City of Carroll

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MEMO TO: Mike Pogge-Weaver, City Manager MSP-W

FROM: Randall M. Krauel, Director of Public Works RMK

DATE: February 20, 2018

SUBJECT: Wastewater Disinfection Treatment Facility Plan

The Wastewater National Pollutant Discharge Elimination Systems (NPDES) Permit includes compliance with effluent limitations on the following improvement schedule:

	Date	Status
DO/Disinfection – Self-Assessment Matrix and Work Record Request	**01/01/17**	**Complete**
Copper: Compliance Strategy	05/01/17	Complete
DO/Disinfection: Facility Plan	**10/01/17**	**Complete**
DO/Disinfection: Progress Report	**04/01/18**	
Copper: Progress Report	05/01/18	
DO/Disinfection: Plans and Specifications	**09/01/18**	
Nutrient Reduction: Feasibility Report	11/01/18	
DO/Disinfection: Construction Contract	**11/01/18**	
Copper: Progress Report	05/01/19	
DO/Disinfection: Progress Report	**07/01/19**	
DO/Disinfection: Complete Construction	**03/01/20**	
DO/Disinfection: Compliance	**04/01/20**	
Copper: Progress Report	05/01/20	
Copper: Progress Report	05/01/21	
Copper: Compliance	10/01/21	

The Wastewater Disinfection Treatment Facility Plan has been completed by Veenstra & Kimm, Inc. A copy, excluding Appendices, is attached. The Appendices are the Wastewater NPDES Permit, a Wedeco UV Proposal and an Enaqua UV Proposal.

The Plan was prepared to address the impact of changes to water quality standards included in the NPDES Permit. The specific standard addressed by the Plan is the geometric mean of E. coli concentration being less than 126 colonies per 100 milliliters.

The plan presents the results of study and analysis of the Wastewater Treatment Facility including the following:

- Identification of alternatives for upgrading the Wastewater Treatment Facility to meet regulatory disinfection requirements.

- Preliminary design considerations and estimated costs of the recommended improvements.

The Plan recommends that Ultraviolet (UV) disinfection be utilized for meeting the E. coli limitations. The UV Disinfection Estimated Project cost is $715,000.

The next step to implement disinfection is to initiate design of the improvements.

RECOMMENDATION: Mayor and City Council consideration and acceptance of the Wastewater Disinfection Treatment Facility Plan.

RMK:km

attachment

REPORT

ON

WASTEWATER DISINFECTION TREATMENT FACILITY PLAN

CARROLL, IOWA

JANUARY, 2018

VEENSTRA & KIMM, INC.

REPORT

ON

WASTEWATER DISINFECTION TREATMENT

FACILITY PLAN

CARROLL, IOWA

JANUARY, 2018

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

LICENSED PROFESSIONAL ENGINEER
Todd W. Penisten
No. 16918
IOWA

Signed: Date:

January 30, 2018

Todd W. Penisten, P.E.
Iowa License No. 16918
My license renewal date is December 31, 2019

Parts covered by this seal:

All

Prepared by
VEENSTRA & KIMM, INC.
West Des Moines,
Iowa

CHAPTER 1 - GENERAL

INTRODUCTION

This report presents the results of the Facility Plan completed for the City of Carroll. The Disinfection Facility Plan was undertaken to address the impact of changes to water quality standards proposed by the State of Iowa.

SCOPE

This report presents the results of the engineering studies and analysis of the wastewater treatment facility for the City of Carroll, Iowa. The studies include the following:

1. Identification of alternatives for upgrading or replacing the existing wastewater treatment facility to meet current and future needs and forthcoming regulatory disinfection requirements.

2. Preliminary design considerations, estimated cost and methods of financing the recommended improvements.

DESCRIPTION OF SERVICE AREA

The service area includes the incorporated limits of the City of Carroll. The City of Carroll is located in West Central Iowa approximately 90 miles northwest of Des Moines.

PRESENT LAND USE

The community consists of residential development with some commercial and industrial development.

PLANNING PERIOD

The Iowa Department of Natural Resources requires the planning period for proposed improvements extend at least 20 years beyond the date when the improvements are scheduled to begin operation. For the purposes of this report, the planning period will be 20 years and extend to the year 2038.

TOPOGRAPHY AND DRAINAGE

The general ground surface topography consists of nearly level to strongly sloping terrain. The drainage in the study area flows into an Unnamed Creek to the Middle Raccoon River.

SOILS

Generally, the soil types in the study area can be characterized as well-drained and poorly drained loamy or silty materials.

COST ESTIMATES AND PRESENT WORTH ANALYSES

All costs included herein represent present day costs. No provisions have been made for inflation or deflation.

CHAPTER 2 - EFFLUENT LIMITATIONS

GENERAL

This chapter discusses the water quality standards and effluent limitations which impact the proposed improvements to the Carroll, Iowa Wastewater Treatment Facility. Point discharges of pollution in Iowa are normally regulated by permits issued by IDNR. Because the permits limit the quantity of certain parameters and pollutants in the effluent from point sources, the limitations which apply to a given effluent are essential for proper planning and design of wastewater treatment facilities. These effluent limitations are also, in turn, directly related to the water quality standards which apply to the river or stream receiving the discharge and must be appropriately modified to suit local conditions.

RECEIVING STREAMS

The City of Carroll currently discharges its treated wastewater into an Unnamed Creek which discharges to Middle Raccoon River. This Unnamed Creek is classified as secondary contact recreational use (Class A2) and a warm water fisheries.

WATER QUALITY STANDARDS

Water quality standards for the State of Iowa are regulated by IDNR and presented in Section 567 - Environmental Protection Commission of the Iowa Administrative Code under Chapter 61 - Water Quality Standards. IDNR has developed a classification system for all surface waters in the State of Iowa to define water quality according to use and for the protection of beneficial uses. This classification system establishes general use and designated use river and stream segments.

General use segments are watercourses with intermittent flow or typically flow only for short periods of time following precipitation or as a result of discharges from wastewater treatment facilities. These waters do not support a viable aquatic community of significance during low flow, and do not maintain pooled conditions during periods of no flow. However, during elevated flow periods when sufficient flow exists in the intermittent watercourses to support various uses, the general use segments are to be protected in accordance with the "General Water Quality Criteria" which are discussed later in this chapter. Also, aquatic life existing within these watercourses during elevated flows are to be protected from acutely toxic conditions.

Designated use segments are bodies of water which maintain flow throughout the year, or contain sufficient pooled areas during intermittent flow periods to maintain a viable aquatic community of significance. Designated use waters are to be protected for all uses of general use segments in addition to the specific uses assigned.

Designated use segments include:

Class A1 - Primary Contact Recreation Use: Waters in which recreational or other uses may result in prolonged and direct contact with the water, involving considerable risk of ingesting water in quantities sufficient to pose a health hazard. Such activities would include, but not be limited to, swimming, diving, water skiing, and water contact recreational canoeing.

Class A2 - Secondary Contact Recreational Use: Waters in which recreational or other uses may result in contact with the water that is either incidental or accidental. During the recreational use, the probability of ingesting appreciable quantities of water is minimal. Class A2 uses include fishing, commercial and recreational boating, any limited contact incidental to shoreline activities and activities in which users do not swim or float in the water body while on a boating activity.

Class A3 - Children's Recreational Use: Waters in which recreational uses by children are common. Class A3 waters are water bodies having definite banks and bed with visible evidence of the flow or occurrence of water. This type of use would primarily occur in urban or residential areas.

Class B(WW-1) Warm Water - Type 1: Waters in which temperature, flow and other habitat characteristics are suitable to maintain warm water game fish populations along with a resident aquatic community that includes a variety of native nongame fish and invertebrate species. These waters generally include border rivers, large interior rivers, and the lower segments of medium-size tributary streams.

Class B(WW-2) Warm Water - Type 2: Waters in which flow or other physical characteristics are capable of supporting a resident aquatic community that includes a variety of native nongame fish and invertebrate species. The flow and other physical characteristics limit the maintenance of warm water game fish populations. These waters generally consist of small perennially flowing streams.

IDNR has also established "General Water Quality Criteria" which are applicable to all surface waters including those which are designated use segments. As stated in Chapter 61, the "General Water Quality Criteria" are applicable at all places and at all times to protect livestock and wildlife watering, aquatic life, non-contact recreation, crop irrigation, and industrial, domestic, agricultural and other incidental water withdrawal uses not protected by specific numerical criteria. The "General Water Quality Criteria" are as follows:

1. Such waters shall be free from substances attributable to point source waste discharges that will settle to form sludge deposits.

2. Such waters shall be free from floating debris, oil, grease, scum, and other floating materials attributable to wastewater discharges or agricultural practices in amounts sufficient to create a nuisance.

3. Such waters shall be free from materials attributable to wastewater discharges or agricultural practices producing objectionable color, odor, or other aesthetically objectionable conditions.

4. Such waters shall be free from substances attributable to wastewater discharges or agricultural practices in concentrations or combinations which or toxic to human, animal, or plant life.

5. Such waters shall be free from substances attributable to wastewater discharges or agricultural practices, in quantities which would produce undesirable or nuisance aquatic life.

6. The turbidity of the receiving water shall not be increased by more than 25 Nephelometric turbidity units by any point source discharge.

7. Cations and anions guideline values to protect livestock watering may be found in the "Supporting Document for Iowa Water Quality Management Plans," Chapter IV, July 1976, as revised on November 11, 2009.

8. The Escherichia coli (E. coli) content of water which enters a sinkhole or losing stream segment, regardless of the water body's designated use, shall not exceed a Geometric Mean value of 126 organisms/100 ml or a sample maximum value of 235 organisms/100 ml. No new wastewater discharges will be allowed on watercourses which directly or indirectly enter sinkholes or losing stream segments.

EFFLUENT LIMITATIONS

The Federal Wastewater treatment Act Amendment of 1972 (PL92-500) increased the role each state plays in control of the discharge of pollutants into its waterways. Under this amendment, the National Pollutant Discharge Elimination System (NPDES) permit program was established which is administered by the Environmental Protection Agency (EPA). Monitoring and surveillance of water quality is conducted by IDNR through its operation permit program. IDNR has assumed the responsibility of the NPDES program for the State and the program is now operated through the state operating permit system. The NPDES permit establishes effluent limitations for all wastewater treatment systems discharging or planning to discharge effluent to rivers and streams within the State of Iowa.

REGULATORY REQUIREMENTS

The City of Carroll's wastewater treatment facility operates under Iowa NPDES Permit No. 1415001 issued by the IDNR. The current permit was issued on November 1, 2016 and expires on October 31, 2021. A copy of this permit is included in Appendix A. A summary of the major effluent parameters of the operating permit are:

Parameter	Permit Limit
Average 30 Day $CBOD_5$, mg/l	25
Average 30 Day $CBOD_5$, ppd	876
Maximum 7 Day Average $CBOD_5$, mg/l	40
Maximum 7 Day Average $CBOD_5$, ppd	1,401
Average 30 Day TSS, mg/l	30
Average 30 Day TSS, ppd	1,051
Maximum 7 Day Average TSS, mg/l	45
Maximum 7 Day Average TSS, ppd	1,576
D.O. Yearly Minimum, mg/l	5.0
7 Day Average pH	6.5
Daily Maximum pH	9.0

The new disinfection and D.O. limits do not become effective until April 1, 2020. The disinfection requirements are such that the geometric mean is less than 126 colonies of E. coli per 100 ml. The E. coli effluent limitations are only required to be met from March 15 through November 15 of each year.

CHAPTER 3 - POPULATION AND FLOWS

The population projections of the City of Carroll are based on the Carroll 2013 Comprehensive Plan report prepared by the Region VII Council of Governments. That study utilized the forecasts made by Woods & Pooole Economics Incorporated, a national economics research firm, for each county in the United States. The population projections of the City of Carroll were interpolated from the Carroll County projections made by Woods & Pool Economics Incorporated.

The population projections of the City of Carroll are summarized below in Table 3-1

TABLE 3-1
Population

Year	Population
1910	3,546
1920	4,254
1930	4,691
1940	5,389
1950	6,231
1960	7,682
1970	8,716
1980	9,705
1990	9,579
2000	10,106
2010	10,103
2020	10,251
2030	10,473
2040	10,705

*Estimate

INDUSTRIES

The city of Carroll is home to two Significant Industrial User (SIU), Smithfield Farmland Corp. and Carroll County Solid Waste Management Commission. The City has a Pretreatment Agreement with both Smithfield Farmland Corp. and Carroll County Solid Waste Management Commission included in their NPDES permit. Effluent flow from both Smithfield Farmland Corp. and Carroll County Solid Waste Management Commission are reported in the City's monthly operating reports to IDNR.

WASTEWATER FLOWS

The Iowa Department of Natural Resources requires wastewater flows during specific conditions be determined to establish the design parameters for improvements to wastewater treatment facilities. These conditions include the following:

Average Dry Weather (ADW) Flow – The daily average flow when the groundwater is at or near normal and runoff is not occurring.

Average Wet Weather Flow (AWW 30) – The daily average flow for the wettest 30 consecutive days.

Maximum Wet Weather (MWW) Flow – The total maximum flow received during any 24-hour period when the groundwater is high and runoff is occurring.

Peak Hourly Wet Weather (PHWW) Flow – The total maximum flow received during one hour when the groundwater is high, runoff is occurring, and the domestic, commercial and industrial flows are at their peak.

EXISTING WASTEWATER HYDRAULIC AND ORGANIC LOADINGS

The existing wastewater hydraulic and organic loadings for the wastewater treatment facility will remain unchanged under this facility plan. If future upgrades to the existing wastewater treatment facility become necessary the design flows and loadings will be modified accordingly. The design of the disinfection facilities would include the flexibility to accommodate an increase in the hydraulic capacity of the facility without requiring significant modifications.

TABLE 3-2
EXISTING PERMITTED DESIGN CAPACITY

CARROLL, IOWA Flow/Loading	Existing Permitted Design Capacity
Flow, mgd	
ADW	1.600
AWW	4.200
MWW	6.300
PHWW (Plant Capacity)	6.300
PHWW (Plant Capacity plus Equalization Basin)	15.00
Organic Loadings, lbs./day	
BOD	4,735
TKN	1,021

CHAPTER 4 – DISINFECTION ALTERNATIVES

INTRODUCTION

The existing treatment plant does not include disinfection. However, the newly received NPDES operating permit includes a compliance schedule for E. coli effluent limitations that will require disinfection. Disinfection would occur downstream of the Vertical Loop Reactor effluent. The two types of disinfection evaluated were UV disinfection and chlorine gas disinfection.

DISINFECTION

The recently issued operating permit for the wastewater treatment plant requires the City to meet an E-coli limit of 126 colonies per 100 milliliter. Disinfection is required during all months except for the winter months. The treatment plant will be required to disinfect to meet the permit standard.

Chlorination/Dechlorination

There are two technologies for disinfecting wastewater. The first technology is chlorination. Under this process disinfection is achieved by the addition of chemical chlorine.

Chlorine is a strong oxidant which destroys pathogenic organisms. IDNR designs standards recommend that a chlorination system be designed to deliver a dosage of 6 mg/l of chlorine for a nitrified effluent. Based on an Average Wet Weather flow of 4.2 mgd, the maximum 30 day usage would average 210 lbs/day. Typically, a 30-day chemical storage capacity would be recommended. A facility capable of storing approximately 6,300 pounds of chlorine would be required.

The IDNR design standards also require that a minimum 30 minutes detention at Average Wet Weather flow be maintained. Therefore, a chlorine contact basin with a volume of 87,500 gallons would need to be constructed.

The Uniform Fire Code (UFC) requires that if more than 150 lbs of chlorine is stored at one time, the facility must be equipped with safety systems to contain and treat the gas in case of an accidental leak. The enforcement of this requirement is typically left up to the local jurisdiction which enforces the code. Because of the potential liability, it is believed that any new system should seriously consider complying with this requirement.

If the facility was to disinfect with chlorine, it would also be required to remove any residual chlorine in the effluent (dechlorination). The residual chlorine is toxic to aquatic life at low levels.

Ultraviolet Light Disinfection
The second technology for disinfection is ultraviolet (UV) light disinfection. Ultraviolet disinfection is by irradiation of the effluent with the UV wavelength light that has a germicidal effect at 250 – 270 nanometers (nm). UV light is effective on bacteria, most viruses, and protozoa by causing photochemical damage to their DNA and RNA rendering them unable to reproduce.

A single channel houses the ultraviolet disinfection lights and associated equipment. There is no chemical addition with ultraviolet disinfection. Ultraviolet disinfection does require a high-quality effluent, as particulate matter is difficult to disinfect. The low suspended solids level in the Carroll effluent should be suitable for ultraviolet disinfection.

Ultraviolet disinfection requires the use of electrical power for the lights. The cost-effectiveness of ultraviolet disinfection is partially dependent on power costs. The City can purchase power at a very favorable rate.

There are options on the type of UV lamps and systems as follows:

- Low Pressure Low Intensity Lamps (LP/LI) – used for smaller systems, manual controls, manual cleaning, requires more lamp bulbs.
- Low Pressure High Intensity Lamps (LP/HI) – has higher power level but fewer lamps. Power can be modulated to demand. Automatic cleaning systems are provided. Longer lamp life is expected of 0.5 to 1.5 years.
- Medium Pressure High Intensity Lamps (MP/HI) – These lamps have a high-power demand but require fewer lamps, have a shorter lamp life, and require automatic cleaning due to scaling. This type of system is used in very large installations and is proprietary to a couple of manufacturers.

The cost-effectiveness of ultraviolet disinfection and chlorine disinfection generally rests on the cost for power. At the City's power purchase cost, ultraviolet disinfection would be less costly than chlorination in the long term. Ultraviolet disinfection has the secondary advantage of not requiring chemical handling.

The new ultraviolet disinfection facility will include a small building located near the UV equipment. The small building will serve the purpose of housing the UV equipment. The UV Building will provide a location for the effluent sampler. The sampling points for the effluent will be relocated to the UV disinfection chamber to allow post-disinfection sampling. The sampler will be located in the building with a capability of sampling at the post-disinfection location.

Recommendation
Based on the evaluation of the various disinfection options available, it is recommended that Ultraviolet disinfection be utilized for meeting any future E. coli limitations contained in the City of Carroll's NPDES operating permit.

The estimated cost for an ultraviolet disinfection facility for the wastewater treatment plant is shown in Table 4-1 UV Disinfection Cost Estimate.

TABLE 4-1
UV DISINFECTION COST ESTIMATE

Description		Estimated Cost
UV Equipment	$	206,000
UV Equipment Installation		70,000
Electrical and Control		45,000
Mason Block Walls & Roof Over Equipment		40,000
Concrete Channel & Building Footing		110,000
Effluent Meter Structure		34,000
Yard Piping, Manholes & Sluice Gates		20,000
Construction Total	$	525,000
Contingency	$	80,000
Engineering, Legal and Administrative Costs	$	110,000
Estimated Project Cost	$	715,000

The above estimate is to construct a concrete block building with a cast-in-place concrete foundation housing the UV disinfection equipment.

The estimated annual operation and maintenance costs for both the Enaqua and Wedeco UV equipment are shown on Table 4-2 Annual UV Disinfection Operation and Maintenance Costs.

Carroll UV **6.3 MGD Unit**

Days UV Running: 3/15/2018 11/15/2018

Days UV Running: 245 days

Hours UV Running: 5,880 Hours

O&M Bulb Replacement Costs

	Lifespan Bulb:	# of Bulbs	# Replaced/ 5-years	Cost/Bulb	5 Year Replacement Cost	Annual Replacement Cost
Enaqua	14,000	70	147	$ 75.00	$ 11,025.00	$ 2,205.00
WEDECO	18,000	24	40	$ 250.00	$ 10,000.00	$ 2,000.00

O&M Sleeve Replacement Costs

	# of Sleeves	Frequency to Replace	# Replaced/ 5-years	Cost per Sleeve	5 Year Replacement Cost	Annual Replacement Cost
Enaqua	70	-	-	$ -	$ -	$ -
WEDECO	24	5	24	$ 120.00	$ 2,880.00	$ 576.00

SLEEVES

Does Not Require Sleeve Replacement

$120 (5 years each sleeve)

O&M Power Consumption Costs

	Power Draw (kW)	Cost/kWhr	Annual Power Cost
Enaqua	30.3	$ 0.08	$ 14,253.12
WEDECO	16.9	$ 0.08	$ 7,949.76

O&M Labor/Maintenance Costs

	Cost/Man Hour	Time	Annual Man Hour Cost	TOTAL O&M
Enaqua	$ 20.00	6.0	$ 120.00	**$ 16,525.00**
WEDECO	$ 20.00	4.5	$ 90.00	**$ 10,666.00**

10-Year Present Worth

	Construction	Rounded Power	Total O&M	Years	Inflation Rate	Present Worth
Enaqua	$ 751,755.00	$ 14,200.00	$ 16,525.00	20	3%	$ 997,605.27
WEDECO	$ 666,684.00	$ 8,000.00	$ 10,666.00	20	3%	$ 825,367.15

Labor Costs

Enaqua	4.5 hrs to clean tubes	1.5 hr to change all 70 lamps
WEDECO	0.5 hr to change a ballast (similar to bulb)	0 No chemicals to refill, no tubes to clean
	1.0 hr to change 24 lamps (pull the rack)	3 Change out rings on wipers

CHAPTER 5 - ENVIRONMENTAL IMPACT

GENERAL

This chapter will describe more specific impacts, both positive and negative, which will result from the implementation of the wastewater treatment facilities improvements. It is divided into four parts: Natural Environment, Socio-Economic Factors, Sensitive Areas, and Irretrievable and Irreversible Commitment of Resources.

NATURAL ENVIRONMENT

Water Quality

The primary goal of the recommended wastewater treatment facilities improvements is to improve the water quality in the area streams. The improvements to the existing treatment facilities will provide the necessary treatment facilities to handle the community's wastewater treatment needs and to comply with state and federal water quality standards.

Construction of the recommended wastewater treatment facilities improvements may impact the area's surface water supplies temporarily. Excavated materials may be introduced into streams during periods of heavy rains or winds or during construction of the wastewater treatment facilities improvements. Measures to prevent construction runoff include excavating the smallest areas of land for the shortest amount of time or applying mulch to exposed areas. Also, the existing wastewater treatment facilities will be in operation at all times during construction of the recommended improvements to protect the water quality of the receiving stream.

Air Quality

Air quality in Carroll will be temporarily impacted by fugitive dust produced during construction depending on weather or soil conditions. Some precautions will be necessary to avoid serious impact on air quality. Spraying earth mounds with water or other dust retardants and excavating the minimum amounts of land are two solutions.

Population growth and development will impact air quality through increased sources of pollution. Automobile ownership and use will increase, thus increasing emissions. Continued advancements by the auto industry to reduce emissions and continued regulation of emissions by EPA will also promote air quality goals. Industrial development may create additional point sources of pollution; however, those emissions will be regulated by the Iowa Department of Natural Resources to help achieve and ultimately maintain ambient air quality in Carroll.

Noise

Noise impacts will be short term and associated with construction. Depending on when construction occurs, residences and businesses near the existing treatment facilities may be affected by heavy equipment noise. No long term impacts are anticipated, however, since noise producing equipment or facilities will be located away from residential development or contained within structures.

Energy

An increase in energy consumption is anticipated as a result of the implementation of the recommended improvements. The operation of the upgraded treatment facilities will increase the demand for electricity.

Future development will also place increased demands on energy. Measures to reduce energy consumption include building more energy efficient homes and landscaping. Advanced developments in alternative forms of energy, such as wind or solar, may make those sources more economically feasible in the future.

SOCIO-ECONOMICAL FACTORS

Population

Implementation of the recommended improvements will indirectly affect population growth. The additional capacity in the treatment facilities may promote new residential, commercial and industrial growth. The creation of new jobs or housing opportunities will help attract people to the community.

Economy

The recommended improvements will result in a positive impact on the community's economy. Carroll will be able to market itself as having complied with water quality management objectives in order to seek new investment in the area. New firms attracted to the area will create new jobs as well as increase the tax base. The community will also benefit from employment opportunities directly associated with construction of the treatment facilities.

Negative impacts associated with the recommended improvements will be the costs to the users for construction, and operation and maintenance of the expanded facilities. Sewer fees per household will increase; however, by maximizing the use of the existing treatment facilities, the costs will be reduced.

Land Use

The recommended improvements will result in both short term and long term impacts on land use. The improvements will temporarily affect land adjacent to the treatment facility and along the sewer routes.

Long term impacts on land use will result from future growth in the community. Development will expand into agricultural areas and the productivity of the land will be lost. The conversion of farmland, however, will not significantly impact the amount of land available in the area for agricultural purposes.

SENSITIVE AREAS

Wildlife Habitats

A direct benefit of the recommended improvements will be an improved environment for aquatic and terrestrial wildlife due to the improved water quality. Construction of the facilities may temporarily affect wildlife habitats, but long term impacts should be minor.

Any future development anticipated in the community may have a greater impact on wildlife. Future development may encroach on wildlife habitats existing in undeveloped areas. Buildings and paved surfaces may adversely affect stream habitats by removing bank cover, resulting in increased runoff, siltation, or bank erosion. Some species may become more vulnerable to predators by removing burrowing or nesting areas. New roads may present barriers to seasonal movements of some species or separate them from food sources. Urbanization can also impact common "urban" wildlife where more intensive human activity on the ground may affect nesting areas.

Means of minimizing impacts to wildlife habitats include cutting the minimum swath of vegetation for trenching and pipe placement; aligning piping which minimize the taking of young and mature trees; filling and regrading backfill material as soon as possible after trenching; using cover material that is equal in quality to the topsoil removed during excavation; replanting excavated areas with materials native to the disturbed areas or otherwise well suited to it; and inspecting replantings and erosion control measures to ensure successful regeneration to plant materials.

Rare and Endangered Species

Little impact is foreseen on rare or endangered species due to the implementation of the recommended improvements. Since construction of the treatment facilities improvements will occur in developed or cultivated areas, no impact is anticipated on endangered species.

Cultural Resources

No archaeological sites in or around the Carroll Wastewater Treatment Facility are expected. A copy of this report will be submitted to the State Historical Preservation Office for approval prior to the construction of any facilities.

Recreational and Open Space

No impact on recreation areas are anticipated from construction of the proposed improvements.

IRRETRIEVABLE AND IRREVERSIBLE COMMITMENT OF RESOURCES

Land, energy and materials are the greatest areas of resource commitment. The Carroll Wastewater Treatment Facility improvements will not require the purchase of additional land.

Energy in various forms will be utilized during construction, operation and maintenance of the facilities. The commitment of resources must be weighed in light of the anticipated water quality and socio-economic benefits resulting from the upgrading and expansion of the existing wastewater collection and treatment facilities.

CHAPTER 6 - FINANCING

GENERAL

This section of the report develops a financing plan for the proposed improvements that has been recommended in this facility plan report. The intention of this financing plan is to be only a rough guide and not to take place of the detailed program which will be developed by the City's bonding attorney and financial counsel.

The financing plan is necessary so that the wastewater utility can carry out its primary responsibility which is to produce a high quality effluent to meet its NPDES permit requirements. The wastewater utility must also function as a business in that revenues generated from water sales and other miscellaneous items must cover all operating and maintenance costs, equipment replacement, capital improvement projects, all outstanding debt, and maintain a reasonable surplus in case of emergencies. In the following paragraphs we will review methods of financing, past utility transactions, projected capital improvement projects, the costs of the proposed improvement program and the impact on existing wastewater rates.

METHODS OF FINANCING

In general, most wastewater improvement projects are financed through one of the following methods or a combination of the following methods: revenue bonds and State Revolving Fund (SRF).

Revenue Bonds are paid through surpluses in the particular utility fund and are usually funded through increases in rates. These bonds are not supported by general taxation and, therefore, are viewed as more risky in the financial market. This increased riskiness causes these bonds to typically sell for ½% above similar GO issues. In addition, reserve funds of approximately 25% of the annual principal and interest are required in order to provide the bond buyers an additional level of protection. Also, other reserve funds for equipment replacement and capital improvements are typically required. Revenue bonds do create a force savings plan in that additional reserve accounts do contain monies which can be used once the revenue issue is paid off. However, revenue bonds, because of the additional required reserve, do demand higher wastewater rates than a comparable GO issue. Finally, unlike general obligation bonds, no election is required for revenue bonds.

State Revolving Fund (SRF). This fund is operated by the Iowa Department of Natural Resources and the Iowa Finance Authority and provides low interest loans for financing improvements to wastewater treatment facilities. The loan takes the form of a revenue bond or a general obligation bond issued by the City and purchased by the Iowa Finance Authority. The interest rate is dependent upon the rate which the State can sell bonds. The annual rate has been running at 2% to 3% depending upon the term of the loan. For a sewer revenue issue the coverage requirement is 10%. This means that the net revenues of the system cannot be less than 110% of the operating, maintenance and debt service

expenses of the system. This compares to a typical coverage of 25% for a conventional sewer revenue bond issue. There is a 1% loan initiation fee and a 0.25% annual loan servicing fee. In addition, the City must have an approved user charge system to ensure "fairness" and to ensure that adequate revenues are generated. There are also some additional requirements with respect to the construction contract documents.