CITY OF HARRISBURG
SOUTH DAKOTA

December 2014

Wastewater Facilities Plan

STOCKWELL
ENGINEERS

WASTEWATER FACILITIES PLAN

FOR

THE

CITY OF HARRISBURG

DECEMBER 2014

SEI NO. 0114

I hereby certify that this report was prepared
by me or under my direct supervision and that
I am a duly Registered Professional Engineer
under the laws of the State of South Dakota.

Gabriel G. Laber, P.E.

S.D. Registration No. 9236

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

PURPOSE OF STUDY

The City of Harrisburg went through a Request for Proposal process (RFP) and selected Stockwell Engineers, Inc. (SEI) to update their Wastewater Facility Plan. The City would like to evaluate all of their wastewater treatment alternatives to determine if they should commit to Regionalization with the City of Sioux Falls and sign a 20 year agreement. This study will take a comprehensive look at Harrisburg's wastewater collection and treatment systems and identify the deficiencies that the systems have based on the South Dakota Design Criteria Manual and presents options to fix these deficiencies. The City of Harrisburg can use this plan to budget for future projects and to obtain grant and loan funding for the proposed improvements.

SCOPE OF STUDY

The scope of the agreement between the City of Harrisburg and SEI is a follows:

1) Provide existing maps, plans, relevant information, wastewater fund financial records, customer connections, lift station pumping records, wastewater treatment plant influent records, billed water records, Sioux Falls pumping records, building permits and sanitary sewer videos and reports.
2) Provide data on existing and future conditions of the City including land use, growth trends and population estimates.
3) Provide data on existing sewer.
4) Complete a general population analysis.
5) Evaluate sanitary sewer collection system, install flow meter, watch sewer video reports, calibrate lift stations, determine infiltration and inflow rates and perform smoke testing.
6) Analyze short-term wastewater treatment options (modify existing site, change discharge point, add aeration, expand site, irrigation and wetlands).
7) Assist with wastewater contract negotiations with the City of Sioux Falls.
8) Assist with State Water Plan and DENR funding applications.
9) Analyze mid and long-term wastewater treatment options (total retention, 180-day storage, wetlands, submerged attached growth reactor (SAGR), irrigation, green field and mechanical treatment).

10) Investigate and assist with regionalization options with Sioux Falls, Tea, Worthing, Canton, Lennox, Lincoln County and Lincoln County Rural Water.
11) Outline need for improvements.
12) Make recommendations for improvements to meet future growth requirements.
13) Prepare "Engineers Estimate" of probable construction cost for project alternatives.
14) Present "draft" study at Council meeting.
15) Address Client's comments and submit final study to the Client.

COMMUNITY INFORMATION

GENERAL

The City of Harrisburg is a Class 2 municipality located in northeastern Lincoln County on Lincoln County Highway 110 four miles east of Interstate 29. Lincoln County is located in southeastern South Dakota. The City is governed by a Mayor and four member Council. The City has a City Administrator, Finance Officer and Public Works Director that oversee the day-to-day activities. Harrisburg was incorporated as a City on January 25, 1902. The City encompasses an area of approximately 1,780 acres. The land uses range from low density residential to commercial and industrial properties.

FINANCIAL STATISTICS

Based on the 2000 Census, Harrisburg has a median household income of $51,196 compared to the state average of $35,282. The 2000 Census also reported that 0.8% of the families in Harrisburg had incomes below the poverty level compared to the state average of 9.3%.

POPULATION STATISTICS

Based on the 2010 census, Harrisburg has a population of 4,089. The City has continued to grow since being incorporated in 1902 and has shown an unprecedented growth rate between the years of 2000 - 2010. Most other communities in South Dakota have seen a decline in recent years. However, Harrisburg's close proximity to Sioux Falls creates a unique opportunity for people to work in Sioux Falls and live in Harrisburg. The 2010 census indicated that 2.0% of the people living in Harrisburg were over the age of 65 compared to 14.3% for the State of South Dakota. It is anticipated that the population will continue to increase due to Harrisburg's location and their low percentage of people over 65. The population for 2014 was based on the average housing unit size and the number of housing units added since the 2010 census. The projected populations through 2034 were estimated by SEI based on past studies and the Comprehensive Plan. Two lower projections were also run and are shown in the following figure. However, the high growth estimate is used to be more conservative.

The City had a housing study completed. The results of the study were released after this Facility Plan was presented to the Council. City staff requested a reduced population projection that matched the housing study. Information about the reduced population is shown later in the plan and in Appendix H.

Table 1 Population Statistics

Year	Population	Year	Population
1910	164	2000	958
1920	193	2010	4,089
1930	205	2014	4,719
1940	241	2015 (proj)	5,382
1950	274	2020 (proj)	8,054
1960	313	2025 (proj)	10,982
1970	338	2030 (proj)	14,150
1980	558	2034 (proj)	17,199
1990	727		

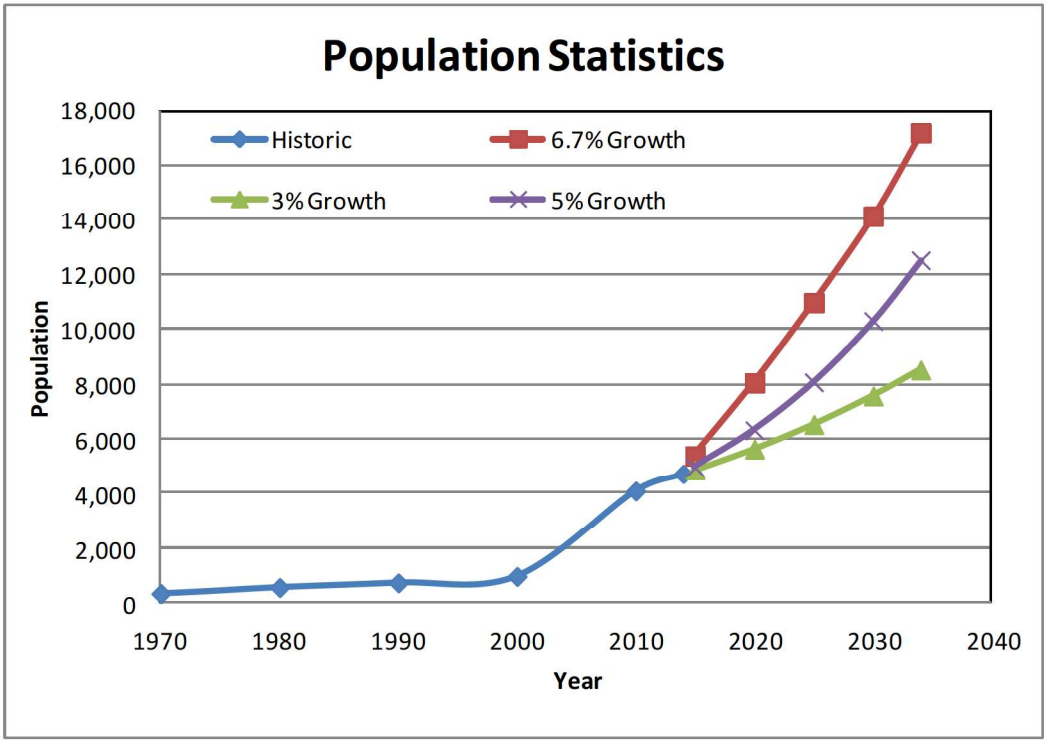


Figure 1 Population Statistics

BUILDING PERMITS

The building permits were used to track the population trends and project future populations. The single family, multi-family and commercial permits are shown in the following figure. The figure shows how the Recession hurt the single and multi-family permits but they have started to trend back up the last couple years. Based on conversations with City staff there are enough lots platted for two more years of growth. New developments are needed to provide enough lots for growth beyond the next two years.

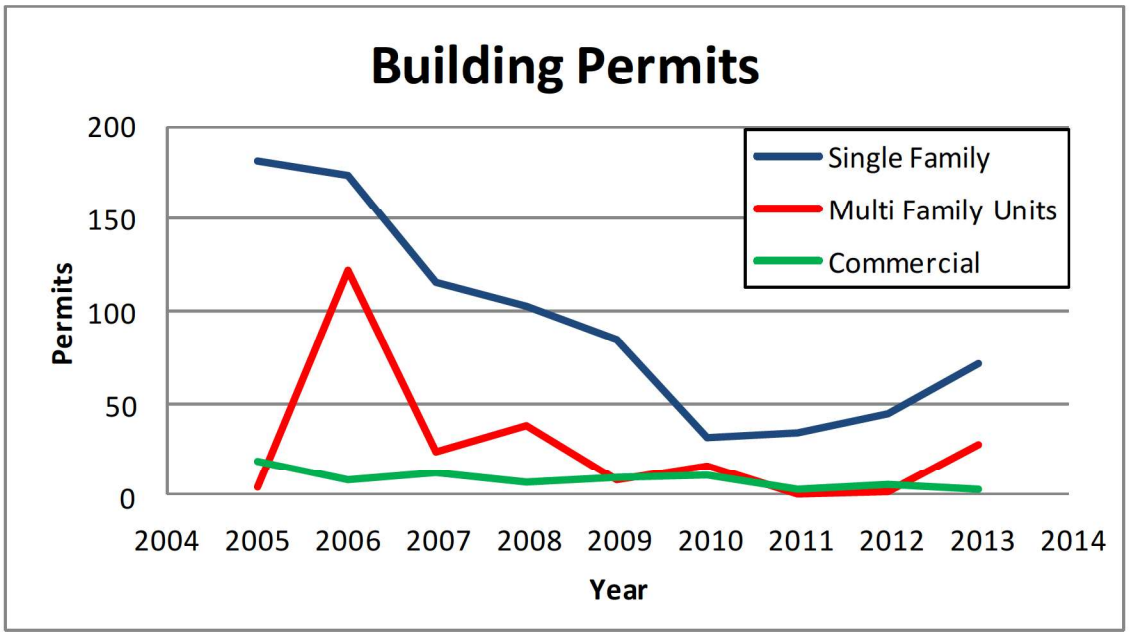


Figure 2 Building Permits

EXISTING WASTEWATER SYSTEM

GENERAL COLLECTION SYSTEM

The current system consists of 24 miles of vitrified clay pipe (VCP) and polyvinyl chloride (PVC) pipe, 7 lift stations with 12 miles of force main. There are currently 1,638 users connected to the system with an estimated 114,000 ft of service line.

There are two areas that currently are not served by gravity sewer in and around the City. The first area is on Willow Street between Cliff Avenue and Columbia Street. The second location is by the Fire Hall at the southwest corner of Willow Street and Southeastern Avenue. The existing system is shown in Figure 4.

EXISTING LIFT STATIONS

The current collection system includes 6 area lift stations and one lift station that pumps to Sioux Falls. These lift stations pump to other areas of the collection system that gravity flow to the treatment system. On March 13, 2014 SEI helped the City calibrate all the area lift station pumps. The lift station calibration determined that some repairs needed to be done to the lift stations. There were two floats that were not working, gauges that didn't work and a heater needed to be replaced. The flow rates between the two pumps were fairly consistent. The City provided the hour meter and flow records for all the lift stations for the years of 2011, 2012 and 2013. The records were used to develop graphs for each lift station showing the average daily pumping. Copies of the graphs are located in Appendix C.

During the lift station inspection it was determined that only the Coyote lift station had a trash basket. However, the lift station didn't have a crane to raise and lower the trash basket. Conversations with City staff indicated that the lift station pumps clog due to household cleaning products being flushed down the drain. It is recommended that all lift stations have a trash basket and a fixed or portable crane to raise and lower the trash baskets. It is also recommended that any areas of rust or paint flaking in the dry well be ground down to bare metal and be repainted. The City should also consider getting an annual service contract with the pump manufacturer to pull and check the pumps, motors and valves on an annual basis. This will help to extend the life of these products and reduce the chance for emergency repairs. Information about the lift stations is shown in the following table. The lift station locations are shown in Figure 4.

Table 2 Lift Station Information

Lift Station	Installed	Type	Pump #1 (gpm)	Pump #2 (gpm)	Pump Variation %
Tiger	2002	Wet/Dry Well	332	302	9%
Honeysuckle	2002	Wet/Dry Well	367	371	1%
Coyote	2004	Wet/Dry Well	198	245	23%
Stencil	2005	Wet/Dry Well	362	362	0%
South Cliff	2006	Wet/Dry Well	493	494	0%
Nielson	2008	Wet/Dry Well	215	215	0%
Gravity	2010	Wet/Dry Well	1,250	1,250	0%

Figure 3 Rust and Paint Deterioration at the Stencil Lift Station

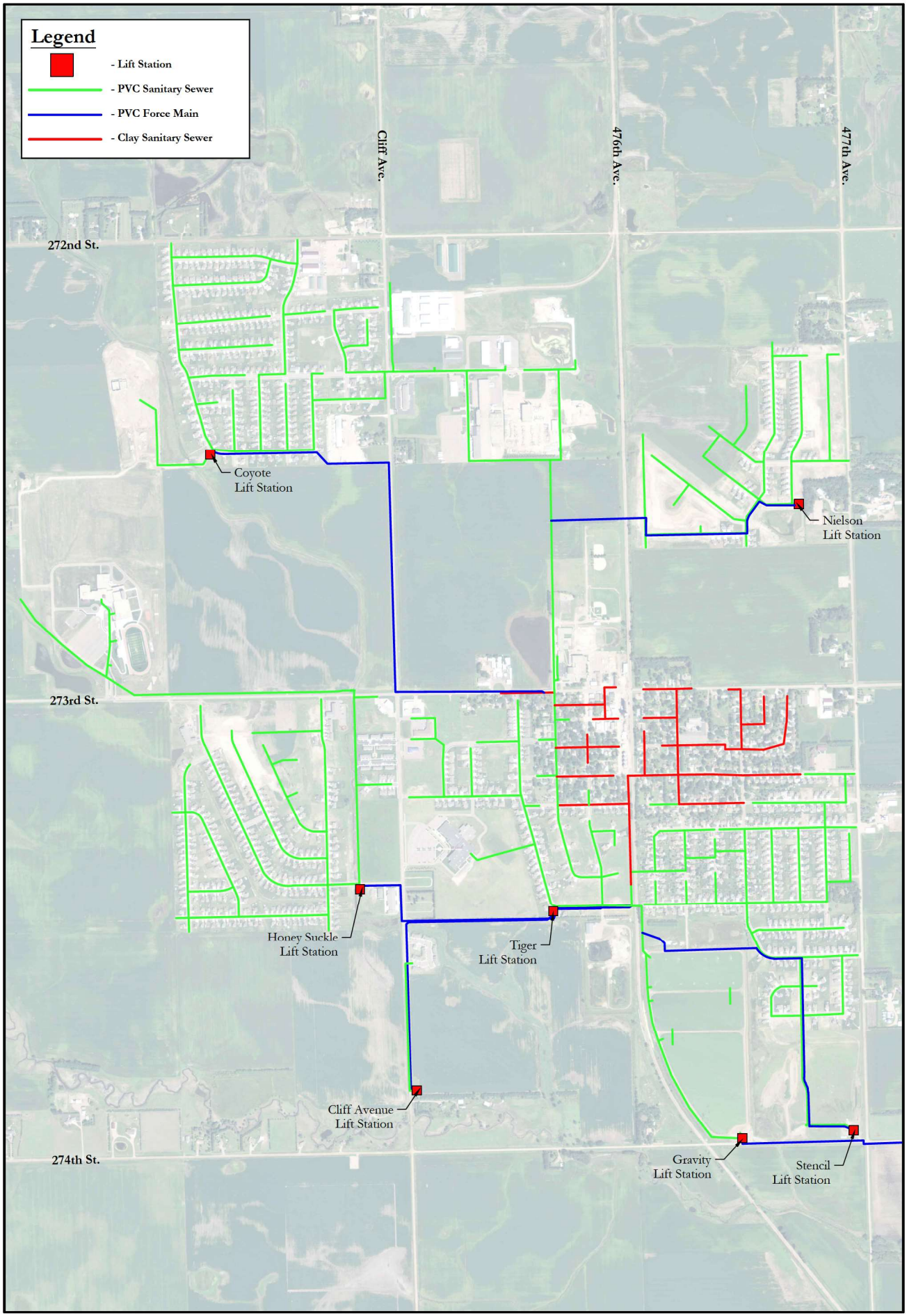


Figure 4 | Existing Wastewater Collection System

0 250 500 1000

STOCKWELL ENGINEERS

EXISTING BASIN INFORMATION

Harrisburg's existing collection system can be divided into 7 basins. These basins include 6 lift station basins and one basin that gravity flows to the treatment system. Determining flow in a basin is largely contingent upon the size of the contributing watershed boundary. The watershed boundary is determined by the topography of the basin. It is defined by the area tributary to a given point on a stream and is separated from adjacent basins by a divide, or ridge that can be traced on topographic maps. Watershed boundaries can be very large depending on the size and location of the stream. Typically they are divided into smaller tributary basins and sub-basins.

The age old method of designing sewer systems generally involves installing trunk line sewers at the lowest point of interception and extending lateral sewers toward higher or more specific locations. Trunk line sewers are typically responsible for capturing all the flow in a primary basin while lateral sewers are dedicated to intercept individual sub-basins. Lateral sewers are typically the direct interceptors for individual properties. It is critical to consider the overall drainage basin when sizing the trunk sewers. The size of the current service area for each basin and the number of acres for each zoning classification is shown in the following table.

Table 3 Existing Basin Information

Basin	Area (acres)	Acres in Each Zoning Classification								
		NRC	R-1	R-2	R-3	CB	GB	LI	HI	PD
Coyote	164	6	152					5		
Honeysuckle	213		159	54						
Cliff	16	11	4							
Tiger	81	20	53	8						
Stencil	121	12	105	4						
Nielson	96		35	61						
Core	264		251	3		5			5	
Total	954	50	760	130	0	5	0	5	5	0

NRC Natural Resource Conservation District

R-1 Single Family Residential District

R-2 Multi-Family Residential District

R-3 Manufactured Housing Residential District

CB Central Business District

GB General Business District

LI Light Industrial District

HI Heavy Industrial District

PD Planned Development District

CLEANING AND TELEVISING

Over the years the City has only done spot televising when there was a problem with the sewer. There are no comprehensive televising reports to review. It is recommended that the City start a cleaning and televising program to get the entire system televised. This would give the City a good base line to establish the condition of their collection system. An approximate cost to clean and televise the entire gravity sewer is $275,000. The estimated cost to clean and televise only the VCP is $34,000. The City should start a phased approach to clean and televise the entire system. The clay lines should be cleaned and televised at a minimum. In order to verify the quality of new construction, the City should require all new sewer lines be televised before they will accept them from the developer.

SMOKE TESTING

On June 30 and July 1 2014 SEI conducted smoke testing of the entire collection system. The smoke testing revealed a couple minor concerns. The concerns included open pick manholes, manholes that could be submerged along the drainage way north of the honey suckle lift station and manholes that had smoke coming from the joints. The smoke testing also discovered several locations that need to be cleaned because of solids buildups. A couple homes and City Hall had smoke coming into them. This was due to dry traps and open drain lines.

Figure 5 Smoke Testing

Figure 6 Smoke From Cracks Around Manhole

WASTEWATER FLOWS

The wastewater flows in a collection system are comprised of domestic water and clear water. Domestic water comes from homes and businesses. Clear water comes from rain water and ground water. Clear water is also called infiltration and inflow (I & I). Infiltration is ground water leaking through joints, cracks in the pipe and manhole walls. Inflow is sump pumps, roof drains, perforated manhole covers and storm sewers that are connected to the sanitary collection system. Every system is subject to some level of I & I.

When I & I becomes excessive, there is potential for sewage backups and flooding of basements.

Domestic wastewater flow can be determined using water use records. The SD Design Criteria states that projected wastewater flows for a community could be calculated by using 80% of the actual water consumption. This is typically applied to the winter months of December, January and February. These months are used because there is little water usage that does not reach the collection system. During these winter months it can be assumed that 100% of metered water at the homes reaches the collection system. The City reads the water meters monthly with a radio drive-by system. Based on these records for 2011-2013, the customers of Harrisburg use an average of 211,264 gallons per day (gpd).

Based on the billed water records, the average daily flow is 49 gallons per capita per day (gpcpd) in the winter months. Chapter I.C.2 of the SD Design Criteria states that an alternate method to determine design capacity could be justified by local water consumption records but shall not be less than 60 gpcpd.

The City of Harrisburg uses an online website called OmniSite to maintain lift station records and wastewater treatment influent. SEI used these records and cross referenced them with the lift station calibration information that SEI performed. The total wastewater that was pumped by each lift station for 2011, 2012 and 2013 are shown in the following table.

Table 4 Wastewater Flows

Lift Station	WW Flow (gpd)
Tiger	26,740
Honeysuckle	60,363
Coyote	45,494
Stencil	37,281
South Cliff	6,681
Nielson	25,896
Total	**202,455**
Wastewater Pond Influent	208,416
Core Basin Gravity Flows	5,961

The average daily flow for the years 2011 thru 2013 from the lift stations was 202,455 gpd and the wastewater ponds receive 208,416 gpd. The core basin area gravity flows to the wastewater ponds and included in the pond influent flow. A graph for the wastewater pond influent is shown in Appendix D. The graph shows how the amount of precipitation affects the wastewater flows. The amount of I & I can be determined by comparing the calculated domestic wastewater flows to the wastewater pond influent. During the years of 2011 and 2013 the average daily influent to the wastewater ponds was 242,241 gpd. This results in an average I & I flow rate of 30,977 gpd (242,241 gpd - 211,264 gpd). In comparison, the maximum daily I&I that the treatment plant experienced was 1,246,736 gpd (1,458,000 gpd - 211,264 gpd) on June 11, 2013. This was due to an intense two-inch rainfall that occurred.

Typically infiltration is considered constant during the winter months because the ground is frozen and the water table is stable. During the summer months wet periods and dry periods can affect the ground water table having a significant effect on the I&I rates. As the ground water table rises, more of the collection system is submerged. Therefore, the amount of infiltration increases. The higher the groundwater table, the higher the pressure is on the sewer, forcing more water into the system. In the case of the City of Harrisburg, the lift station and influent records show how rainfall events affect the wastewater flows.

The SD Design Criteria Manual states in section I.C.2 that the design allowance for a sewer system shall be 200 gallons per inch of pipe diameter per mile of pipe per day for VCP. Current practice recommends an allowance for PVC of 50 gallons per inch of pipe diameter per mile of pipe per day. Based on this allowance, Harrisburg's collection system can have a maximum allowable infiltration rate of 19,943 gpd which is lower than the average I&I rate of 30,977 gpd.

Table 5 Allowable Collection System Infiltration

Sanitary Sewer Dia (in)	Pipe Type	Length (ft)	Diameter-Length (in-mile)	Allowable Infiltration (gpd)
4	Clay	12,510	9.5	1,895
8	Clay	13,523	20.5	4,098
4	PVC	102,151	77.4	3,869
6	PVC	1,844	2.1	105
8	PVC	81,487	123.5	6,173
10	PVC	6,676	12.6	632
12	PVC	5,165	11.7	587
15	PVC	4,544	12.9	645
16	PVC	41	0.1	6
18	PVC	7,177	24.5	1,223
21	PVC	3,011	12.0	599
24	PVC	482	2.2	110
			Total =	19,943

The Environmental Protection Agency (EPA) has established guidelines to determine dry weather flow and wet weather flow. The dry weather flow is 120 gpcpd and the wet weather flow is 275 gpcpd. Wastewater flows over these amounts are considered excessive. The dry weather period is during the winter months when the collection system is subject to domestic flow and infiltration. The wet weather period is during the summer when the collection system is subject to domestic flow, infiltration and inflow. Based on these limits, the City of Harrisburg should not experience flows over 566,280 gpd (120 gpcpd x 4,719) during December, January and February. The wet weather flows should not exceed 1,297,725 gpd (275 gpcpd x 4,719). Records show the wet weather flow was exceeded 2 days and the dry weather flow was never exceeded during 2011, 2012 and 2013.

WASTEWATER TREATMENT

Harrisburg's wastewater treatment system was built in 1999 and it is located in the southeast corner of the community on the east side of the railroad tracks and south of Tiger Street. The wastewater treatment plant consists of a three cell stabilization pond with Air Inductors Co. aerators in cell one. The system operates under Surface Water Discharge (SWD) Permit #SDG823728 and is permitted as "No Discharge". A copy of the permit is located in Appendix A. Cell one has a water surface area of 10.21 acres, cell two has a water surface area of 10.18 acres and cell three has a water surface area of 19.6 acres. Cell one has an effective storage depth of three feet, cell two has an effective storage depth of four feet and cell three has an effective storage depth of six feet. Typically, the dikes are built with the top three feet for freeboard and the bottom two feet for residual storage resulting in an effective storage depth of three feet. The SD Design Criteria does allow deeper effective storage depths when aeration is provided. Freeboard is used as a safety factor and the water level should never be into the freeboard. The freeboard also keeps wave action from overtopping the berm and creating a breach of the berm. The City does have 14 Air Inductors Company aerators in cell one to try and improve the oxygen level in the water, help with mixing and improve treatment. The existing treatment system is shown in the following figures.

Figure 7 Air Inductors Company Aerator

Figure 8 Inlet Channel with Grinder

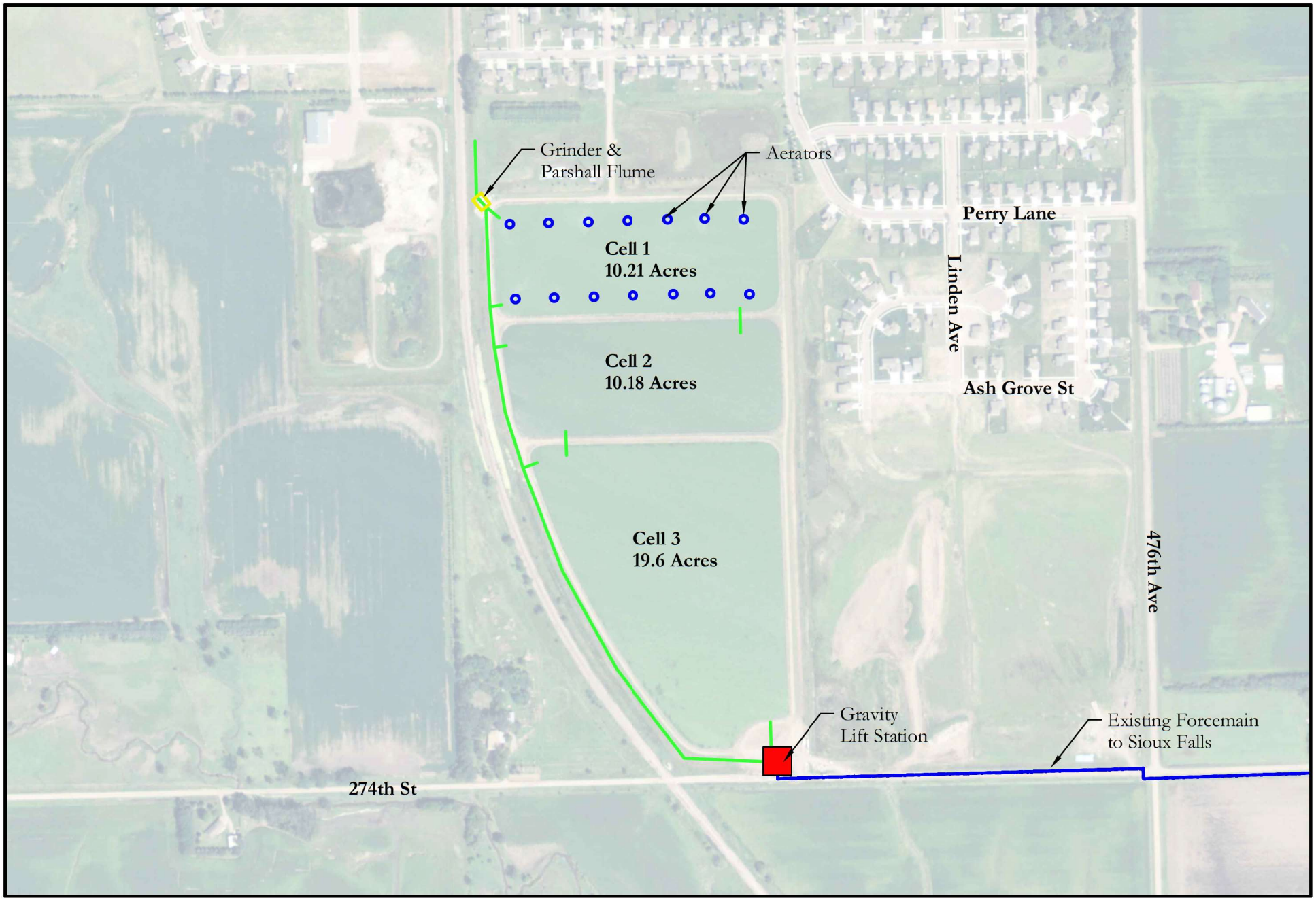


Figure 9 | Existing Treatment System

1" = 500'

CITY OF HARRISBURG SOUTH DAKOTA

STOCKWELL ENGINEERS

On August 15, 2011 the SD DENR completed a Surface Water Discharge Compliance Inspection. A copy of the inspection is located in Appendix B. The inspection provided the following recommendations:

- The City should consider developing a pump calibration schedule for the lift stations.
- The weed growth in the rip rap should be eliminated.
- The reed growth in pond #3 should be eliminated.
- The City staff is encouraged to attend more training courses sponsored by the State.

SLUDGE

Approximately seven years ago the City used a sludge judge to measure the depth in cell one. At that time the sludge depth ranged from 6" - 12". It can be assumed that the depth has only increased over the years. Based on conversation with the City and the following picture the sludge is currently a problem around the inlet structure. The inlet structure does not meet the design criteria because it does not extend 1/3 the distance into the cell. The City should plan to remove this sludge in the near future. Typically the sludge is dredged out of the cell and then land applied as a dry product or knifed in as a liquid. The sludge does have nutrient value and farmers utilize it for fertilizer.

Figure 10 Sludge Build-up

INTAKE STRUCTURE

All of the wastewater flow from the City of Harrisburg currently flows through an intake structure before entering cell one. This structure consists of a grinder followed by a nine-inch parshall flume with ultrasonic level transducer flow meter. The grinder was installed to help break-down the solids entering the treatment system. The flows through the parshall flume are recorded by OmniSite.

AERATORS

In the spring of 2014 the City experienced a longer and more predominant smells from the ponds. It is typical for wastewater ponds to smell in the spring. This is due to the colder water rising to the top bringing anaerobic wastewater and solids that were on the bottom to the top of surface. The anaerobic wastewater and solids are responsible for the strong odor. The smell during spring turnover will become longer and more predominant as the treatment system is overloaded organically. The City took dissolved oxygen tests on the ponds this spring. The results indicated the levels were very low. The City investigated the problem and determined several of the aerators were malfunctioning. The problems with the aerators included the pumps falling off because the bolts rusted, the air hoses have fallen off, the diffuser has fallen off and the motors have quit. The City has started to rebuild the aerators in order to try and improve the treatment in cell one.

Figure 11 Failed Aerator

GRAVITY LIFT STATION

In 2010 the City of Harrisburg added a lift station at the backside of the treatment system to pump wastewater to the City of Sioux Falls. The lift station was added because the treatment system was overloaded and the City of Sioux Falls was willing to take the additional wastewater that Harrisburg could not treat. A wet/dry well lift station with three pumps and a back-up generator was added at the southeast corner of cell three. The lift station is capable of pumping from cell three or the bypass line. Currently, the City pumps approximately 600,000 gpd to Sioux Falls whenever cell three is full and the City needs more storage. Each of the three pumps has a capacity of 1,250 gpm. The lift station and force main cost $2,544,000. The City uses a sale tax bond to make the $133,074 annual payment.

Figure 12 Gravity Lift Station

Figure 13 Gravity Lift Station Pumps

Harrisburg's current contract with the City of Sioux Falls was signed on December 9, 2009. The initial term of the agreement is five years and can be extended three times for an additional five years. However, in the last year the City of Sioux Falls approved a new ordinance that sets rates and charges for regional wastewater customers. Sioux Falls is not willing to extend the current contract when the initial terms expires and wants the City of Harrisburg to sign the Regional Wastewater System Agreement.

Starting on January 1, 2014 the Regional Wastewater Agreement sets the charge per 1,000 gallons at $4.01. The City of Harrisburg can receive a $0.44 per 1,000 gallon credit for equalization and $0.55 per 1,000 gallon credit for partial treatment. The City should receive the equalization credit because they have more than 30-day continuous storage volume. The strength parameters to meet the partial treatment credit is 20 mg/l for BOD, 10 mg/l for TKN and 45 mg/l for TSS. Based on sampling records at the gravity wet well the City of Harrisburg would only meet these requirements half the time. Continued growth of the City will only increase the loading to the wastewater treatment system and

therefore increase the test results. Therefore, the City should not plan on receiving the partial treatment credit.

Section 6 of the Joint Powers Agreement for Use of Regional Wastewater System established flow limitations. The daily maximum flow is 1,003,000 gallons and the monthly maximum is 15,531,000 gallons. These limits are a concern because Harrisburg has already exceeded the daily maximum 18 times and the monthly maximum was exceeded in June 2013. This agreement is for 20 years and the continued growth of the City will only add to the wastewater flows increasing the number of times these limit are exceeded.

Sioux Falls also implemented a new System Development Charge "SDC". The City of Harrisburg will be required to pay the City of Sioux Falls for every sewer connection. The charge will range from $2,391 for a 3/4" water meter to $60,000 for a four-inch water meter. Other Regionalization customers have been pumping wastewater to Sioux Falls for several years and the existing customers were grandfathered in. Unfortunately, the City of Harrisburg will be required to pay for all existing customers. In 2013 this cost was estimated at $3,677,000 for 1,506 customers. The SD DENR awarded the City a $600,000 Consolidate Grant and $2,577,000 loan plus the City was going to contribute $500,000 cash to pay this charge. The loan has a term of 30 years and interest rate of 3.25%. However, Harrisburg currently has 1,631 customer which would add approximately $648,000 to the SDC. A history of the pumping charge is shown in the following table.

Table 6 Sioux Falls Charge History

Year	Cost of Service	Multiplier	Charge per Thousand Gallons	Cost to Pump to Sioux Falls
2010	$ 1.85	1.25	$ 2.31	$98,743.75
1/1/11-6/30/11	$ 1.94	1.25	$ 2.43	$46,879.15
7/1/11-12/31/11	$ 1.94	1.50	$ 2.91	$49,518.00
2012	$ 1.98	2.00	$ 3.96	$64,517.29
2013	$ 2.92	2.00	$ 5.84	$369,210.83
2014	$ 2.92	2.00	$ 5.84	

WASTEWATER TREATMENT HYDRAULIC LOADING

There are two elements to consider when sizing a treatment system. The element that provides the larger size governs. The first way is to calculate the hydraulic loading or the amount of wastewater that is flowing to the treatment system. The following table shows the wastewater flows that the treatment system is experiencing. The table also

shows the constructed and projected hydraulic loading for the treatment system. The current treatment system is overloaded hydraulically as shown by the negative values. The overloading is due to the City's population increasing by 493% since the treatment system was built.

Table 7 Treatment System Hydraulic Loading

	Constructed 1999	Current 2014	Future 2034
Population	958	4,719	17,199
Wastewater Flow (gpcpd)	100	60	60
Infiltration & Inflow (gpd)	0	31,000	31,000
Design Storage Time (days)	365	365	365
Total Pond Influent (gal)	34,967,000	114,661,100	387,973,100
Total Pond Influent (ac/ft)	107	352	1,191
Primary Seepage (in/day)	1/16	1/16	1/16
Secondary Seepage (in/day)	1/8	1/8	1/8
Seepage (ft/yr)	3.3	3.3	3.3
Evaporation (in/yr)	35.4	35.4	35.4
Evaporation (ft/yr)	3.0	3.0	3.0
Precipitation (in/yr)	23.5	23.5	23.5
Precipitation (ft/yr)	2.0	2.0	2.0
Total Losses	4.3	4.3	4.3
Required Surface Area (ac)	**25**	**82**	**277**

WASTEWATER TREATMENT ORGANIC LOADING

The second way to size a treatment system is to calculate the organic loading. The SD Design Criteria states in Section B.1.a of Chapter IV that the maximum design loading on the primary cell shall not exceed 30 pounds of Biochemical Oxygen Demand (BOD_5) per acre. Based on this criteria, the primary pond should receive less than 291 pounds of BOD_5. Furthermore, Section B.1.d states the total organic loading for the total surface area shall not exceed 20 pounds BOD_5 per acre per day. Based on this criteria, the treatment system should receive less than 756 pounds of BOD_5. The SD Design Criteria also states that on average a person will generate 0.17 pounds of BOD_5.

Wastewater influent sampling completed in April 2014 indicated the average influent composite BOD sample was 427 mg/L or 534 lbs. This results in a per capita loading of .11 lbs per person per day. It is anticipated that the per capita BOD rate will continue to increase as more commercial and industrial property develops. Therefore, the DENR minimum is used for these calculations in the following table. The influent samples and the loading in the following table both indicate the system is overloaded organically. The overloading is further reinforced by the lack of wave action this spring in cell one compared to cells two and three. Typically a cell will lack wave action on windy days when the cell is overloaded.

Table 8 Treatment System Organic Loading

	Constructed 1999	Current 2014	Projected 2034
Population	958	4,719	17,199
Per Capita Loading (lbs)	0.17	0.17	0.17
Total Loading (lbs)	163	802	2,924
Primary Loading Limit (lbs/ac)	30	30	30
Primary Size Required (ac)	5.4	26.7	97.5
Total System Loading Limit (lbs/ac)	20	20	20
Total System Size Required (ac)	8.1	40.1	146.2

DEVELOPMENT OF WASTEWATER ALTERNATIVES

GENERAL ALTERNATIVE INFORMATION

Each of the following alternatives includes an estimate of the total project cost. Included in the total project cost are the construction cost, contingencies, legal and administration, engineering and testing costs. It should be noted that these are only estimates and does not guarantee the cost of actual construction. Field measurements will be taken during the design phase to complete a more accurate estimate. Contract prices can be affected by project location, year built, contractor work load, project size, contract time and the time of year that the project is built. These estimates should be updated on a yearly basis to reflect current industry conditions. Inflation factors have not been included in the estimates.

EQUIVALENT UNIFORM ANNUAL COST

When choosing the most cost effective solution to a problem, you have to consider the initial cost, long term cost and lifetime of the system. The alternative that reflects the cheapest initial cost may not be the least expensive alternative when operation and maintenance cost are taken into account. The capital cost and equivalent uniform annual cost (EUAC) are provided for some of the alternatives. The EUAC is evaluated over 20 years and an interest rate of 3.0% to provide the long term costs. The salvage value at the end of 20 years will be 0% or 60%. However, any land purchase will assume a 100% salvage value. The EUAC will provide the owner with the best long term solution.

WASTEWATER COLLECTION ALTERNATIVES

The following alternatives were developed to correct the deficiencies listed below:

1) The VCP has outlived its useful life expectancy and needs to be replaced or rehabilitated.
2) The system is experiencing I & I.
3) New trunk sewers should be installed to eliminate lift stations.
4) Trash baskets should be installed on the lift stations.
5) A SCADA system should be installed to closely monitor lift stations and the treatment system closer.

COLLECTION ALTERNATIVE 1: DO NOTHING

The first collection alternative is the "Do Nothing" alternative. This alternative is not considered acceptable because it will not address any of the deficiencies identified above.

COLLECTION ALTERNATIVE 2: REPLACE VCP WITH PVC

Alternative 2 includes replacement of all the remaining VCP with PVC. The service lines would be replaced from the main line to the property line and the streets would be completely rebuilt. The new PVC lines would reduce the amount of I&I which would reduce the loading and extent the life of the wastewater treatment system.

It should be noted that the cost for this alternative may be reduced if during the design it is determined that sections of the sewer system can be lined. The estimated cost to clean and televise the clay lines is $34,000. Reviewing the televising video and reports would determine which rehabilitation method should be used. Normally liner is more cost effective because the asphalt surface doesn't need to be replaced. The cost estimate for this alternative is shown in the following table.

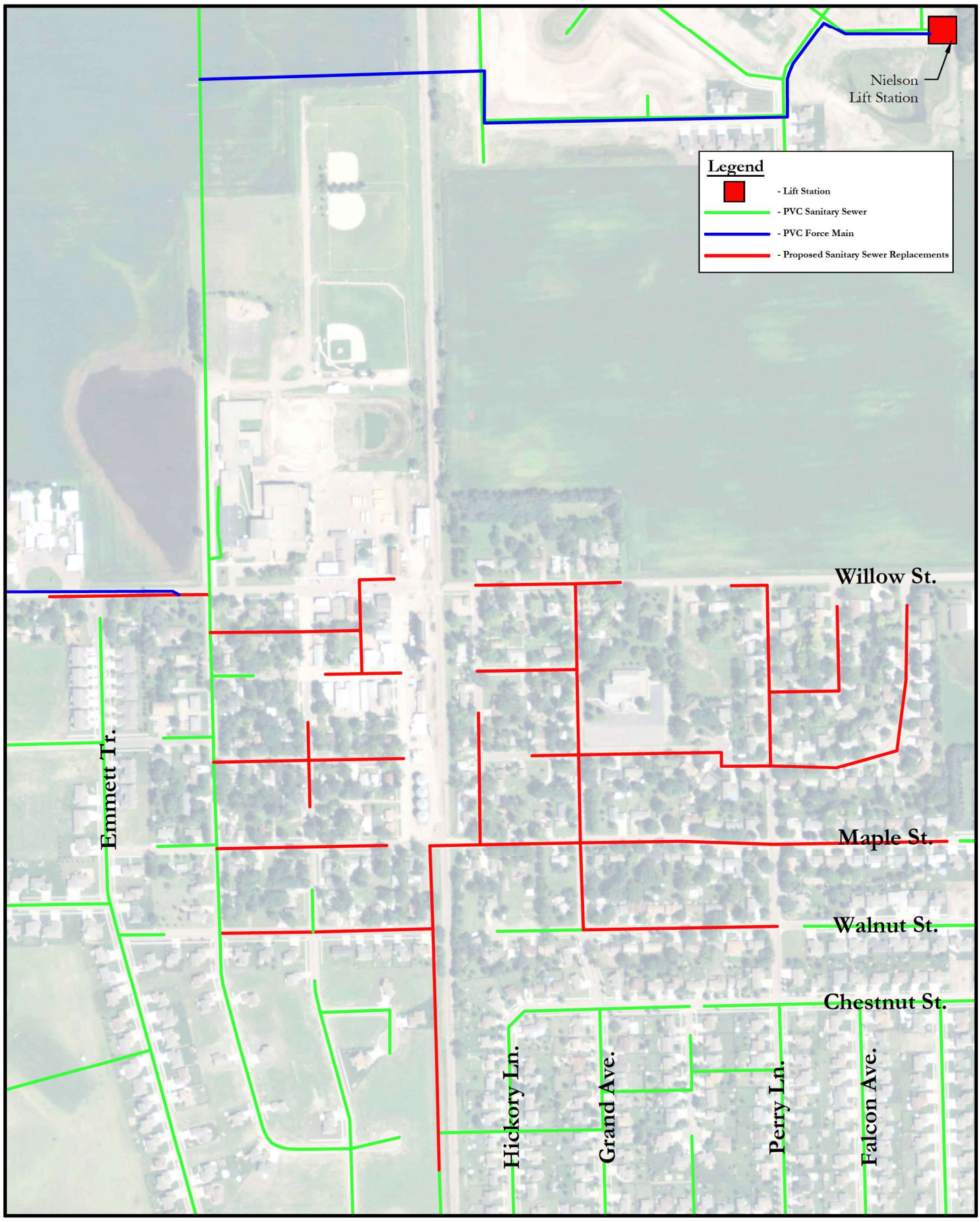


Figure 14 | Collection Alternative 2

STOCKWELL ENGINEERS

Table 9 Cost Estimate for Collection Alternative 2

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$353,000.00	$353,000.00
2	Clearing	1	LS	$10,000.00	$10,000.00
3	Remove Sewer Pipe	13,600	FT	$4.00	$54,400.00
4	Remove Asphalt Concrete Pavement	42,100	SY	$2.50	$105,250.00
5	Remove Existing Manhole	50	EA	$400.00	$20,000.00
6	Remove Concrete Curb & Gutter	27,200	FT	$4.00	$108,800.00
7	Saw Existing Surfacing	440	FT	$7.00	$3,080.00
8	Unclassified Excavation	23,400	CY	$6.00	$140,400.00
9	Scarify & Recompact Subgrade	52,600	SY	$1.00	$52,600.00
10	Sanitary Sewer Manhole	50	EA	$3,000.00	$150,000.00
11	4" PVC Sanitary Service Line	6,000	FT	$25.00	$150,000.00
12	8" PVC Sanitary Sewer Pipe	13,600	FT	$35.00	$476,000.00
13	Railroad Crossing	100	FT	$200.00	$20,000.00
14	Sanitary Sewer Pipe Bedding Material	13,600	FT	$6.00	$81,600.00
15	Sewer Wye	180	EA	$300.00	$54,000.00
16	Sewer Fittings	540	EA	$100.00	$54,000.00
17	Reconnect Sewer Main	12	EA	$500.00	$6,000.00
18	Reconnect Sewer Service	180	EA	$250.00	$45,000.00
19	Salvage & Place Topsoil	10,900	CY	$5.00	$54,500.00
20	Aggregate Base Course (12")	34,400	TON	$12.00	$412,800.00
21	Asphalt Concrete Surfacing (4")	9,800	TON	$70.00	$686,000.00
22	Concrete Curb & Gutter	27,200	FT	$12.00	$326,400.00
23	Geotextile Fabric	52,600	SY	$2.50	$131,500.00
24	6" Concrete Fillet Section	1,870	SY	$45.00	$84,150.00
25	6" Concrete Valley Gutter	1,940	SY	$45.00	$87,300.00
26	4" Concrete Sidewalk	5,760	SF	$4.00	$23,040.00
27	Detectable Warning Surface	390	SF	$45.00	$17,550.00
28	Traffic Control	1	LS	$20,000.00	$20,000.00
29	Seeding, Fertilizing & Mulching	65,400	SY	$1.50	$98,100.00
30	Post Televising	13,600	FT	$1.00	$13,600.00
31	Erosion Control	1	LS	$15,000.00	$15,000.00
32	Bypass Pumping	1	LS	$15,000.00	$15,000.00
33	Trench Dewatering	1	LS	$10,000.00	$10,000.00
				Subtotal	$3,879,070.00
				Contingencies (15%)	$582,000.00
				Total Estimated Construction Costs	**$4,461,070.00**
				ENGINEERING	**$597,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$179,000.00**
				TOTAL ESTIMATED PROJECT COST	**$5,237,070.00**

Table 10 EUAC for Collection Alternative 2

Capital Cost		Salvage	Present Worth	Net Present
Description	Price	Value	of Salvage Value	Worth
Mobilization	$353,000	$0	$0	$353,000
Clearing	$10,000	$0	$0	$10,000
Remove Sewer Pipe	$54,400	$0	$0	$54,400
Remove Asphalt Concrete Pavement	$105,250	$0	$0	$105,250
Remove Existing Manhole	$20,000	$0	$0	$20,000
Remove Concrete Curb & Gutter	$108,800	$0	$0	$108,800
Saw Existing Surfacing	$3,080	$0	$0	$3,080
Unclassified Excavation	$140,400	$0	$0	$140,400
Scarify & Recompact Subgrade	$52,600	$0	$0	$52,600
Sanitary Sewer Manhole	$150,000	$90,000	$49,831	$100,169
4" PVC Sanitary Service Line	$150,000	$90,000	$49,831	$100,169
8" PVC Sanitary Sewer Pipe	$476,000	$285,600	$158,130	$317,870
Railroad Crossing	$20,000	$12,000	$6,644	$13,356
Sanitary Sewer Pipe Bedding Material	$81,600	$0	$0	$81,600
Sewer Wye	$54,000	$32,400	$17,939	$36,061
Sewer Fittings	$54,000	$32,400	$17,939	$36,061
Reconnect Sewer Main	$6,000	$0	$0	$6,000
Reconnect Sewer Service	$45,000	$0	$0	$45,000
Salvage & Place Topsoil	$54,500	$0	$0	$54,500
Aggregate Base Course (12")	$412,800	$247,680	$137,134	$275,666
Asphalt Concrete Surfacing (4")	$686,000	$411,600	$227,893	$458,107
Concrete Curb & Gutter	$326,400	$195,840	$108,432	$217,968
Geotextile Fabric	$131,500	$0	$0	$131,500
6" Concrete Fillet Section	$84,150	$50,490	$27,955	$56,195
6" Concrete Valley Gutter	$87,300	$52,380	$29,002	$58,298
4" Concrete Sidewalk	$23,040	$13,824	$7,654	$15,386
Detectable Warning Surface	$17,550	$10,530	$5,830	$11,720
Traffic Control	$20,000	$0	$0	$20,000
Seeding, Fertilizing & Mulching	$98,100	$0	$0	$98,100
Post Televising	$13,600	$0	$0	$13,600
Erosion Control	$15,000	$0	$0	$15,000
Bypass Pumping	$15,000	$0	$0	$15,000
Trench Dewatering	$10,000	$0	$0	$10,000
Remaining Capital Costs	$1,358,000	$0	$0	$1,358,000
Total Construction Cost	**$5,237,070**	**$1,524,744**	**$844,214**	**$4,392,856**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$2,000			$29,755
Supplies	$2,000			$29,755
Utilities	$0			$0
Labor	$3,000			$44,632
Total Annual Cost	**$7,000**			**$104,142**
			Total Net Present Worth	**$4,496,999**
			EUAC	**$302,269**

COLLECTION ALTERNATIVE 3: LIFT STATION IMPROVEMENTS

Collection Alternative 3 proposes improvements to the existing lift stations. Conversations with City Staff has indicated that the existing lift station pumps clog due to wipes, rags or other flushable products getting stuck in the impellers. Installing trash baskets on the influent lines in the wet wells would help capture this material and prevent it from clogging the pumps. However, trash baskets need to be cleaned on a regular basis to prevent the material from overflowing. Currently, Coyote is the only lift station with a trash basket. This alternative also includes recoating the floor of the Stencil lift station because the paint is starting to deteriorate.

The City should consider hiring the manufacturer of the lift station or another company to complete annual maintenance on the stations. It is recommended that the pumps be pulled and the valves checked on a regular basis. A good maintenance program for the lift stations will help extend the life of the stations. It will also help to discover issues with the pumps before the pump fails and there is an emergency. New parts for pumps could take several weeks to arrive leaving the City with a difficult situation until the station is fully operational again.

During the lift station inspection and calibration it was also discussed to add a Supervisory Control and Data Acquisition (SCADA) system for the wastewater treatment system. SCADA allows the remote monitoring of several facilities at one location. The base unit consisting of a computer and radio antenna would be installed at the City Shop. Radios would then be installed at each lift station and the influent structure at the ponds. The computer screen would show an icon for each site. The screen would show if pumps are running and what the water level is in the wet well. Submersible level transducers would be added in the wet well to track the water level and control the pumps. Floats would remain in the wet well as back-up in case the transducer would malfunction. The influent at the wastewater treatment plant could be shown on the screen. All alarm conditions would show up on the screen as well. The installation of a SCADA system would reduce the time spent going to each individual site and it would also notify the operators sooner if there was a problem. During the design phase the existing water SCADA system would be evaluated to determine if it could be expanded to add the sewer sites. The cost estimate for this alternative is shown in the following table.

Table 11 Cost Estimate for Collection Alternative 3

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$19,000.00	$19,000.00
2	SCADA System	1	LS	$114,000.00	$114,000.00
3	Radio Installation	1	LS	$10,000.00	$10,000.00
4	Recoat Deteriorated Paint Areas	1	EA	$2,500.00	$2,500.00
5	Furnish Trash Basket	5	EA	$3,600.00	$18,000.00
6	Install Trash Basket	5	EA	$1,100.00	$5,500.00
7	Furnish Crane	5	EA	$3,600.00	$18,000.00
8	Install Crane	5	EA	$300.00	$1,500.00
9	Furnish New Wet Well Lid	5	EA	$1,800.00	$9,000.00
10	Install New Wet Well Lid	5	EA	$1,100.00	$5,500.00
				Subtotal	$203,000.00
				Contingencies (15%)	$31,000.00
				Total Estimated Construction Costs	**$234,000.00**
				ENGINEERING	**$53,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$10,000.00**
				TOTAL ESTIMATED PROJECT COST	**$297,000.00**

Table 12 EUAC for Collection Alternative 3

Capital Cost		**Salvage**	**Present Worth**	**Net Present**
Description	**Price**	**Value**	**of Salvage Value**	**Worth**
Mobilization	$19,000	$0	$0	$19,000
SCADA System	$114,000	$0	$0	$114,000
Radio Installation	$10,000	$0	$0	$10,000
Recoat Deteriorated Paint Areas	$2,500	$0	$0	$2,500
Furnish Trash Basket	$18,000	$10,800	$5,980	$12,020
Install Trash Basket	$5,500	$0	$0	$5,500
Furnish Crane	$18,000	$10,800	$5,980	$12,020
Install Crane	$1,500	$0	$0	$1,500
Furnish New Wet Well Lid	$9,000	$5,400	$2,990	$6,010
Install New Wet Well Lid	$5,500	$0	$0	$5,500
Remaining Capital Costs	$94,000	$0	$0	$94,000
Total Construction Cost	**$297,000**	**$27,000**	**$14,949**	**$282,051**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$2,000			$29,755
Supplies	$2,000			$29,755
Utilities	$0			$0
Labor	$3,000			$44,632
Total Annual Cost	**$7,000**			**$104,142**
			Total Net Present Worth	**$386,193**
			EUAC	**$25,958**

COLLECTION ALTERNATIVE 4: FUTURE BASIN IMPROVEMENTS

Collection Alternative 4 proposes a long range future basin plan to reduce or eliminate lift stations. This can be accomplished by installing new trunk sewers along the bottom of the basin. These new trunk sewers would be deeper and would extend further to eliminate the need for lift stations. The new trunk sewers would also open up new areas for development. Harrisburg's rapid growth in the recent past has caused the City to install area lift stations to service new developments instead of being able to construct deeper truck sewers.

The City of Sioux Falls has an extensive basin plan map. Currently, Sioux Falls is not developing any more basins to the south until they have filled their existing basins. Figure 15 on the following page shows the basins around Harrisburg and the current service limits for the City of Sioux Falls. Figure 16 is a more in depth look at the subbasins that cover the future growth area that SECOG developed in their Comprehensive Plan. The map also shows intersecting the Schindler Creek basin with a future trunk sewer that extends to the Sioux Falls service area. A lift station would need to be installed to pump the wastewater over the ridge to the Nielson or Ninemile basins.

The two main components in the design of trunk sewers are the location and size. Trunk line sewers are typically responsible for capturing all the flow in a primary basin while lateral sewers are dedicated to intercept individual sub-basins. Lateral sewers are typically the direct interceptors for individual properties. It is critical to consider the overall drainage basin when sizing the trunk sewers. The wastewater flow from a basin can be calculated by knowing the size of the basin and the land use. The recommended wastewater flows for each land use type is shown in the following table. These recommendations were established from conversations with City staff about current and future lot sizes. The land use type is based on the current zoning and the future land use established in the Harrisburg Comprehensive Plan. It is recommended the City change their current Design Standards to follow the table below.

Table 13 Density Design Table

Districts	A_D Area Density (Units/Acre)	U_D Unit Density (People/Unit)	R Rate (gpcd)	F Flow (gal/ac)
Natural Resource Conservation (NRC)	1	3	100	300
Single Family Residential (R-1)	4	3	100	1,200
Multi-Family Residential (R-2)	12	3	100	3,600
Manufactured Housing Residential (R-3)	6	3	100	1,800
Central Business (CB)	2	10	100	2,000
General Business (GB)	2	10	100	2,000
Light Industrial (LI)	2	3	100	600
Heavy Industrial (HI)	1	15	100	1,500
Planned Development (PD)	2	10	100	2,000

The previous table determines the average daily flow from a basin by multiplying the number of acres from each zoning classification by a unit density and flow rate. The flow of wastewater varies throughout the day and the year. The peak daily flow from a small residential area will typically occur around noon or in the early evening hours and may vary from 200 to 400 percent of the average daily flow. Due to storage and lag time in larger basins, daily peak flows are more consistent and may only vary 180 to 250 percent of the average daily flow. For this reason a peak daily flow factor or peaking factor is assumed and multiplied by the average daily flow to obtain the peak daily flow. The SD Design Criteria Manual requires a peaking factor of 2.5 for trunk sewers and 4 for lateral sewers. The peak daily flow is typically used in the design and sizing of sanitary sewer mains. The wastewater flows from the future basins are shown in the following table.

Table 14 Future Basin Flows

Basin	Area (acres)	Acres in Each Zoning Classification									Average Daily Flow (cfs)	Peaking Factor	Peak Flow (cfs)
		NRC	R-1	R-2	R-3	CB	GB	LI	HI	PD			
Schindler	1,904	231	1,361						312		3.4	2.5	8.4
Coyote	2,388	290	1,971				31			97	4.2	2.5	10.5
Honeysuckle	640		505				5			130	1.4	2.5	3.4
Nine Mile	3,020	181	2,839								5.4	2.5	13.4
Tiger	558	31	493				34				1.0	2.5	2.6
Stencil	2,037	149	1,886				2				3.6	2.5	8.9
Nielson	852	22	808				21				1.6	2.5	3.9
Minnesota	294		154				16			124	0.7	2.5	1.8
Total	11,692	904	10,017	0	0	0	109	0	312	350			

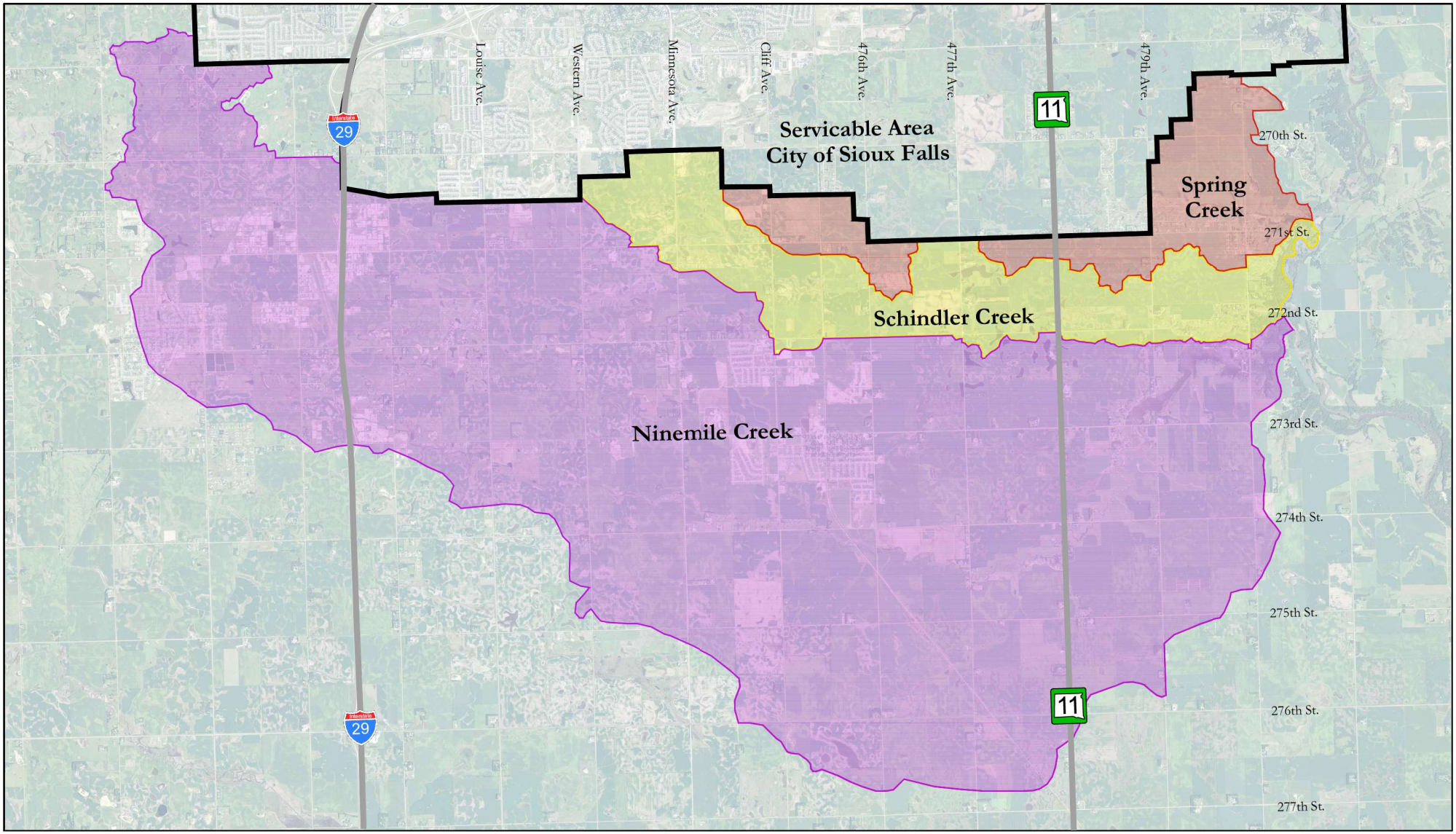


Figure 15 | Master Basin Plan

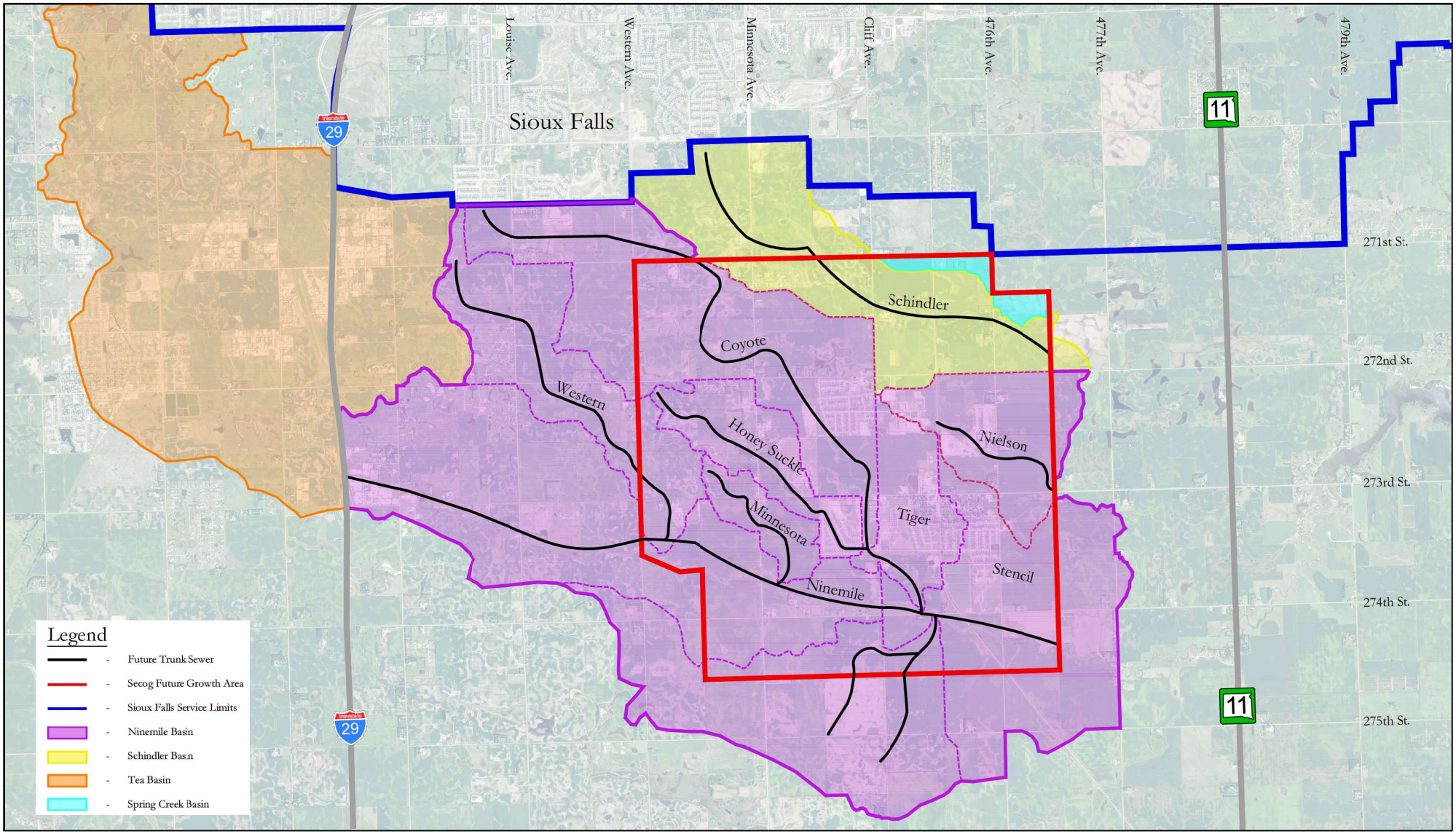


Figure 16 | Growth Area Basin Plan

1" = 4000'

STOCKWELL ENGINEERS

WASTEWATER TREATMENT ALTERNATIVES

The following alternatives were developed to correct the deficiencies listed below:

1) The existing treatment system is overloaded hydraulically.
2) The existing treatment system is overloaded organically.
3) The City receives several complaints about smell from the ponds.
4) Sludge is building up around the inlet structure.

PERMIT LIMITS

Harrisburg currently does not have permit limits because they do not discharge. However, Kathleen Grigg with the SD DENR was contacted about potential discharge limits for various streams to determine if discharging would be a possible treatment alternative. The streams that were evaluated include Ninemile Creek, Schindler Creek, Spring Creek and the Big Sioux River. Ninemile Creek is not a feasible discharge site because the ponds are within five miles of Lake Alvin. Schindler and Spring Creeks were investigated because the existing force main to Sioux Falls crosses these streams. The force main allows the potential to add a discharge structure and discharge to one of these streams. However, the DENR proposed low limits for these two streams because they have similar low flows. Beaver Creek was also considered in previous conversations but the proposed limits would be similar to Schindler and Spring Creek. The Big Sioux River has the highest proposed limits because it has the highest flow. Therefore, any proposed discharges are recommended to go to the Big Sioux River. The DENR provided a range for the ammonia limits but the low end is utilized in order to be conservative. They also provided a limit based on two different discharge rates. The proposed discharge limits for the Big Sioux River are shown in the following table. Anti-degradation limits were never provided by the DENR.

Table 15 Big Sioux River Discharge Limits

	30-Day Average	7-Day Average	Daily Maximum
BOD5 (mg/L)	30	45	N/A
Total Suspended Solids (mg/L)	30	45	N/A
E. coli (#/100mL)			
May 1 - September 30	126		235
Ammonia-Nitrogen(mg/L)			
180,000 gpd	23.4		172
900,000 gpd	4.9		36.2
pH	6.5 - 9.0		

Future changes to the permit limits were also considered. Albert Spangler with the DENR was contacted to determine how limits would change in the future. The Environmental Protection Agency directs the SD DENR on what they want the Water Quality Standards to be. The DENR renews their Water Quality Standards every three years. The latest revision just occurred earlier this year. The DENR indicated that the next change to permit limits will be lower ammonia limits. Kathleen Grigg said they are doing fieldwork this summer and will have a better idea of how much the ammonia limits will be lowered. Preliminary indications are that the daily maximum would be reduced by one third and the 30-day average would be reduced by two thirds. In three years the DENR would implement the lower ammonia limits and then each community would have an implementation schedule added to their permit when they renew. Proposed alternatives to the wastewater treatment system will be designed for these lower treatment limits.

The DENR also indicated that nutrient removal would be required when their Water Quality Standards renew in 2020. Preliminary indications are that total nitrogen would be less than 10 and phosphorus would be less than one. These removal processes are not included in the estimates but the City should be aware of the future requirements. Additional area should be included with the proposed improvements to add this process at a later date.

TREATMENT ALTERNATIVE 1: DO NOTHING

The first treatment alternative is the "Do Nothing". This alternative is not considered acceptable because it will not address any of the deficiencies identified above.

TREATMENT ALTERNATIVE 2: TOTAL RETENTION

The current treatment system was constructed in 1999 and was designed for total retention. Since construction the City has grown by 493% which has caused the system to be undersized. Treatment Alternative 2 expands the treatment system and provides enough hydraulic capacity to meet the 20 year design flows for total retention. The dikes in the existing system would be removed to increase the size of the primary cell for the organic loading. However, this would still not be large enough to meet the 2034 required primary cell size. Sludge removal in cell one is included in this alternative. This alternative would not require the DENR Permit to be changed because Harrisburg is currently "No Discharge". The City is not allowed to discharge because Ninemile Creek is the receiving stream and Lake Alvin is only four miles downstream.

There are three negative aspect of this alternative. First the gravity lift station would only be used to pump wastewater from the existing cell three to the new cells. The force main

to Sioux Falls would no longer be needed. Second, the SD DENR requires a pond site be located one-half mile from a community, one-fourth mile from farm home or residence and 1,000 feet from a potable well. This limits the location for the expansion and the current cells do not meet these criteria. Third, there is still the potential for complaints about smell because the ponds are still adjacent to the City. The proposed hydraulic loading and cost estimate are shown in the following tables. The hydraulic loading requires a total water surface area of 253 acres or an additional 213 acres. It should be noted that the seepage rate of the new cells is critical in determining the required surface area. If the seepage rate would be reduced to 1/16 in/day the required surface area would be 412 acres.

Table 16 Hydraulic Loading for Total Retention

	Proposed
Population	17,199
Wastewater Flow (gpcpd)	60
Infiltration & Inflow (gpd)	31,000
Design Storage Time (days)	365
Total Pond Influent (gal)	387,973,100
Total Pond Influent (ac/ft)	1,191
Primary Seepage (in/day)	1/16
Secondary Seepage (in/day)	1/8
Seepage (ft/yr)	3.7
Evaporation (in/yr)	35.4
Evaporation (ft/yr)	3.0
Precipitation (in/yr)	23.5
Precipitation (ft/yr)	2.0
Total Losses	4.7
Required Surface Area (ac)	**253**

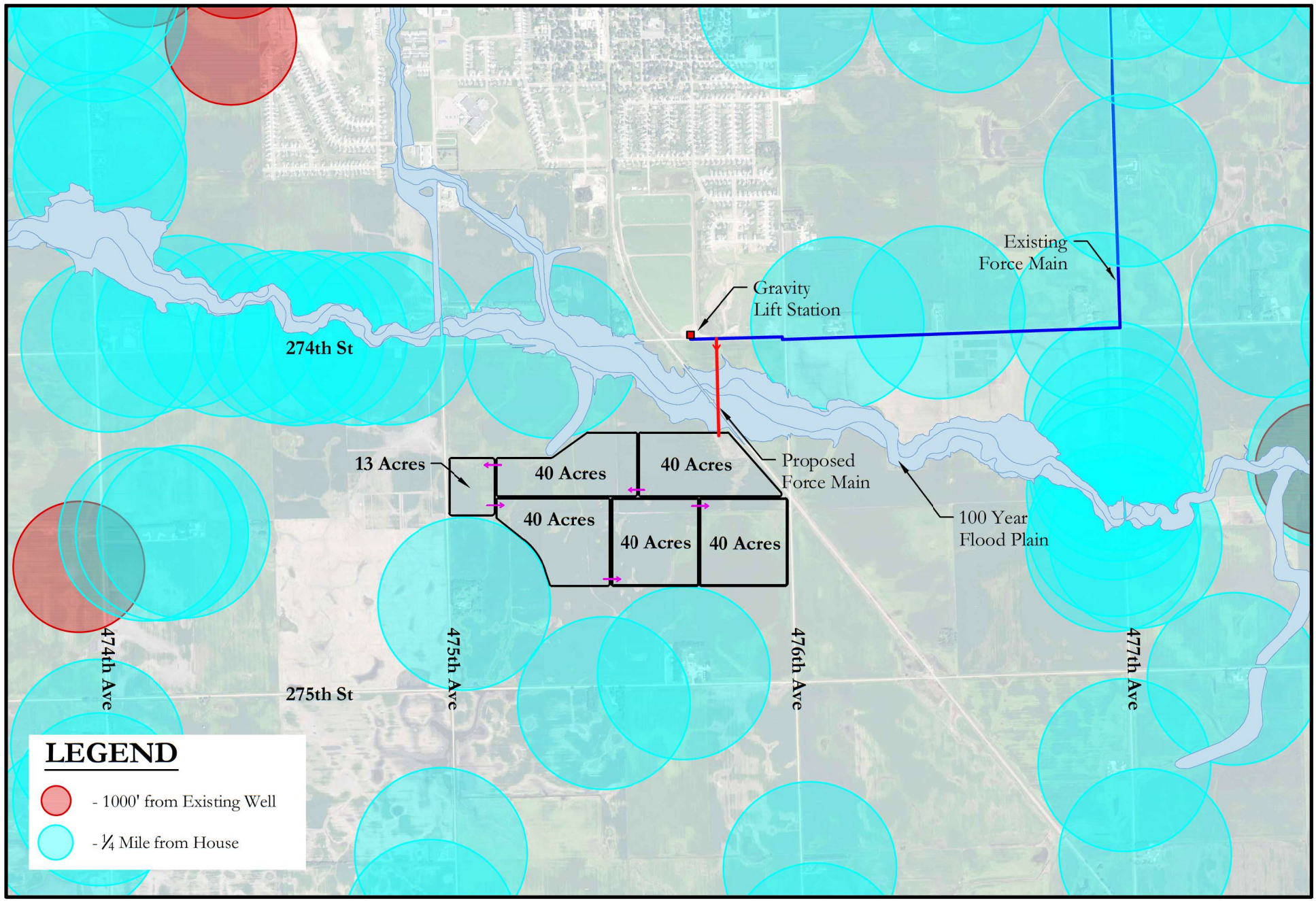


Figure 17 | Treatment Alternative 2

1" = 2000'

STOCKWELL ENGINEERS

Table 17 Cost Estimate for Treatment Alternative 2

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$793,000.00	$793,000.00
2	Clearing	1	LS	$15,000.00	$15,000.00
3	Traffic Control	1	LS	$5,000.00	$5,000.00
4	Gravel Surfacing	100	TON	$15.00	$1,500.00
5	Remove Existing Dikes	37,500	CY	$4.00	$150,000.00
6	Unclassified Excavation	1,031,000	CY	$3.00	$3,093,000.00
7	Salvage & Place Topsoil	172,000	CY	$5.00	$860,000.00
8	Scarify & Recompact Liner	1,031,000	SY	$1.00	$1,031,000.00
9	Pond Site Warning Signs	50	EA	$150.00	$7,500.00
10	Class B Rip Rap	47,000	TON	$35.00	$1,645,000.00
11	Type B Drainage Fabric	65,000	SY	$3.00	$195,000.00
12	Dewatering	1	LS	$20,000.00	$20,000.00
13	12" DIP Piping	450	LF	$75.00	$33,750.00
14	12" Gate Valve & Box	6	EA	$3,000.00	$18,000.00
15	Concrete Water Stop	12	EA	$500.00	$6,000.00
16	Pond Inlet Structure	6	EA	$2,500.00	$15,000.00
17	Pond Outlet Structure	5	EA	$2,500.00	$12,500.00
18	Pond Depth Indicators	6	EA	$4,000.00	$24,000.00
19	16" Force Main	1,700	FT	$55.00	$93,500.00
20	16" Sanitary Bedding Material	1,700	FT	$5.00	$8,500.00
21	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
22	Railraod Crossing	2	EA	$10,000.00	$20,000.00
23	Connect to Existing Force Main	1	EA	$2,500.00	$2,500.00
24	Sludge Removal	14,900	CY	$30.00	$447,000.00
25	Woven Wire Fence	13,000	FT	$6.00	$78,000.00
26	Seeding, Fertilizing & Mulching	86,000	SY	$1.50	$129,000.00
				Subtotal	$8,720,750.00
				Contingencies (15%)	$1,309,000.00
				Total Estimated Construction Costs	**$10,029,750.00**
				ENGINEERING	**$1,299,000.00**
				LAND PURCHASE (260 AC.)	**$6,500,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$402,000.00**
				TOTAL ESTIMATED PROJECT COST	**$18,230,750.00**

Table 18 EUAC for Treatment Alternative 2

Capital Cost Description	Price	Salvage Value	Present Worth of Salvage Value	Net Present Worth
Mobilization	$793,000	$0	$0	$793,000
Clearing	$15,000	$0	$0	$15,000
Traffic Control	$5,000	$0	$0	$5,000
Gravel Surfacing	$1,500	$0	$0	$1,500
Remove Existing Dikes	$150,000	$0	$0	$150,000
Unclassified Excavation	$3,093,000	$0	$0	$3,093,000
Salvage & Place Topsoil	$860,000	$0	$0	$860,000
Scarify & Recompact Liner	$1,031,000	$0	$0	$1,031,000
Pond Site Warning Signs	$7,500	$4,500	$2,492	$5,008
Class B Rip Rap	$1,645,000	$987,000	$546,478	$1,098,522
Type B Drainage Fabric	$195,000	$0	$0	$195,000
Dewatering	$20,000	$0	$0	$20,000
12" DIP Piping	$33,750	$20,250	$11,212	$22,538
12" Gate Valve & Box	$18,000	$10,800	$5,980	$12,020
Concrete Water Stop	$6,000	$3,600	$1,993	$4,007
Pond Inlet Structure	$15,000	$9,000	$4,983	$10,017
Pond Outlet Structure	$12,500	$7,500	$4,153	$8,347
Pond Depth Indicators	$24,000	$14,400	$7,973	$16,027
16" Force Main	$93,500	$56,100	$31,061	$62,439
16" Sanitary Bedding Material	$8,500	$5,100	$2,824	$5,676
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
Railraod Crossing	$20,000	$12,000	$6,644	$13,356
Connect to Existing Force Main	$2,500	$0	$0	$2,500
Sludge Removal	$447,000	$0	$0	$447,000
Woven Wire Fence	$78,000	$0	$0	$78,000
Seeding, Fertilizing & Mulching	$129,000	$0	$0	$129,000
Land Purchase	$6,500,000	$6,500,000	$3,598,892	$2,901,108
Remaining Capital Costs	$3,010,000	$0	$0	$3,010,000
Total Construction Cost	**$18,230,750**	**$7,640,450**	**$4,230,332**	**$14,000,418**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$1,500			$22,316
Supplies	$1,500			$22,316
Utilities	$0			$0
Labor	$5,000			$74,387
Total Annual Cost	**$8,000**			**$119,020**
			Total Net Present Worth	**$14,119,438**
			EUAC	**$949,048**

TREATMENT ALTERNATIVE 3: 180 DAY STORAGE

Treatment Alternative 3 expands the treatment system and provides enough hydraulic capacity to meet the 20 year design flows for 180 day storage. The dikes in the existing

system would be removed to increase the size of the primary cell for the organic loading. However, this would still not be large enough to meet the 2034 required primary cell size. Sludge removal in cell one is included in this alternative. This alternative would require the DENR Permit to be changed because Harrisburg is currently "No Discharge". The City is not allowed to discharge because Ninemile Creek is the receiving stream and Lake Alvin is only four miles downstream. This alternative would utilize the existing lift station to pump to the new treatment ponds and it would also be used to discharge to the Big Sioux River.

There are three negative aspect of this alternative. First, the SD DENR requires a pond site be located one-half mile from a community, one-fourth mile from farm home or residence and 1,000 feet from a potable well. This limits the location for the expansion and the current cells do not meet these criteria. Second, there is still the potential for complaints about smell because the ponds are still adjacent to the City. Third, this type of treatment system cannot guarantee that the permit limits can be met 100% of the time. The proposed hydraulic loading and cost estimate are shown in the following tables. The hydraulic loading requires an additional 69 acres of water surface area.

Table 19 Hydraulic Loading for 180 Day Storage

	Proposed
Population	17,199
Wastewater Flow (gpcpd)	60
Infiltration & Inflow (gpd)	31,000
Design Storage Time (days)	180
Total Pond Influent (gal)	191,330,113
Cell One	
9.7 ac x 43560 x 3 x 7.48	9,482,252
Cell Two	
9.6 ac x 43560 x 4 x 7.48	12,512,662
Cell Three	
18.5 ac x 43560 x 6 x 7.48	36,169,414
Additional Storage	
69 ac x 43560 x 6 x 7.48	134,902,140
Total Storage (gal)	193,066,469
Remaining Storage (gal)	1,736,356

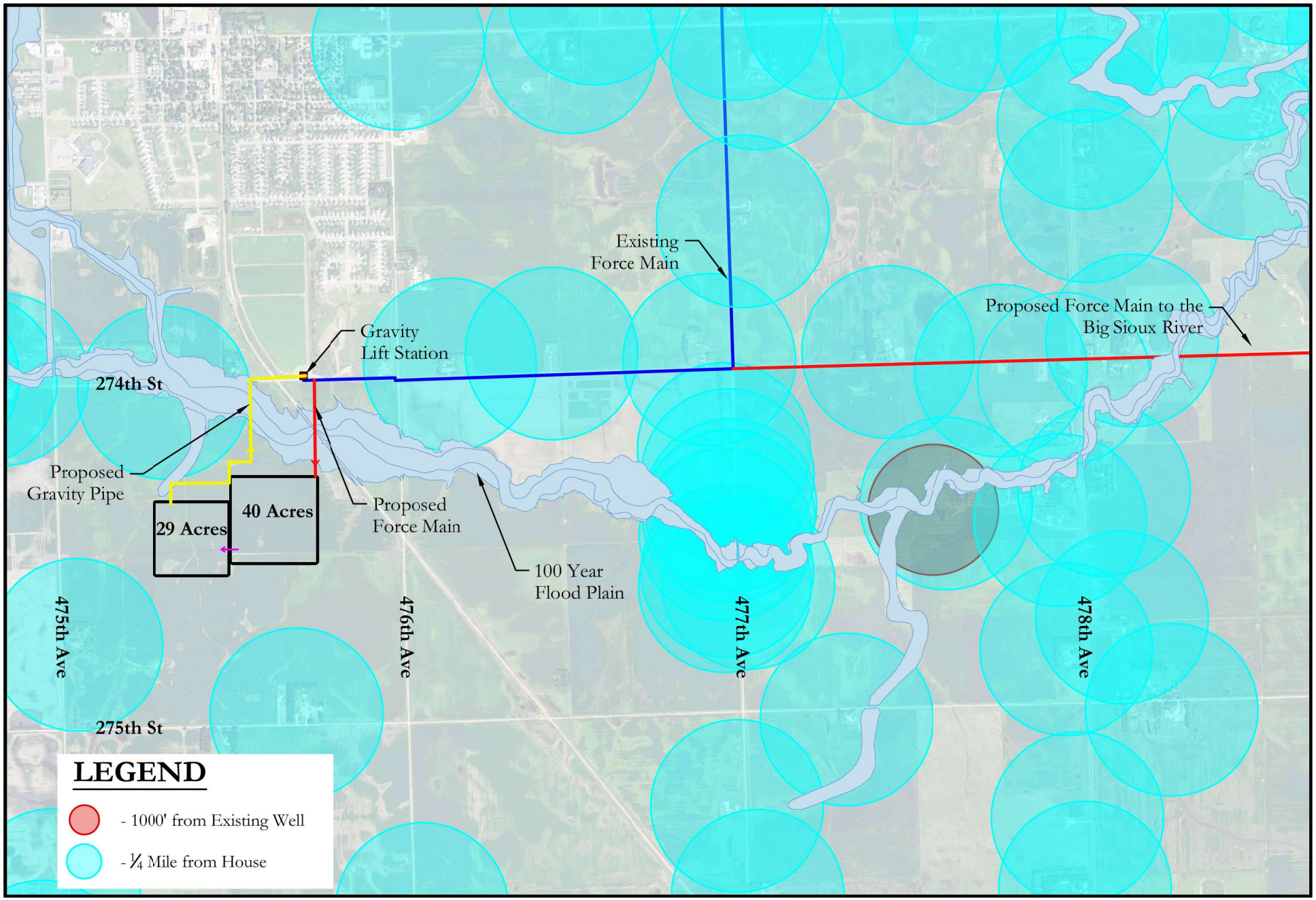


Figure 18 | Treatment Alternative 3

1" = 2000'

CITY OF HARRISBURG SOUTH DAKOTA

STOCKWELL ENGINEERS

Table 20 Cost Estimate for Treatment Alternative 3

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$680,000.00	$680,000.00
2	Clearing	1	LS	$20,000.00	$20,000.00
3	Traffic Control	1	LS	$15,000.00	$15,000.00
4	Gravel Surfacing	200	TON	$15.00	$3,000.00
5	Surfacing Repairs	1	LS	$5,000.00	$5,000.00
6	Remove Existing Dikes	37,500	CY	$4.00	$150,000.00
7	Unclassified Excavation	613,000	CY	$3.00	$1,839,000.00
8	Salvage & Place Topsoil	65,000	CY	$5.00	$325,000.00
9	Scarify & Recompact Liner	334,000	SY	$1.00	$334,000.00
10	Pond Site Warning Signs	20	EA	$150.00	$3,000.00
11	Class B Rip Rap	35,000	TON	$35.00	$1,225,000.00
12	Type B Drainage Fabric	48,000	SY	$3.00	$144,000.00
13	Dewatering	1	LS	$15,000.00	$15,000.00
14	12" DIP Piping	200	LF	$75.00	$15,000.00
15	12" Gate Valve & Box	2	EA	$3,000.00	$6,000.00
16	Concrete Water Stop	4	EA	$500.00	$2,000.00
17	Pond Inlet Structure	2	EA	$2,500.00	$5,000.00
18	Pond Outlet Structure	2	EA	$2,500.00	$5,000.00
19	Pond Depth Indicators	2	EA	$4,000.00	$8,000.00
20	River Discharge Structure	1	EA	$10,000.00	$10,000.00
21	16" Force Main	27,600	FT	$55.00	$1,518,000.00
22	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
23	15" PVC Gravity Sewer	3,700	FT	$55.00	$203,500.00
24	16" Sanitary Bedding Material	27,600	FT	$6.00	$165,600.00
25	15" Sanitary Bedding Material	3,700	FT	$5.00	$18,500.00
26	Ninemile & Railraod Crossing	3	EA	$10,000.00	$30,000.00
27	Post Televising	3,700	FT	$1.50	$5,550.00
28	Connect to Existing Force Main	2	EA	$2,500.00	$5,000.00
29	Connect to Existing Lift Station	1	EA	$5,000.00	$5,000.00
30	Sanitary Sewer Manhole	10	EA	$3,500.00	$35,000.00
31	Air Release Manhole	5	EA	$8,000.00	$40,000.00
32	Sludge Removal	14,900	CY	$30.00	$447,000.00
33	Woven Wire Fence	5,000	FT	$6.00	$30,000.00
34	Seeding, Fertilizing & Mulching	100,000	SY	$1.50	$150,000.00
				Subtotal	$7,479,150.00
				Contingencies (15%)	$1,122,000.00
				Total Estimated Construction Costs	**$8,601,150.00**
				ENGINEERING	**$1,119,000.00**
				LAND PURCHASE (90 AC.)	**$2,250,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$345,000.00**
				TOTAL ESTIMATED PROJECT COST	**$12,315,150.00**

Table 21 EUAC for Treatment Alternative 3

Capital Cost		Salvage	Present Worth	Net Present
Description	Price	Value	of Salvage Value	Worth
Mobilization	$680,000	$0	$0	$680,000
Clearing	$20,000	$0	$0	$20,000
Traffic Control	$15,000	$0	$0	$15,000
Gravel Surfacing	$3,000	$0	$0	$3,000
Surfacing Repairs	$5,000	$0	$0	$5,000
Remove Existing Dikes	$150,000	$0	$0	$150,000
Unclassified Excavation	$1,839,000	$0	$0	$1,839,000
Salvage & Place Topsoil	$325,000	$0	$0	$325,000
Scarify & Recompact Liner	$334,000	$0	$0	$334,000
Pond Site Warning Signs	$3,000	$1,800	$997	$2,003
Class B Rip Rap	$1,225,000	$735,000	$406,952	$818,048
Type B Drainage Fabric	$144,000	$0	$0	$144,000
Dewatering	$15,000	$0	$0	$15,000
12" DIP Piping	$15,000	$9,000	$4,983	$10,017
12" Gate Valve & Box	$6,000	$3,600	$1,993	$4,007
Concrete Water Stop	$2,000	$1,200	$664	$1,336
Pond Inlet Structure	$5,000	$3,000	$1,661	$3,339
Pond Outlet Structure	$5,000	$3,000	$1,661	$3,339
Pond Depth Indicators	$8,000	$4,800	$2,658	$5,342
River Discharge Structure	$10,000	$6,000	$3,322	$6,678
16" Force Main	$1,518,000	$910,800	$504,288	$1,013,712
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
15" PVC Gravity Sewer	$203,500	$122,100	$67,604	$135,896
16" Sanitary Bedding Material	$165,600	$0	$0	$165,600
15" Sanitary Bedding Material	$18,500	$0	$0	$18,500
Ninemile & Railraod Crossing	$30,000	$0	$0	$30,000
Post Televising	$5,550	$0	$0	$5,550
Connect to Existing Force Main	$5,000	$0	$0	$5,000
Connect to Existing Lift Station	$5,000	$0	$0	$5,000
Sanitary Sewer Manhole	$35,000	$21,000	$11,627	$23,373
Air Release Manhole	$40,000	$24,000	$13,288	$26,712
Sludge Removal	$447,000	$0	$0	$447,000
Woven Wire Fence	$30,000	$0	$0	$30,000
Seeding, Fertilizing & Mulching	$150,000	$0	$0	$150,000
Land Purchase	$2,250,000	$2,250,000	$1,245,770	$1,004,230
Remaining Capital Costs	$2,586,000	$0	$0	$2,586,000
Total Construction Cost	**$12,315,150**	**$4,105,500**	**$2,273,116**	**$10,042,034**
Annual Operation and Maintenance Cost				
Description	Annual Cost			Net Present Worth
Equipment	$3,000			$44,632
Supplies	$3,000			$44,632
Utilities	$15,000			$223,162
Labor	$10,000			$148,775
Total Annual Cost	**$31,000**			**$461,202**
			Total Net Present Worth	**$10,503,236**
			EUAC	**$705,982**

TREATMENT ALTERNATIVE 4: ARTIFICIAL WETLAND

Treatment Alternative 4 proposes the City expands the treatment system to provide more storage and an artificial wetland. The dikes in the existing system would be removed to increase the size of the primary cell for the organic loading. However, this would still not be large enough to meet the 2034 required primary cell size. Sludge removal in cell one is included in this alternative. This alternative would require the DENR Permit to be changed because Harrisburg is currently "No Discharge". This alternative would utilize the existing lift station to pump to the new treatment ponds and it would also be used to discharge to the Big Sioux River.

There are three negative aspects of this alternative. First, the SD DENR requires a pond site be located one-half mile from a community, one-fourth mile from farm home or residence and 1,000 feet from a potable well. This limits the location for the expansion and the current cells do not meet these criteria. Second, there is still the potential for complaints about smell because the ponds are still adjacent to the City. Third, this type of treatment system cannot guarantee that the permit limits can be met 100% of the time. The proposed hydraulic loading and cost estimate are shown in the following tables. The SD DENR requires a minimum of 180 days of combined storage between the cells and the wetland. The hydraulic loading requires an additional 63 acres of water surface area and 43 acres of wetland.

Table 22 Hydraulic Loading for Artificial Wetland

	Proposed
Population	17,199
Wastewater Flow (gpcpd)	60
Infiltration & Inflow (gpd)	31,000
Design Storage Time (days)	180
Total Pond Influent (gal)	191,330,113
Cell One	
9.7 ac x 43560 x 3 x 7.48	9,482,252
Cell Two	
9.6 ac x 43560 x 4 x 7.48	12,512,662
Cell Three	
18.5 ac x 43560 x 6 x 7.48	36,169,414
Additional Storage	
63 ac x 43560 x 6 x 7.48	123,171,519
Wetland	
43 ac x 43560 x .75 x 7.48	10,508,681
Total Storage (gal)	191,844,529
Remaining Storage (gal)	514,416

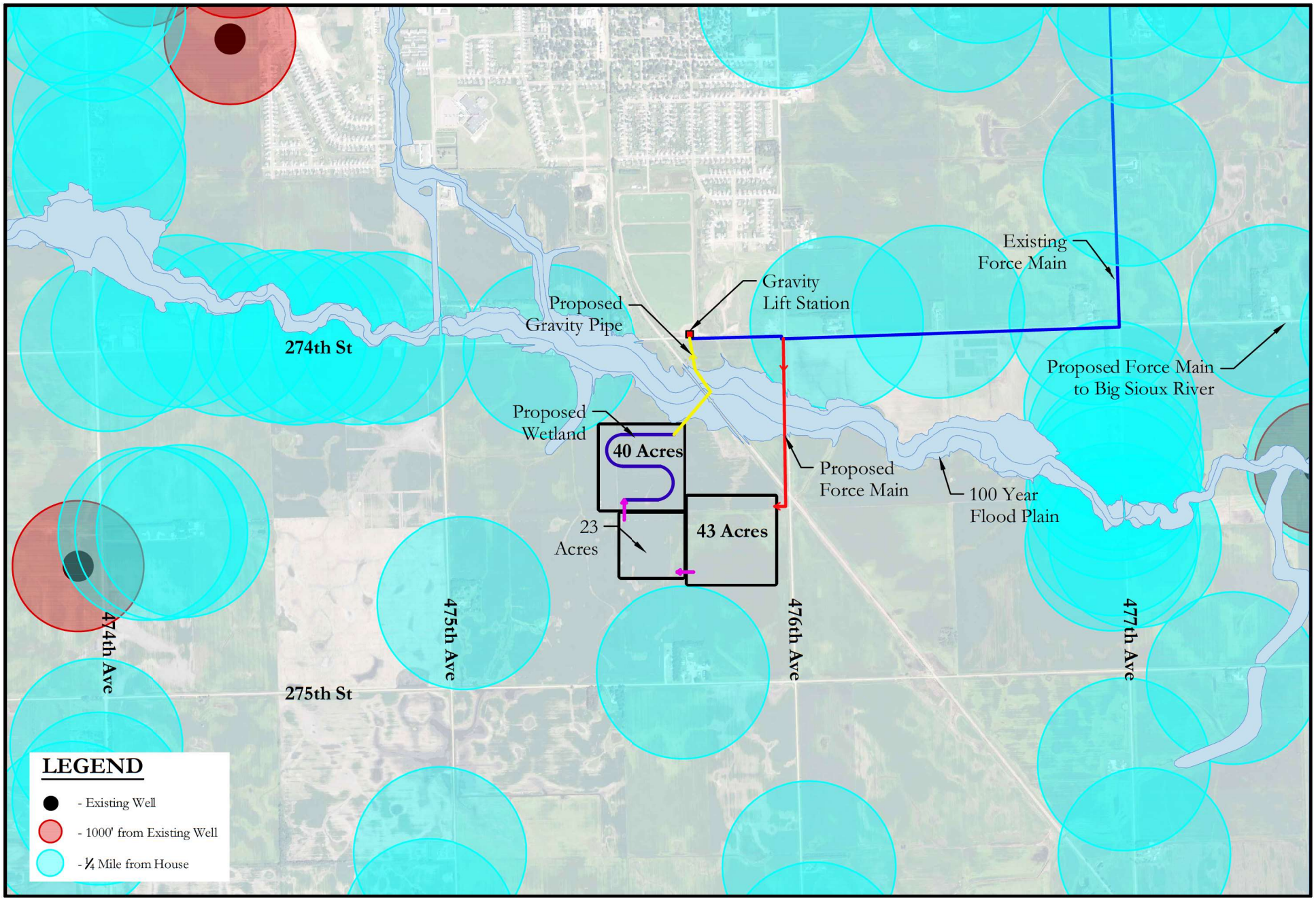


Figure 19 | Treatment Alternative 4

1" = 2000'

STOCKWELL ENGINEERS

Table 23 Cost Estimate for Treatment Alternative 4

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$751,000.00	$751,000.00
2	Clearing	1	LS	$20,000.00	$20,000.00
3	Traffic Control	1	LS	$15,000.00	$15,000.00
4	Gravel Surfacing	200	TON	$15.00	$3,000.00
5	Surfacing Repairs	1	LS	$5,000.00	$5,000.00
6	Remove Existing Dikes	37,500	CY	$4.00	$150,000.00
7	Unclassified Excavation	837,000	CY	$3.00	$2,511,000.00
8	Salvage & Place Topsoil	94,000	CY	$5.00	$470,000.00
9	Scarify & Recompact Liner	305,000	SY	$1.00	$305,000.00
10	Pond Site Warning Signs	30	EA	$150.00	$4,500.00
11	Class B Rip Rap	33,000	TON	$35.00	$1,155,000.00
12	Type B Drainage Fabric	46,000	SY	$3.00	$138,000.00
13	Dewatering	1	LS	$20,000.00	$20,000.00
14	12" DIP Piping	300	LF	$75.00	$22,500.00
15	12" Gate Valve & Box	3	EA	$3,000.00	$9,000.00
16	Concrete Water Stop	6	EA	$500.00	$3,000.00
17	Pond Inlet Structure	3	EA	$2,500.00	$7,500.00
18	Pond Outlet Structure	3	EA	$2,500.00	$7,500.00
19	Pond Depth Indicators	3	EA	$4,000.00	$12,000.00
20	River Discharge Structure	1	EA	$10,000.00	$10,000.00
21	16" Force Main	29,200	FT	$55.00	$1,606,000.00
22	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
23	15" PVC Gravity Sewer	1,200	FT	$55.00	$66,000.00
24	16" Sanitary Bedding Material	29,200	FT	$6.00	$175,200.00
25	15" Sanitary Bedding Material	1,200	FT	$5.00	$6,000.00
26	Ninemile & Railraod Crossing	3	EA	$10,000.00	$30,000.00
27	Post Televising	1,200	FT	$1.50	$1,800.00
28	Connect to Existing Force Main	2	EA	$2,500.00	$5,000.00
29	Connect to Existing Lift Station	1	EA	$5,000.00	$5,000.00
30	Sanitary Sewer Manhole	3	EA	$3,500.00	$10,500.00
31	Air Release Manhole	5	EA	$8,000.00	$40,000.00
32	Sludge Removal	14,900	CY	$30.00	$447,000.00
33	Woven Wire Fence	8,000	FT	$6.00	$48,000.00
34	Seeding, Fertilizing & Mulching	123,000	SY	$1.50	$184,500.00
				Subtotal	$8,261,000.00
				Contingencies (15%)	$1,240,000.00
				Total Estimated Construction Costs	**$9,501,000.00**
				ENGINEERING	**$1,232,000.00**
				LAND PURCHASE (130 AC.)	**$3,250,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$381,000.00**
				TOTAL ESTIMATED PROJECT COST	**$14,364,000.00**

Table 24 EUAC for Treatment Alternative 4

Capital Cost Description	Price	Salvage Value	Present Worth of Salvage Value	Net Present Worth
Mobilization	$751,000	$0	$0	$751,000
Clearing	$20,000	$0	$0	$20,000
Traffic Control	$15,000	$0	$0	$15,000
Gravel Surfacing	$3,000	$0	$0	$3,000
Surfacing Repairs	$5,000	$0	$0	$5,000
Remove Existing Dikes	$150,000	$0	$0	$150,000
Unclassified Excavation	$2,511,000	$0	$0	$2,511,000
Salvage & Place Topsoil	$470,000	$0	$0	$470,000
Scarify & Recompact Liner	$305,000	$0	$0	$305,000
Pond Site Warning Signs	$4,500	$2,700	$1,495	$3,005
Class B Rip Rap	$1,155,000	$693,000	$383,697	$771,303
Type B Drainage Fabric	$138,000	$0	$0	$138,000
Dewatering	$20,000	$0	$0	$20,000
12" DIP Piping	$22,500	$13,500	$7,475	$15,025
12" Gate Valve & Box	$9,000	$5,400	$2,990	$6,010
Concrete Water Stop	$3,000	$1,800	$997	$2,003
Pond Inlet Structure	$7,500	$4,500	$2,492	$5,008
Pond Outlet Structure	$7,500	$4,500	$2,492	$5,008
Pond Depth Indicators	$12,000	$7,200	$3,986	$8,014
River Discharge Structure	$10,000	$6,000	$3,322	$6,678
16" Force Main	$1,606,000	$963,600	$533,522	$1,072,478
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
15" PVC Gravity Sewer	$66,000	$39,600	$21,926	$44,074
16" Sanitary Bedding Material	$175,200	$0	$0	$175,200
15" Sanitary Bedding Material	$6,000	$0	$0	$6,000
Ninemile & Railraod Crossing	$30,000	$0	$0	$30,000
Post Televising	$1,800	$0	$0	$1,800
Connect to Existing Force Main	$5,000	$0	$0	$5,000
Connect to Existing Lift Station	$5,000	$0	$0	$5,000
Sanitary Sewer Manhole	$10,500	$6,300	$3,488	$7,012
Air Release Manhole	$40,000	$24,000	$13,288	$26,712
Sludge Removal	$447,000	$0	$0	$447,000
Woven Wire Fence	$48,000	$0	$0	$48,000
Seeding, Fertilizing & Mulching	$184,500	$0	$0	$184,500
Land Purchase	$3,250,000	$3,250,000	$1,799,446	$1,450,554
Remaining Capital Costs	$2,853,000	$0	$0	$2,853,000
Total Construction Cost	**$14,364,000**	**$5,032,300**	**$2,786,262**	**$11,577,738**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$3,000			$44,632
Supplies	$3,000			$44,632
Utilities	$15,000			$223,162
Labor	$10,000			$148,775
Total Annual Cost	**$31,000**			**$461,202**
			Total Net Present Worth	**$12,038,939**
			EUAC	**$809,206**

TREATMENT ALTERNATIVE 5: IRRIGATION

Treatment Alternative 5 proposes the City expands the treatment system to provide more storage and allow farmers to use the treated wastewater to irrigate. The Cities of Sturgis, Custer, Hot Springs and Mitchell all irrigate with their wastewater. The dikes in the existing system would be removed to increase the size of the primary cell for the organic loading. However, this would still not be large enough to meet the 2034 required primary cell size. Sludge removal in cell one is included in this alternative. This alternative would require the DENR Permit to be changed because Harrisburg is currently "No Discharge". This alternative would utilize the existing lift station to pump to the new treatment ponds and it would also be used to pump to the irrigation pivots.

There are two negative aspects of this alternative. First, the SD DENR requires a pond site be located one-half mile from a community, one-fourth mile from farm home or residence and 1,000 feet from a potable well. This limits the location for the expansion and the current cells do not meet these criteria. The DENR also requires the location of the irrigation system be one mile from municipal water supply, one-fourth mile from a domestic water supply, one-fourth mile from state parks or recreation areas, 100 feet from neighboring property lines and one-fourth mile from lakes. Second, there is still the potential for complaints about smell because the ponds are still adjacent to the City.

A sample was taken of the wastewater on the south end of cell three. The sample determined that the salinity was low. Low salinity water reduces the infiltration rate of soils. Soil crusting and crop emergence can also become a problem. The Lincoln County USDA was contacted to discuss what soil types would be suitable for irrigation. Soils map units starting with a W should be targeted and map units starting with a T or C should be avoided.

The DENR has established the maximum application rate for purposes of irrigation. The maximum rate is two inches per acre per week or 24 inches per acre per year. Based on this requirement the City would need 343 acres to meet the 20 year design flows. The City needs to be cautious on how they structure the irrigation agreements with the farmers. Other communities have had troubles because the City needs to irrigate at a time when the farmer doesn't want them too. This alternative assumes the City purchases the land and pivots so they can control when they want to irrigate. It is assumed the farm ground rent would cover the operation and maintenance costs. The proposed hydraulic loading and cost estimate are shown in the following tables. The SD DENR requires a minimum of 210 days of storage because the City would only be able to

irrigation during the summer. The hydraulic loading requires an additional 85 acres of water surface area.

Table 25 Hydraulic Loading for Irrigation

	Proposed
Population	17,199
Wastewater Flow (gpcpd)	60
Infiltration & Inflow (gpd)	31,000
Design Storage Time (days)	210
Total Pond Influent (gal)	223,218,465
Cell One	
9.7 ac x 43560 x 3 x 7.48	9,482,252
Cell Two	
9.6 ac x 43560 x 4 x 7.48	12,512,662
Cell Three	
18.5 ac x 43560 x 6 x 7.48	36,169,414
Additional Storage	
85 ac x 43560 x 6 x 7.48	166,183,796
Total Storage (gal)	224,348,124
Remaining Storage (gal)	1,129,660

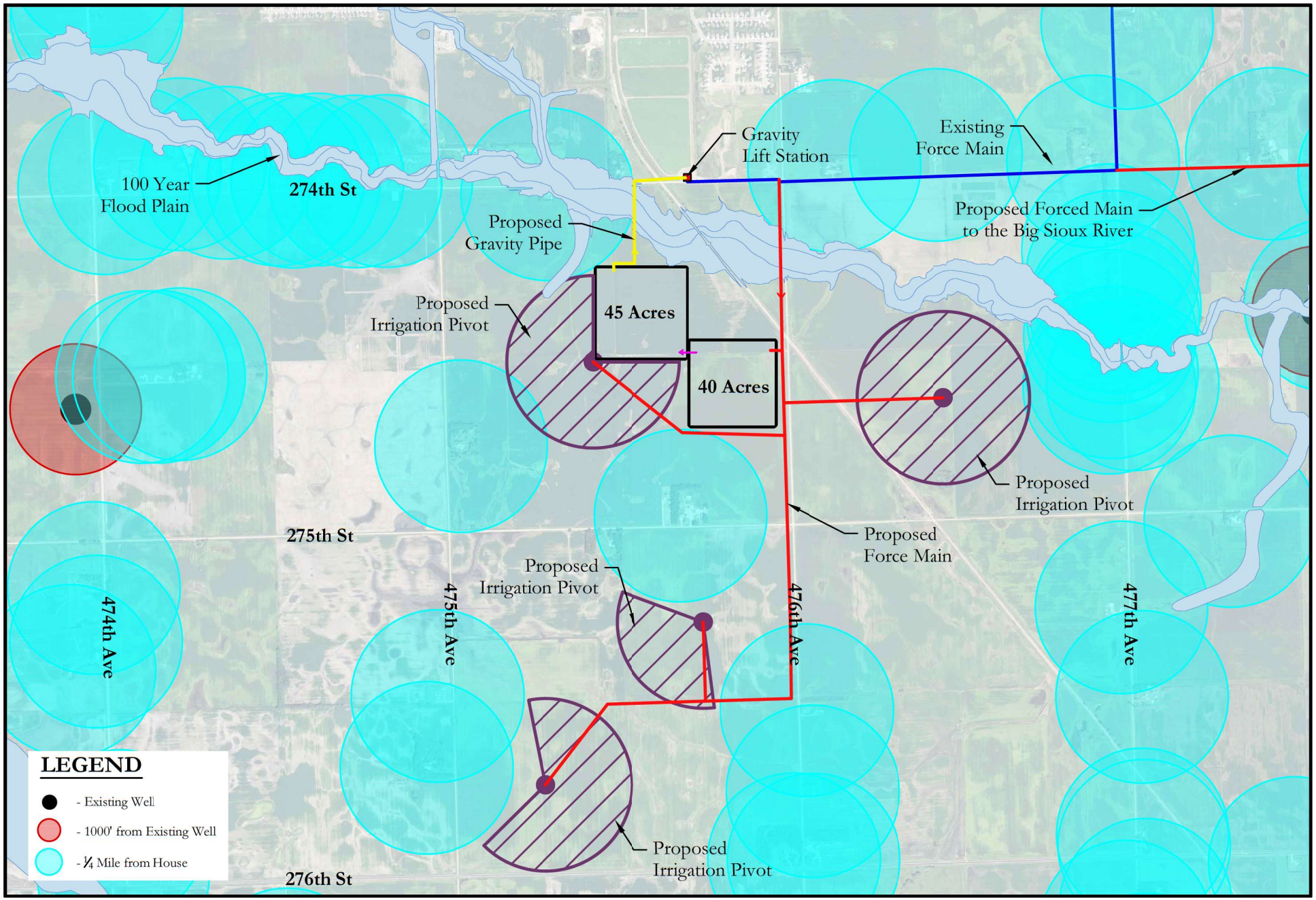


Figure 20 | Treatment Alternative 5

1" = 2000'

STOCKWELL ENGINEERS

Table 26 Cost Estimate for Treatment Alternative 5

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$744,000.00	$744,000.00
2	Clearing	1	LS	$15,000.00	$15,000.00
3	Traffic Control	1	LS	$5,000.00	$5,000.00
4	Gravel Surfacing	200	TON	$15.00	$3,000.00
5	Remove Existing Dikes	37,500	CY	$4.00	$150,000.00
6	Unclassified Excavation	755,000	CY	$3.00	$2,265,000.00
7	Salvage & Place Topsoil	75,000	CY	$5.00	$375,000.00
8	Scarify & Recompact Liner	412,000	SY	$1.00	$412,000.00
9	Pond Site Warning Signs	30	EA	$150.00	$4,500.00
10	Class B Rip Rap	39,000	TON	$35.00	$1,365,000.00
11	Type B Drainage Fabric	54,000	SY	$3.00	$162,000.00
12	Dewatering	1	LS	$15,000.00	$15,000.00
13	12" DIP Piping	200	LF	$75.00	$15,000.00
14	12" Gate Valve & Box	2	EA	$3,000.00	$6,000.00
15	Concrete Water Stop	4	EA	$500.00	$2,000.00
16	Pond Inlet Structure	2	EA	$2,500.00	$5,000.00
17	Pond Outlet Structure	2	EA	$2,500.00	$5,000.00
18	Pond Depth Indicators	2	EA	$4,000.00	$8,000.00
19	16" Force Main	20,000	FT	$55.00	$1,100,000.00
20	16" Gate Valve & Box	6	EA	$8,500.00	$51,000.00
21	15" PVC Gravity Sewer	2,600	FT	$55.00	$143,000.00
22	16" Sanitary Bedding Material	20,000	FT	$6.00	$120,000.00
23	15" Sanitary Bedding Material	2,600	FT	$5.00	$13,000.00
24	Railroad Crossing	2	EA	$10,000.00	$20,000.00
25	Post Televising	2,600	FT	$1.50	$3,900.00
26	Connect to Existing Force Main	2	EA	$2,500.00	$5,000.00
27	Connect to Existing Lift Station	1	EA	$5,000.00	$5,000.00
28	Sanitary Sewer Manhole	7	EA	$3,500.00	$24,500.00
29	Irrigation Pivot	4	EA	$130,000.00	$520,000.00
30	Sludge Removal	14,900	CY	$30.00	$447,000.00
31	Woven Wire Fence	6,000	FT	$6.00	$36,000.00
32	Seeding, Fertilizing & Mulching	91,000	SY	$1.50	$136,500.00
				Subtotal	$8,181,400.00
				Contingencies (15%)	$1,228,000.00
				Total Estimated Construction Costs	**$9,409,400.00**
				ENGINEERING	**$1,221,000.00**
				LAND PURCHASE (110 AC.)	**$6,750,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$377,000.00**
				TOTAL ESTIMATED PROJECT COST	**$17,757,400.00**

Table 27 EUAC for Treatment Alternative 5

Capital Cost		Salvage	Present Worth	Net Present
Description	Price	Value	of Salvage Value	Worth
Mobilization	$744,000	$0	$0	$744,000
Clearing	$15,000	$0	$0	$15,000
Traffic Control	$5,000	$0	$0	$5,000
Gravel Surfacing	$3,000	$0	$0	$3,000
Remove Existing Dikes	$150,000	$0	$0	$150,000
Unclassified Excavation	$2,265,000	$0	$0	$2,265,000
Salvage & Place Topsoil	$375,000	$0	$0	$375,000
Scarify & Recompact Liner	$412,000	$0	$0	$412,000
Pond Site Warning Signs	$4,500	$2,700	$1,495	$3,005
Class B Rip Rap	$1,365,000	$819,000	$453,460	$911,540
Type B Drainage Fabric	$162,000	$0	$0	$162,000
Dewatering	$15,000	$0	$0	$15,000
12" DIP Piping	$15,000	$9,000	$4,983	$10,017
12" Gate Valve & Box	$6,000	$3,600	$1,993	$4,007
Concrete Water Stop	$2,000	$1,200	$664	$1,336
Pond Inlet Structure	$5,000	$3,000	$1,661	$3,339
Pond Outlet Structure	$5,000	$3,000	$1,661	$3,339
Pond Depth Indicators	$8,000	$4,800	$2,658	$5,342
16" Force Main	$1,100,000	$660,000	$365,426	$734,574
16" Gate Valve & Box	$51,000	$30,600	$16,942	$34,058
15" PVC Gravity Sewer	$143,000	$85,800	$47,505	$95,495
16" Sanitary Bedding Material	$120,000	$0	$0	$120,000
15" Sanitary Bedding Material	$13,000	$0	$0	$13,000
Railroad Crossing	$20,000	$0	$0	$20,000
Post Televising	$3,900	$0	$0	$3,900
Connect to Existing Force Main	$5,000	$0	$0	$5,000
Connect to Existing Lift Station	$5,000	$0	$0	$5,000
Sanitary Sewer Manhole	$24,500	$14,700	$8,139	$16,361
Irrigation Pivot	$520,000	$312,000	$172,747	$347,253
Sludge Removal	$447,000	$0	$0	$447,000
Woven Wire Fence	$36,000	$0	$0	$36,000
Seeding, Fertilizing & Mulching	$136,500	$0	$0	$136,500
Land Purchase	$6,750,000	$6,750,000	$3,737,311	$3,012,689
Remaining Capital Costs	$2,826,000	$0	$0	$2,826,000
Total Construction Cost	**$17,757,400**	**$8,699,400**	**$4,816,647**	**$12,940,753**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$3,000			$44,632
Supplies	$3,000			$44,632
Utilities	$15,000			$223,162
Labor	$10,000			$148,775
Total Annual Cost	**$31,000**			**$461,202**
			Total Net Present Worth	**$13,401,955**
			EUAC	**$900,822**

TREATMENT ALTERNATIVE 6: SAGR RETROFIT

Treatment Alternative 6 proposes the City retrofit the existing site to add fine bubble aeration and a Submerged Attached Growth Reactor (SAGR). The treatment process in traditional facultative ponds is limited by water temperature and oxygen. Aeration systems do not rely on natural surface aeration or algae to provide oxygen in the water. Diffusers on the bottom of the cell allow the air bubbles to rise that causes mixing and convection between the diffusers. The solids settle out and the air bubbles rise. The solids that accumulate on the bottom have more oxygen because of the placement of the diffusers therefore increasing biodegradation. This mixing process also helps reduce the temperature stratification in the cells that causes turnover and smell in the spring.

The second limiting factor in treatment is water temperature. The SAGR process has developed a way to provide nitrification in cold climates. The SAGR beds are made of clean gravel beds that evenly distribute wastewater flow across the width of the cell. Aeration is added to the floor of the SAGR causing aerobic conditions and nitrification. This process has been proven in Canada and has started to expand south into the United States. Currently, there are several sites in operation or under construction in Iowa. In addition, there is a SAGR in operation at Sylvan Lake in the Black Hills. This alternative would require the DENR Permit to be changed because Harrisburg is currently "No Discharge". This alternative would utilize the existing lift station to pump the SAGR effluent to the Big Sioux River. The only negative aspect of this alternative is the setback requirements. The SD DENR requires an aeration system be located one-half mile from a community, 750 feet from habitation and 1,000 feet from a potable well. This limits the location for the expansion and the current cells do not meet these criteria.

Nutrient removal is not included in these cost estimates. An area will be included in the design to add this process when the SD DENR requires it. The current cost to add phosphorus and total nitrogen removal is $1,800,000 and would add $180,000 to the annual O&M costs. Discussions with the DENR indicate these requirements are ten years away. Waiting ten years to implement phosphorus removal would add $600,000 to the construction cost based on 3% inflation. This estimate will need to be adjusted in the future because permit limits are unknown at this time and the limit levels will adjust the treatment process. Sludge removal in cell one is included in this alternative. The proposed hydraulic loading and cost estimate are shown in the following tables. The operation and maintenance costs are based on the manufacturer's recommendation.

Table 28 Hydraulic Loading for SAGR Retrofit

	Proposed
Population	17,199
Wastewater Flow (gpcpd)	60
Infiltration & Inflow (gpd)	31,000
Average Annual Influent (gpd)	1,062,945
Wet Weather Influent (gpd)	1,235,848
Cell One	
9.2 ac x 43560 x 15 x 7.48	44,967,380
Cell Two	
4.1 ac x 43560 x 15 x 7.48	19,910,772
Cell Three	
3.9 ac x 43560 x 15 x 7.49	19,241,230
Total Storage (gal)	84,119,382
Aeration Retention Time (days)	68

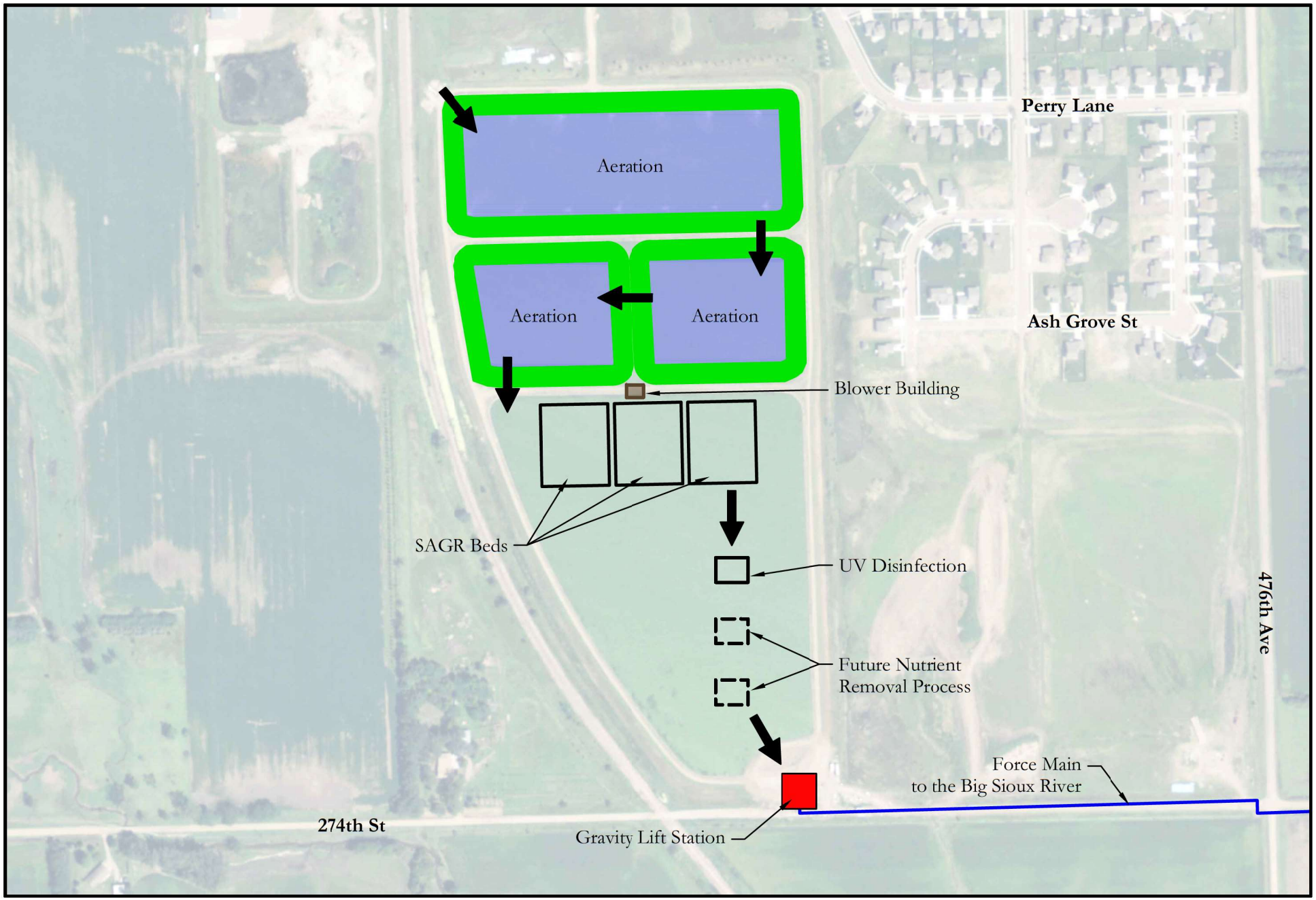


Figure 21 | Treatment Alternative 6

1" = 400'

STOCKWELL ENGINEERS

Table 29 Cost Estimate for Treatment Alternative 6

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$934,000.00	$934,000.00
2	Clearing	1	LS	$5,000.00	$5,000.00
3	Seeding, Fertilizing & Mulching	45,000	SY	$1.50	$67,500.00
4	Gravel Surfacing	2,100	TON	$12.00	$25,200.00
5	Surfacing Repairs	1	LS	$5,000.00	$5,000.00
6	Unclassified Excavation	233,000	CY	$3.00	$699,000.00
7	Salvage & Place Topsoil	8,000	CY	$3.00	$24,000.00
8	Class B Rip Rap	13,400	TON	$35.00	$469,000.00
9	Type B Drainage Fabric	18,400	SY	$2.50	$46,000.00
10	12" DIP Piping	190	FT	$65.00	$12,350.00
11	12" Gate Valve & Box	4	EA	$2,500.00	$10,000.00
12	Concrete Water Stop	8	EA	$500.00	$4,000.00
13	Pond Inlet Structure	3	EA	$2,500.00	$7,500.00
14	Pond Outlet Structure	3	EA	$2,500.00	$7,500.00
15	River Discharge Structure	1	EA	$10,000.00	$10,000.00
16	16" Force Main	27,000	FT	$55.00	$1,485,000.00
17	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
18	16" Sanitary Bedding Material	27,000	FT	$6.00	$162,000.00
19	Ninemile Crossing	1	EA	$10,000.00	$10,000.00
20	Connect to Existing Force Main	1	EA	$2,500.00	$2,500.00
21	Connect to Existing Lift Station	1	EA	$5,000.00	$5,000.00
22	Air Release Manhole	5	EA	$8,000.00	$40,000.00
23	Cell Dewatering	1	LS	$20,000.00	$20,000.00
24	Bar Screen	1	LS	$212,000.00	$212,000.00
25	Blower & Bar Screen Buildings	2	EA	$70,000.00	$140,000.00
26	Control & SCADA System	1	LS	$75,000.00	$75,000.00
27	Electrical Service	1	LS	$25,000.00	$25,000.00
28	Aeration & SAGR System	1	LS	$2,883,000.00	$2,883,000.00
29	Sludge Removal	14,900	CY	$30.00	$447,000.00
30	Clean Graded Rock	78,800	TON	$20.00	$1,576,000.00
31	Mulch Insulation	6,900	CY	$10.00	$69,000.00
32	Geotextile Fabric	37,600	SY	$1.50	$56,400.00
33	HDPE Liner	183,100	SF	$1.25	$228,875.00
34	Aerated Rock Bed Walls	2,800	LF	$16.00	$44,800.00
35	Influent Flow Splitter Structure	1	EA	$15,000.00	$15,000.00
36	Piping, Fittings, Valves	1	LS	$135,600.00	$135,600.00
37	Effluent Level Control MH	3	EA	$5,000.00	$15,000.00
38	Aeration Site Piping	3,100	LF	$30.00	$93,000.00
39	Discharge Piping	1,200	LF	$50.00	$60,000.00
40	Concrete Anchor Posts	38	EA	$200.00	$7,600.00
41	UV Disinfection System	1	LS	$119,000.00	$119,000.00
				Subtotal	$10,269,825.00
				Contingencies (15%)	$1,541,000.00
				Total Estimated Construction Costs	**$11,810,825.00**
				ENGINEERING	**$1,524,000.00**
				SF PUMPING CHARGE DURING CONST	**$755,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$473,000.00**
				TOTAL ESTIMATED PROJECT COST	**$14,562,825.00**

Table 30 EUAC for Treatment Alternative 6

Capital Cost Description	Price	Salvage Value	Present Worth of Salvage Value	Net Present Worth
Mobilization	$934,000	$0	$0	$934,000
Clearing	$5,000	$0	$0	$5,000
Seeding, Fertilizing & Mulching	$67,500	$0	$0	$67,500
Gravel Surfacing	$25,200	$0	$0	$25,200
Surfacing Repairs	$5,000	$3,000	$1,661	$3,339
Unclassified Excavation	$699,000	$0	$0	$699,000
Salvage & Place Topsoil	$24,000	$0	$0	$24,000
Class B Rip Rap	$469,000	$281,400	$155,804	$313,196
Type B Drainage Fabric	$46,000	$0	$0	$46,000
12" DIP Piping	$12,350	$7,410	$4,103	$8,247
12" Gate Valve & Box	$10,000	$6,000	$3,322	$6,678
Concrete Water Stop	$4,000	$2,400	$1,329	$2,671
Pond Inlet Structure	$7,500	$4,500	$2,492	$5,008
Pond Outlet Structure	$7,500	$4,500	$2,492	$5,008
River Discharge Structure	$10,000	$6,000	$3,322	$6,678
16" Force Main	$1,485,000	$891,000	$493,325	$991,675
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
16" Sanitary Bedding Material	$162,000	$0	$0	$162,000
Ninemile Crossing	$10,000	$0	$0	$10,000
Connect to Existing Force Main	$2,500	$0	$0	$2,500
Connect to Existing Lift Station	$5,000	$0	$0	$5,000
Air Release Manhole	$40,000	$24,000	$13,288	$26,712
Cell Dewatering	$20,000	$0	$0	$20,000
Bar Screen	$212,000	$127,200	$70,428	$141,572
Blower & Bar Screen Buildings	$140,000	$84,000	$46,509	$93,491
Control & SCADA System	$75,000	$45,000	$24,915	$50,085
Electrical Service	$25,000	$15,000	$8,305	$16,695
Aeration & SAGR System	$2,883,000	$1,729,800	$957,748	$1,925,252
Sludge Removal	$447,000	$0	$0	$447,000
Clean Graded Rock	$1,576,000	$945,600	$523,556	$1,052,444
Mulch Insulation	$69,000	$0	$0	$69,000
Geotextile Fabric	$56,400	$0	$0	$56,400
HDPE Liner	$228,875	$137,325	$76,034	$152,841
Aerated Rock Bed Walls	$44,800	$0	$0	$44,800
Influent Flow Splitter Structure	$15,000	$9,000	$4,983	$10,017
Piping, Fittings, Valves	$135,600	$81,360	$45,047	$90,553
Effluent Level Control MH	$15,000	$9,000	$4,983	$10,017
Aeration Site Piping	$93,000	$55,800	$30,895	$62,105
Discharge Piping	$60,000	$36,000	$19,932	$40,068
Concrete Anchor Posts	$7,600	$4,560	$2,525	$5,075
UV Disinfection System	$119,000	$71,400	$39,532	$79,468
Remaining Capital Costs	$4,293,000	$0	$0	$4,293,000
Total Construction Cost	**$14,562,825**	**$4,591,455**	**$2,542,177**	**$12,020,648**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Aeration Blowers	$74,000			$1,100,933
SAGR Blowers	$67,000			$996,791
Diffuser Membrane Replacement	$7,000			$104,142
Labor	$17,000			$252,917
Total Annual Cost	**$165,000**			**$2,454,783**
			Total Net Present Worth	**$14,475,431**
			EUAC	**$972,976**

TREATMENT ALTERNATIVE 7: SAGR NEW SITE

Treatment Alternative 7 proposes the City build a new treatment system adjacent to the Big Sioux River and abandon the existing site. The new site would meet the SD DENR setback requirements. The Gravity lift station would be used to pump wastewater to the new site. A small portion of the existing third cell would be used for additional storage for the wet well.

The new treatment site would have fine bubble aeration and a SAGR system. The treatment process in traditional facultative ponds is limited by water temperature and oxygen. Aeration systems do not rely on natural surface aeration or algae to provide oxygen in the water. Diffusers on the bottom of the cell allow the air bubbles to rise that causes mixing and convection between the diffusers. The solids settle out and the air bubbles rise. The solids that accumulate on the bottom have more oxygen because of the placement of the diffusers therefore increasing biodegradation. This mixing process also helps reduce the temperature stratification in the cells that causes turnover and smell in the spring.

The second limiting factor in treatment is water temperature. The SAGR process has developed a way to provide nitrification in cold climates. The SAGR beds are made of clean gravel beds that evenly distribute wastewater flow across the width of the cell. Aeration is added to the floor of the SAGR causing aerobic conditions and nitrification. This process has been proven in Canada and has started to expand south into the United States. Currently, there are several sites in operation or under construction in Iowa. In addition, there is a SAGR in operation at Sylvan Lake in the Black Hills. This alternative would require the DENR Permit to be changed because Harrisburg is currently “No Discharge”.

Nutrient removal is not included in these cost estimates. An area will be included in the design to add this process when the SD DENR requires it. The current cost to add phosphorus and total nitrogen removal is $1,800,000 and would add $180,000 to the annual O&M costs. Discussions with the DENR indicate these requirements are ten years away. Waiting ten years to implement phosphorus removal would add $600,000 to the construction cost based on 3% inflation. This estimate will need to be adjusted in the future because permit limits are unknown at this time and the limit levels will adjust the treatment process. Sludge removal in cell one is included in this alternative. The proposed hydraulic loading and cost estimate are shown in the following tables. The operation and maintenance costs are based on the manufacturer’s recommendation. This alternative requires 50 acres to be purchased.

Table 31 Hydraulic Loading for SAGR New Site

	Proposed
Population	17,199
Wastewater Flow (gpcpd)	60
Infiltration & Inflow (gpd)	31,000
Average Annual Influent (gpd)	1,062,945
Wet Weather Influent (gpd)	1,235,848
Cell One	
4.7 ac x 43560 x 15 x 7.48	23,115,474
Cell Two	
3.0 ac x 43560 x 15 x 7.48	14,606,555
Cell Three	
3.0 ac x 43560 x 15 x 7.48	14,606,555
Total Storage (gal)	52,328,585
Aeration Retention Time (days)	42

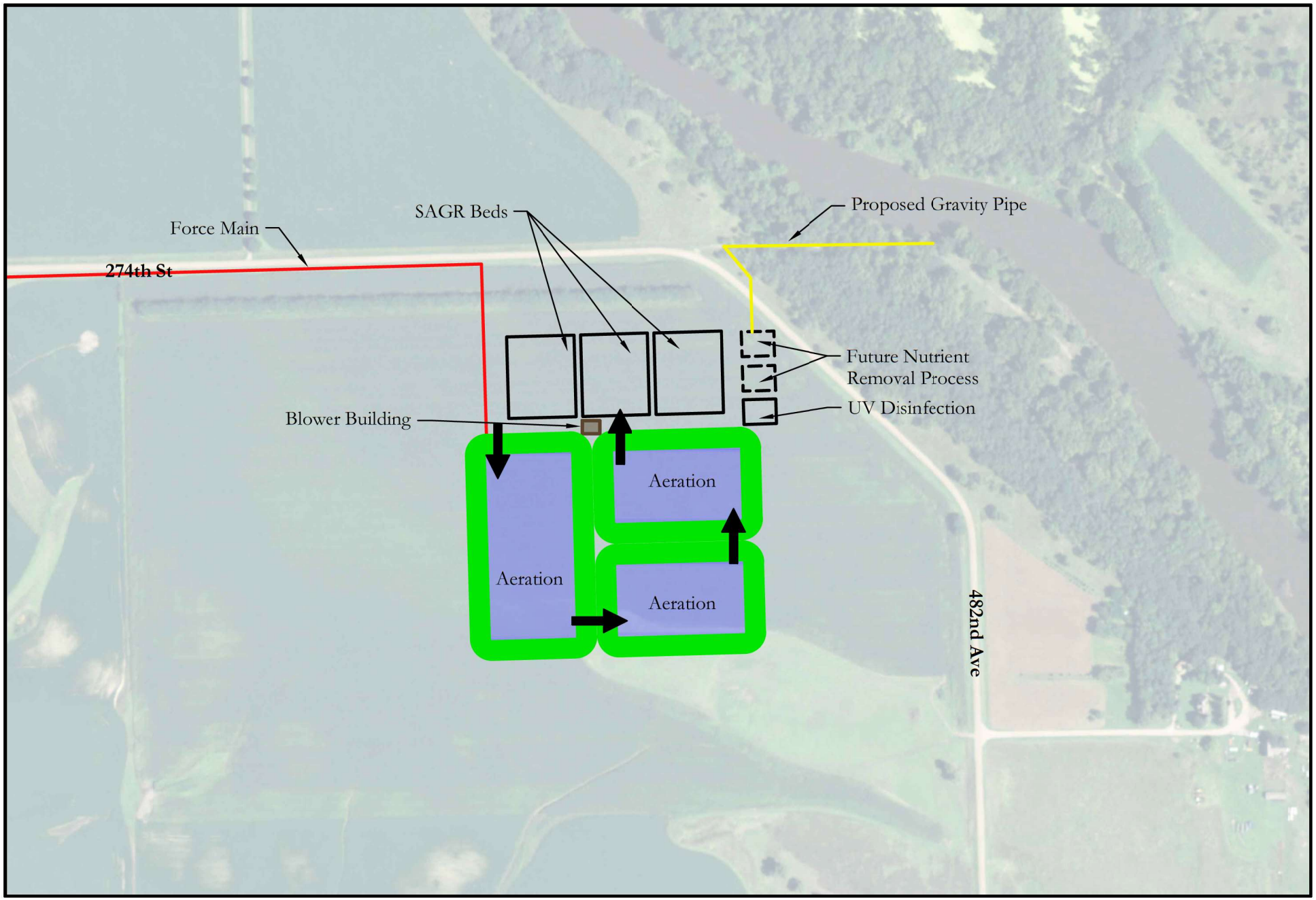


Figure 22 | Treatment Alternative 7

1" = 400'

STOCKWELL ENGINEERS

Table 32 Cost Estimate for Treatment Alternative 7

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$985,000.00	$985,000.00
2	Clearing	1	LS	$10,000.00	$10,000.00
3	Seeding, Fertilizing & Mulching	93,000	SY	$1.50	$139,500.00
4	Gravel Surfacing	1,800	TON	$12.00	$21,600.00
5	Surfacing Repairs	1	LS	$5,000.00	$5,000.00
6	Remove Existing Dikes	47,800	CY	$4.00	$191,200.00
7	Unclassified Excavation	205,000	CY	$3.00	$615,000.00
8	Salvage & Place Topsoil	48,000	CY	$3.00	$144,000.00
9	Class B Rip Rap	20,400	TON	$35.00	$714,000.00
10	Type B Drainage Fabric	28,200	SY	$2.50	$70,500.00
11	Woven Wire Fence	6,000	FT	$6.00	$36,000.00
12	12" DIP Piping	190	FT	$65.00	$12,350.00
13	12" Gate Valve & Box	4	EA	$2,500.00	$10,000.00
14	Concrete Water Stop	8	EA	$500.00	$4,000.00
15	Pond Inlet Structure	3	EA	$2,500.00	$7,500.00
16	Pond Outlet Structure	3	EA	$2,500.00	$7,500.00
17	Pond Depth Indicators	3	EA	$4,000.00	$12,000.00
18	Pond Site Warning Signs	20	EA	$150.00	$3,000.00
19	River Discharge Structure	1	EA	$10,000.00	$10,000.00
20	16" Force Main	25,500	FT	$55.00	$1,402,500.00
21	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
22	15" PVC Gravity Sewer	1,200	FT	$55.00	$66,000.00
23	16" Sanitary Bedding Material	25,500	FT	$6.00	$153,000.00
24	15" Sanitary Bedding Material	1,200	FT	$5.00	$6,000.00
25	Ninemile Crossing	1	EA	$10,000.00	$10,000.00
26	Connect to Existing Force Main	1	EA	$2,500.00	$2,500.00
27	Air Release Manhole	5	EA	$8,000.00	$40,000.00
28	Bar Screen	1	LS	$212,000.00	$212,000.00
29	Blower & Bar Screen Buildings	2	EA	$70,000.00	$140,000.00
30	Control & SCADA System	1	LS	$75,000.00	$75,000.00
31	Electrical Service	1	LS	$50,000.00	$50,000.00
32	Aeration & SAGR System	1	LS	$2,883,000.00	$2,883,000.00
33	Sludge Removal	14,900	CY	$30.00	$447,000.00
34	Clean Graded Rock	78,800	TON	$20.00	$1,576,000.00
35	Mulch Insulation	6,900	CY	$10.00	$69,000.00
36	Geotextile Fabric	37,600	SY	$1.50	$56,400.00
37	HDPE Liner	183,100	SF	$1.25	$228,875.00
38	Aerated Rock Bed Walls	2,800	LF	$16.00	$44,800.00
39	Influent Flow Splitter Structure	1	EA	$15,000.00	$15,000.00
40	Piping, Fittings, Valves	1	LS	$135,600.00	$135,600.00
41	Effluent Level Control MH	3	EA	$5,000.00	$15,000.00
42	Aeration Site Piping	1,900	LF	$30.00	$57,000.00
43	Concrete Anchor Posts	40	EA	$200.00	$8,000.00
44	UV Disinfection System	1	LS	$119,000.00	$119,000.00
				Subtotal	$10,826,825.00
				Contingencies (15%)	$1,625,000.00
		Total Estimated Construction Costs			**$12,451,825.00**
				ENGINEERING	**$1,604,000.00**
				LAND PURCHASE (50 AC.)	**$1,250,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$499,000.00**
				TOTAL ESTIMATED PROJECT COST	**$15,804,825.00**

Table 33 EUAC for Treatment Alternative 7

Capital Cost Description	Price	Salvage Value	Present Worth of Salvage Value	Net Present Worth
Mobilization	$985,000	$0	$0	$985,000
Clearing	$10,000	$0	$0	$10,000
Seeding, Fertilizing & Mulching	$139,500	$0	$0	$139,500
Gravel Surfacing	$21,600	$0	$0	$21,600
Surfacing Repairs	$5,000	$3,000	$1,661	$3,339
Remove Existing Dikes	$191,200	$0	$0	$191,200
Unclassified Excavation	$615,000	$0	$0	$615,000
Salvage & Place Topsoil	$144,000	$0	$0	$144,000
Class B Rip Rap	$714,000	$428,400	$237,195	$476,805
Type B Drainage Fabric	$70,500	$0	$0	$70,500
Woven Wire Fence	$36,000	$0	$0	$36,000
12" DIP Piping	$12,350	$7,410	$4,103	$8,247
12" Gate Valve & Box	$10,000	$6,000	$3,322	$6,678
Concrete Water Stop	$4,000	$2,400	$1,329	$2,671
Pond Inlet Structure	$7,500	$4,500	$2,492	$5,008
Pond Outlet Structure	$7,500	$4,500	$2,492	$5,008
Pond Depth Indicators	$12,000	$7,200	$3,986	$8,014
Pond Site Warning Signs	$3,000	$1,800	$997	$2,003
River Discharge Structure	$10,000	$6,000	$3,322	$6,678
16" Force Main	$1,402,500	$841,500	$465,918	$936,582
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
15" PVC Gravity Sewer	$66,000	$39,600	$21,926	$44,074
16" Sanitary Bedding Material	$153,000	$0	$0	$153,000
15" Sanitary Bedding Material	$6,000	$0	$0	$6,000
Ninemile Crossing	$10,000	$0	$0	$10,000
Connect to Existing Force Main	$2,500	$0	$0	$2,500
Air Release Manhole	$40,000	$24,000	$13,288	$26,712
Bar Screen	$212,000	$127,200	$70,428	$141,572
Blower & Bar Screen Buildings	$140,000	$84,000	$46,509	$93,491
Control & SCADA System	$75,000	$45,000	$24,915	$50,085
Electrical Service	$50,000	$30,000	$16,610	$33,390
Aeration & SAGR System	$2,883,000	$1,729,800	$957,748	$1,925,252
Sludge Removal	$447,000	$0	$0	$447,000
Clean Graded Rock	$1,576,000	$945,600	$523,556	$1,052,444
Mulch Insulation	$69,000	$0	$0	$69,000
Geotextile Fabric	$56,400	$0	$0	$56,400
HDPE Liner	$228,875	$137,325	$76,034	$152,841
Aerated Rock Bed Walls	$44,800	$0	$0	$44,800
Influent Flow Splitter Structure	$15,000	$9,000	$4,983	$10,017
Piping, Fittings, Valves	$135,600	$81,360	$45,047	$90,553
Effluent Level Control MH	$15,000	$9,000	$4,983	$10,017
Aeration Site Piping	$57,000	$34,200	$18,936	$38,064
Concrete Anchor Posts	$8,000	$4,800	$2,658	$5,342
UV Disinfection System	$119,000	$71,400	$39,532	$79,468
Land Purchase	$1,250,000	$1,250,000	$692,095	$557,905
Remaining Capital Costs	$3,728,000	$0	$0	$3,728,000
Total Construction Cost	**$15,804,825**	**$5,945,195**	**$3,291,710**	**$12,513,115**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Aeration Blowers	$74,000			$1,100,933
SAGR Blowers	$67,000			$996,791
Diffuser Membrane Replacement	$7,000			$104,142
Labor	$17,000			$252,917
Total Annual Cost	**$165,000**			**$2,454,783**
			Total Net Present Worth	**$14,967,898**
			EUAC	**$1,006,078**

TREATMENT ALTERNATIVE 8: REGIONALIZATION WITH SIOUX FALLS (PARTIAL PUMPING)

The City of Harrisburg has been pumping wastewater to Sioux Falls since 2010. In 2013 Sioux Falls established a Regional Wastewater System. The proposed charge under the Regional Wastewater Agreement is $4.01 per 1,000 gallons. The City of Harrisburg can receive a $0.44 per 1,000 gallon credit for equalization and $0.55 per 1,000 gallon credit for partial treatment. Based on current flows the City needs to maintain 1.6 feet of storage below the freeboard in cell three to receive the equalization credit for 30-days of storage. The 20-year projected flows require 5.4 feet of storage below the freeboard in cell three to meet this requirement. This alternative assumes the City will receive the equalization and treatment credits for ten years. Eventually the City will have to leave cell three at the residual level in order to receive this credit.

The strength parameters to meet the partial treatment credit is 20 mg/l for BOD, 10 mg/l for TKN and 45 mg/l for TSS. Based on sampling records at the gravity wet well the City of Harrisburg would only meet these requirements half the time. However, this alternative includes adding aeration in cells one and two. Aeration will improve the treatment and reduce the odor. Aeration also reduces the setback requirements. This alternative assumes the City will receive the partial treatment credit for 10 years. It is also recommended the City increase the daily maximum flow of 1,000,300 gallons and the monthly maximum flow of 15,531,000 gallons in the Joint Power Agreement.

Sioux Falls also implemented a new System Development Charge "SDC". The City of Harrisburg will be required to pay the City of Sioux Falls for every sewer connection. The charge will range from $2,391 for a 3/4" water meter to $60,000 for a four-inch water meter. Other Regionalization customers have been pumping wastewater to Sioux Falls for several years and the existing customers were grandfathered in. Unfortunately, the City of Harrisburg will be required to pay for all existing customers. In 2013 this cost was estimated at $3,677,000 for 1,506 customers. The SD DENR awarded the City a $600,000 Consolidate Grant and $2,577,000 loan plus the City was going to contribute $500,000 cash to pay this charge. The loan has a term of 30 years and interest rate of 3.25%. However, Harrisburg currently has 1,638 customers which would add approximately $648,000 to the SDC. The calculation for the SDC charge is shown in the following table.

Table 34 System Development Charge

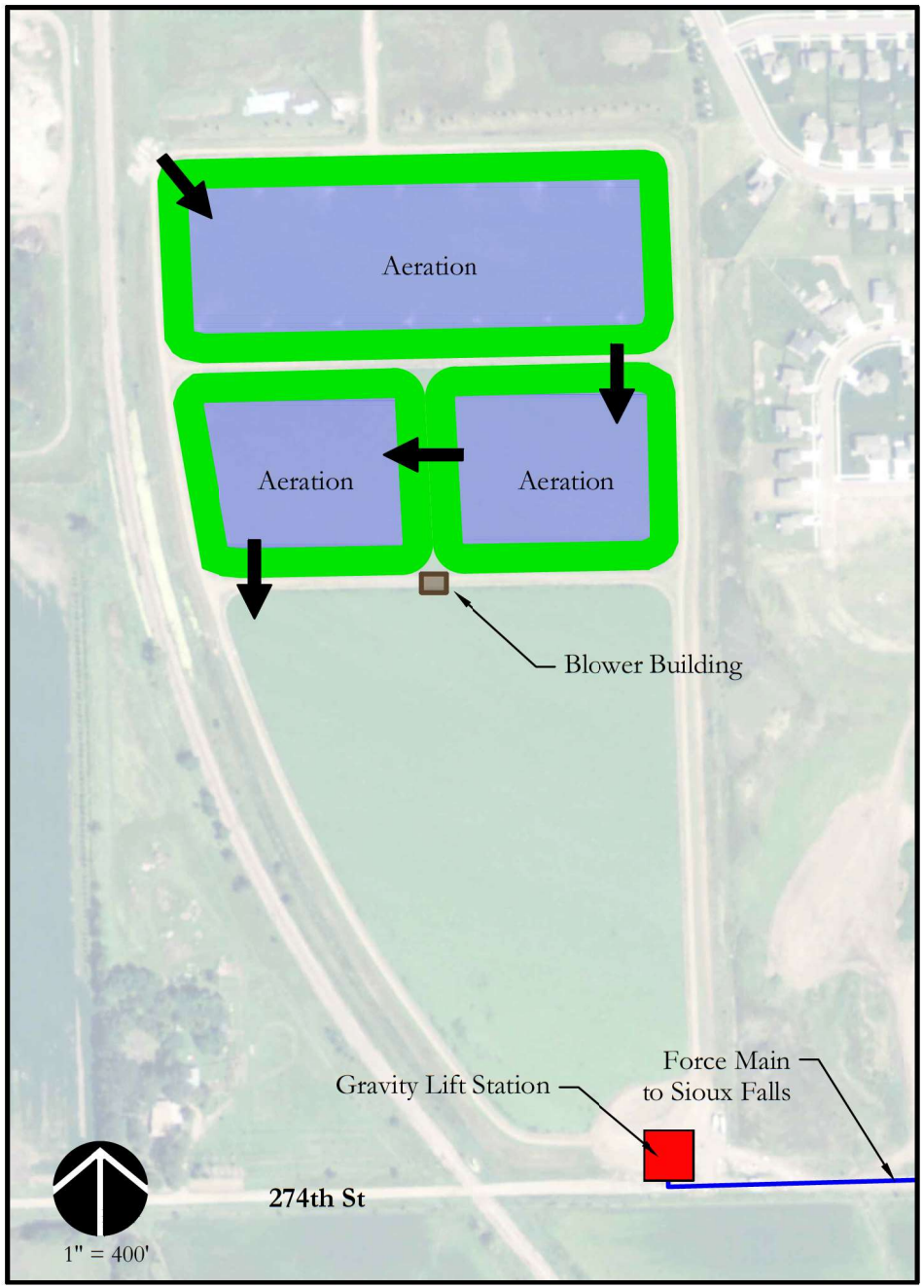
System Development Charges			
Meter Size	Meter Charge	Customers	Total Charge
5/8" to 3/4"	$2,391	1,593	$3,808,863
1"	$5,978	26	$155,428
1 1/2"	$11,954	6	$71,724
2"	$19,127	12	$229,524
3"	$35,863		$0
4"	$60,000	1	$60,000
		1,638	$4,325,539

This alternative allows the City to compare the Sioux Falls pumping cost to other alternatives. The table below illustrates how the pumping charge will increase over time. This table assumes the Sioux Falls charge will increase by 3.0% annually. It also shows the System Development Charge that Sioux Falls will require. The lowest SDC charge of $2,391 is assumed for each new customer. The cost estimate for this alternative is shown on the following page.

Table 35 Future Treatment Cost

Year	Charge per Thousand Gallons	Charge With Credits	Annual Cost to Pump to Sioux Falls	SDC	Annual Sioux Falls Cost
2010	$ 2.31	$ 2.31	$98,744		$98,744
2011	$ 2.67	$ 2.67	$96,397		$96,397
2012	$ 3.96	$ 3.96	$64,517		$64,517
2013	$ 5.84	$ 5.84	$369,211		$369,211
2014	$ 5.84	$ 5.84	$229,000	$186,498	$415,498
2015	$ 4.01	$ 3.02	$163,000	$192,093	$355,093
2020	$ 4.65	$ 3.66	$411,000	$222,688	$633,688
2025	$ 5.39	$ 5.39	$951,000	$258,157	$1,209,157
2030	$ 6.25	$ 6.25	$1,536,000	$299,275	$1,835,275
2034	$ 7.03	$ 7.03	$2,198,000	$336,836	$2,534,836

A major benefit of pumping wastewater to Sioux Falls is Harrisburg doesn't need to worry about implementing new treatment processes because Sioux Falls handles the treatment. Treatment requirements will change over time and Sioux Falls will be required to implement these changes at their wastewater treatment plant. Harrisburg can continue to operate just like they have over the last few years.



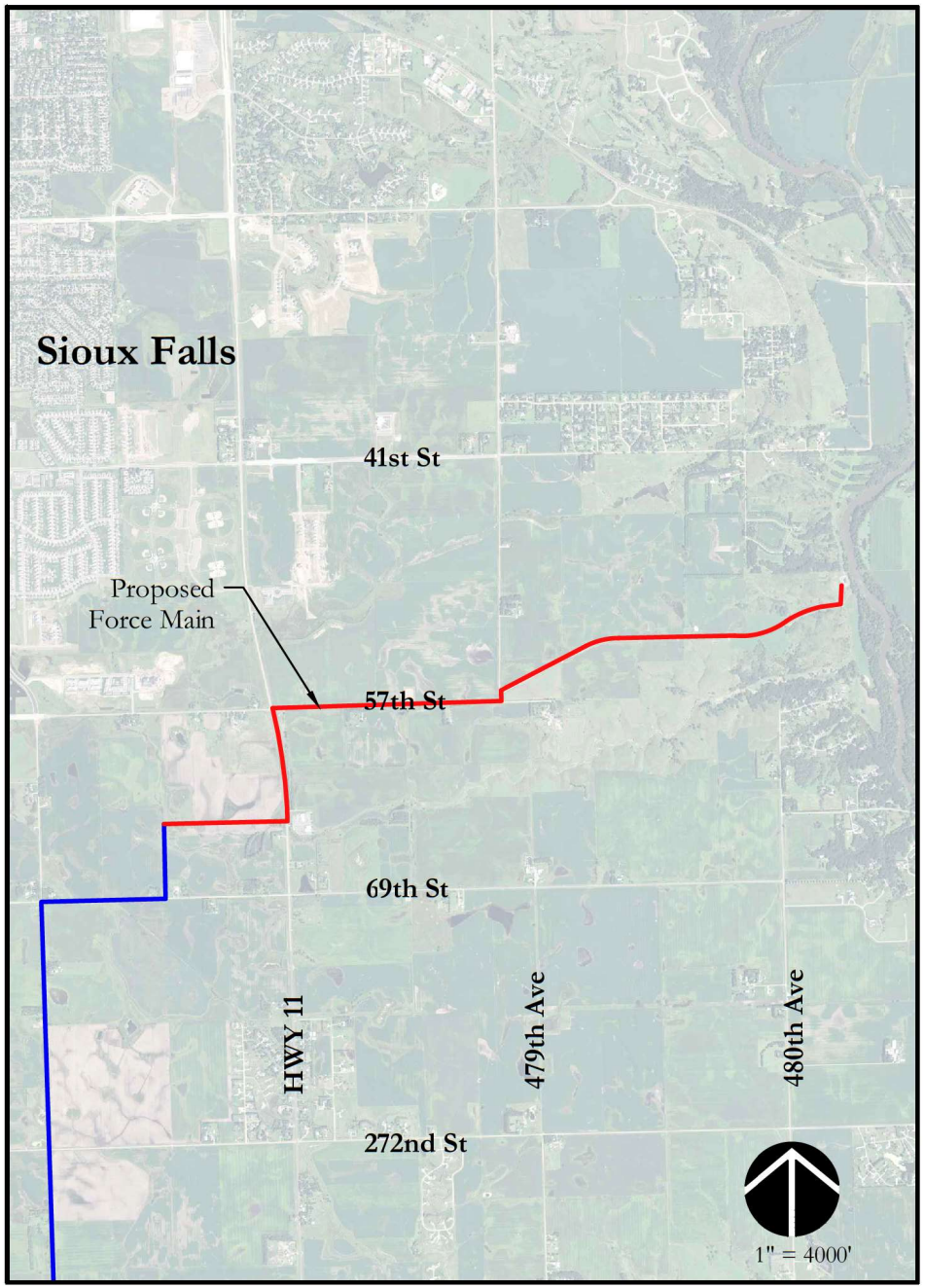


Figure 23 | Treatment Alternative 8

The proposed regionalization agreement also includes a requirement that the City of Harrisburg will have to extend their force main to the new wastewater treatment plant that will be built at Pump Station No. 240. Currently, the force main discharges to a trunk sewer northeast of Sycamore Avenue and 69th Street. Harrisburg is required to make this extension within 18 months of notification but no later than December 31, 2017. Current growth rates in Sioux Falls indicate that this extension will actually be required later than 2017. Sludge removal in cell one is included in this alternative. The cost estimate for this alternative is shown in the following table.

Table 36 Cost Estimate for Treatment Alternative 8

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$427,000.00	$427,000.00
2	Clearing	1	LS	$10,000.00	$10,000.00
3	Traffic Control	1	LS	$10,000.00	$10,000.00
4	Gravel Surfacing	100	TON	$20.00	$2,000.00
5	Unclassified Excavation	245,000	CY	$3.00	$735,000.00
6	Salvage & Place Topsoil	6,000	CY	$5.00	$30,000.00
7	Class B Rip Rap	11,900	TON	$35.00	$416,500.00
8	Type B Drainage Fabric	16,400	SY	$2.50	$41,000.00
9	16" Force Main	21,000	FT	$55.00	$1,155,000.00
10	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
11	16" Sanitary Bedding Material	21,000	FT	$6.00	$126,000.00
12	Connect to Existing Force Main	1	EA	$2,500.00	$2,500.00
13	Connection at Discharge Point	1	EA	$5,000.00	$5,000.00
14	Highway Crossing	1	LS	$10,000.00	$10,000.00
15	Air Release Manhole	2	EA	$8,000.00	$16,000.00
16	Cell Dewatering	1	LS	$20,000.00	$20,000.00
17	Bar Screen	1	LS	$212,000.00	$212,000.00
18	Blower & Bar Screen Buildings	2	EA	$70,000.00	$140,000.00
19	Control & SCADA System	1	LS	$75,000.00	$75,000.00
20	Electrical Service	1	LS	$25,000.00	$25,000.00
21	Aeration System	1	LS	$625,500.00	$625,500.00
22	Aeration Site Piping	1,100	LF	$30.00	$33,000.00
23	Sludge Removal	14,900	CY	$30.00	$447,000.00
24	Erosion Control	1	LS	$10,000.00	$10,000.00
25	Seeding, Fertilizing & Mulching	70,000	SY	$1.50	$105,000.00
				Subtotal	$4,695,500.00
				Contingencies (15%)	$705,000.00
				Total Estimated Construction Costs	**$5,400,500.00**
				ENGINEERING	**$716,000.00**
				SF PUMPING CHARGE DURING CONST	**$755,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$217,000.00**
				TOTAL ESTIMATED PROJECT COST	**$7,088,500.00**

Table 37 EUAC for Treatment Alternative 8

Capital Cost Description	Price	Salvage Value	Present Worth of Salvage Value	Net Present Worth
Mobilization	$427,000	$0	$0	$427,000
Clearing	$10,000	$0	$0	$10,000
Traffic Control	$10,000	$0	$0	$10,000
Gravel Surfacing	$2,000	$0	$0	$2,000
Unclassified Excavation	$735,000	$0	$0	$735,000
Salvage & Place Topsoil	$30,000	$0	$0	$30,000
Class B Rip Rap	$416,500	$249,900	$138,364	$278,136
Type B Drainage Fabric	$41,000	$0	$0	$41,000
16" Force Main	$1,155,000	$693,000	$383,697	$771,303
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
16" Sanitary Bedding Material	$126,000	$0	$0	$126,000
Connect to Existing Force Main	$2,500	$0	$0	$2,500
Connection at Discharge Point	$5,000	$0	$0	$5,000
Highway Crossing	$10,000	$0	$0	$10,000
Air Release Manhole	$16,000	$9,600	$5,315	$10,685
Cell Dewatering	$20,000	$0	$0	$20,000
Bar Screen	$212,000	$127,200	$70,428	$141,572
Blower & Bar Screen Buildings	$140,000	$84,000	$46,509	$93,491
Control & SCADA System	$75,000	$45,000	$24,915	$50,085
Electrical Service	$25,000	$15,000	$8,305	$16,695
Aeration System	$625,500	$375,300	$207,795	$417,705
Aeration Site Piping	$33,000	$19,800	$10,963	$22,037
Sludge Removal	$447,000	$0	$0	$447,000
Erosion Control	$10,000	$0	$0	$10,000
Seeding, Fertilizing & Mulching	$105,000	$0	$0	$105,000
Remaining Capital Costs	$2,393,000	$0	$0	$2,393,000
Total Construction Cost	**$7,088,500**	**$1,629,000**	**$901,938**	**$6,186,562**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$1,500			$22,316
Supplies	$1,500			$22,316
Aeration Blowers	$74,000			$1,100,933
Labor	$9,000			$133,897
Total Annual Cost	**$86,000**			**$1,279,463**
			Total Net Present Worth	**$7,466,025**
			EUAC	**$501,834**

TREATMENT ALTERNATIVE 9: REGIONALIZATION WITH SIOUX FALLS

This alternative is very similar to Treatment Alternative 8. However, this alternative assumes cells one and two will be abandoned. The City will only use a portion of cell three for equalization. All of the wastewater will be pumped to Sioux Falls. This alternative assumes the City will not receive the partial treatment credit and they will

receive the equalization credit. It is also recommended the City increase the daily maximum flow of 1,000,300 gallons and the monthly maximum flow of 15,531,000 gallons in the Joint Power Agreement. The SDC charges will be the same as the last alternative.

This alternative allows the City to compare the Sioux Falls pumping cost to other alternatives. The table below illustrates how the pumping charge will increase over time. This table assumes the Sioux Falls charge will increase by 3.0%. It also shows the System Development Charge that Sioux Falls will require. The lowest SDC charge of $2,391 is assumed for each new customer. The cost estimate for this alternative is shown on the following page. Sludge removal in cell one and the force main extension are included.

Table 38 Future Treatment Cost

Year	Charge per Thousand Gallons	Charge With Credit	Annual Cost to Pump to Sioux Falls	SDC	Annual Sioux Falls Cost
2010	$ 2.31	$ 2.31	$98,744		$98,744
2011	$ 2.67	$ 2.67	$96,397		$96,397
2012	$ 3.96	$ 3.96	$64,517		$64,517
2013	$ 5.84	$ 5.84	$369,211		$369,211
2014	$ 5.84	$ 5.84	$670,000	$186,498	$856,498
2015	$ 4.01	$ 3.57	$519,000	$192,093	$711,093
2020	$ 4.65	$ 4.21	$873,000	$222,688	$1,095,688
2025	$ 5.39	$ 4.95	$1,358,000	$258,157	$1,616,157
2030	$ 6.25	$ 5.81	$2,007,000	$299,275	$2,306,275
2034	$ 7.03	$ 6.59	$2,729,000	$336,836	$3,065,836

A major benefit of pumping wastewater to Sioux Falls is Harrisburg doesn't need to worry about implementing new treatment processes because Sioux Falls handles the treatment. Treatment requirements will change over time and Sioux Falls will be required to implement these changes at their wastewater treatment plant. Harrisburg can continue to operate just like they have over the last few years.

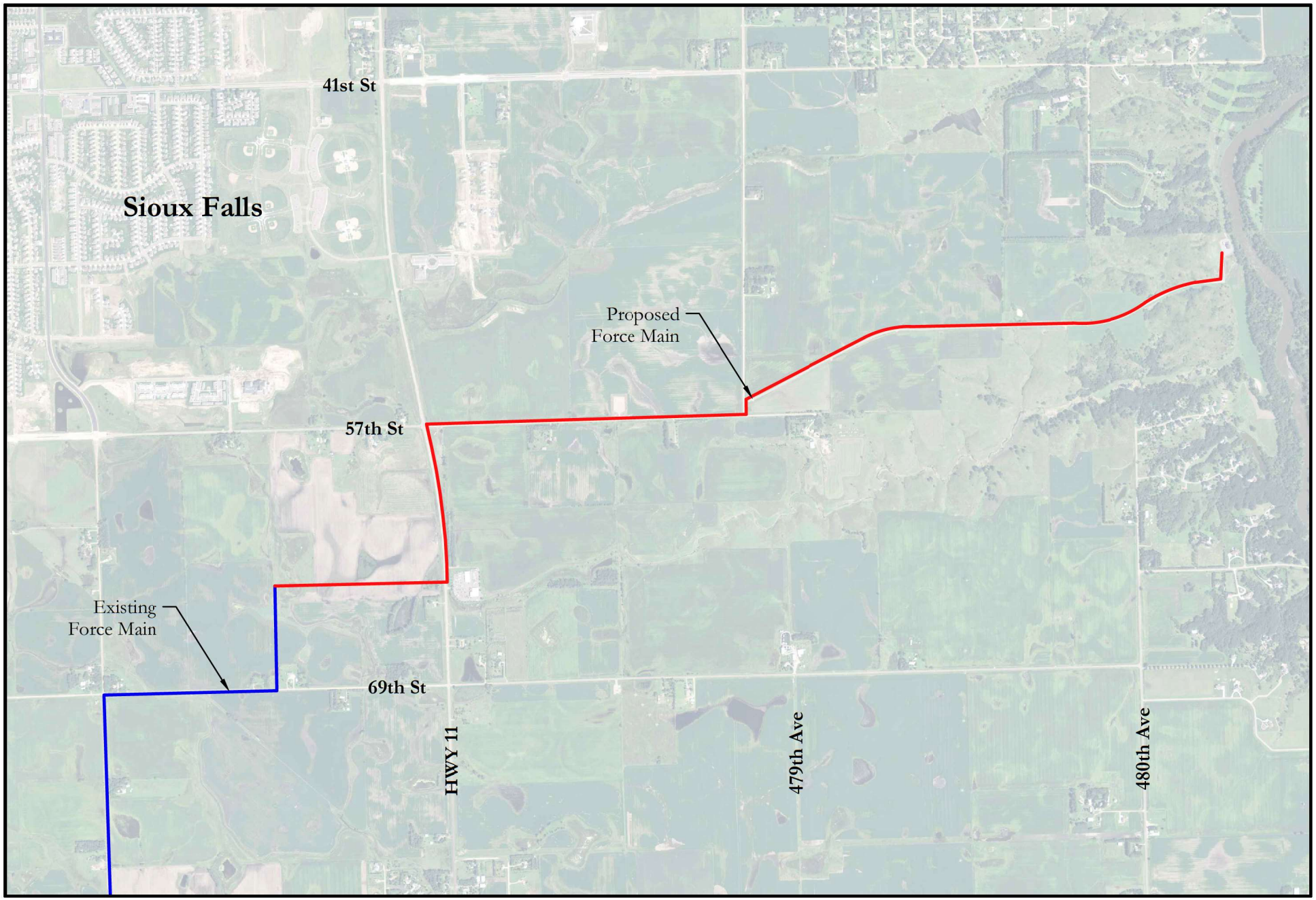


Figure 24 | Treatment Alternative 9

1" = 2000'

CITY OF HARRISBURG SOUTH DAKOTA

STOCKWELL ENGINEERS

Table 39 Cost Estimate for Treatment Alternative 9

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$210,000.00	$210,000.00
2	Clearing	1	LS	$10,000.00	$10,000.00
3	Traffic Control	1	LS	$10,000.00	$10,000.00
4	Gravel Surfacing	100	TON	$20.00	$2,000.00
5	Remove Existing Dikes	37,500	CY	$4.00	$150,000.00
6	Salvage & Place Topsoil	6,000	CY	$5.00	$30,000.00
7	16" Force Main	21,000	FT	$55.00	$1,155,000.00
8	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
9	16" Sanitary Bedding Material	21,000	FT	$6.00	$126,000.00
10	Connect to Existing Force Main	1	EA	$2,500.00	$2,500.00
11	Connection at Discharge Point	1	EA	$5,000.00	$5,000.00
12	Highway Crossing	1	LS	$10,000.00	$10,000.00
13	Air Release Manhole	2	EA	$8,000.00	$16,000.00
14	Sludge Removal	14,900	CY	$30.00	$447,000.00
15	Erosion Control	1	LS	$10,000.00	$10,000.00
16	Seeding, Fertilizing & Mulching	70,000	SY	$1.50	$105,000.00
				Subtotal	$2,305,500.00
			Contingencies (15%)		$346,000.00
			Total Estimated Construction Costs		**$2,651,500.00**
				ENGINEERING	**$369,000.00**
			LEGAL, ADMINISTRATION & TESTING (4%)		**$107,000.00**
			TOTAL ESTIMATED PROJECT COST		**$3,127,500.00**

Table 40 EUAC for Treatment Alternative 9

Capital Cost		Salvage	Present Worth	Net Present
Description	Price	Value	of Salvage Value	Worth
Mobilization	$210,000.00	$0.00	$0.00	$210,000.00
Clearing	$10,000.00	$0.00	$0.00	$10,000.00
Traffic Control	$10,000.00	$0.00	$0.00	$10,000.00
Gravel Surfacing	$2,000.00	$0.00	$0.00	$2,000.00
Remove Existing Dikes	$150,000.00	$0.00	$0.00	$150,000.00
Salvage & Place Topsoil	$30,000.00	$0.00	$0.00	$30,000.00
16" Force Main	$1,155,000.00	$693,000.00	$383,697.30	$771,302.70
16" Gate Valve & Box	$17,000.00	$10,200.00	$5,647.49	$11,352.51
16" Sanitary Bedding Material	$126,000.00	$0.00	$0.00	$126,000.00
Connect to Existing Force Main	$2,500.00	$0.00	$0.00	$2,500.00
Connection at Discharge Point	$5,000.00	$0.00	$0.00	$5,000.00
Highway Crossing	$10,000.00	$0.00	$0.00	$10,000.00
Air Release Manhole	$16,000.00	$9,600.00	$5,315.29	$10,684.71
Sludge Removal	$447,000.00	$0.00	$0.00	$447,000.00
Erosion Control	$10,000.00	$0.00	$0.00	$10,000.00
Seeding, Fertilizing & Mulching	$105,000.00	$0.00	$0.00	$105,000.00
Remaining Capital Costs	$822,000.00	$0.00	$0.00	$822,000.00
Total Construction Cost	**$3,127,500.00**	**$712,800.00**	**$394,660.08**	**$2,732,839.92**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$1,500.00			$22,316.21
Supplies	$1,500.00			$22,316.21
Utilities	$15,000.00			$223,162.12
Labor	$3,000.00			$44,632.42
Total Annual Cost	**$21,000.00**			**$312,426.97**
			Total Net Present Worth	**$3,045,266.89**
			EUAC	**$204,689.77**

TREATMENT ALTERNATIVE 10: REGIONALIZATION WITHOUT SIOUX FALLS

In 2005 Lincoln County Rural Water System evaluated the possibility of constructing a regional system for Tea and Harrisburg. This system would be located east of Harrisburg along the Big Sioux River. A gravity trunk sewer would be installed along Ninemile Creek from Tea to east of Harrisburg. Then a lift station would be installed to pump the wastewater over the hill to the treatment site. The study was completed but nothing really developed from the findings.

The City of Harrisburg wanted to investigate the possibility of a regional system as part of this study. However, the potential customers were expanded to include Harrisburg, Tea, Worthing, Canton, Lennox, Lincoln County and Lincoln County Rural Water. The biggest hurdle to overcome with a regional system will be the capital cost for all the customers to build the pipeline from their system to the treatment site. Each community was contacted to determine their interest in a regional system.

The City of Worthing's engineer was contacted about their current treatment system. The current system is designed for 180-day storage and has a capacity of 11,180,000 gallons. The current population is 877 based on the 2010 Census and requires a storage volume of 11,800,000 gallons. The projected population in 2025 is 2,377 and requires a storage volume of 40,600,000 gallons. Worthing's treatment system is currently overloaded and they need to expand. The City of Worthing would be interest in exploring the possibility of regionalization.

The City of Canton's engineer was contacted about their current treatment system. The current system is designed for 180 day storage and discharges to the Big Sioux River. The current population is 3,057 based on the 2010 Census and requires a storage volume of 72,700,000 gallons. The projected population in 2028 is 4,303 and requires a storage volume of 92,000,000 gallons. The wastewater treatment system was just upgraded in 2011 to include aeration, storage and disinfection. The system has adequate capacity for the 20 year design life and the City doesn't need to regionalize.

The Public Works Director for the City of Lennox was contacted about their current treatment system. The current system is a mechanical treatment plant that discharges to Long Creek. The current population is 2,111 based on the 2010 Census. The mechanical plant was built in 2009 with an average annual capacity of 305,000 gpd and a peak monthly capacity of 670,000 gpd. The system has adequate capacity for the 20 year design life and the City doesn't need to regionalize. The City would be willing to accept wastewater from other communities.

DEVELOPMENT OF WASTEWATER ALTERNATIVES

The City of Tea's engineer was contacted about their current treatment system. The current system is designed for 180 day storage and discharges to Ninemile Creek. The system includes an aeration cell, future aeration cell and four facultative ponds. The current population is 3,806 based on the 2010 Census and requires a storage volume of 63,000,000 gallons. The projected population in 2035 is 11,642 and requires a storage volume of 360,000,000 gallons. The system is currently overloaded hydraulically and will exceed the organic loading within five years. The engineer has investigated six alternatives for the treatment system but regionalization with communities other than Sioux Falls was not investigated.

Paul Aslesen with Lincoln County Planning and Zoning was contacted about a potential regional system. Paul has been in a couple meetings over the last year with the communities in Lincoln County. Discussions have been very brief and nothing has really developed. Stockwell assumes that Lincoln County would not build the system and one of the communities in the County would take the lead. The County would assist with the permitting process because a treatment system outside City limits would be a conditional use. This would be a hurdle to overcome because local residents are typically against wastewater treatment systems being in their back yard.

Robin Dykstra with Lincoln County Rural Water System was contacted about a potential regional wastewater system. In 2005 they investigated the potential to build a regional system for Tea and Harrisburg. They would also stub a line for rural residential areas like Baker's Crossing. The proposed system would install a gravity sewer along Ninemile Creek. Then a lift station would be installed before Lake Alvin and the wastewater would be pumped to a treatment site along the Big Sioux River. The study only evaluated three different treatment options and didn't include the cost to get the wastewater from the community to the treatment site. The cost of collection lines is significant due to the separation between the communities and the treatment site. The idea of building this regional system in 2005 never really gained any traction and therefore it was never built.

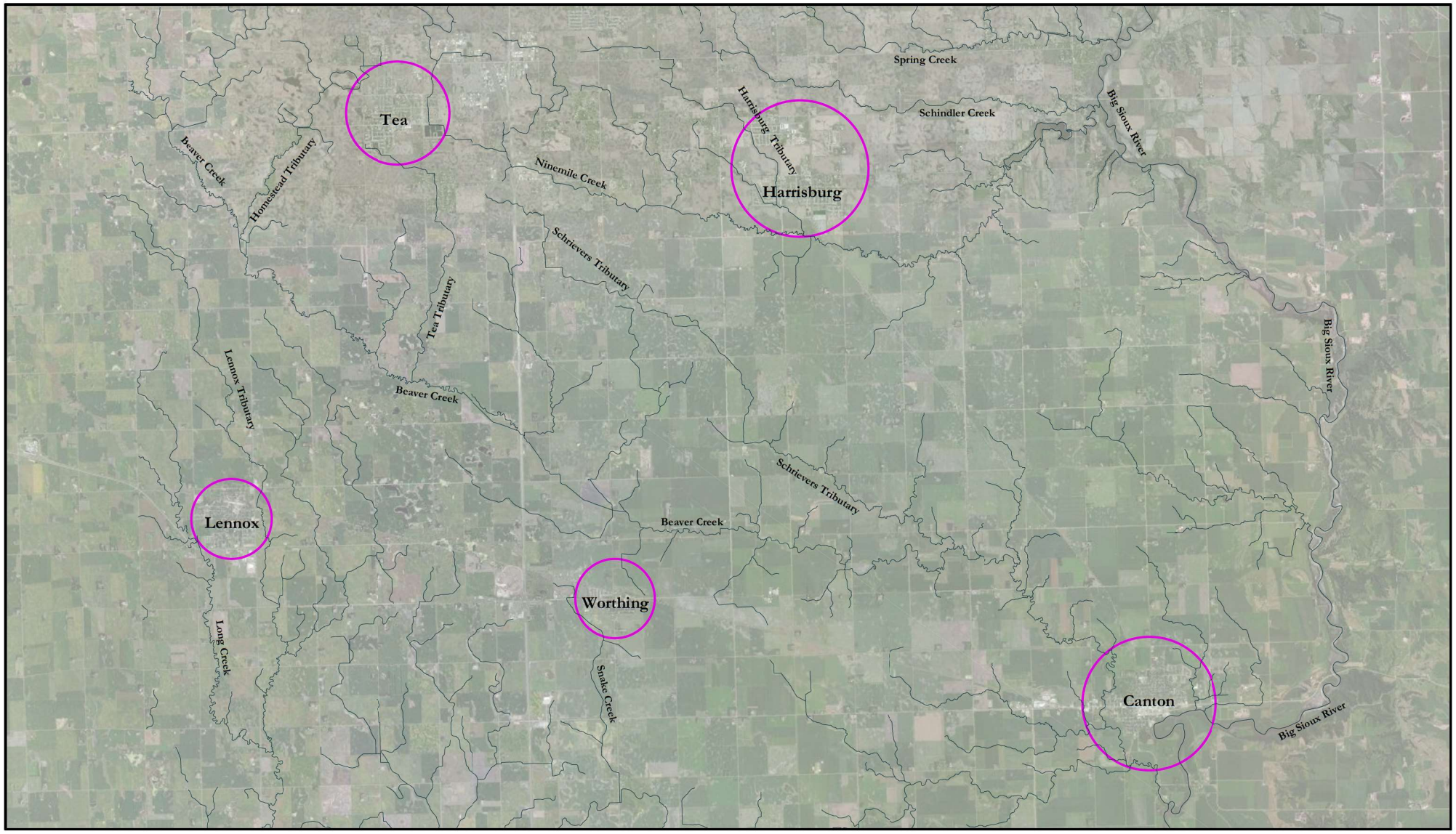


Figure 25 | Potential Regional Customers

1" = 8,000'

STOCKWELL ENGINEERS

TREATMENT ALTERNATIVE 11: MECHANICAL TREATMENT

Treatment Alternative 11 proposes a mechanical plant be built. The plant could be built on existing City property around the treatment site or it could be built at the Big Sioux River. The existing lift station would be used to pump the treatment plant effluent to the Big Sioux River or pump to the treatment plant if it was built adjacent to the Big Sioux River. This alternative would be continuous discharge and eliminate the need to pump to Sioux Falls. This alternative would require the DENR Permit to be changed because Harrisburg is currently "No Discharge".

Currently, in the State of South Dakota there are 375 permitted facilities and approximately 275 are municipal. There are only 23 municipal treatment plants in the entire state. The mechanical treatment process is very robust and would require additional labor force to operate. This alternative does not evaluate the different mechanical treatment processes. Extra processes could be added to the plant to meet future permit limits for nutrient removal. The cost estimate for this alternative is shown on the following page.

Table 41 Cost Estimate for Treatment Alternative 11

Item No.	Description	Quantity	Unit	Unit Price	Price
1	Mobilization	1	LS	$1,744,000.00	$1,744,000.00
2	Clearing	1	LS	$10,000.00	$10,000.00
3	Gravel Surfacing	1,000	TON	$12.00	$12,000.00
4	Surfacing Repairs	1	LS	$5,000.00	$5,000.00
5	Remove Existing Dikes	37,500	CY	$4.00	$150,000.00
6	Unclassified Excavation	16,200	CY	$3.00	$48,600.00
7	River Discharge Structure	1	EA	$10,000.00	$10,000.00
8	16" Force Main	25,400	FT	$55.00	$1,397,000.00
9	15" PVC Gravity Sewer	1,200	FT	$55.00	$66,000.00
10	16" Gate Valve & Box	2	EA	$8,500.00	$17,000.00
11	16" Sanitary Bedding Material	25,400	FT	$6.00	$152,400.00
12	15" Sanitary Bedding Material	1,200	FT	$5.00	$6,000.00
13	Ninemile Crossing	1	EA	$10,000.00	$10,000.00
14	Connect to Existing Force Main	1	EA	$2,500.00	$2,500.00
15	Air Release Manhole	5	EA	$8,000.00	$40,000.00
16	Sludge Removal	14,900	CY	$30.00	$447,000.00
17	Sanitary Manhole	3	EA	$3,000.00	$9,000.00
18	Mechanical Treatment Plant	1	LS	$14,831,000.00	$14,831,000.00
19	SCADA System	1	LS	$40,000.00	$40,000.00
20	Electrical Service	1	LS	$25,000.00	$25,000.00
21	Standby Generator & Tank	1	LS	$50,000.00	$50,000.00
22	Woven Wire Fence	3,000	FT	$6.00	$18,000.00
23	Salvage & Place Topsoil	7,400	CY	$3.00	$22,200.00
24	Seeding, Fertilizing & Mulching	44,340	SY	$1.50	$66,510.00
				Subtotal	$19,179,210.00
				Contingencies (15%)	$2,877,000.00
		Total Estimated Construction Costs			**$22,056,210.00**
				ENGINEERING	**$2,814,000.00**
				LAND PURCHASE (10 Ac.)	**$250,000.00**
				LEGAL, ADMINISTRATION & TESTING (4%)	**$883,000.00**
				TOTAL ESTIMATED PROJECT COST	**$26,003,210.00**

Table 42 EUAC for Treatment Alternative 11

Capital Cost Description	Price	Salvage Value	Present Worth of Salvage Value	Net Present Worth
Mobilization	$1,744,000	$0	$0	$1,744,000
Clearing	$10,000	$0	$0	$10,000
Gravel Surfacing	$12,000	$0	$0	$12,000
Surfacing Repairs	$5,000	$3,000	$1,661	$3,339
Remove Existing Dikes	$150,000	$0	$0	$150,000
Unclassified Excavation	$48,600	$0	$0	$48,600
River Discharge Structure	$10,000	$6,000	$3,322	$6,678
16" Force Main	$1,397,000	$838,200	$464,091	$932,909
15" PVC Gravity Sewer	$66,000	$39,600	$21,926	$44,074
16" Gate Valve & Box	$17,000	$10,200	$5,647	$11,353
16" Sanitary Bedding Material	$152,400	$0	$0	$152,400
15" Sanitary Bedding Material	$6,000	$0	$0	$6,000
Ninemile Crossing	$10,000	$0	$0	$10,000
Connect to Existing Force Main	$2,500	$0	$0	$2,500
Air Release Manhole	$40,000	$24,000	$13,288	$26,712
Sludge Removal	$447,000	$0	$0	$447,000
Sanitary Manhole	$9,000	$5,400	$2,990	$6,010
Mechanical Treatment Plant	$14,831,000	$8,898,600	$4,926,939	$9,904,061
SCADA System	$40,000	$24,000	$13,288	$26,712
Electrical Service	$25,000	$15,000	$8,305	$16,695
Standby Generator & Tank	$50,000	$30,000	$16,610	$33,390
Woven Wire Fence	$18,000	$0	$0	$18,000
Salvage & Place Topsoil	$22,200	$0	$0	$22,200
Seeding, Fertilizing & Mulching	$66,510	$0	$0	$66,510
Land Purchase	$250,000	$250,000	$138,419	$111,581
Remaining Capital Costs	$6,574,000	$0	$0	$6,574,000
Total Construction Cost	**$26,003,210**	**$10,144,000**	**$5,616,487**	**$20,386,723**
Annual Operation and Maintenance Cost				
Description	**Annual Cost**			**Net Present Worth**
Equipment	$8,000			$119,020
Supplies	$8,000			$119,020
Utilities	$75,000			$1,115,811
Sludge Disposal	$20,000			$297,549
Labor (two new employees)	$200,000			$2,975,495
Total Annual Cost	**$311,000**			**$4,626,895**
			Total Net Present Worth	**$25,013,618**
			EUAC	**$1,681,308**

IMPLEMENTATION OF ALTERNATIVES

WASTEWATER COLLECTION

Collection Alternative 1 “Do Nothing” is not recommended. This alternative will not address any of the deficiencies of the system. The City needs to continue to improve the collection system and reduce the amount of I&I.

Collection Alternative 2 "Replace VCP with PVC" should be implemented by the City. However, due to the large capital cost the City should break the project into multiple phases and begin to budget for the first phase. The City needs to clean and televise the existing clay lines to determine the condition of the existing lines and the type of rehabilitation method that can be used. This information will also help determine the phasing for this alternative. These improvements will reduce the amount of I&I and correct the deficiencies that will be discovered during televising. This alternative will also replace streets that are beyond their useful life and can be combined with water line and storm sewer improvements.

Collection Alternative 3 "Lift Station Improvements" should be implemented by the City. This alternative will reduce the frequency that the pumps clog. It will also help monitor the lift stations remotely and warn the City of a problem before it becomes an emergency.

Collection Alternative 4 "Future Basin Improvements" should be implemented by the City. This is a long term plan to reduce the number of lift stations therefore reducing O&M costs. The City should use this plan as a guide as new development occurs.

WASTEWATER TREATMENT

The EUAC for each system proposed needs to be compared in order to determine the most cost effective long term solution for the wastewater treatment system. The following table compares the capital cost and EUAC for all of the treatment alternatives.

Table 43 Comparison of Wastewater Treatment Alternatives for Population 17,199

Treatment Alternatives	Capital Cost	Equivalent Uniform Annual Cost
2: Total Retention	$18,230,750	$949,048
3: 180 Day Storage	$12,315,150	$705,982
4: Artificial Wetland	$14,364,000	$809,206
5: Irrigation	$17,757,400	$900,822
6: SAGR at Existing Site	$14,562,825	$972,976
7: SAGR at New Site	$15,804,825	$1,006,078
8: Regionalization with Sioux Falls (partial pumping)	$11,414,039	$1,688,506
9: Regionalization with Sioux Falls	$7,453,039	$1,737,742
10: Regionalization without Sioux Falls	-	-
11: Mechanical Treatment	$26,003,210	$1,681,308

REDUCED POPULATION PROJECTION

In August 2014, Community Partners Research, Inc. completed a housing study for the City. In September the City requested that Treatment Alternatives 2, 6, 7, 8 and 9 be updated to reflect the new 2034 population projection of 10,353. The projection is consistent with a 4% growth rate. A summary of the revised cost estimates is below.

TREATMENT ALTERNATIVE 2: TOTAL RETENTION

The smaller population projection requires 117 acres of surface area in addition to the existing storage volume and has a total project cost of $11,040,700. The required surface area is based on the DENR allowable seepage rate. Soil borings at the proposed site will be required to determine the seepage rate. The seepage rate can drastically change the surface area that is required. If the seepage rate is 1/16 in/day in the cells then the required additional surface area increases to 213 acres.

TREATMENT ALTERNATIVE 2A: TOTAL RETENTION WITH AERATION

As part of the revised population projections, staff asked that an alternative be created to include aeration in the front part of the treatment system to reduce the odor and provide better treatment. The addition of aeration increases the total project cost to $13,634,800. The required storage area stays the same.

TREATMENT ALTERNATIVE 6: SAGR RETROFIT

This alternative would build three new aeration cells and two SAGR beds in the existing cell one and cell two. The system would be continuous discharge. The total project cost

for this alternative is $11,663,000. Nutrient removal is an additional $2,198,000 in ten years.

TREATMENT ALTERNATIVE 7: SAGR NEW SITE

This alternative requires the same aeration and SAGR size as Treatment Alternative 6. This alternative also requires 40 acres of land to be purchased. The total project cost for this alternative is $13,245,000. Nutrient removal is an additional $2,198,000 in ten years.

TREATMENT ALTERNATIVE 8: REGIONALIZATION WITH SIOUX FALLS (PARTIAL PUMPING)

Lowering the population projection also reduced the projected pumping charges. The initial capital cost for this alternative is $8,314,000 which includes the SDC buy-in of $4,326,000. The force main extension is an additional capital cost of $2,600,000 in five years.

TREATMENT ALTERNATIVE 9: REGIONALIZATION WITH SIOUX FALLS

The initial capital cost for this alternative is $5,211,000. This includes the SDC buy-in of $4,326,000. The force main extension is an additional capital cost of $2,600,000 in five years. The following table summarizes the difference in cost for the 2034 population projections.

Table 44 Comparison of Wastewater Treatment Alternatives for Different Projections

	Population Projection	
Treatment Alternatives	10,353	17,199
2: Total Retention	$11,040,700	$18,230,750
2a: Total Retention with Aeration	$13,634,800	NA
6: SAGR at Existing Site	$13,860,800	$16,956,825
7: SAGR at New Site	$15,442,800	$18,198,825
8: Regionalization with Sioux Falls (partial pumping)	$10,914,639	$11,768,039
9: Regionalization with Sioux Falls	$7,807,039	$7,807,039

A table showing the annual cost comparison for these alternatives over the next 20 years is included in Appendix H. The most economical option that includes the lowest capital cost and long term cost is to select Treatment Alternative 2. However, this does nothing to improve the issues with odor. The City should try to obtain an option on a parcel of land. To further explore Treatment Alternative 2, the City should then complete an environmental review of the site and soil borings. The surface area required for total retention is drastically changed by the seepage rate. The soil borings will determine what the seepage rate will be. A very low seepage rate based on actual site condition may

require more surface area which would drive the cost up and not make this the most cost effective alternative. It Treatment Alternative 2 does prove to be cost prohibitive, the City should then proceed with building a SAGR on the property in question and discharge to the Big Sioux River. This will address the odor issues with the existing site by moving the facility away from the backyards of existing residences and provide a system that will meet discharge limits.

IMPACT ON OWNER'S BUDGET

There are several alternatives the City needs to implement. Due to budget constraints and priority, the following alternatives should be implemented immediately. The following table shows the combined recommendations.

Table 45 Recommended Improvements

Alternative	Capital Cost
Collection Alternative 3: Lift Station Improvements	$297,000
Treatment Alternative 2: Total Retention	$11,040,700
Combined Project Cost	**$11,337,700**

The City provided SEI their sewer revenue and expenses for the last two years. SEI evaluated the budget and the cost of the recommended improvements to determine how the City could fund the project. Based on Harrisburg's current revenue and expenses, they will have to obtain grant and loan dollars from various funding agencies to finance the project. The loan is based on an interest rate of 3.25% over 30 years. The City's sewer fees will be used to make the loan payments. The current monthly residential sewer rate is a minimum of $15.45 plus $6.70 per thousand. The sewer bill for 5,000 gallons of water usage is $48.95.

Table 46 Funding Proposed Improvements

Revenue	$987,241
Expenses	$628,765
Current Debt Payment	$253,919
Net Cash From Operations	**$104,557**
New Loan Payment	$597,290
Debt Reserves (10%)	$59,729
Net Fund Balance	**-$552,461**
Monthly Rate Increase	$29.00
Number of Customers	1,638
Annual Revenue Generated	$570,024
Fund Balance After Increase	**$17,563**

The previous table shows that the City of Harrisburg would have to increase their sewer rates to fund the project. The City will try to obtain grant dollars to reduce the loan amount. In order to be eligible for grant dollars the DENR has required a minimum monthly sewer rate of $22.00 for 5,000 gallons. The City of Harrisburg currently meets this requirement. The City should also consider raising their rates annually by 3%. This will keep up with the cost of inflation and avoid a bigger jump in rates to complete any future projects.

The potential project grant/loan percentages and how those amounts affect user rates are shown in the following table.

Table 47 Potential Grant/Loan Amounts

Grant/Loan	50/50	40/60	30/70	20/80	10/90
Expenses	$628,765	$628,765	$628,765	$628,765	$628,765
Current Debt	$253,919	$253,919	$253,919	$253,919	$253,919
Project Cost	$11,337,700	$11,337,700	$11,337,700	$11,337,700	$11,337,700
Grant Amount	$5,668,850	$4,535,080	$3,401,310	$2,267,540	$1,133,770
Loan Amount	$5,668,850	$6,802,620	$7,936,390	$9,070,160	$10,203,930
Annual Loan Payment	$298,645	$358,374	$418,103	$477,832	$537,561
Debt Reserves	$29,864	$35,837	$41,810	$47,783	$53,756
Total Annual Cost	$1,211,194	$1,276,896	$1,342,597	$1,408,299	$1,474,001
Revenue	$987,241	$987,241	$987,241	$987,241	$987,241
Balance After Project	-$223,952	-$289,654	-$355,356	-$421,058	-$486,760
Minimum Rate Increase	$11.39	$14.74	$18.08	$21.42	$24.76
Current Rate (5,000 gal)	$48.95	$48.95	$48.95	$48.95	$48.95
Proposed Monthly Rate	$60.34	$63.69	$67.03	$70.37	$73.71

SEI has completed an in depth rate analysis for other communities. It is recommended that SEI complete a rate analysis for the City that include the proposed improvements to verify the potential rate increases. The above calculations are very cursory and do not include any increase in customers or savings from not pumping to Sioux Falls. The rate analysis is more in depth and will give a more accurate depiction of the impact on rates.

ENVIRONMENTAL EVALUATION

Funding agencies will require an environmental review to be completed for the proposed improvements before funding can be obtained. SEI will request comments on the proposed improvements prior to construction from various agencies. These comment letters will be provided to the funding agencies.

VIEWS OF THE PUBLIC AND CONCERNED INTEREST GROUPS

The City of Harrisburg will be required by the funding agencies to hold a public hearing to discuss the proposed improvements. Typically these meetings are held during council meetings. The City will work with SEI and SECOG to schedule this meeting and keep minutes of the meeting. These minutes will be provided to the funding agencies.

JUSTIFICATION AND DESCRIPTION OF SELECTED PLAN

This Comprehensive Study identified several deficiencies with the sewer system that do not meet current SD Design Criteria Standards. The alternatives will bring the system into compliance and provide an improved system to adequately handle growth.

DESIGN OF SELECTED PLAN

The alternatives will be designed by a licensed engineer. All construction plans and specifications will be reviewed and approved by the SD DENR. All state bid laws will be followed for the bidding process.

STAGED CONSTRUCTION

Typically communities do not see the growth rate that Harrisburg has experienced. This growth rate causes new facilities to be drastically larger than needed the first few years after construction is completed. Staging the construction should be considered during the design phase. Adequate land should be acquired for the full build out but there is the potential that some of the improvements could be implemented later when wastewater flows require it.

LAND ACQUISITION

Land acquisition, temporary construction easements and permanent easements will be necessary to complete the improvements. Land acquisition costs have been included in the estimates. All easements will be obtained before construction is started. Land acquisition should start immediately to keep the project moving.

IMPLEMENTATION SCHEDULE

The City should implement the recommended improvements as soon as possible. Funding application should be submitted as soon as possible. The earliest construction could begin is 2016.

REFERENCES

National Weather Service Forecast Office, Sioux Falls, SD, 10 January 2014 <http://www.weather.gov/climate/index.php?wfo=fsd>.

South Dakota Department of Environment and Natural Resources, (March 1991). Recommended Design Criteria Manual Wastewater Collection and Treatment Facilities, Pierre, SD: Division of Environmental Services.

Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, (2004). Recommended Standards for Wastewater Facilities, Health Research Inc., Albany NY.