must be installed after the existing 6 mm Lakeside Raptor® Micro Strainer screen, which will remain in service in the existing Operations Building.

A vortex grit removal system will be installed as well. This grit system will reduce formation of heavy grit deposits throughout the system, reduce the frequency of aerobic digester cleaning, and protect equipment, such as the fine screen, from abnormal wear and abrasion.

The new fine screens and grit removal equipment are to be installed in a newly constructed building estimated at 2,500 square feet (sf).

For the fine screen capacity, 1 mgd is approx. $165,000 each and 2 mgd is approximately $205,000 each. An additive or deductive alternative could be an option to optimize construction costs.

Treatment process

The process treatment will include 1 treatment train consisting of 4 concrete basins, 2 concrete MBR membrane basins, and 1 concrete aerobic digester basin. All 4 basins included in the train will be sized for a 0.5 mgd capacity. The 4 aeration basins listed in treatment system sequence include: anaerobic, anoxic, anoxic/aerobic, and aerobic. Each MBR basins would be constructed for 0.5 mgd but only equipped to handle 0.25 mgd.

The pumps, controls, electrical equipment, and other secondary treatment equipment (e.g. the on-site sodium hypochlorite system and blowers) will be installed in the newly constructed Operations building estimated at 5,000 sf.

Disinfection

The existing disinfection equipment will be replaced for the MBR system. The new system will provide UV disinfection with a 1.0 mgd capacity for redundancy. The UV equipment will be installed in a newly constructed Operations building.

For the UV capacity, 1 mgd is approximately $208,000 each and 2 mgd is approximately $303,000 with full redundancy. An additive or deductive alternative could be an option to optimize construction costs.

Biosolids

Solids handling is accomplished by aerobic digestion (1 basin) and concrete sludge drying beds (2 beds) that are composted by a paddle aerator. Class A sludge will be produced and may be hauled off to a landfill or used as compost on various parks, fields, etc.

Irrigation

Improvements to the existing onsite reuse irrigation system were not studied in this PER.

The existing clay-lined reuse storage pond is to remain in place. This storage pond will continue to hold reuse effluent for on-site irrigation purposes.

Depending on the final location of the reuse water, additional transmission and distribution reuse piping, and pump stations will be required.

Laboratory and Operations

Additional supervisory control and data acquisition (SCADA) controls could be added to the existing laboratory.

Additive alternatives

Additional improvements that could be included as additive/deductive alternatives which have been identified, but possibly outside the budget of this project, include:

1. Regrading and relining the existing settling ponds into additional reuse storage ponds. This would be after the removal and disposal of existing sludge.
2. Aeration Lagoon No. 1 could also be regraded with the removal and disposal of existing sludge.
3. Installing BNR basins with a capacity of 1.0 mgd for future expansion. This alternative would have 1.0 mgd basins equipped with 0.5 mgd equipment. This alternative may provide a long-term capital cost savings.
4. Regrading and relining with HDPE the existing reuse storage pond.

A preliminary rendering of the 1.0 mgd MBR system option for the Quill WWTF is shown in Figure 15.

TO REPLACE SHEET

Figure 15: Preliminary Rendering of MBR System

b. Project Schedule

The proposed project schedule is as follows:

- Design – 6 to 8 months
- Construction bidding, evaluation and award – 1 to 2 months
- Construction – 12 to 18 months; MBR equipment lead time can be up to 8 months.
- Startup and project closeout – 1 month

c. Permit Requirements

As stated in Section 3), land application of reuse water will meet Class 1A from the NMED GWDP and any discharge to surface water will meet Tier 2 of the NDPES permit. The existing GWDP DP-234 will need to be updated. Also, a new NDPES permit (or renewal if the permit is dormant) will be required.

d. Sustainability Considerations

I) Water and Energy Efficiency

The MBR increases water and energy efficiency by allowing for more effective reuse of water, which contributes positively to water conservation efforts. The new facilities will allow for more energy efficient design and practices.

II) Green Infrastructure

The MBR alternative provides for the reuse of treated effluent for either NPDES or GWDP uses. This process aids in water conservation for the community.

III) Other Sustainability Considerations

The new facilities will optimize energy costs by using VFDs (variable frequency drives), energy efficient pumps, premium efficiency motors and other methods to ensure the County that this project is sustainable.

e. Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

The cost for a 0.5 mgd design flow MBR system is $8,582,670 as shown in Section 4.1). These costs for the new MBR facility are shown in more detail in Appendix E.

f. Annual Operating Budget

The wastewater O&M costs will increase with the proposed WWTF improvements, therefore sewer rates may increase accordingly.

A future Rate Study and Cost of Service study will be included in the Wastewater Master Plan.

I) Annual O&M Costs

The annual wastewater O&M costs are expected to increase for the proposed WWTF improvements because of an increase in staff and maintenance.

The Quill WWTF is currently managed by a level 4 operator and at least one operator is onsite during the day. These operators may require additional training to operate the treatment alternatives under consideration required per the Utility Operator Certification Regulations.

Accordingly, the County WWTF staff is estimated to need six employees at 1,500 hours per year at $20/hour, based on the Estimating Staffing for Municipal Wastewater Treatment Facilities from the US EPA (See Appendix F).

The estimated increase in wastewater O&M cost is as follows:

Table 18: Wastewater O&M Cost Difference

Component	Annual Cost Difference
Power*	$ 179,252
Chemicals	$ 7,500
Operations	$ 147,030
Total	$ 333,782
*Based on energy consumption at $0.13 / kWh	

7) Conclusions and Recommendations

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The recommendations for design as discussed in this PER will substantially benefit the Santa Fe County for both existing and future demands. The proposed MBR system improvements will allow the County to meet NMED GWDP Class 1A limits and anticipated future EPA NPDES limits by consistently providing the highest level of quality effluent for reuse irrigation with no limitations on surface water disposal.

The MBR does have a higher capital construction cost at the lower flows, but as the County expands to 1.0 mgd and beyond, the construction costs are equivalent.

The MBR system increases reliability and provides a smaller footprint at the Quill WWTF. In addition, the proposed alternative allows for optimized expansion/modularity of the MBR system to meet future population demands and permit requirements into the future since filtration is included.

The MBR enables the County to discharge to surface water, for example to the Rio Grande in exchange for water rights and provides the treatment required for possible aquifer storage recovery (ASR).