20 YEAR LIFECYCLE EVALUATION

City of Fort Wayne, Indiana

May 16th, 2013

The intent of this document is to provide a standardized basis of analysis that will allow for consistent 20-year life cycle evaluations of gravity sewers, lift stations, and low-pressure sewer systems.

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LIFT STATIONS, GRAVITY SANITARY SEWERS, AND LOW PRESSURE SEWER SYSTEMS

Table of Contents

List of Appendices

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LIFT STATIONS, GRAVITY SANITARY SEWERS, AND LOW PRESSURE SEWER SYSTEMS

1. INTRODUCTION

This document was created by American Structure Point Inc for Citizens Energy Group of Indianapolis, Indiana. The City of Fort Wayne has customized the document to the needs of City Utilities.

2. USE OF THIS DOCUMENT

The intent of this document is to provide a standardized basis of analysis that will allow for consistent 20-year life cycle evaluations of gravity sewers, lift stations, and low-pressure sewer systems. Following review and understanding of this document's content, the user will utilize the worksheets included in the appendices to complete a 20-year life cycle evaluation for the proposed project.

The information included in the worksheets was developed from actual City construction projects as well as operation and maintenance data in Fort Wayne between 2002 and 2012. Cost and inflation data was developed from published information sources and reflect 5-year historical trends. Therefore, this information is considered "typical" for Fort Wayne City Utilities lift stations and gravity sewers. As a result, the data inputs should be reviewed and updated every five years at a minimum. The goal of this document is to make this evaluation as straightforward as possible.
Examples are provided in Section 8 of this report. The user is encouraged to use the "20-Year Life Cycle Cost Summary" worksheet provided in this document. Electronic versions of the "20-Year Life Cycle Cost Summary" worksheet can be obtained from City Utilities.

3. DEFINITIONS

3.1 Financial Definitions

3.1.1 Annual Costs: Costs regularly occurring at a yearly interval.

3.1.2 Consumer's Price Index (Urban): CPI is a publication of the US Bureau of Labor Statistics (BLS) that measures the monthly changes in prices paid for a representative basket of goods and services and is used as a general measure of inflation in the US economy. The base year (equals 100) is 1982-1984 for the Consumer's Price Index (Urban) (CPI-U). (www.bls.gov/cpi/)

3.1.3 Producer Price Index (PPI): Measures the average change over time in the selling prices received by domestic producers for their output. The prices included in the PPI are from the first commercial transaction for many products and some services. The base year (equals 100) is 1982. The five-year average change in PPI Item "Industrial electric power" under the group "Fuels and related products and power" was selected for purposes of inflating power costs over time. (www.bls.gov/ppi/)

3.1.4 Employment Cost Index (ECI): A quarterly measure of changes in labor costs, free from the influence of employment shifts among occupations and industries, published by the Bureau of Labor Statistics. The ECI was rebased to December 2005 (equals 100) in 2006. The 5-year average change in ECI's "Total compensation, Private Industry, Construction" was selected for purposes of projecting increases in labor costs over time. (www.bls.gov/ncs/ect/)

3.1.5 Depreciation: A method of allocating the net cost of an asset to those periods of time expected to benefit from the use of the asset. In this analysis, it is an accounting concept, reflecting the expected economic life of the assets considered, based upon a 40-year depreciation schedule adopted by the Indiana Utility Regulatory Commission (IURC) for the wastewater system assets. Straight-line depreciation means the cost of the asset is depreciated in equal increments over the economic life of the asset.

3.1.6 Design Life (Useful Life): The period for which a component, device, or system is expected to function at its designated capacity without major repairs.

3.1.7 Discount Rate: The rate at which costs occurring in the future are converted to present worth. The discount rate in public sector projects is similar to the Minimum Acceptable Rate of Return (MARR) in private sector projects. The discount rate used for this analysis is the 5-year annual average rate of inflation (CPI-U).

3.1.8 ENR Cost Index: Engineering News Record is a publication that measures changes in construction costs on a monthly basis. (enr.construction.com/economics/)

3.1.9 Future Worth: The value of an asset at some future date, inflated to reflect the increased costs of providing or replacing that asset at some future date.

3.1.10 Index Date: Date at which a particular index value is assigned (typically a monthly or annual index date).

3.1.11 Index Value: Valuation at a particular Index Date. Allows users to be able to measure the change in values between Index Dates. Indices are often stated in percentiles, with a stated year being the base year or base period and equal to 100 percent.

3.1.12 Inflation Rate: An annual percentage of increase in the price of goods and services as measured by the Consumer Price Index (CPI-U).

3.1.13 Least Cost Analysis: An analysis comparing the costs of mutually exclusive options.

3.1.14 Life Cycle Costs: Sum of all recurring and one-time (non-recurring) costs over the full life span or a specified period of a good, service, structure, or system. It includes purchase price, installation cost, operating costs, maintenance and upgrade costs, and remaining (residual or salvage) value at the end of ownership or its useful life.

3.1.15 Present Worth: The value of a future payment or asset discounted back to the present period so as to be stated in "today's dollars." The discount rate often reflects the time value of money and the impact of inflation.

3.1.16 Residual / Salvage Value: For purposes of this analysis, it is assumed that the residual / salvage value at the end of the 20 year term shall be equal to the remaining

straight-line depreciated value of the original cost of the assets based upon a projected 40 year useful life for the assets considered.

3.1.17 Single-Payment Present Worth Factor (P/F Factor): The conversion factor that, when multiplied by a future amount (F), yields a Present Worth (P) of an future amount "F" after "n" years at interest rate (or discount rate) "i." The formula is as follows:

$$P/_F = \frac{1}{(1+i)^n}$$

3.1.18 Single-Payment Compound Amount Factor (F/P Factor): The conversion factor that, when multiplied by a Present Worth (P), yields the future amount (F) of an initial amount "P" after "n" years at interest rate "i." The formula is as follows:

$$F/_P = (1+i)^n$$

3.1.19 Geometric-Gradient-Series Present Worth Factor: The conversion factor that, when multiplied by an annual payment in Year 1 (A_1), yields a Present Worth (P) of a series of yearly future payments, which increase at a rate of "g" each year, for "n" years with an interest rate (or discount rate) "i." The formula is as follows:

$$P/_A = \frac{1-\left(\frac{1+g}{1+i}\right)^n}{i-g}$$

3.2 General Definitions

3.2.1 Design Standards: References the most-current version of the *"City Utilities Design Standards Manual"*. This manual is available on the Fort Wayne website.

3.3 Lift Station

3.3.1 Lift Station: A sanitary lift station that is equipped with constant speed submersible pumps in a wet well, a separate valve vault, and SCADA controls meeting City design standards.

3.4 Low-Pressure Sewer System (For Septic Elimination)

3.4.1 Low Pressure Sewer System: A low pressure sewer system consists of a network of pressure pipes and grinder pumps, which shred solids and are often installed at each home.

Note: This evaluation assumes more than ten grinder pump stations will be provided for the proposed septic elimination project and that E/One pumping units are supplied.

4. LIFE CYCLE COST METHODOLOGY

4.1 Present Worth Analysis

The purpose of a life cycle cost analysis is to evaluate all of the present and future costs to construct and maintain a facility over the life of the asset. A present worth analysis allows comparisons between the value of spending a dollar today for initial construction versus the future costs of operating, maintaining, repairing, and replacing a facility over time. Present worth can be a valuable tool to weigh the total costs of different construction alternatives, especially when expenses are incurred at different points in time. In this case, a present worth analysis has been completed comparing gravity sewers, lift stations, and low pressure sewer systems.

To determine the present value of a project's overall costs, future costs are determined by inflating the current costs to reflect increased costs at the time of the construction or expense, and then these future costs are discounted back to today's dollars. If a project is expected to have no future operation, maintenance, replacement, or rehabilitation expenses, then the present worth is just the initial construction cost. However, if a project has future operation, maintenance, replacement, or rehabilitation costs, then present worth would include the amount of money needed, expressed in today's dollars, to cover all future costs as well as residual asset value at the end of the evaluation period.

This model takes into account four different future cost or value components that will affect the total projected life cycle cost: 1) future construction costs to replace equipment or capital upgrades, 2) annual utility expenditures to operate the lift stations and/or low pressure systems, 3) labor expenses related to annual maintenance, cleaning, or at the time of expected repair and replacement schedules for the facility and 4) remaining salvage or residual value at the end of 20 (twenty) years, assuming the assets all have 40 (forty) year useful lives.
Yearly increases in construction cost were based on the 5-year ENR Cost Index. This construction inflation rate of 3.40 percent between 2005 and 2010 is accounted for in the worksheets in Appendix A.

Yearly increases in power cost were based on the BLS 5-year Industrial Electric Power Rates published by Produce Price Index. This electric utility inflation rate of 4.30 percent between 2005 and 2010 is accounted for in the worksheets in Appendix A. Since the Utility will be responsible for funding the future operating and replacement costs, it is important conservative estimates of power costs are made before concluding that a gravity sewer is too costly. Therefore, the 20-Year Life Cycle Cost Worksheet will use 4.30 percent as the energy cost escalator based on historic electric utility price increases.

Yearly increases in labor cost were based on BLS: Employment Cost Index: "Total Compensation, Private Industry, Construction" from 2005 to 2010. This labor inflation rate of 2.94 percent between 2005 and 2010 is accounted for in the worksheets in Appendix A.

Salvage or residual value is the remaining asset value at the end of 20 (twenty) years, based upon a projected 40 (forty) year useful life for the each of the projects and straight-line annual depreciation of the asset over its useful life.

Costs are assumed to occur at the end of the year. Methods whereby the costs are assumed to occur one time at the middle of the year, first of the year or continuously through the year may be considered if justified. Although none of these models may describe the exact pattern of actual cash flows, they will, in most cases, provide a sufficient level of accuracy for economic decision making while offering the advantage of reduced computation.

4.2 Inflation and Discount Rates

Least cost analysis based upon present worth requires an assumption of future inflation rates to facilitate a comparison of costs over time. Short term fluctuations in inflationary rates have been and will be experienced. However, over the proposed evaluation period for the project, rates are reasonably stable. The Consumer Price Index (CPI-U) measures the cost of living increases for all urban consumers from year to year. Depending upon the time periods that one might reference, the average annual compounded increase in CPI will yield different results:

Index Changes Over Time		CPI Index (Yrs) - Compounded Average Annual Change				
Index Date	Index Value	5	10	20	30	40
12/31/2010	218.056					
12/31/2005	195.300	2.23%				
12/31/2000	172.200		2.39%			
12/31/1990	130.700			2.59%		
12/31/1980	82.400				3.30%	
12/31/1970	38.800					4.41%

From 1970 to 2010, the overall average annual change in inflation (CPI-U) was 4.41 percent per year. However, in the last 20 years inflation has moderated, remaining relatively stable at 2.23 percent to 2.59 percent per year. Therefore, a discount rate of 2.23 percent shall be used since 2.23 percent is the average annual rate of inflation for the last five years, and it is intended this life cycle analysis be updated every five years. This discount rate will be utilized so as to allow a comparison of spending a dollar today for initial construction versus future costs incurred over time for operation, maintenance, utilities, repairs and capital replacement, allowing all costs to be stated in 'today's dollars.' Using a discount rate can be a valuable tool to compare cost alternatives, especially when expenses are incurred at different points in time.

4.3 Construction Costs Data Sources

Initial construction costs for gravity sewers, lift stations, and low pressure sewer systems are generally readily available. Typical initial construction costs for sanitary sewer lift stations, gravity sewers, and low-pressure sewer systems are included in the "20-Year Life Cycle Cost Summary" worksheet in Appendix A of this document. These costs were developed based upon average installed costs from public sector projects from 2002 through 2011. Although the construction cost data utilized is from public sector projects (labor cost projections were based on private sector data), they are applicable for this evaluation for private sector projects as well since the ratio of costs between public and private sector projects should be consistent.

4.4 Operation and Maintenance Data Sources

Since the City of Fort Wayne has not tracked the operation and maintenance (O&M) costs for analysis, data provided by the City of Indianapolis was used to complete the evaluation. A summary of the O&M costs provided by the City of Indianapolis are provided below in sections 4.4.1 - 4.4.3.

4.4.1 Lift Stations O&M Data Sources

The City of Indianapolis, through their contract operator United Water, has tracked operation and maintenance (O&M) costs of Lift Stations since 1998. This information was analyzed from all Lift Stations installed prior to 2011, to determine any trends. The data includes costs which include, but are not limited to the following:

a) Corrective Maintenance: The maintenance that is required when an item has failed or worn out, to bring it back to working order.
b) Preventative Maintenance: Preventive maintenance helps to prevent parts, material, and systems failure by ensuring parts, materials and systems are in good working order. Preventative maintenance includes regular and systematic inspection, cleaning, and replacement of worn parts, materials, and systems.
c) Routine Maintenance: Work that is planned and performed on a routine basis to maintain and preserve the condition of the system or to respond to specific conditions and events that restore the system to an adequate level of service.
d) Capital Improvements (major upgrades): Betterment to a building or equipment, that extends its life or increases its usefulness or productivity.

In addition to information supplied by United Water, data regarding replacement periods and costs were received from Indianapolis-approved pump suppliers. The results of this analysis are in Section 6.3.

4.4.2 Gravity Sewers O&M Data Sources

While maintenance costs for gravity sewers vary widely across the country, they are a small percentage of the total life cycle cost. Some cities routinely clean gravity sewers every five to ten years, some never. Most cities clean gravity sewers whenever a problem arises. City of Fort Wayne cleans sewers whenever a problem arises. For

this cost the City of Fort Wayne assumed a ten (10) year cleaning frequency. Recent cleaning and televising projects were considered in developing the unit costs associated with this work.

4.4.3 Low Pressure Sewer Systems O&M Data Sources

The City of Fort Wayne does not plan to own or operate the grinder pumps installed. However, there is still an O&M cost associated with the grinder pumps. The following sources were utilized to estimate the cost to operate and maintain grinder pump stations.

a) City of Lawrence Utilities – Lawrence, Indiana
b) Bonner Springs Wastewater Department – Bonner Springs, Kansas
c) Fairfield Glade Community Club (HOA) – Fairfield, Tennessee
d) City of Lake Tapawingo – Lake Tapawingo, Missouri
e) Lumberton Municipal Utility District – Lumberton, Texas
f) Twin Lakes Regional Sewer District – Monticello, Indiana
g) Coolspring—Jackson Lake Latonka Joint Authority – Lake Latonka, Pennsylvania
h) West Sound Utility District – Port Orchard, Washington

The size of the systems varied from 80 units to 4,000 units installed, and the majority of the municipalities are responsible for operating and maintaining the grinder stations. The results of this analysis are in Section 7.3.

4.5 Salvage Value

For the purpose of this evaluation, the design lives of gravity sewers, lift stations, force mains, and grinder pump station structures is 40 years based upon the recommendation of the IURC. While each alternative may have a residual value at the end of 40 years, all may be functionally obsolete by hydraulic capacity or service area needs. Therefore, the salvage value of gravity sewers, lift stations, force mains, and grinder pump station structures are considered zero at the end of the 40-year design life. However, since this evaluation is for a 20-year life cycle, each of these items will include a salvage value. For purposes of this analysis, the salvage value will be the remaining value at the end of the 20 year period, assuming 40 year straight-line depreciation of the asset.

4.6 Life Cycle Cost Computation

A timeline of estimated initial and future costs is calculated in the worksheets included in Appendix A. All costs are estimated in the dollars that correspond with the proposed year of construction (Year X). One-time future costs are multiplied by the present worth single payment factor for the year of the proposed work (i.e. replacement costs, etc.) to convert to 2010 dollars. Costs occurring annually are multiplied by the present worth annual payment factor to convert to 2010 dollars. A geometric gradient is used to account for inflation of annual costs.

After all costs are converted to year 2010 costs, the costs are inflated to convert them to current year dollars at the time of construction (the current year is referred to as "Year X" in the Worksheets). The total present worth is the sum of all present values.

5. GRAVITY SEWER OPTION – LIFE CYCLE ANALYSIS

5.1 Design Life

Although certain gravity sewer materials have proven, or claim, a design life exceeding 50 years, many other factors (i.e. hydraulic capacity) affect the actual design life of a gravity sewer pipe. However, for the purpose of this evaluation and consistent with the rate order adopted by the IURC for the Wastewater Utility, it will be assumed the design life of the gravity sewer will be 40 years and residual / salvage values will be calculated accordingly.

5.2 Initial Construction

5.2.1 Gravity Sewer

For the purpose of this evaluation all the gravity sewer construction costs will be considered as the same regardless of the property on which construction is proposed. The cost per linear foot of intial construction for gravity sewer takes into account but is not limited to the following:

- Pipe Materials
- Manholes
- Excavation
- Backfill
- Pavement
- Pavement Subbase

An oversizing cost can also be added as a lump sum to the gravity sewer construction section. The oversizing cost should be added to the miscellaneous construction cost if oversizing is determined to be necessary.

5.2.2 Land

For the purposes of this analysis, it was assumed all sewers are located within the right-of-way. Therefore, no easement acquisition property purchase has been included in the Gravity Sewer Option. However, if land acquisition or easements are required, these costs may be added as a lump sum in the Gravity Sewer Construction Cost worksheet as a miscellaneous cost.

5.3 Operation and Maintenance

5.3.1 Cleaning and Inspecting

The City of Fort Wayne does have an operations and maintenance (O&M) staff to maintain the City's gravity sanitary sewers. However, there is no set schedule as to how often the sewer must be cleaned and televised. For the purpose of analysis the following was assumed:

- **Inspection:** Gravity sewers are inspected, on average, once every ten years.

- **Cleaning:** Gravity sewers are cleaned, on average, once every ten years.

A cost of $2.50 per foot to inspect and clean sanitary sewers has been input into the 20-year Life Cycle Cost worksheets. This cost is based on recent prices to complete similar work.

5.3.2 Maintenance

The costs associated with maintenance of gravity sewers is generally covered with the inspection and cleaning noted above. Therefore, no separate maintenance costs have been included in the worksheets.

5.3.3 Replacement

The life expectancy of a gravity sewer is considered to be 40 years. Therefore, replacement costs of gravity sewers will not be considered in this analysis.

5.3.4 Rehabilitation

Through an aggressive rehabilitation program, the City of Fort Wayne was able to extend the life expectancies of gravity sewers. However, as noted above, the life expectance of a gravity sewer is considered to be 40 years. Therefore, rehabilitation costs of gravity sewers will not be considered in this analysis.

5.4 Power Usage

There is no power usage associated with the Gravity Sewer Option.

5.5 Salvage Value

Since the design life of gravity sewers is estimated at 40 years for the purpose of this evaluation, gravity sewers will have a residual / salvage value at the end of the 20-year life cycle.

6. LIFT STATION OPTION – LIFE CYCLE ANALYSIS

6.1 Design Lives and Replacement Schedules

For the purpose of this evaluation, Lift Station components listed below are assumed to have the following design lives and replacement schedules. The estimated design lives were established based upon information provided by City Utilities-approved pump suppliers and typical life cycles observed by Lift Station operations staff through the year 2010:

Design Lives:

- Lift Station Structure: 40 years
- Pumps and Controls: 20 years
- Motors: 10 years
- Impellers: 7 years
- Valves: 25 years
- Force Main: 40 years

Replacement Schedules:

Based upon the above-referenced typical design lives, the following replacement schedules will be assumed for repair/replacements of Lift Station components for the 20-Year Life Cycle Evaluation:

- Lift Station Structure: Does not require repair/replacements; will include a residual/salvage value at the end of 20 years (Note: Evaluation includes costs associated with Preventative Maintenance and Routine Maintenance).
- Pumps and Controls: Requires replacement in Year 20; residual/salvage value at the end of 20 years is included in the overall lift station residual/salvage value.
- Motors: Require repair/replacements at Year 10 in the evaluation; this cost is included in the Yearly Maintenance Cost (see Section 6.3.5) because it is not a capital cost. The residual/salvage value at the end of 20 years is included in the overall lift station residual/salvage value.
- Impellers: Require repair/replacements at Year 7 and Year 14; this cost is included in the Yearly Maintenance Cost (see Section 6.3.5) because it is not a capital cost. The residual/salvage value at the end of 20 years is included in the overall lift station residual/salvage value.
- Valves: Does not require repair/replacements; the residual/salvage value at the end of 20 years is included in the overall lift station residual/salvage value.
- Force Main: Does not require repair/replacements; the residual/salvage value at the end of 20 years is included in the overall lift station residual/salvage value.

6.2 Initial Construction

6.2.1 Gravity Sewer

The Lift Station Option will require gravity sewer on the development to convey the flow to the proposed lift station. However, because the depths and lengths of the gravity sewer may vary when compared to the Gravity Sewer Option, there is a separate table for the Lift Station Option in the Gravity Sewer Worksheet in Appendix A.

6.2.2 Pumps, Wet Well, and Valve Vault (Installed)

For the purposes of this evaluation, a lump sum cost of $160,000 will be used for this construction item based on public bid tabs. This cost (in 2010 dollars) includes all labor, material, site work, and overhead costs to install a typical (approximately 25 feet deep) Lift Station according to City standards (refer to the most current version of the "*City Utilities Design Standards Manual*"). The cost is included in the Lift Station Construction Cost Worksheet in Appendix A.

6.2.3 Electrical Feed to Site

For the purposes of this evaluation, it will be assumed the required electrical feed (three-phase) is available at the lift station site. If this is not the case, then an actual initial cost to provide the required power feed must be included in the Evaluation

Summary Worksheet (refer to 20-Year Life Cycle Cost Summary worksheet in Appendix A). The estimated cost to bring three-phase power one-quarter mile to the site is $25,000. If required, this cost should be input in the "miscellaneous" line of the spreadsheet.

6.2.4 Force Main

The Lift Station Construction Cost worksheet in Appendix A includes typical installed costs for 4-inch through 10-inch force mains. It is assumed the force main will be installed utilizing open-cut construction and the material is Class 200/SDR-21 PVC pipe. At the time of publishing this report, other force main materials (i.e. HDPE and ductile iron) are also acceptable materials. Since the costs of all force main materials are subject to significant change, the user shall confirm costs when using the typical construction costs included in Appendix A. The costs provided in this table can be readily adjusted by inputting actual material costs (per linear foot) and by utilizing the proper inflation factor.

6.2.5 Land

For the purpose of this evaluation, it is assumed a typical Lift Station requires a 35-foot-by-35-foot footprint (or an approximate 0.03 acre parcel) at a cost of $3 per square foot. For "Private Development," it is assumed this cost is negligible; therefore, no land cost is included. However, for "Public Projects," it will be assumed the cost of parcel and the administrative costs to purchase the parcel is a lump sum cost of $10,000 (in 2010 dollars). The 20-Year Life Cycle Cost Evaluation worksheet to be completed as part of this evaluation includes a cell to fill in that designates whether the project is a "Private Development" or "Public Project." The worksheet automatically includes a lump sum cost of $10,000 for all public projects and no cost for all private developments.

6.2.6 Site Work

This evaluation assumes a short access drive is required. For the purpose of this evaluation, it is assumed all costs related to site work are included in the unit cost for lift stations (refer to Paragraph 6.2.2).

6.2.7 SCADA

Supervisory Control and Data Acquisition (SCADA) requirements for Lift Stations are outlined in the most current version of the "City Utilities Design Standards Manual"

These costs have been included in the Pumps, Wet Well, and Valve Vault (Installed) cost indicated above in Paragraph 6.2.2. Those completing 20-year life cycle cost evaluations should contact a City engineer to determine if the SCADA requirements have been updated in a manner that would require re-evaluation of the typical costs provided in this report.

6.2.8 Communications

The City's current standards include requirements that include a radio and antennae pole or telephone service that are compatible with the City's SCADA communication network. The costs of this equipment are already included in Paragraph 6.2.2 above.

6.3 Operation and Maintenance

Operation and maintenance (O&M) cost data provided by the City of Indianapolis will be used for the evaluation. A summary of the O&M costs are provided below in sections 6.3.1 – 6.6.5.

For the purposes of this evaluation, the O&M costs have been divided into the following subcategories (refer to definitions in Section 4.4.1):

6.3.1 Corrective Maintenance (CM)

Items included in this subcategory include the following:

a) Mechanical and Electrical Labor and Repair Parts

6.3.2 Preventative Maintenance (PM)

Items included in this subcategory include, but are not limited to, the following:

a) Regular and systematic inspection
b) Replacement of worn parts, materials, and systems
c) Cleaning

6.3.3 Routine Maintenance (RT)

Items included in this subcategory include, but are not limited to, the following:

a) Response to Alarms
b) Bi-weekly Inspections
c) Cleaning Floats
d) Cleaning Wet Well
e) Exercising and Lubing Valves
f) Lubricating Equipment
g) Site Maintenance

6.3.4 Capital Improvements

Items included in this subcategory include intermittent major expenditures (replacement costs) associated with normal wear on lift station equipment. Capital improvements are replacements with costs that exceed $25,000. Pump and motor replacements as well as SCADA/controls replacements are examples of these. The total costs of these combined replacements exceed $25,000 based on information provided by BBC Pump and Equipment. These expenditures are assumed to occur at year 20 or the end of the 20-year evaluation.

6.3.5 Lift Station O&M Cost Conclusions

Maintenance costs were split into two categories:

- Lift stations 20 horsepower and under: $3,900 per year (2010 dollars)
- Lift stations larger than 20 horsepower: $8,100 per year (2010 dollars)

The above-referenced maintenance fees include corrective maintenance, preventative maintenance, and routine maintenance of the lift stations. Examples of the types of maintenance included in these fees are as follows:

a) Motor Rewinding: For the purposes of this study, it shall be assumed motors are rewound at the following times during the 20-year lift station life cycle:
   - Year 10

b) Impeller Replacement: For the purposes of this study, it shall be assumed impeller replacement will be required at the following times during the 20-year lift station life cycle:
   - Year 7
   - Year 14

c) Valve Replacement: For the purposes of this study, it shall be assumed that the useful life of valves is 20 years. Therefore, this evaluation does not include valve replacements during the 20-year lift station life cycle.

The costs paid for maintenance do not, however, include capital improvements (refer to Paragraph 6.3.4) and power costs. Note, these costs are based on 2010 dollars and an appropriate inflation factor shall be utilized when evaluating the 20-year life cycle costs for Lift Stations.

6.4 Power Usage

Typical power requirements (expressed in dollars per year) to provide power to a Lift Station have been developed and are automatically calculated as a linear function of single pump horsepower by the "20-Year Life Cycle Cost Summary" worksheet in Appendix A. Energy costs are assumed to increase at a faster rate than CPI. Based upon historical increases in industrial electric utility energy costs as measured by the BLS Producer Price Index, along with the expected new investments required in order to comply with the Clean Air Act, the City of Fort Wayne will utilize an average annual energy cost index of 4.30 percent for this analysis. This assumption may be revisited from time to time as warranted by changes in the energy markets and utility rate changes in the future.

6.5 Communications

The City's current standards include requirements that include a radio and antennae pole or telephone service that are compatible with the City's SCADA communication network. The monthly phone service fees are separate. For the purposes of this evaluation, the "20-Year Life Cycle Cost Summary" worksheet in Appendix A assumes a yearly service fee of $240 for telephone.

7. LOW PRESSURE SEWER OPTION – LIFE CYCLE ANALYSIS – Septic Elimination ONLY

7.1 Design Lives and Replacement Schedules

Similar to gravity sewers, it will be assumed that the design life of the low pressure sewer piping will be 40 years. The design lives for the pumps and controls are assumed as follows:

Design Lives:

- Grinder Pump Station Structure: 40 years
- Pumps: 10 years
- Controls: 20 years
- Air Release Valves: 15 years

Replacement Schedules:

Based upon the above-referenced typical design lives, the following replacement schedules will be assumed for repair/replacements of Low Pressure Grinder Pump Station components for the 20-Year Life Cycle Evaluation:

- Grinder Pump Station Structure: Does not require repair/replacements; will include a salvage value at the end of 20 years (Note: Evaluation includes costs associated with Preventative Maintenance and Routine Maintenance)
- Pumps: Require repair/replacements at Year 10 in the evaluation; this cost is included in the yearly maintenance cost (see Section 7.3.1). The salvage/residual value of entire low pressure system is included at the end of 20 years.
- Controls: Requires replacement at Year 20; salvage/residual value of entire low pressure system is included at the end of 20 years.
- Air Release Valves: Require repair/replacement at Year 15 in the evaluation; salvage/residual value of entire low pressure system is included at the end of 20 years.
- Force Main: Does not require repair/replacements; salvage/residual value of entire low pressure system is included at the end of 20 years (Note: Evaluation includes costs associated with Preventative Maintenance and Routine Maintenance).

7.2 Initial Construction

7.2.1 Grinder Pump Stations

Public bid tabs, from the City of Fort Wayne utilities projects, were used to determine the construction cost of simplex grinder stations. The bid tabs used did not reflect delivered materials and installed costs; therefore, the costs were adjusted to reflect the installed costs. Based on the data, lump sum costs of $4,800 (in 2010 dollars) will be used for simplex stations. Because the bid tab data did not include connection of control panels to the homeowner's power feed, an additional $1,200 is added in the worksheets for each station to account for installation of the power feed (see 7.2.2 for assumptions regarding power feed costs). The power feed cost brings the total installed cost to $6,000 for simplex stations.

Generally speaking, the installed cost for the simplex stations includes $3,000 for materials, $1,800 for labor, and $1,200 for power feed. These costs include the following:

- Equipment cost of grinder station including control panel
- Installation of the grinder pump station on the homeowner's property
- Installation of the grinder pump's control panel (mounted on a wood post) including power and control wiring from the grinder unit to the control panel

- Restoration of the homeowner's yard due to construction activities
- Power connection from the control panel to the homeowner's power feed (see 7.2.2 below)
- Gravity Sewer Connection
- Septic Decommissioning

7.2.2 Electrical Feed to Sites

For the purposes of this evaluation, it will be assumed the required electrical feed (single phase) is provided from the home to grinder station site. It is important to note a local disconnect switch would need to be installed near the grinder station per Section 430 of the Indiana Electric Code. The estimated cost for running the power from the home to the grinder station site, including the required disconnect switch, is $1,200 in 2010 dollars. This assumes the average distance from the control panel to the connection point to the homeowner's power feed is 50 feet. This cost is included in the Grinder Stations Construction Worksheet in Appendix A.

7.2.3 Low Pressure Sewer Force Mains

Small diameter force mains – typically 1.25-inch through 4-inch – are used in a low pressure sewer system in lieu of larger diameter gravity sewers. This analysis assumes the force mains are directionally drilled DR-11 HDPE. Public bid tabs were utilized to estimate the construction costs. The Grinder Station Construction Worksheet in Appendix A includes typical installed costs for 1.25-inch through 4-inch low pressure force mains. Since the costs of all force main materials are subject to significant change, the user shall exercise caution when using the typical construction costs included in Appendix A.

7.2.4 Land

It is also assumed the low pressure sewer force main will all be located within the right-of-way, so no additional easements will be required for the force mains.

7.3 Operation and Maintenance Costs

Operation and Maintenance costs associated with grinder pumps and low pressure force mains will be the responsibility of the homeowner for typical septic elimination projects. The O&M costs of the grinder pumps and low pressure force mains have been included in this evaluation to ensure complete accuracy. A summary of each cost is included below in sections 7.3.1 to 7.4

7.3.1 Grinder Pump Stations O&M

Information was obtained from eight grinder pump stations communities (see Section 4.4.3) located throughout the United States. A majority of the municipalities are in charge of the O&M on the grinder stations, and the average annual maintenance cost per pump is approximately $375 in 2010 dollars. This cost includes regular maintenance as well as pump replacements. The cost is included in the Grinder Stations O&M Worksheet in Appendix A.

7.3.2 Electrical O&M

Operation and maintenance of this scenario would consist of replacing some of the wiring and components at 20-year intervals. Control panel replacement would also be estimated at 20-year intervals. The estimated cost to replace the control panel and miscellaneous wiring is $1,300 per station. This cost occurs at the end of the 20-year evaluation period.

7.3.3 Low Pressure Sewer O&M

Cleaning of the low pressure has been assumed on an annual basis. This would consist of a vacuum truck flushing the lines once per year. In addition, it has been assumed this work would be completed in one day. The estimated cost to complete this work is $2,000 per year in 2010 dollars.

In addition, maintenance of air release valves would be required. It has been assumed for the purposes of this analysis that regular checking of air release valves is covered by the cost noted in paragraph 7.3.1 above. However, regular replacement of these valves is also required. The assumption is that replacement would be required at 15 year intervals, and the cost to replace each valve is $625 in 2010 dollars. The salvage value of the entire low pressure sewer system is included as a lump sum.

7.4 Power Usage

Based on information obtained from the sources noted above, the approximate power cost to operate a grinder station is $2 per month ($24 per year) per pump. This cost will be the homeowners. The present worth value of power for the grinder units is calculated in the worksheets. However, this cost is not included in the overall “20-Year Life Cycle Cost” of the Low Pressure Sewer Option.

8. 20-YEAR LIFE CYCLE COST EVALUATION EXAMPLES

The life cycle costs for two hypothetical example developments were determined as part of this analysis. All gravity sewers (with the exception of laterals) are assumed to have granular backfill, full depth pavement, and pavement subbase. Force mains that are not directionally drilled are assumed to be 90 percent in native backfill and ten percent in granular backfill. For gravity sewers, the trench width is assumed to be ten feet and a 1.5-inch overlay is assumed for a road 20 feet wide. For force mains, the trench width is assumed to be six feet and no overlay is assumed.

Additional assumptions, including quantities, for each are detailed below. The two examples were completed in order to illustrate the difference between two types of projects that can be completed. The examples should not be construed as “typical”; however, assumptions were made in an attempt to make the developments realistic.

8.1 EXAMPLE 1 – Project Lifecycle Evaluation

8.1.1 Gravity Sewer Option

In this example, a new development containing 100 homes is being constructed in year 2015. In the nomenclature in the worksheet, 2015 is referred to as "Year X." The following assumptions have been made for construction of the gravity sewer option:

a) Gravity Sewer Construction: 4,500 LF of 8-inch gravity sewer buried 8 to 12 feet deep, 4,700 LF of 8-inch gravity sewer buried 12 to 16 feet deep, and 100 laterals would be installed. These lengths are inputted by the user into the "Gravity Sewer Construction" worksheet yielding a total construction cost of $1,525,000.

b) Gravity Sewer Operation and Maintenance: The total length of collection sewer (excluding laterals) of 9,200 LF is automatically inputted into the "Gravity Sewer O&M" worksheet. At a cost of $2.50 per foot to clean and televise the sewers, this yields a "Total 2010 Present Worth of Gravity Sewer O&M" of $51,000.

c) Remaining Useful Life Value: The remaining useful life value of $762,500 is calculated using the "Construction and Capital Costs" value of $1,525,000 and utilizing straight line depreciation. This value is shown is shown as negative because it represents a residual value and not a cost. Therefore, this value is subtracted from the costs to establish the "Total Year X Gravity Sewer Life Cycle Cost" indicated in the worksheet.

d) Gravity Sewer Life Cycle Cost: The total 2010 present worth costs for "Construction and Capital Costs" (i.e. $1,525,000), "Maintenance Costs" (i.e. $51,000), and "Remaining Useful Life Value" (i.e. -$762,500) are automatically inputted into the "20-Year Life Cycle Cost Summary" worksheet and converted to Year X dollars yielding a "Total Year X Sewer Present Worth" of **$960,000.** Note, this example assumes construction in year 2015, which is a user input into the "20-Year Life Cycle Cost Summary" worksheet.

8.1.2 Lift Station and Force Main Option

In this example, the same new 100-home private development is being constructed in year 2015 using a combination of onsite sewers and a new onsite 150-gpm lift station with a 4-inch force main. The user inputs the required horsepower of the pumps and also indicates whether it is a public or private project in the "20-Year Life Cycle Cost" worksheet. The following assumptions have been made for construction of this option:

a) Gravity Sewer Construction: 4,500 LF of 8-inch gravity sewer buried less than 8 feet deep, 4,700 LF of 8-inch gravity sewer buried 8-12 feet deep, and 100 laterals would be installed. This is the same total length of sewer as the Gravity Sewer Option, but it is assumed the sewer does not have to be as deep for the Lift Station Option. These lengths are input by the user into the "LS Gravity Sewer

Construction Cost" worksheet yielding a total 2010 construction cost of $1,310,000.

b) Lift Station and Force Main Construction: A 20-Hp lift station and 1,000 LF of 4-inch force main would be installed. The length of 4-inch force main is inputted by the user into the "Lift Station Construction Cost" worksheet yielding a total construction cost of $234,000 in 2010 dollars.

Notes:

- The user is required to input either a "1" or a "2" into the General Data cells of the 20-Year Life Cycle Cost Summary" worksheet. This information is required to determine whether an initial cost for lift station land acquisition should be included in the evaluation. Refer to paragraph V. A. 1 of this document for further information.
- A "typical" lift station cost of $160,000 (in year 2010 dollars) is assumed for this evaluation.

c) Gravity Sewer and Lift Station Operation and Maintenance: The lift station pumps size of 20 horsepower is automatically copied by the program into the "Lift Station O&M Costs" worksheet yielding a "2010 Present Worth Power Cost" of $36,000. The present worth of annual lift station maintenance, including SCADA service fees, is calculated by the program to be $89,000 based upon $3,900 per year maintenance fee per paragraph 6.3.5. In addition, the program calculates the cost of replacement of pumps and controls based on horsepower size as the "2010 Present Worth of Capital Improvements." This value is $92,000.The total length of collection sewer (minus laterals) of 9,200 LF is automatically inputted by the program into the "Lift Station O&M Costs" worksheet yielding a "Total 2010 Present Worth of Onsite Gravity Sewer O&M" of $41,000.

d) Remaining Useful Life Value: The remaining useful life value of $902,500 is calculated using the "Construction and Capital Costs" value of $1,805,000 and utilizes straight line depreciation. This value is shown is shown as negative because it represents a residual value and not a cost. Therefore, this value is subtracted from the costs to establish the "Total Year X Lift Station and Force Main Life Cycle Cost" indicated in the worksheet.

e) Lift Station and Force Main Life Cycle Cost: The total 2010 present worth costs for "Construction and Capital Costs" (i.e. $1,544,000), "Yearly Lift Station Maintenance Costs" (i.e. $89,000), "Capital Improvement Costs" (i.e. $92,000), "Onsite Gravity Sewer Maintenance Costs" (i.e. $41,000), "Power Costs" (i.e. $36,000), and "Remaining Useful Life Value" (i.e. -$772,000) are automatically inputted into the "20-Year Life Cycle Cost Summary" worksheet and converted to Year X dollars yielding a "Total Year X Sewer Present Worth" of **$1,214,000**. Note, this example assumes construction in year 2015 and year of construction is a user input into the "20-Year Life Cycle Cost Summary" worksheet.

8.1.3 Conclusions

Based on the 20-Year Life Cycle Costs, construction of a gravity sewer system yields the lowest cost in the 20-year period and would be selected as the most cost-effective option for this new development. Appendix B shows all worksheet data from this analysis.

8.2 EXAMPLE 2 – Project Lifecycle Evaluation for Septic Elimination ONLY

8.2.1 Gravity Sewer Option

In this example, septic elimination project containing 100 homes is being constructed in year 2015. The quantity of gravity sewer required is the same as for Example 1. The following assumptions have been made for construction of the gravity sewer option

a) Gravity Sewer Construction: 4,500 LF of 8-inch gravity sewer buried 8 to 12 feet deep, 4,700 LF of 8-inch gravity sewer buried 12 to 16 feet deep, and 100 laterals would be installed. These lengths are inputted by the user into the "Gravity Sewer Construction" worksheet yielding a total construction cost of $1,525,000.

b) Gravity Sewer Operation and Maintenance: The total length of collection sewer (excluding laterals) of 9,200 LF is automatically inputted into the "Gravity Sewer O&M" worksheet. At a cost of $2.50 per foot to clean and televise the sewers, this yields a "Total 2010 Present Worth of Gravity Sewer O&M" of $51,000.

c) Remaining Useful Life Value: The remaining useful life value of $762,500 is calculated using the "Construction and Capital Costs" value of $1,525,000 and utilizing straight line depreciation. This value is shown is shown as negative because it represents a residual value and not a cost. Therefore, this value is subtracted from the costs to establish the "Total Year X Gravity Sewer Life Cycle Cost" indicated in the worksheet.

d) Gravity Sewer Life Cycle Cost: The total 2010 present worth costs for "Construction and Capital Costs" (i.e. $1,525,000), "Maintenance Costs" (i.e. $51,000), and "Remaining Useful Life Value" (i.e. -$762,500) are automatically inputted into the "20-Year Life Cycle Cost Summary" worksheet and converted to Year X dollars yielding a "Total Year X Sewer Present Worth" of **$960,000.** Note, this example assumes construction in year 2015, which is a user input into the "20-Year Life Cycle Cost Summary" worksheet.

8.2.2 Lift Station and Force Main Option

In this example, the same new 100-home private development is being constructed in year 2015 using a combination of onsite sewers and a new onsite 150-gpm lift station with a 4-inch force main. The user inputs the required horsepower of the pumps and also indicates whether it is a public or private project in the "20-Year Life Cycle Cost" worksheet. The following assumptions have been made for construction of this option:

a) Gravity Sewer Construction: 4,500 LF of 8-inch gravity sewer buried less than 8 feet deep, 4,700 LF of 8-inch gravity sewer buried 8-12 feet deep, and 100 laterals would be installed. This is the same total length of sewer as the Gravity Sewer Option, but it is assumed the sewer does not have to be as deep for the Lift Station Option. These lengths are input by the user into the "LS Gravity Sewer Construction Cost" worksheet yielding a total 2010 construction cost of $1,310,000.

b) Lift Station and Force Main Construction: A 20-Hp lift station and 1,000 LF of 4-inch force main would be installed. The length of 4-inch force main is inputted by the user into the "Lift Station Construction Cost" worksheet yielding a total construction cost of $234,000 in 2010 dollars.

Notes:

- The user is required to input either a "1" or a "2" into the General Data cells of the 20-Year Life Cycle Cost Summary" worksheet. This information is required to determine whether an initial cost for lift station land acquisition should be included in the evaluation. Refer to paragraph V. A. 1 of this document for further information.
- A "typical" lift station cost of $160,000 (in year 2010 dollars) is assumed for this evaluation.

c) Gravity Sewer and Lift Station Operation and Maintenance: The lift station pumps size of 20 horsepower is automatically copied by the program into the "Lift Station O&M Costs" worksheet yielding a "2010 Present Worth Power Cost" of $36,000. The present worth of annual lift station maintenance, including SCADA service fees, is calculated by the program to be $89,000 based upon $3,900 per year maintenance fee per paragraph 6.3.5. In addition, the program calculates the cost of replacement of pumps and controls based on horsepower size as the "2010 Present Worth of Capital Improvements." This value is $92,000.The total length of collection sewer (minus laterals) of 9,200 LF is automatically inputted by the program into the "Lift Station O&M Costs" worksheet yielding a "Total 2010 Present Worth of Onsite Gravity Sewer O&M" of $41,000.

d) Remaining Useful Life Value: The remaining useful life value of $902,500 is calculated using the "Construction and Capital Costs" value of $1,805,000 and utilizes straight line depreciation. This value is shown is shown as negative because it represents a residual value and not a cost. Therefore, this value is subtracted from the costs to establish the "Total Year X Lift Station and Force Main Life Cycle Cost" indicated in the worksheet.

e) Lift Station and Force Main Life Cycle Cost: The total 2010 present worth costs for "Construction and Capital Costs" (i.e. $1,544,000), "Yearly Lift Station Maintenance Costs" (i.e. $89,000), "Capital Improvement Costs" (i.e. $92,000), "Onsite Gravity Sewer Maintenance Costs" (i.e. $41,000), "Power Costs" (i.e. $36,000), and "Remaining Useful Life Value" (i.e. -$772,000) are automatically inputted into the "20-Year Life Cycle Cost Summary" worksheet and converted to

Year X dollars yielding a "Total Year X Sewer Present Worth" of **$1,214,000**. Note, this example assumes construction in year 2015 and year of construction is a user input into the "20-Year Life Cycle Cost Summary" worksheet.

8.2.3 Low Pressure Sewer System Option

In this example, the same new 100-home septic elimination project is being constructed in year 2015 using a low-pressure sewer system. The following assumptions have been made for construction of this option:

a) Low-Pressure Sewer System Construction: 4,100 LF of 1.5-inch HDPE force main, 5,100 LF of 2-inch HDPE force main, and 3,700 LF of 1.25-inch laterals would be installed. This yields the same total length of pipe as the Gravity Sewer Option and the Lift Station and Force Main Option. It is assumed each home will require its own simplex grinder pump station (i.e. no opportunity to connect two homes into one grinder station); therefore, 100 simplex stations are required. These quantities are inputted by the user into the "Grinder Stations Construction" worksheet yielding a total construction cost of $945,000.

b) Low-Pressure Sewer System Operation and Maintenance: The total number of simplex grinder pump stations is automatically inputted into the "Grinder Stations O&M Costs" worksheet yielding a "Yearly Grinder Station Maintenance 2010 Present Worth" of $807,000. In addition, the "Grinder Stations Corrective Maintenance 2010 Present Worth" is $149,000. These costs yield a total 2010 present worth for Grinder Station Maintenance Costs of $956,000.

Yearly maintenance and corrective maintenance of the low pressure sewer are calculated and totaled separate from grinder station maintenance. Yearly cleaning of the low pressure sewer yields a "Yearly Low Pressure Sewer Maintenance 2010 Present Worth" of $43,000. Replacement of the air release valves at 15-year intervals yields a "Low Pressure Sewer Corrective Maintenance 2010 Present Worth" of $6,000. This yields a Total Low Pressure Sewer Maintenance cost of $49,000.

The power costs are also calculated in this worksheet based upon a "typical" power cost of $24 per grinder station per year yielding a "Power 2010 Present Worth" of $60,000. Note, this present worth cost is not included in the "20-Year Life Cycle Cost" since this cost will likely be a homeowner cost.

c) Remaining Useful Life Value: The remaining useful life value of $472,500 is calculated using the "Construction and Capital Costs" value of $945,000and utilizes straight line depreciation. This value is shown is shown as negative because it represents a residual value and not a cost. Therefore, this value is subtracted from the costs to establish the "Total Year X Grinders & Low Pressure Sewer Life Cycle Cost" indicated in the worksheet.

d) Low-Pressure Sewer System Life Cycle: The total 2010 present worth costs for "Construction and Capital Costs" (i.e. $945,000), "Grinder Station Maintenance Costs" (i.e. $956,000), "Low Pressure Sewer Maintenance Costs" (i.e. $49,000),

and "Remaining Useful Life Value" (i.e. -$472,500) are automatically inputted into the "20-Year Life Cycle Cost" worksheet and converted to Year X dollars yielding a "Total Year X Sewer Present Worth" of **$1,720,000**. Note, this present worth does not include the Year X Present Worth of the "Grinder Station Power Costs", which is $74,000 and would likely be borne by the homeowner.

8.2.4 Conclusions

Based on the 20-Year Life Cycle Costs, construction of a gravity sewer collection system yields the lowest cost in the 20-year period and would be selected as the most cost-effective option for this new development. Appendix C shows all the worksheet data from this analysis. However, if the homeowner is responsible for the operation and maintenance costs of the proposed low-pressure sewer system, then the low-pressure sewer system option becomes the most cost-effective to the City.

Appendix A

Project Lifecycle Evaluation – Blank

See Appendix A1 – Project Lifecycle Evaluation- Blank.xlsx

See Appendix A2 – Project Lifecycle Evaluation- Septic Elimination – Blank.xlsx

20-Year Life Cycle Cost Summary Worksheet

Instructions: Fill In Yellow Cells

Year of Proposed Construction (Year X):		<ENTER 4-digit year
Horsepower of Pumps Required in Lift Station:		
Insert "1" for Private Development, Insert "2" for Public Project:		
Study Period (years):	20	
Construction Inflation (5-year ENCR):	3.40%	
Yearly Power Cost Increase:	4.30%	
Yearly Labor Cost Increase:	2.94%	
Discount Rate Used (5-year CPI):	2.23%	

Notes:

1. Construction inflation based on Published "ENR Cost Indexing" 2005-2010.
2. Yearly power cost increase based on BLS 5-year Industrial Electric Power Rates 2005-2010 published by Produce Price Index.
3. Yearly labor cost increase based on BLS: Employment Cost Index: " Total Compensation, Private Industry, Construction" 2005-2010.
4. Discount rate based on BLS: Consumer Price Index: "All Urban Consumers - (CPI-U) U.S. City average; All Items" 2005-2010.

GRAVITY SEWER LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ -	0.00	$ -
Maintenance Costs	$ -	0.00	$ -
Power Costs	$ -	0.00	$ -
Remaining Useful Life Value	$ -	0.00	$ -
TOTAL YEAR X GRAVITY SEWER PRESENT WORTH			**$ -**

LIFT STATION AND FORCE MAIN LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 187,000	0.00	$ 0
Power Costs	$ 9,000	0.00	$ 0
Yearly Lift Station Maintenance Costs	$ 89,000	0.00	$ 0
Capital Improvement Costs	$ 75,000	0.00	$ 0
Onsite Gravity Sewer Maintenance Costs	$ -	0.00	$ -
Remaining Useful Life Value	$ (93,500)	0.00	$ (0)
TOTAL YEAR X LIFT STATION AND FORCE MAIN PRESENT WORTH			**$ -**

Gravity Sewer Option Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Option Construction Cost

ITEM NO.	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	AMOUNT
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 111	$ -
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 131	$ -
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 154	$ -
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA		$ 750	$ -
20	Misc. Construction	LSUM	1	$ -	$ -
	2010 Gravity Sewer Construction Subtotal - GRAVITY SEWER OPTION =				*$* -
21	Mobilization	LSUM	5%	$ -	$ -
22	Erosion Control and Restoration	LSUM	3%	$ -	$ -
23	Maintenance of Traffic	LSUM	2%	$ -	$ -
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - GRAVITY SEWER OPTION =				**$ -**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

2 Oversizing Gravity Sewer Construction Cost is saved as a hidden tab

Gravity Sewer O&M Worksheet

Instructions: No data entry required.

Year of Construction (Year X):	0
Yearly Labor Increase:	2.94%
Discount Rate:	2.23%

Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	0	LFT	$ 2.50	$ -

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ -	0.80	$ -
20	1.79	$ -	0.64	$ -
Total 2010 Present Worth of Gravity Sewer O&M				**$ -**

Notes:

1. Assumes sewer cleaning is completed every ten (10) years.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Cleaning of the off-site sewer is included only.

Lift Station Option - Gravity Sewer Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Construction Cost - LIFT STATION OPTION					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 111	$ -
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 131	$ -
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 154	$ -
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA		$ 750	$ -
20	Misc. Construction	LSUM	1		$ -
	2010 Gravity Sewer Construction Subtotal - LIFT STATION OPTION =				*$* -
21	Mobilization	LSUM	5%	$ -	$ -
22	Erosion Control and Restoration	LSUM	3%	$ -	$ -
23	Maintenance of Traffic	LSUM	2%	$ -	$ -
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - LIFT STATION OPTION =				**$ -**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

Lift Station & Force Main Construction Cost Worksheet

Instructions: Fill In Yellow Cells

Lift Station & Force Main Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Force Main, 4", Depth Range 6'-10'	LF		$ 43	$ -
2	Force Main, 6", Depth Range 6'-10'	LF		$ 48	$ -
3	Force Main, 8", Depth Range 6'-10'	LF		$ 51	$ -
4	Force Main, 10", Depth Range 6'-10'	LF		$ 65	$ -
5	Land Acquisition for Lift Station	LSUM	1	$ 10,000	$ 10,000
6	Lift Station and Appurtenances	LSUM	1	$ 160,000	$ 160,000
	2010 Lift Station & Force Main Construction Subtotal =				*$ 170,000*
7	Mobilization	LSUM	5%	$ 8,500	$ 8,500
8	Erosion Control and Restoration	LSUM	3%	$ 5,100	$ 5,100
9	Maintenance of Traffic	LSUM	2%	$ 3,400	$ 3,400
	2010 LIFT STATION & FORCE MAIN CONSTRUCTION TOTAL =				**$ 187,000**

Notes

1 Force main items include pipe, excavation, granular backfill, pavement, and pavement subbase.

Lift Station O&M Worksheet

Instructions: No data entry required.

General Data: DO NOT EDIT (SEE 50 YEAR LIFE CYCLE COST SHEET)

Horsepower:	0
Year of Proposed Construction (Year X):	0
Life Cycle (years):	20
Yearly Power Cost Increase:	4.30%
Yearly Labor Increase (Used for Maintenance & Replacements):	2.94%
Discount Rate:	2.23%

Lift Station Power Costs

Annual Power Cost in 2010 Dollars:	$	376
Annual Power Cost at Year 1	$	392
Power P_{2010}/A Factor with Geometric Gradient:		23.83
Power 2010 Present Worth:	***$***	***9,000***

Note: Annual Power Cost in 2010 dollars is based on data provided by Indianapolis DPW and is dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

Yearly Lift Station Maintenance Costs

Annual SCADA Service Fee in 2010 Dollars (A):	$	240
Annual Maintenance Cost in 2010 Dollars (B):	$	3,900
Sum of SCADA Fee and Maintenance (A+B):	$	4,140
Annual Yearly Maintenance Costs at Year 1:	$	4,262
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:		20.91
Yearly Maintenance 2010 Present Worth:	**$**	**89,000**

Capital Improvement Costs (Replacements Exceeding $25,000 in 2010 Dollars)

Replacements of Pumps and Control Panels

Horsepower	2 Pumps & Controls Material	2 Pumps & Controls Installed
0		$ -
5	$ 33,746	$ 67,492
10	$ 36,120	$ 72,240
15	$ 37,946	$ 75,892
25	$ 43,912	$ 87,824
40	$ 47,576	$ 95,152
50	$ 49,711	$ 99,422

Horsepower: 0
Pump & Controls Replacement Period (years): 20
2010 Pump & Control Replacement Cost: $ 65,535

Replacement Schedule

Year after Construction	Work Done	2010 Cost	F/P_{2010} Factor [1]	Future Dollars	P_{2010}/F Factor [2]	2010 Present Worth
20	Pump & Controls	$ 65,535	1.79	$ 116,992	0.64	$ 75,264
					Capital Improvements 2010 Present Worth:	**$75,000**

Notes:

1. Future costs are projected with yearly labor increase.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Pump and Controls replacement costs are dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

On-Site Gravity Sewer Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	0	LFT	$ 2.00	$ -

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ -	0.80	$ -
20	1.79	$ -	0.64	$ -
Total 2010 Present Worth of On-Site Gravity Sewer O&M				**$ -**

20-Year Life Cycle Cost Summary Worksheet

Instructions: Fill In Yellow Cells

Year of Proposed Construction (Year X):	0	<ENTER 4-digit year
Horsepower of Pumps Required in Lift Station:	0	
Insert "1" for Private Development, Insert "2" for Public Project:	0	
Study Period (years):	20	
Construction Inflation (5-year ENCR):	3.40%	
Yearly Power Cost Increase:	4.30%	
Yearly Labor Cost Increase:	2.94%	
Discount Rate Used (5-year CPI):	2.23%	

Notes:

1. Construction inflation based on Published "ENR Cost Indexing" 2005-2010.
2. Yearly power cost increase based on BLS 5-year Industrial Electric Power Rates 2005-2010 published by Produce Price Index.
3. Yearly labor cost increase based on BLS: Employment Cost Index: " Total Compensation, Private Industry, Construction" 2005-2010.
4. Discount rate based on BLS: Consumer Price Index: "All Urban Consumers - (CPI-U) U.S. City average; All Items" 2005-2010.

GRAVITY SEWER LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ -	0.00	$ -
Maintenance Costs	$ -	0.00	$ -
Power Costs	$ -	0.00	$ -
Remaining Useful Life Value	$ -	0.00	$ -
TOTAL YEAR X GRAVITY SEWER PRESENT WORTH			**$ -**

LIFT STATION AND FORCE MAIN LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 187,000	0.00	$ 0
Power Costs	$ 9,000	0.00	$ 0
Yearly Lift Station Maintenance Costs	$ 89,000	0.00	$ 0
Capital Improvement Costs	$ 75,000	0.00	$ 0
Onsite Gravity Sewer Maintenance Costs	$ -	0.00	$ -
Remaining Useful Life Value	$ (93,500)	0.00	$ (0)
TOTAL YEAR X LIFT STATION AND FORCE MAIN PRESENT WORTH			**$ -**

GRINDER STATIONS AND LOW PRESSURE SEWER LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ -	0.00	$ -
Grinder Station Maintenance Costs	$ -	0.00	$ -
Low Pressure Sewer Maintenance Costs	$ 43,000	0.00	$ 0
Remaining Useful Life Value	$ -	0.00	$ -
TOTAL YEAR X GRINDERS & LOW PRESSURE SEWER PRESENT WORTH			**$ -**
Grinder Stations Power Costs	*$ -*	*0.00*	*$ -*

Note: Cost converted from 2010 to Year X using the yearly increase rates for construction, power, and labor for construction, power and O&M respectively. Positive values indicate costs.

Gravity Sewer Option Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Option Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 111	$ -
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 131	$ -
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 154	$ -
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	LF		$ 40	$ -
20	Misc. Construction	LSUM	1	$ -	$ -
	2010 Gravity Sewer Construction Subtotal - GRAVITY SEWER OPTION =				*$* -
21	Mobilization	LSUM	5%	$ -	$ -
22	Erosion Control and Restoration	LSUM	3%	$ -	$ -
23	Maintenance of Traffic	LSUM	2%	$ -	$ -
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - GRAVITY SEWER OPTION =				**$ -**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

2 Oversizing Gravity Sewer Construction Cost is saved as a hidden tab

Gravity Sewer O&M Worksheet

Instructions: No data entry required.

Year of Construction (Year X):	0
Yearly Labor Increase:	2.94%
Discount Rate:	2.23%

Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	0	LFT	$ 2.50	$ -

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ -	0.80	$ -
20	1.79	$ -	0.64	$ -
Total 2010 Present Worth of Gravity Sewer O&M				**$ -**

Notes:

1. Assumes sewer cleaning is completed every ten (10) years.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Cleaning of the off-site sewer is included only.

Lift Station Option - Gravity Sewer Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Construction Cost - LIFT STATION OPTION					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 111	$ -
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 131	$ -
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 154	$ -
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA		$ 750	$ -
20	Misc. Construction	LSUM	1	$ -	$ -
	2010 Gravity Sewer Construction Subtotal - LIFT STATION OPTION =				*$* -
21	Mobilization	LSUM	5%	$ -	$ -
22	Erosion Control and Restoration	LSUM	3%	$ -	$ -
23	Maintenance of Traffic	LSUM	2%	$ -	$ -
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - LIFT STATION OPTION =				**$ -**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

Lift Station & Force Main Construction Cost Worksheet

Instructions: Fill In Yellow Cells

Lift Station & Force Main Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Force Main, 4", Depth Range 6'-10'	LF		$ 43	$ -
2	Force Main, 6", Depth Range 6'-10'	LF		$ 48	$ -
3	Force Main, 8", Depth Range 6'-10'	LF		$ 51	$ -
4	Force Main, 10", Depth Range 6'-10'	LF		$ 65	$ -
5	Land Acquisition for Lift Station	LSUM	1	$ 10,000	$ 10,000
6	Lift Station and Appurtenances	LSUM	1	$ 160,000	$ 160,000
	2010 Lift Station & Force Main Construction Subtotal =				*$ 170,000*
7	Mobilization	LSUM	5%	$ 8,500	$ 8,500
8	Erosion Control and Restoration	LSUM	3%	$ 5,100	$ 5,100
9	Maintenance of Traffic	LSUM	2%	$ 3,400	$ 3,400
	2010 LIFT STATION & FORCE MAIN CONSTRUCTION TOTAL =				**$ 187,000**

Notes

1 Force main items include pipe, excavation, granular backfill, pavement, and pavement subbase.

Lift Station O&M Worksheet

Instructions: No data entry required.

General Data: DO NOT EDIT (SEE 50 YEAR LIFE CYCLE COST SHEET)

Horsepower:	0
Year of Proposed Construction (Year X):	0
Life Cycle (years):	20
Yearly Power Cost Increase:	4.30%
Yearly Labor Increase (Used for Maintenance & Replacements):	2.94%
Discount Rate:	2.23%

Lift Station Power Costs

Annual Power Cost in 2010 Dollars:	$	376
Annual Power Cost at Year 1	$	392
Power P_{2010}/A Factor with Geometric Gradient:		23.83
Power 2010 Present Worth:	***$***	***9,000***

Note: Annual Power Cost in 2010 dollars is based on data provided by Indianapolis DPW and is dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

Yearly Lift Station Maintenance Costs

Annual SCADA Service Fee in 2010 Dollars (A):	$	240
Annual Maintenance Cost in 2010 Dollars (B):	$	3,900
Sum of SCADA Fee and Maintenance (A+B):	$	4,140
Annual Yearly Maintenance Costs at Year 1:	$	4,262
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:		20.91
Yearly Maintenance 2010 Present Worth:	**$**	**89,000**

Capital Improvement Costs (Replacements Exceeding $25,000 in 2010 Dollars)

Replacements of Pumps and Control Panels

Horsepower	2 Pumps & Controls Material	2 Pumps & Controls Installed
0		$ -
5	$ 33,746	$ 67,492
10	$ 36,120	$ 72,240
15	$ 37,946	$ 75,892
25	$ 43,912	$ 87,824
40	$ 47,576	$ 95,152
50	$ 49,711	$ 99,422

Horsepower: 0
Pump & Controls Replacement Period (years): 20
2010 Pump & Control Replacement Cost: $ 65,535

Replacement Schedule

Year after Construction	Work Done	2010 Cost	F/P_{2010} Factor [1]	Future Dollars	P_{2010}/F Factor [2]	2010 Present Worth
20	Pump & Controls	$ 65,535	1.79	$ 116,992	0.64	$ 75,264
					Capital Improvements 2010 Present Worth:	**$75,000**

Notes:

1. Future costs are projected with yearly labor increase.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Pump and Controls replacement costs are dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

On-Site Gravity Sewer Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	0	LFT	$ 2.00	$ -

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ -	0.80	$ -
20	1.79	$ -	0.64	$ -
Total 2010 Present Worth of On-Site Gravity Sewer O&M				**$ -**

Grinder Stations and Low Pressure Sewer Construction Worksheet

Instructions: Fill In Yellow Cells

Grinder Stations and Low Pressure Sewer System Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Service Lateral, 1-1/4"	LF		$ 20	$ -
2	Force Main, 1-1/2" HDPE DR-11	LF		$ 15	$ -
3	Force Main, 2" HDPE DR-11, Directionally Bored	LF		$ 15	$ -
4	Force Main, 3" HDPE DR-11, Directionally Bored	LF		$ 20	$ -
5	Force Main, 4" HDPE DR-11, Directionally Bored	LF		$ 20	$ -
6	Air Release Structure	EA		$ 4,400	$ -
7	Grinder Pump Station, Simplex, Installed	EA		$ 4,800	$ -
8	Power Feed from Home to Grinder Pump Station	EA	0	$ 1,200	$ -
9	Easements for Grinder Stations (200 SF per Station)	SF	0	$ 1	$ -
	2010 Grinders and Low Pressure Sewer Construction Subtotal =				*$ -*
10	Mobilization	LSUM	5%	$ -	$ -
11	Erosion Control and Restoration	LSUM	2%	$ -	$ -
12	Maintenance of Traffic	LSUM	2%	$ -	$ -
	2010 GRINDERS AND LOW PRESSURE SEWER CONSTRUCTION TOTAL =				**$ -**

Notes

1 Provide a description of any items included in the "Miscellaneous Construction Costs" to the Utility.

Grinder Stations and Low Pressure Sewer O&M Worksheet

Instructions: No data entry required.

General Data: DO NOT EDIT (SEE 50 YEAR LIFE CYCLE COST SHEET)

Number of Simplex Stations:	0
Number of Pumps:	0
Number of ARV's:	0
Year of Proposed Construction (Year X):	0
Life Cycle (years):	20
Yearly Power Cost Increase:	4.30%
Yearly Labor Increase (Used for Maintenance & Replacements):	2.94%
Discount Rate:	2.23%

Power Costs	
Annual Power Cost in 2010 Dollars:	$ -
Annual Power Cost at Year 1:	$ -
Power P_{2010}/A Factor with Geometric Gradient:	23.83
Power 2010 Present Worth:	**$ -**

Grinder Stations and Low Pressure Sewer O&M Worksheet (Cont.)

Grinder Station Maintenance Costs

Yearly Maintenance

Yearly Grinder Station Maintenance Cost 2010 Dollars (per Pump):	$ 375
Grinder Station Yearly Maintenance Cost at Year 1	$ -
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:	20.91
Yearly Grinder Station Maintenance 2010 Present Worth:	**$ -**

Corrective Maintenance

Replacement Unit Costs

Item	*Material Cost*	*Installation Cost*	*Total Unit Cost*
Control Panel	$ 850	$ 450	$ 1,300

Replacement Schedule (at Grinder Stations)

Years after Construction	Replacement Done	2010 Cost	F/P_{2010} Factor	Future Dollars	P_{2010}/F Factor	2010 Present Worth
20	Control Panel	$ -	1.79	$ -	0.64	$ -
Grinder Stations Corrective Maintenance 2010 Present Worth:						**$0**

Yearly Grinder Station Maintenance 2010 Present Worth (A):	$0
Grinder Stations Corrective Maintenance 2010 Present Worth (B):	$0
Total Grinder Station Maintenance 2010 Present Worth (A+B):	**$0**

Grinder Stations and Low Pressure Sewer O&M Worksheet (Cont.)

Low Pressure Sewer Maintenance Costs

Yearly Maintenance of Low Pressure Sewer

Yearly Maintenance Cost for Cleaning Low Pressure Sewer (Lump Sum):	$ 2,000
Yearly Maintenance Cost at Year 1:	$ 2,059
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:	20.91
Yearly Low Pressure Sewer Maintenance 2010 Present Worth:	**$ 43,000**

Corrective Maintenance of Low Pressure Sewer

Replacement Unit Costs

Item	*Material Cost*	*Installation Cost*	*Total Unit Cost*
Air Release Valve	$ 500	$ 125	$ 625

Replacement Schedule (on Low Pressure Sewer)

Years after Construction	Replacement Done	2010 Cost	F/P_{2010} Factor	Future Dollars	P_{2010}/F Factor	2010 Present Worth
15	ARV	$ -	1.54	$ -	0.72	$ -
Low Pressure Sewer Corrective Maintenance 2010 Present Worth:						**$ -**

Yearly Low Pressure Sewer Maintenance 2010 Present Worth (C):	$ 43,000
Low Pressure Sewer Corrective Maintenance 2010 Present Worth (D):	$ -
Total Low Pressure Sewer Maintenance 2010 Present Worth (C+D):	**$ 43,000**

Appendix B

Example No. 1 - Project Lifecycle Evaluation

See Appendix B – Example 1 – Project Lifecycle Evaluation

20-Year Life Cycle Cost Summary Worksheet

Instructions: Fill In Yellow Cells

Year of Proposed Construction (Year X):	2015	<ENTER 4-digit year
Horsepower of Pumps Required in Lift Station:	20	
Insert "1" for Private Development, Insert "2" for Public Project:	2	
Study Period (years):	20	
Construction Inflation (5-year ENCR):	3.40%	
Yearly Power Cost Increase:	4.30%	
Yearly Labor Cost Increase:	2.94%	
Discount Rate Used (5-year CPI):	2.23%	

Notes:

1. Construction inflation based on Published "ENR Cost Indexing" 2005-2010.
2. Yearly power cost increase based on BLS 5-year Industrial Electric Power Rates 2005-2010 published by Produce Price Index.
3. Yearly labor cost increase based on BLS: Employment Cost Index: " Total Compensation, Private Industry, Construction" 2005-2010.
4. Discount rate based on BLS: Consumer Price Index: "All Urban Consumers - (CPI-U) U.S. City average; All Items" 2005-2010.

GRAVITY SEWER LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 1,525,000	1.18	$ 1,802,489
Maintenance Costs	$ 51,000	1.16	$ 58,951
Power Costs	$ -	1.23	$ -
Remaining Useful Life Value	$ (762,500)	1.18	$ (901,244)
TOTAL YEAR X GRAVITY SEWER PRESENT WORTH			**$ 960,000**

LIFT STATION AND FORCE MAIN LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 1,544,000	1.18	$ 1,824,946
Power Costs	$ 36,000	1.23	$ 44,435
Yearly Lift Station Maintenance Costs	$ 89,000	1.16	$ 102,875
Capital Improvement Costs	$ 92,000	1.16	$ 106,343
Onsite Gravity Sewer Maintenance Costs	$ 41,000	1.16	$ 47,392
Remaining Useful Life Value	$ (772,000)	1.18	$ (912,473)
TOTAL YEAR X LIFT STATION AND FORCE MAIN PRESENT WORTH			**$ 1,214,000**

Gravity Sewer Option Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Option Construction Cost

ITEM NO.	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	AMOUNT
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 111	$ -
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF	4,500	$ 131	$ 588,696
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF	4,700	$ 154	$ 722,195
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA	100	$ 750	$ 75,000
20	Misc. Construction	LSUM	1		$ -
	2010 Gravity Sewer Construction Subtotal - GRAVITY SEWER OPTION =				*$ 1,386,000*
21	Mobilization	LSUM	5%	$ 69,300	$ 69,300
22	Erosion Control and Restoration	LSUM	3%	$ 41,580	$ 41,580
23	Maintenance of Traffic	LSUM	2%	$ 27,720	$ 27,720
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - GRAVITY SEWER OPTION =				**$ 1,525,000**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

2 Oversizing Gravity Sewer Construction Cost is saved as a hidden tab

Gravity Sewer O&M Worksheet

Instructions: No data entry required.

Year of Construction (Year X):	2015
Yearly Labor Increase:	2.94%
Discount Rate:	2.23%

Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	9,200	LFT	$ 2.50	$ 23,000

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ 30,730	0.80	$ 24,648
20	1.79	$ 41,059	0.64	$ 26,415
Total 2010 Present Worth of Gravity Sewer O&M				**$ 51,000**

Notes:

1. Assumes sewer cleaning is completed every ten (10) years.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Cleaning of the off-site sewer is included only.

Lift Station Option - Gravity Sewer Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Construction Cost - LIFT STATION OPTION					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF	4,500	$ 111	$ 501,203
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF	4,700	$ 131	$ 614,861
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 154	$ -
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA	100	$ 750	$ 75,000
20	Misc. Construction	LSUM	1		$ -
	2010 Gravity Sewer Construction Subtotal - LIFT STATION OPTION =				*$ 1,191,000*
21	Mobilization	LSUM	5%	$ 59,550	$ 59,550
22	Erosion Control and Restoration	LSUM	3%	$ 35,730	$ 35,730
23	Maintenance of Traffic	LSUM	2%	$ 23,820	$ 23,820
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - LIFT STATION OPTION =				**$ 1,310,000**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

Lift Station & Force Main Construction Cost Worksheet

Instructions: Fill In Yellow Cells

Lift Station & Force Main Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Force Main, 4", Depth Range 6'-10'	LF	1,000	$ 43	$ 43,000
2	Force Main, 6", Depth Range 6'-10'	LF		$ 48	$ -
3	Force Main, 8", Depth Range 6'-10'	LF		$ 51	$ -
4	Force Main, 10", Depth Range 6'-10'	LF		$ 65	$ -
5	Land Acquisition for Lift Station	LSUM	1	$ 10,000	$ 10,000
6	Lift Station and Appurtenances	LSUM	1	$ 160,000	$ 160,000
	2010 Lift Station & Force Main Construction Subtotal =				*$ 213,000*
7	Mobilization	LSUM	5%	$ 10,650	$ 10,650
8	Erosion Control and Restoration	LSUM	3%	$ 6,390	$ 6,390
9	Maintenance of Traffic	LSUM	2%	$ 4,260	$ 4,260
	2010 LIFT STATION & FORCE MAIN CONSTRUCTION TOTAL =				**$ 234,000**

Notes

1 Force main items include pipe, excavation, granular backfill, pavement, and pavement subbase.

Lift Station O&M Worksheet

Instructions: No data entry required.

General Data: DO NOT EDIT (SEE 50 YEAR LIFE CYCLE COST SHEET)

Horsepower:	20
Year of Proposed Construction (Year X):	2015
Life Cycle (years):	20
Yearly Power Cost Increase:	4.30%
Yearly Labor Increase (Used for Maintenance & Replacements):	2.94%
Discount Rate:	2.23%

Lift Station Power Costs

Annual Power Cost in 2010 Dollars:	$	1,433
Annual Power Cost at Year 1	$	1,494
Power P_{2010}/A Factor with Geometric Gradient:		23.83
Power 2010 Present Worth:	***$***	***36,000***

Note: Annual Power Cost in 2010 dollars is based on data provided by Indianapolis DPW and is dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

Yearly Lift Station Maintenance Costs

Annual SCADA Service Fee in 2010 Dollars (A):	$	240
Annual Maintenance Cost in 2010 Dollars (B):	$	3,900
Sum of SCADA Fee and Maintenance (A+B):	$	4,140
Annual Yearly Maintenance Costs at Year 1:	$	4,262
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:		20.91
Yearly Maintenance 2010 Present Worth:	**$**	**89,000**

Capital Improvement Costs (Replacements Exceeding $25,000 in 2010 Dollars)

Replacements of Pumps and Control Panels

Horsepower	2 Pumps & Controls Material	2 Pumps & Controls Installed
0		$ -
5	$ 33,746	$ 67,492
10	$ 36,120	$ 72,240
15	$ 37,946	$ 75,892
25	$ 43,912	$ 87,824
40	$ 47,576	$ 95,152
50	$ 49,711	$ 99,422

Horsepower: 20
Pump & Controls Replacement Period (years): 20
2010 Pump & Control Replacement Cost: $ 79,992

Replacement Schedule

Year after Construction	Work Done	2010 Cost	F/P_{2010} Factor [1]	Future Dollars	P_{2010}/F Factor[2]	2010 Present Worth
20	Pump & Controls	$ 79,992	1.79	$ 142,801	0.64	$ 91,868
				Capital Improvements 2010 Present Worth:		**$92,000**

Notes:

1. Future costs are projected with yearly labor increase.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Pump and Controls replacement costs are dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

On-Site Gravity Sewer Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	9,200	LFT	$ 2.00	$ 18,400

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ 24,584	0.80	$ 19,719
20	1.79	$ 32,847	0.64	$ 21,132
Total 2010 Present Worth of On-Site Gravity Sewer O&M				**$ 41,000**

Appendix C

Example No. 2
Project Lifecycle Evaluation for Septic Elimination ONLY

See Appendix C – Example 2 – Project Lifecycle Evaluation – Septic Elimination Project

20-Year Life Cycle Cost Summary Worksheet

Instructions: Fill In Yellow Cells

Year of Proposed Construction (Year X):	2015	<ENTER 4-digit year
Horsepower of Pumps Required in Lift Station:	20	
Insert "1" for Private Development, Insert "2" for Public Project:	2	
Study Period (years):	20	
Construction Inflation (5-year ENCR):	3.40%	
Yearly Power Cost Increase:	4.30%	
Yearly Labor Cost Increase:	2.94%	
Discount Rate Used (5-year CPI):	2.23%	

Notes:

1. Construction inflation based on Published "ENR Cost Indexing" 2005-2010.
2. Yearly power cost increase based on BLS 5-year Industrial Electric Power Rates 2005-2010 published by Produce Price Index.
3. Yearly labor cost increase based on BLS: Employment Cost Index: " Total Compensation, Private Industry, Construction" 2005-2010.
4. Discount rate based on BLS: Consumer Price Index: "All Urban Consumers - (CPI-U) U.S. City average; All Items" 2005-2010.

GRAVITY SEWER LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 1,525,000	1.18	$ 1,802,489
Maintenance Costs	$ 51,000	1.16	$ 58,951
Power Costs	$ -	1.23	$ -
Remaining Useful Life Value	$ (762,500)	1.18	$ (901,244)
TOTAL YEAR X GRAVITY SEWER PRESENT WORTH			**$ 960,000**

LIFT STATION AND FORCE MAIN LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 1,544,000	1.18	$ 1,824,946
Power Costs	$ 36,000	1.23	$ 44,435
Yearly Lift Station Maintenance Costs	$ 89,000	1.16	$ 102,875
Capital Improvement Costs	$ 92,000	1.16	$ 106,343
Onsite Gravity Sewer Maintenance Costs	$ 41,000	1.16	$ 47,392
Remaining Useful Life Value	$ (772,000)	1.18	$ (912,473)
TOTAL YEAR X LIFT STATION AND FORCE MAIN PRESENT WORTH			**$ 1,214,000**

GRINDER STATIONS AND LOW PRESSURE SEWER LIFE CYCLE COST

Item	2010 Present Worth	$F_{YEAR\ X}/P_{2010}$ Factor	Year X Value at Time of Construction
Construction and Capital Costs	$ 945,000	1.18	$ 1,116,952
Grinder Station Maintenance Costs	$ 956,000	1.16	$ 1,105,042
Low Pressure Sewer Maintenance Costs	$ 49,000	1.16	$ 56,639
Remaining Useful Life Value	$ (472,500)	1.18	$ (558,476)
TOTAL YEAR X GRINDERS & LOW PRESSURE SEWER PRESENT WORTH			**$ 1,720,000**
Grinder Stations Power Costs	*$ 60,000*	*1.23*	*$ 74,000*

Note: Cost converted from 2010 to Year X using the yearly increase rates for construction, power, and labor for construction, power and O&M respectively. Positive values indicate costs.

Gravity Sewer Option Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Option Construction Cost

ITEM NO.	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	AMOUNT
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 111	$ -
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF	4,500	$ 131	$ 588,696
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF	4,700	$ 154	$ 722,195
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA	100	$ 750	$ 75,000
20	Misc. Construction	LSUM	1		$ -
	2010 Gravity Sewer Construction Subtotal - GRAVITY SEWER OPTION =				*$ 1,386,000*
21	Mobilization	LSUM	5%	$ 69,300	$ 69,300
22	Erosion Control and Restoration	LSUM	3%	$ 41,580	$ 41,580
23	Maintenance of Traffic	LSUM	2%	$ 27,720	$ 27,720
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - GRAVITY SEWER OPTION =				**$ 1,525,000**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

2 Oversizing Gravity Sewer Construction Cost is saved as a hidden tab

Gravity Sewer O&M Worksheet

Instructions: No data entry required.

Year of Construction (Year X):	2015
Yearly Labor Increase:	2.94%
Discount Rate:	2.23%

Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	9,200	LFT	$ 2.50	$ 23,000

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ 30,730	0.80	$ 24,648
20	1.79	$ 41,059	0.64	$ 26,415
Total 2010 Present Worth of Gravity Sewer O&M				**$ 51,000**

Notes:

1. Assumes sewer cleaning is completed every ten (10) years.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Cleaning of the off-site sewer is included only.

Lift Station Option - Gravity Sewer Construction Worksheet

Instructions: Fill In Yellow Cells

Gravity Sewer Construction Cost - LIFT STATION OPTION					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF	4,500	$ 111	$ 501,203
2	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 122	$ -
3	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 0'-8' w/ Granular Backfill	LF		$ 129	$ -
4	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF	4,700	$ 131	$ 614,861
5	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 142	$ -
6	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 8'-12' w/ Granular Backfill	LF		$ 150	$ -
7	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 154	$ -
8	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 165	$ -
9	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 12'-16' w/ Granular Backfill	LF		$ 174	$ -
10	Gravity Sanitary Sewer, 8" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 180	$ -
11	Gravity Sanitary Sewer, 10" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 191	$ -
12	Gravity Sanitary Sewer, >= 12" SDR-35 PVC, Depth Range 16'-20' w/ Granular Backfill	LF		$ 201	$ -
13	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 212	$ -
14	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 223	$ -
15	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 20'-24' w/ Granular Backfill	LF		$ 234	$ -
16	Gravity Sanitary Sewer, 8" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 249	$ -
17	Gravity Sanitary Sewer, 10" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 259	$ -
18	Gravity Sanitary Sewer, >= 12" SDR-26 PVC, Depth Range 24'+ w/ Granular Backfill	LF		$ 271	$ -
19	Sewer Laterals	EA	100	$ 750	$ 75,000
20	Misc. Construction	LSUM	1		$ -
	2010 Gravity Sewer Construction Subtotal - LIFT STATION OPTION =				*$ 1,191,000*
21	Mobilization	LSUM	5%	$ 59,550	$ 59,550
22	Erosion Control and Restoration	LSUM	3%	$ 35,730	$ 35,730
23	Maintenance of Traffic	LSUM	2%	$ 23,820	$ 23,820
	2010 GRAVITY SEWER CONSTRUCTION TOTAL - LIFT STATION OPTION =				**$ 1,310,000**

Notes

1 Gravity sanitary sewer items include pipe, manholes, excavation, granular backfill, pavement, and pavement subbase.

Lift Station & Force Main Construction Cost Worksheet

Instructions: Fill In Yellow Cells

Lift Station & Force Main Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Force Main, 4", Depth Range 6'-10'	LF	1,000	$ 43	$ 43,000
2	Force Main, 6", Depth Range 6'-10'	LF		$ 48	$ -
3	Force Main, 8", Depth Range 6'-10'	LF		$ 51	$ -
4	Force Main, 10", Depth Range 6'-10'	LF		$ 65	$ -
5	Land Acquisition for Lift Station	LSUM	1	$ 10,000	$ 10,000
6	Lift Station and Appurtenances	LSUM	1	$ 160,000	$ 160,000
	2010 Lift Station & Force Main Construction Subtotal =				*$ 213,000*
7	Mobilization	LSUM	5%	$ 10,650	$ 10,650
8	Erosion Control and Restoration	LSUM	3%	$ 6,390	$ 6,390
9	Maintenance of Traffic	LSUM	2%	$ 4,260	$ 4,260
	2010 LIFT STATION & FORCE MAIN CONSTRUCTION TOTAL =				**$ 234,000**

Notes

1 Force main items include pipe, excavation, granular backfill, pavement, and pavement subbase.

Lift Station O&M Worksheet

Instructions: No data entry required.

General Data: DO NOT EDIT (SEE 50 YEAR LIFE CYCLE COST SHEET)

Horsepower:	20
Year of Proposed Construction (Year X):	2015
Life Cycle (years):	20
Yearly Power Cost Increase:	4.30%
Yearly Labor Increase (Used for Maintenance & Replacements):	2.94%
Discount Rate:	2.23%

Lift Station Power Costs

Annual Power Cost in 2010 Dollars:	$	1,433
Annual Power Cost at Year 1	$	1,494
Power P_{2010}/A Factor with Geometric Gradient:		23.83
Power 2010 Present Worth:	***$***	***36,000***

Note: Annual Power Cost in 2010 dollars is based on data provided by Indianapolis DPW and is dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

Yearly Lift Station Maintenance Costs

Annual SCADA Service Fee in 2010 Dollars (A):	$	240
Annual Maintenance Cost in 2010 Dollars (B):	$	3,900
Sum of SCADA Fee and Maintenance (A+B):	$	4,140
Annual Yearly Maintenance Costs at Year 1:	$	4,262
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:		20.91
Yearly Maintenance 2010 Present Worth:	**$**	**89,000**

Capital Improvement Costs (Replacements Exceeding $25,000 in 2010 Dollars)

Replacements of Pumps and Control Panels

Horsepower	2 Pumps & Controls Material	2 Pumps & Controls Installed
0		$ -
5	$ 33,746	$ 67,492
10	$ 36,120	$ 72,240
15	$ 37,946	$ 75,892
25	$ 43,912	$ 87,824
40	$ 47,576	$ 95,152
50	$ 49,711	$ 99,422

Horsepower: 20
Pump & Controls Replacement Period (years): 20
2010 Pump & Control Replacement Cost: $ 79,992

Replacement Schedule

Year after Construction	Work Done	2010 Cost	F/P_{2010} Factor [1]	Future Dollars	P_{2010}/F Factor[2]	2010 Present Worth
20	Pump & Controls	$ 79,992	1.79	$ 142,801	0.64	$ 91,868
				Capital Improvements 2010 Present Worth:		**$92,000**

Notes:

1. Future costs are projected with yearly labor increase.
2. 2010 Present Worth was calculated assuming the discount rate is applied to future costs already "inflated" to reflect increases in labor costs.
3. Pump and Controls replacement costs are dependent on horsepower.

Lift Station O&M Worksheet (Cont.)

On-Site Gravity Sewer Maintenance Costs

Item	Qty.	Units	Unit Cost	2010 Item Cost
Cleaning & Televising Sewer	9,200	LFT	$ 2.00	$ 18,400

Cleaning Schedule

Years After Construction	F/P_{2010} Factor	Future Cost	P_{2010}/F Factor	2010 Present Worth
10	1.34	$ 24,584	0.80	$ 19,719
20	1.79	$ 32,847	0.64	$ 21,132
Total 2010 Present Worth of On-Site Gravity Sewer O&M				**$ 41,000**

Grinder Stations and Low Pressure Sewer Construction Worksheet

Instructions: Fill In Yellow Cells

Grinder Stations and Low Pressure Sewer System Construction Cost					
ITEM NO.	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Service Lateral, 1-1/4"	LF	3,700	$ 20	$ 74,000
2	Force Main, 1-1/2" HDPE DR-11	LF	4,100	$ 15	$ 61,500
3	Force Main, 2" HDPE DR-11, Directionally Bored	LF	5,100	$ 15	$ 76,500
4	Force Main, 3" HDPE DR-11, Directionally Bored	LF		$ 20	$ -
5	Force Main, 4" HDPE DR-11, Directionally Bored	LF		$ 20	$ -
6	Air Release Structure	EA	8	$ 4,400	$ 35,200
7	Grinder Pump Station, Simplex, Installed	EA	100	$ 4,800	$ 480,000
8	Power Feed from Home to Grinder Pump Station	EA	100	$ 1,200	$ 120,000
9	Easements for Grinder Stations (200 SF per Station)	SF	20,000	$ 1	$ 20,000
	2010 Grinders and Low Pressure Sewer Construction Subtotal =				*$ 867,000*
10	Mobilization	LSUM	5%	$ 43,350	$ 43,350
11	Erosion Control and Restoration	LSUM	2%	$ 17,340	$ 17,340
12	Maintenance of Traffic	LSUM	2%	$ 17,340	$ 17,340
	2010 GRINDERS AND LOW PRESSURE SEWER CONSTRUCTION TOTAL =				**$ 945,000**

Notes

1 Provide a description of any items included in the "Miscellaneous Construction Costs" to the Utility.

Grinder Stations and Low Pressure Sewer O&M Worksheet

Instructions: No data entry required.

General Data: DO NOT EDIT (SEE 50 YEAR LIFE CYCLE COST SHEET)

Number of Simplex Stations:	100
Number of Pumps:	100
Number of ARV's:	8
Year of Proposed Construction (Year X):	2015
Life Cycle (years):	20
Yearly Power Cost Increase:	4.30%
Yearly Labor Increase (Used for Maintenance & Replacements):	2.94%
Discount Rate:	2.23%

Power Costs		
Annual Power Cost in 2010 Dollars:	$	2,400
Annual Power Cost at Year 1:	$	2,503
Power P_{2010}/A Factor with Geometric Gradient:		23.83
Power 2010 Present Worth:	**$**	**60,000**

Grinder Stations and Low Pressure Sewer O&M Worksheet (Cont.)

Grinder Station Maintenance Costs

Yearly Maintenance

Yearly Grinder Station Maintenance Cost 2010 Dollars (per Pump):	$ 375
Grinder Station Yearly Maintenance Cost at Year 1	$ 38,603
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:	20.91
Yearly Grinder Station Maintenance 2010 Present Worth:	**$ 807,000**

Corrective Maintenance

Replacement Unit Costs

Item	*Material Cost*	*Installation Cost*	*Total Unit Cost*
Control Panel	$ 850	$ 450	$ 1,300

Replacement Schedule (at Grinder Stations)

Years after Construction	**Replacement Done**	**2010 Cost**	**F/P_{2010} Factor**	**Future Dollars**	**P_{2010}/F Factor**	**2010 Present Worth**
20	Control Panel	$ 130,000	1.79	$ 232,074	0.64	$ 149,300
Grinder Stations Corrective Maintenance 2010 Present Worth:						**$149,000**

Yearly Grinder Station Maintenance 2010 Present Worth (A):	$807,000
Grinder Stations Corrective Maintenance 2010 Present Worth (B):	$149,000
Total Grinder Station Maintenance 2010 Present Worth (A+B):	**$956,000**

Grinder Stations and Low Pressure Sewer O&M Worksheet (Cont.)

Low Pressure Sewer Maintenance Costs

Yearly Maintenance of Low Pressure Sewer

Yearly Maintenance Cost for Cleaning Low Pressure Sewer (Lump Sum):	$ 2,000
Yearly Maintenance Cost at Year 1:	$ 2,059
Yearly Maintenance P_{2010}/A Factor with Geometric Gradient:	20.91
Yearly Low Pressure Sewer Maintenance 2010 Present Worth:	**$ 43,000**

Corrective Maintenance of Low Pressure Sewer

Replacement Unit Costs

Item	*Material Cost*	*Installation Cost*	*Total Unit Cost*
Air Release Valve	$ 500	$ 125	$ 625

Replacement Schedule (on Low Pressure Sewer)

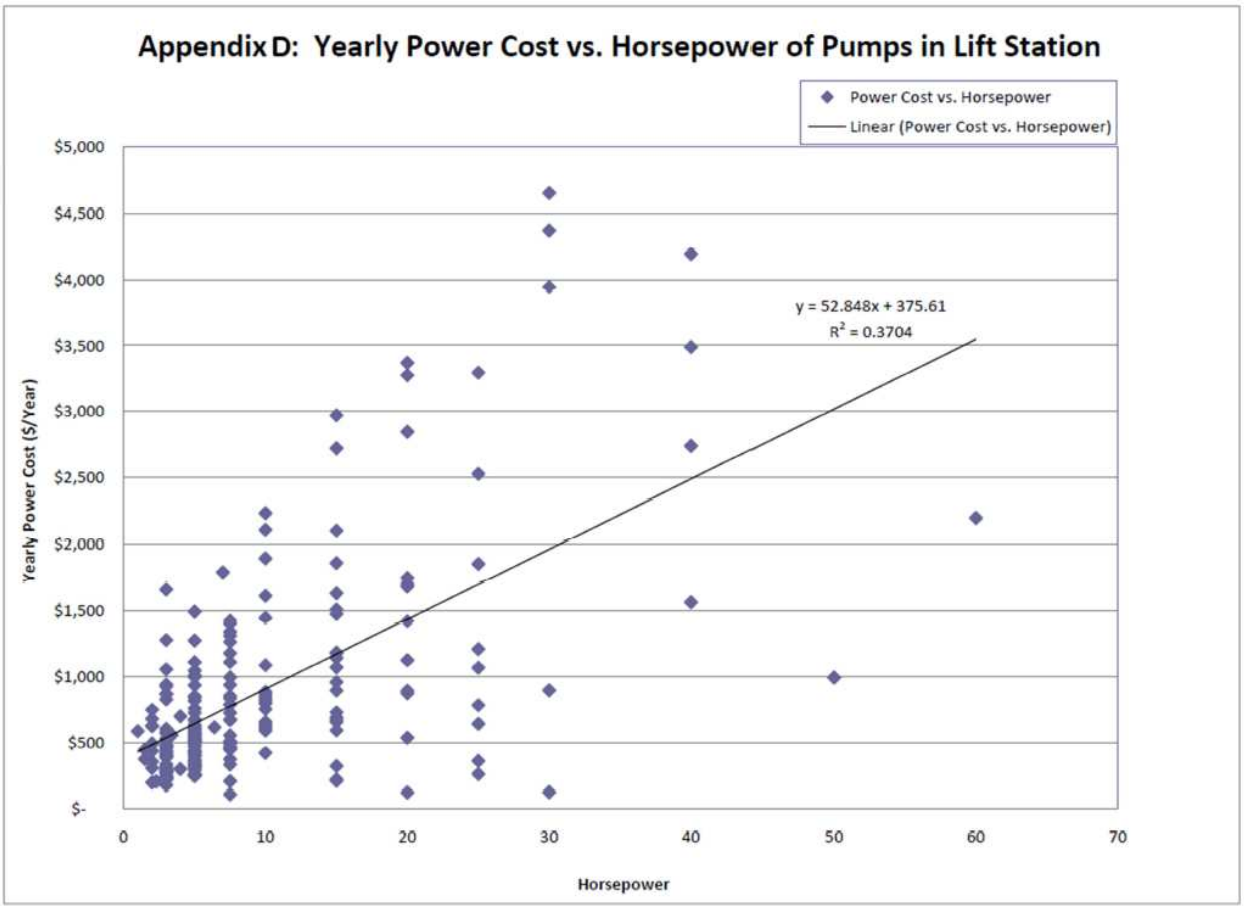
Years after Construction	Replacement Done	2010 Cost	F/P_{2010} Factor	Future Dollars	P_{2010}/F Factor	2010 Present Worth
15	ARV	$ 5,000	1.54	$ 7,722	0.72	$ 5,547
Low Pressure Sewer Corrective Maintenance 2010 Present Worth:						**$ 6,000**

Yearly Low Pressure Sewer Maintenance 2010 Present Worth (C):	$ 43,000
Low Pressure Sewer Corrective Maintenance 2010 Present Worth (D):	$ 6,000
Total Low Pressure Sewer Maintenance 2010 Present Worth (C+D):	**$ 49,000**

Appendix D

Graph: Power Costs vs. Horsepower

See Appendix D.pdf



Appendix E

Graph: Pump and Control Replacement Costs vs. Horsepower

See Appendix E.pdf