OFFICIAL EXHIBITS

FILED September 3, 2021 INDIANA UTILITY REGULATORY COMMISSION

STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF THE CITY OF EVANSVILLE, INDIANA, FOR AUTHORITY TO ISSUE BONDS, NOTES, OR OTHER OBLIGATIONS, FOR AUTHORITY TO INCREASE ITS RATES AND CHARGES FOR WATER SERVICE, AND FOR APPROVAL OF NEW SCHEDULES OF WATER RATES AND CHARGES.	)))))))	**CAUSE NO. 45545**

IURC
PUBLIC'S
EXHIBIT NO. 4
10-27-21 AT
DATE REPORTER

PUBLIC'S EXHIBIT NO. 4

TESTIMONY OF JAMES T. PARKS

ON BEHALF OF

THE INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

SEPTEMBER 3, 2021

Respectfully submitted

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CERTIFICATE OF SERVICE

This is to certify that a copy of the ***Public's Exhibit No. 4, Testimony of James T. Parks*** has been served upon the following counsel of record in the captioned proceeding by electronic service on September 3, 2021.

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TESTIMONY OF OUCC WITNESS JAMES T. PARKS
CAUSE NO. 45545
CITY OF EVANSVILLE

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is James T. Parks, P.E., and my business address is 115 W. Washington Street, Suite 1500 South, Indianapolis, IN 46204.

Q: By whom are you employed and in what capacity?

A: I am employed by the Office of Utility Consumer Counselor ("OUCC") as a Utility Analyst II in the Water/Wastewater Division. My qualifications and experience are described in Appendix A.

Q: What is the purpose of your testimony?

A: My testimony evaluates the City of Evansville's ("Petitioner" or "Evansville") $269.2 million dollar capital improvement plan. I describe Evansville's water system and discuss how the proposed capital improvements will replace aging infrastructure. I explain why the OUCC generally considers the projects themselves appropriate as they replace the existing water treatment plant, aging water mains, and water mains in conflict with road projects. I explain that Petitioner is oversizing the new treatment plant by 25% because of unsupported aggressive water demand growth forecasts that are contradicted by Petitioner's overall declining use. I recommend Evansville size its new plant for 40 million gallons per day ("MGD") instead of the proposed 50 MGD.

I explain that Petitioner's selection of a new offsite treatment plant was made with a life cycle cost analysis that did not include all costs, especially the costs for a new residuals management system. I explain that Petitioner's consultant prepared detailed assembly level line-item cost estimates but assumed high levels of contingencies resulting in Petitioner's project cost estimates being overstated. I also recommend the Commission authorize approximately $3.5 million for relocation of the City garage to a new offsite location instead of Petitioner's requested $13.2 million.

Q: Please describe the review and analysis you conducted to prepare your testimony.

A: I reviewed Evansville's Petition and the testimonies of Lane T. Young, Executive Director, Evansville Water and Sewer Utility ("EWSU"), Douglas L. Baldessari, CPA, Baker Tilly Municipal Advisors, LLC ("BTMA"), Michael Labitzke, P.E, Director of the Program Management Office, EWSU, and Simon M. Breese, P. Eng. Vice President and National Technical Director, Water Treatment, Americas, AECOM. I reviewed Petitioner's Attachments, a late filed supplemental workpaper, and a revised Advanced Facility Plan for the new treatment plant including:

Attachment DLB-1	*Accounting Report on Proposed Improvement Project and Increase in Rates and Charges*, Baker Tilly US, LLP, April 20, 2021.
Attachment ML-1	*EWSU Water Master Plan*, HNTB Corp., Sept. 2016.
Attachment ML-2	*Water Main Replacement Scoping Reports* (33 water main projects), HNTB Corp., Dec. 2020, Revised Feb. 2021.
Attachment ML-3	*EWSU 2022 Rate Case Complete Project Listing.*
Attachment ML-4	*Booster Station Improvements Scoping Reports*, HNTB Corp., Dec. 2020, Revised Feb. 2021.
Attachment ML-5	*Facility Relocation Feasibility Assessment*, for the Evansville Street Maintenance Department &

Vanderburgh Levee Authority, VS Engineering, Inc., Dec. 15, 2020.

Attachment SMB-1 *Water Treatment Plant Advanced Facility Plan ("WTPAFP"), Alternatives Report*, AECOM, March 2021.

Supplemental Workpaper, *Preliminary Engineering Report – Water Treatment Plant*, VS Engineering, June 2021.

Water Treatment Plant Advanced Facility Plan, Alternatives Report, AECOM, April 23, 2021. (Obtained from Indiana Finance Authority ("IFA")).

I reviewed Petitioner's recent annual reports filed with the Indiana Utility Regulatory Commission ("Commission" or "IURC") and Monthly Reports of Operation ("MROs") filed with the Indiana Department of Environmental Management ("IDEM") to analyze Evansville's historical water usage, customer growth and water demand. I wrote discovery requests and reviewed Petitioner's responses. On July 21, 2021, OUCC Utility Analyst, Carl Seals, and I met with EWSU staff to discuss Petitioner's current operations and capital improvement plans and tour Evansville's existing filtration plant, the site for the proposed water treatment plant, and the Lincoln, Killian and Stallings Booster Stations.

I reviewed Petitioner's funding requests, project information and estimated costs from Cause Nos. 44760 (2016), 45073 (2018) and 45545 (2021). I also reviewed the October 2009 *Water Master Plan* and Drinking Water *Preliminary Engineering Reports* Petitioner submitted to the Indiana Finance Authority's Drinking Water State Revolving Fund ("DWSRF"). Finally, I compiled and attached various documents, which I refer to in my testimony. These attachments are listed in Appendix B.

II. DESCRIPTION OF THE EVANSVILLE WATER SYSTEM

Q: Please provide a brief description of the Evansville Water System and potential future demands.

A: Petitioner provides water utility service to approximately 63,473 residential, commercial, industrial, and public authority customers in and around the City of Evansville in Vanderburgh County and to three wholesale customers. Petitioner's customer base grew 4.7% in the last decade (2011-2020).[1] According to data from its Annual Reports to the IURC, reported water production (16.9 million gallon per day ("MGD") in 2020) and water sold (14.28 MGD on average in 2020) have been relatively flat for the past ten years (*See* Table 12, Appendix C).[2]

Evansville draws its water from the Ohio River and treats it at its surface water treatment plant which has a 60 MGD total capacity (all units in service) and a 42 MGD firm capacity.[3] Petitioner reports "Demand has been well below this capacity in recent years, with average day demands in mid to low 20 MGD range, and peak summer demands rarely exceeding 30 MGD."[4] Petitioner has three existing interconnected clearwells at the treatment plant totaling 8.5 million gallon ("MG") and 28.5 MG of water storage capacity in the distribution system, for a total finished water storage capacity of 37 MG. Evansville's distribution system consists of approximately 1,015 miles of water mains ranging from 1-inch

[1] Customer growth averaged 0.46% annually from 2011 to 2020.
[2] In response to DR 15-11, Evansville stated the 2020 water produced and water sold volumes reported on its 2020 Annual Report do not appear to have been entered correctly.
[3] The firm rated capacity is based on the largest single unit being out of service under worst-case conditions (such as high raw turbidity and high system demand). For Evansville, the limiting treatment processes are mixing, flocculation, primary sedimentation, and secondary sedimentation. *See* Table 3.1 Water Treatment Plant Firm Capacities in Mr. Labitzke's case-in-chief testimony, Attachment ML-1 *Water Master Plan*, HNTB Corporation, September 2016, page 51 of 460.
[4] Mr. Breese case-in-chief testimony, page 6, lines 3-4.

up to 60-inch.[5] For a more detailed description of the Evansville water system, please refer to Appendix C.

III. WATER DEMAND FORECASTS AND DESIGN CAPACITIES

Q: Is Petitioner oversizing the new water treatment plant's capacity?

A: Yes. Based on my analysis of water produced reported to IDEM on the Monthly Reports of Operation ("MRO"), water sold data, and forecasted 2050 water demand data in the AECOM Advanced Facility Plan, Evansville has overstated 2020 water demand and future 2050 water demand. This overstatement causes the proposed treatment plant capacity to be oversized by 25%, which increases the project's construction costs. The oversizing is caused by several incorrect planning assumptions. Evansville's 2020 base year water demands by customer class are not based on actual volumes, overstated, and not supported by data. Evansville's high water demand growth projections for each customer class (i.e., residential, commercial, etc.) are also unsupported and contradicted by historical water usage trends. The high growth assumptions are also contradicted by Petitioner's overall declining water consumption.

OUCC population estimates show Petitioner's 2050 residential water demand projection does not align with Indiana Business Research Center ("IBRC") population projections. IBRC has forecasted Vanderburgh County will

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[5] Attachment ML-1 *Water Master Plan*, HNTB Corporation, September 2016, Tables 2-1 and 2-2 pages 14 and 16 of 460.

add fewer than 9,000 people in the next 30 years.[6] Petitioner's consultant, AECOM, forecasts a 2050 residential usage of 12.91 MGD (for direct Evansville customers), equivalent to a 222,586 person-connected population that is unlikely to occur.[7] This connected population exceeds the IBRC's forecasted 2050 Vanderburgh County population by 29,198 people or 15%. Evansville does not serve all customers in Vanderburgh County.

Q: What are Petitioner's projected 2050 water demands?

A: For the year 2050, Petitioner is projecting an Average Day Demand of 36.4 MGD, and a Maximum Day Demand of 49.4 MGD. AECOM's 2050 projections start with assumed higher 2020 water demands by customer class (not actual) which are then multiplied by unsupported annual growth rates.

Q: Did Petitioner indicate the 2020 Water Demands were assumed volumes?

A: No. In my initial review of the Advanced Facility Plan, I understood the 2020 water demands listed in Table 3-7 were actual volumes. It was only from a review of water sold data that I realized AECOM assumed the 2020 volumes and that these assumed volumes were greater than the actual 2020 volumes.[8]

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[6] IBRC's current Vanderburgh County population growth projections to 2050 use the 2010 Census base year population to project the 2050 population at 193,388 people. Vanderburgh County's actual 2020 Census population at 180,136 was below the IBRC's 184,440 projected population. Updated population forecasts, using the lower 2020 Census count, are unavailable but are also expected to be adjusted lower.

[7] Calculated by the OUCC as 12,910,000 gallons per day residential usage divided by AECOM's 58 gallons per capita per day ("gpcd") water usage (AECOM *Advanced Facility Plan*, page 17) equals 222,586 people. AECOM did not provide an estimated 2050 population or residential customer count.

[8] Petitioner provided actual water demands for each customer class for 2014 to 2021 in response to OUCC Data Request 17-1.

Table 1 – AECOM Projected Average and Maximum Day Demand through 2050[9]

Demand Source	Assumed 2020 Demand (MGD)	Projected 2050 Demand (MGD)	Assumed Annual Increase (%)	Total % Increase 2020-2050
Average Residential	8.26	12.91	1.5%	56.3%
Average Commercial	5.00	9.05	2.0%	81.0%
Average Industrial	3.00	6.29	2.5%	109.7%
Average Wholesale	2.88	3.60	0.75%	25.0%
Average Public Authority	1.00	1.08	0.25%	8.0%
Avg. Leaks and Losses	3.50	3.25	-0.2%	-7.1%
Avg. Day Demand	23.6	36.4	1.5%	54.2%
Max. Day Demand	31.7	49.4	1.5%	55.8%
Max Day / Avg. Day	1.4	1.4		

Q: Are the 2020 water demands used by AECOM reasonable?

A: No. By using assumed demands AECOM overstates water demand for all customer classes. In contrast, non-revenue water (which AECOM calls leaks and losses) appears to be understated. In Table 2 I compare actual 2020 water demand to AECOM's assumed demand and show the percentage AECOM overstated demand.

To forecast future 2050 flows, AECOM started with assumed higher 2020 water demand volumes rather than actual volumes. In effect, AECOM created two future flow projections, one for 2020 and the second for 2050. Actual 2020 demand for each customer class is comparable to the four-year average actual

[9] The data source for the 2020 and 2050 water demands is Table 3-7 in the *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021. This revised Advanced Facility Plan was submitted to the Indiana Finance Authority for SRF funding on April 30, 2021, but was not submitted with Petitioner's case-in-chief on May 10, 2021.

demand (2017 to 2020).[10] Despite overstated customer class usage ranging from 14% (commercial) to 35% (public authority), AECOM overstates 2020 average demand only by 5%. This is because AECOM uses a lower 3.50 MGD non-revenue water volume than the actual 6.13 MGD I calculated.[11] AECOM did not provide data supporting its assumed 2020 water usage by customer class nor how it determined the assumed 3.50 MGD leaks and losses volume.

Table 2 – Comparison of Actual 2020 Average Demand (MGD) to the AECOM Assumed 2020 Demand

	Actual 2020 Demand[12]		Assumed 2020 Demand AECOM	
Demand Source	**BG/Yr.**	**MGD**	**MGD**	**Percent Overstated**
Average Residential	2.43	6.64	8.26	24%
Average Commercial	1.60	4.38	5.00	14%
Average Industrial	0.90	2.45	3.00	22%
Average Wholesale	0.80	2.19	2.88	31%
Average Public Authority	0.27	0.74	1.00	35%
Avg. Leaks and Losses		6.13	3.50	-43%
Avg. Day Demand[13]		22.53	23.6	5%
Max. Day Demand		28.8	31.7	10%
Max Day / Avg. Day Ratio		1.28	1.4	

Q: Why is it important to use actual 2020 water demand data?

A: It is important because AECOM uses the 2020 demand data as the starting point

[10] OUCC analysis of water sold for all five customer classes shows the 2020 average water sold at 16.4 MGD is slightly below the four-year average (2017-2020) water sold of 17.18 MGD.
[11] Non-revenue water is equal to the 22.53 MGD annual average flow based on 2020 MRO data reported to IDEM minus the 16.4 MGD 2020 water sold data (total from each customer class) reported to the OUCC in response to DR 17-1 equals 6.13 MGD of non-revenue water.
[12] *Id.*
[13] Actual 2020 average day demand of 22.53 MGD and maximum day demand of 28.8 MGD were taken from Evansville's Monthly Reports of Operation ("MRO") submitted to IDEM.

for its 2050 flow projections. AECOM uses the 2050 flow projections as justification for the proposed 36.4 MGD average day and 50 MGD maximum day plant capacities. By using inflated 2020 water demands, all flow projections emanating from those demands are also overstated. This means AECOM's 2050 water demand and design capacity are both overstated. Due to the high cost of Evansville's proposed new plant and its ratepayer impact, it is critical the most accurate base year data be used.

Q: What annual percent increases in water demand for each customer class did AECOM project?

A: AECOM's unsupported annual growth projections are:

a. Initial City population of 118,000 people and a per capita demand of 70 gal/day/person, or 8.26 MGD (higher than the per capita estimate of 58 gal/day/person).[14, 15]
b. City population growth rate of 1.5% per year, maintaining the same per capita demand through 2050.
c. Initial commercial demand of 5.0 MGD and a growth rate of 2.0% per year.
d. Initial industrial demand of 3.0 MGD with flow increase of 2.5% per year.
e. Initial wholesale demand of 2.88 MGD with flow increase of 0.75% per year.
f. Initial public authority demand of 1 MGD and growth rate of 0.25% per year.

Q: Did AECOM or Petitioner provide support for its growth projections?

A: No. Petitioner was unable to explain the basis used to set these specific annual growth percentages and did not provide data or any study, report, or analyses to support its assumptions. In discovery, Petitioner provided narrative discussions

[14] AECOM calculated the per capita water usage as follows: 2017 residential water sold volume of 2.5 BG/year divided by 365 days/year divided by Evansville's 2017 population of 117,500 people equals 58 gallons per capita per day ("gpcd"). The OUCC believes AECOM's per capita usage calculation is incorrect. The actual usage may be 50 gpcd based on a 2020 residential water sold volume of 2.43 BG/year divided by 366 days/year divided by Evansville's 2020 residential customers of 59,605 divided by 2.23 people per housing unit equals 50 gpcd.

[15] AECOM does not explain why it raised the 58 gpcd water usage by 21% to an assumed 70 gpcd.

that shed no light on how AECOM developed the assumed growth rates.[16] Because Petitioner and AECOM were unable to support the growth percentages, I recommend the growth projections not be relied on to set future 2050 water demands for the individual customer classes. If these growth percentages are relied on to set 2050 water demands, it will produce a larger than needed treatment plant.

Q: Is Petitioner's assumed 1.5% annual population growth rate reasonable?

A: No. It is overstated by nearly an order of magnitude. The source of the assumed 1.5% growth rate is in Section 3.1 Population Projections, of the WTPAFP, where AECOM misread the Vanderburgh Co. Comprehensive Plan's 7% growth rate as an *annual, not a total* rate.[17] AECOM described the annual rate as follows:

> The Comprehensive Plan included a section about future capacity needs of the WTP and recommended an annual population growth rate of about 7% through 2035. However, this is a very aggressive growth model and can yield an unnecessarily large facility. Based on the historical data summarized above, it is recommended to utilize a lower and more representative rate of population growth to not drastically oversize the facility. This report considers an annual population growth rate of 1.5% through 2050 for future plant capacity.[18]
>
> (Emphasis added by the OUCC)

AECOM presented no information, data sources or support of any kind to justify choosing a 1.5% annual population growth rate. AECOM recognized a 7% rate

[16] *See* Attachment JTP-1 for Petitioner's responses to Data Requests 3-15 to 3-18 requesting support for the annual growth assumptions used by AECOM to estimate 2050 water demands for each customer class.
[17] *See* Attachment JTP-2 for excerpts on demographics and housing from the *Evansville-Vanderburgh County Comprehensive Plan, 2015-2035*, Evansville-Vanderburgh County Area Plan Commission, June 27, 2016. The 6.99% total population growth from 2010 to 2035 (AECOM refers to a 7% annual rate) (Attachment JTP-2, page 15 of 17) is based on the IBRC's population projection starting from 179,703 actual 2010 Vanderburgh County Census population to 192,271 people in 2035.
[18] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021, page 14.

was a problem but did not realize the real issue, namely that it was not an annual rate. Checking the 7% as an annual growth rate would have shown Vanderburgh County's 2010 Census population of 179,703 nearly doubling every ten years and growing by over 15-fold to 2,680,913 people by 2050.[19] Obviously, this is unrealistic and should have caused the Comprehensive Plan's demographics section to be reread followed by converting the 7% total growth rate to an *annual* growth rate and applying the annual growth rate to determine future water demands. Instead, AECOM cut back to "a lower and more representative rate of population growth *to not drastically oversize* the facility." (Emphasis added by the OUCC.)

However, AECOM's assumed 1.5% annual growth rate, albeit lower, is still incorrect, unsupported, and too aggressive. I calculate the annualized growth rate using the pre 2015 IBRC population forecast (based on 2010 Census data) should be only 0.27%.[20] AECOM's assumed 1.5% growth rate is over five times greater than the correctly calculated annual rate using the Comprehensive Plan's IBRC data (based on 2010 Census data). Recent 2020 Census data shows slower Evansville and Vanderburgh County growth than previously forecasted.[21]

Q: Using recent 2020 Census data for Vanderburgh County, what would be the annual population growth rate?

A: Recent 2020 Census data shows Vanderburgh Co. added just 433 people between

[19] Calculated by multiplying Vanderburgh County's 2010 Census population of 179,703 people times 1.0699 raised to the power of 40 yields 2,680,913 people in year 2050.

[20] Calculated using pre 2015 IBRC population projections based on Vanderburgh County's 2010 Census population of 179,703 people and a 2035 forecasted population of 192,271 people. The total growth rate is 6.99% over 25 years and the annualized growth rate is 0.27%.

[21] 2020 Census data shows Evansville lost 131 people (2010 population of 117,429 and a 2020 population of 117,298) and Vanderburgh County added 433 people (2010 population of 179,703 and a 2020 population of 180,136).

2010 (179,703 people) and 2020 (180,136 people). Keeping the IBRC's forecasted 2020 to 2050 growth rates, the annualized population growth rate is 0.16% as shown in Table 3.[22]

Table 3 – OUCC Adjustments for Vanderburgh Co. Population based on 2020 Census Data and OUCC Adjusted IBRC Forecasts to 2050

Year	Population Data Source	Census / IBRC Population	IBRC Percent Growth	OUCC Adjusted Population	IBRC Percent Growth
2010	US Census	179,703		179,703	
2020	IBRC forecast[23]	184,440	2.64%		
2020	US Census			180,136	0.24%
2030	IBRC forecast	189,441	2.71%	185,020	2.71%
2040	IBRC forecast	191,966	1.33%	187,486	1.33%
2050	IBRC forecast	193,388	0.74%	188,875	0.74%
Total population added		8,948		8,739	
Total 2020 to 2050 growth rate (%)			4.85%		4.85%
Annual growth rate 2020 to 2050 (%)			0.16%		0.16%

Q: What service area population are direct customers of Evansville?

A: None of Petitioner's witnesses provide the service area population. AECOM states "Water is currently delivered to over 62,000 customer accounts and serves a population of approximately 120,000 people."[24] AECOM's population figure is incorrect since it ignores Vanderburgh Co. residential customers outside City limits who are not customers of a wholesale customer. The Preliminary Design

[22] Calculated starting with Vanderburgh County's 2020 Census population of 180,136 people and a 2050 OUCC adjusted population of 188,875 people. The total growth rate is 4.85% over 30 years and the annualized growth rate is 0.16%.

[23] The unadjusted IBRC forecasted populations were derived from 2010 Census data. New IBRC population forecasts using 2020 Census data have not yet been made.

[24] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021, p. 13.

Summary in Petitioner's Supplemental Workpaper indicates a current City population of 118,000 and a 173,000 served population.[25]

Q: What is the future service area population for the 2050 Design Year?

A: Again, none of Petitioner's witnesses state the future population and AECOM does not report it in the Advanced Facility Plan. The Preliminary Design Summary lists 2050 City and total served populations of 184,400 and 253,300 people.[26] This represents a 66,400 City population gain and an 80,300 total served population gain.

Table 4 – Evansville's Projected Population Gains 2020 to 2050
PER - Preliminary Design Summary[27]

Year	Assumed City Population	Assumed Total Served Population
2050	184,400	253,300
2020	118,000	173,000
Population gain 2020 to 2050	66,400	80,300
2020 to 2050 total increase %	56%	46%
Assumed annual growth rate %	1.50%	1.28%

It appears VS Engineering calculated the 2050 populations assuming a 1.5% annual City growth rate and a 1.28% annual growth rate for total served population. Neither of these assumed growth rates are supported by data or IBRC population projections. The unsupported 1.5% annual population city growth rate matches the value used by AECOM.

[25] Attachment E: DWSRF Loan Program Preliminary Design Summary in Petitioner's Supplemental Workpaper - *Preliminary Engineering Report, Water Treatment Plant*, VS Eng., June 2021, page 70 of 80.
[26] *Id.*
[27] *Id.*

Q: Are Petitioner's 2050 City and total served populations reasonable?

A: No. They are overstated and exceed the IBRC's 12,076-person total population gain for the four-county area (2020 to 2050) by 565%.[28] I compared Evansville's Preliminary Design Summary population to the IBRC's projected gains for Gibson, Posey, Vanderburgh, and Warrick Counties as shown in Table 5.

Table 5– Forecasted Population Gains by County 2020 to 2050
Indiana Business Research Center[29]

Year	Vanderburgh County	Gibson County	Posey County	Warrick County	Four-County Population
2010 Census	179,703	33,503	25,910	59,689	298,805
2020 Census	180,136	33,011	25,222	63,898	302,267
2020	184,440	34,077	25,053	63,818	307,388
2030	189,441	34,783	23,874	67,958	316,056
2040	191,966	34,898	21,979	70,261	319,104
2050	193,388	34,950	19,969	71,157	319,464
Gain 2020 to 2050	13,252	1,939	-5,253	7,259	12,076
2020 to 2050 gain assumed in Petitioner's Preliminary Design Summary					80,300
Population gain 2020 to 2050, percent overstated					565%

AECOM presented 1960 to 2010 population data for Evansville and Vanderburgh County showing long term declines for Evansville, a 2017 population of 117,500 people and an assumed initial 2020 population of 118,000 people that it used for its residential customer flow projections.[30] AECOM provides no other discussion

[28] The IBRC only makes long term population forecasts for Indiana Counties. There is no 2010 to 2050 IBRC population forecast for the City of Evansville.
[29] The IBRC forecasted populations for 2020 to 2050 were derived from 2010 Census data. New IBRC population forecasts using 2020 Census data have not yet been made.
[30] AECOM's inclusion of Evansville's total 118,000 population (within City limits) in the residential customer class is incorrect because Evansville directly serves residential customers outside City limits. Residential customers living in apartments are accounted for in the Commercial customer class.

about the residential population or future population other than to state "Section Three, Population Projections and Water Demand of the Advanced Facility Plan summarizes Evansville's anticipated population growth and draws upon historical usage patterns to formulate future projected demands."[31] AECOM assumed significant increases in water demand across all customer classes even though the historical water sold trend is negative. *See* Tables 1 and 6.

Q: Isn't Petitioner simultaneously requesting a declining usage adjustment and proposing to design the new treatment plant for increased demand?

A: Yes. AECOM projected increased demand based on inflated population growth projections and inflated demand growth for all customer classes. Historical water demands have declined for each customer class except the Wholesale customers as shown by Table 6 which also shows annual rainfall data.

Table 6 – Historical Water Demand by Customer Class (MGD)

Customer Types	2014	2015	2016	2017	2018	2019	2020
Residential	7.34	7.15	6.94	6.90	6.77	6.47	6.64
Commercial	5.07	5.32	5.00	5.07	4.93	4.77	4.38
Industrial	2.63	2.93	2.81	2.77	2.93	2.66	2.45
Wholesale	2.11	2.11	2.19	2.05	2.25	2.19	2.19
Public Authority	1.01	0.99	0.85	0.90	0.88	0.85	0.74
Water sold (MGD)	18.16	18.49	17.79	17.70	17.75	16.93	16.39
Water sold (BG/Yr.)	6.616	6.741	6.496	6.409	6.490	6.180	6.011
Rainfall (inches)[32]	52.68	58.65	43.20	35.80	56.24	61.22	60.61

Petitioner's witness Mr. Baldessari graphically showed the declining use for annual water sold on page 34 of his testimony, which I include as Figure 1.

[31] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021. *See* p. 3.
[32] Water demand on an annual basis appears to be relatively unaffected by rainfall totals.

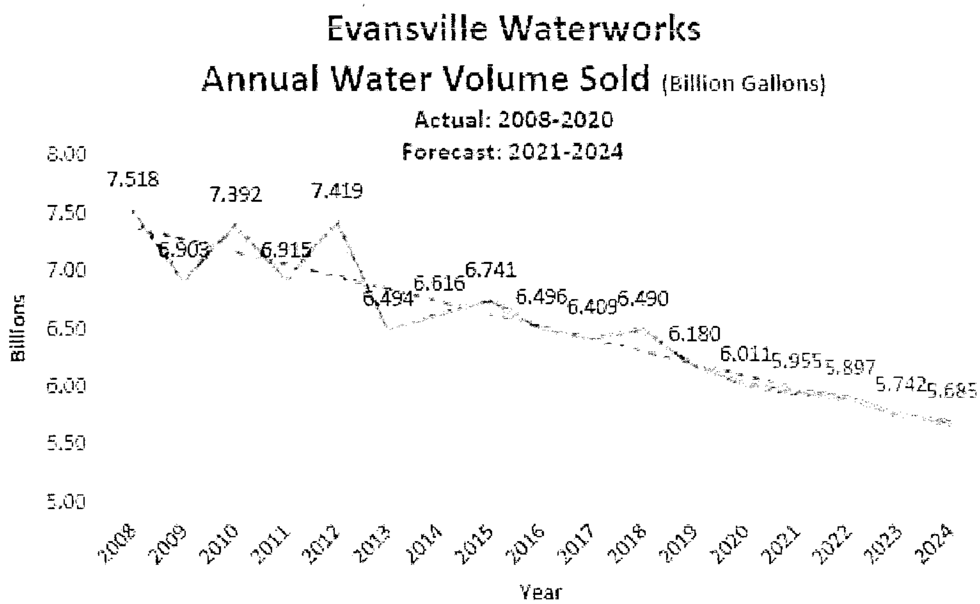

Figure 1 – Declining use graph (Mr. Baldessari's case-in-chief testimony, page 34)

Q: What did AECOM project for 2050 residential water demand?

A: AECOM projects residential demand will rise from 8.26 MGD in 2020 to 12.91 MGD in 2050. As I explained earlier, the 8.26 MGD demand for 2020 is a projected value, not actual, and is overstated by 24%. Actual 2020 residential water sold was only 6.64 MGD.

Q: Is AECOM's projected 2050 residential demand of 12.91 MGD reasonable?

A: No. AECOM's projection has a starting point (2020) that is 1.62 MGD higher than it should be. AECOM's projection also includes an inflated population growth projection. I estimate AECOM's projection is inflated by 85% (5.94 MGD overstated) and will not occur. I estimate residential demand will rise from 6.64

MGD in 2020 to approximately 7 MGD in 2050.[33] AECOM reported current water usage of 115 gallons per customer per day and 58 gallons per capita per day.[34] At these daily consumption rates, to reach the estimated 12.91 MGD residential demand in 2050, Evansville would have to add another 54,522 customers to its current 59,605 residential customers.[35] For AECOM's projections to be realistic Evansville's total residential customers would need to be 114,127 in 2050 or increase by 91 percent.

Q: Are AECOM's assumed 1.5% annual residential population growth rate and the 12.91 MGD forecasted 2050 residential demand justified?

Q: No. Evansville will not add another 54,522 residential customers over the next 30 years. As a check on how unlikely AECOM's projected growth is, I calculated the expected population from 54,522 new residential customers based on 2010 Census data for Evansville of 2.23 people per housing unit. The 54,522 new residential customers are equivalent to 121,584 people.[36] This far exceeds the Vanderburgh County population gain of 8,948 people forecasted by the IBRC. *See* Table 3.

Q: Are growth in the other customer classes similarly overstated?

A: Yes. AECOM's growth rates in the other customer classes also appear to be overstated. Petitioner did not provide support for any of its initial 2020 demand

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[33] Based on an annual population growth rate of 0.16% for Vanderburgh County per the IBRC population forecast. *See* Table 3 for the annual population growth rate. The OUCC estimate of 2050 residential water demand is calculated as 1.0016 raised to the power of 30 times 6.64 MGD (2020 residential water sold) equals 6.97 MGD.

[34] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021. *See* Table 3-5 2017 Individual Category Daily Water Use, page 17.

[35] Calculated as 12.91 MGD (2050 projected residential) minus 6.64 MGD (2020 actual residential) equals 6.27 MGD residential demand growth. At AECOM's 115 gallons per day ("gpd") per customer usage, additional residential customers are 6.27 MGD times 1,000,000 divided by 115 gpd per customer equals 54,522 new residential customers.

[36] Calculated as 54,522 new residential customers times 2.23 people per housing unit (2010 Census housing data) equals 121,584 people.

volumes and annual growth rates. Also, the starting point for each customer class is overstated because AECOM did not use actual 2020 data.

Q: Did you prepare demand and annual growth rate estimates that could be used to establish the new plant's needed capacity?

Yes. I estimated 2050 water demands under two growth scenarios, which I summarize in Table 7. These estimates reflect actual 2020 water sold volumes and residential growth rates calculations based on IBRC population projections. In OUCC Growth Estimate 1, I assumed the commercial growth rate would mirror the residential growth rate and I lowered the industrial growth rate to 1.5% based on the negative demand trend. I matched the wholesale, public authority and leaks and losses growth rates assumed by AECOM. Under Growth Estimate 1, the new treatment plant should be sized for a maximum day demand of 34.5 MGD.

In OUCC Growth Estimate 2, I matched AECOM's assumed rates for the industrial, wholesale, public authority classes. I tripled the residential annual growth I calculated using IBRC data for Estimate 1 to 0.474% and used a 1.25% commercial rate. Commercial growth rates should track with the residential growth, but I conservatively gave more growth, over 2.5 times the residential rate, to the commercial class. Based on the more optimistic Growth Estimate 2, the new treatment plant should be sized for a maximum day demand of 39.7 MGD (rounded up to 40 MGD) and an average day demand of 28.4 MGD. For design, I recommend Evansville's new plant have a design maximum day capacity not to exceed 40 MGD. I compare the various AECOM assumed growth rates and water demand projections to actual 2020 water demands and Growth Estimates 1 and 2 in Table 7.

Table 7 – Comparison of Actual 2020 Demand (MGD), AECOM Assumed 2020 and 2050 Demands, and OUCC Projected Demands

Demand Source	Actual 2020 (MGD)	AECOM Assumed Demand		
		2020 (MGD)	% Annual Growth	2050 (MGD)
Average Residential	6.64	8.26	1.5%	12.91
Average Commercial	4.38	5.00	2.0%	9.05
Average Industrial	2.45	3.00	2.5%	6.29
Average Wholesale	2.19	2.88	0.75%	3.60
Average Public Authority	0.74	1.00	0.25%	1.08
Avg. Leaks and Losses	6.13	3.50	-0.25%	3.25
Avg. Day Demand[37]	22.53	23.6		36.4
Max. Day Demand	28.8	31.7		49.4
Max Day / Avg. Day	1.28	1.34		1.36
2050 Forecasts – OUCC Projections[38]				
	OUCC Growth Est. 1		**OUCC Growth Est. 2**	
Demand Source	**% Annual Growth Estimate**	**2050 Est. Demand (MGD)**	**% Annual Growth High Est.**	**2050 High Demand (MGD)**[39]
Average Residential	0.16%	6.96	0.474%	7.65
Average Commercial	0.16%	4.59	1.25%	6.36
Average Industrial	1.5%	3.83	2.5%	5.14
Average Wholesale	0.75%	2.74	0.75%	2.74
Average Public Authority	0.25%	0.80	0.25%	0.80
Avg. Leaks and Losses	-0.25%	5.69	-0.25%	5.69
Avg. Day Demand		24.6		28.4
Max. Day Demand		34.5		39.7
Max Day / Avg. Day		1.4		1.4

I compare AECOM's water demand to OUCC Growth Estimates 1 and 2 in

[37] Actual 2020 average day demand of 22.53 MGD and maximum day demand of 28.8 MGD were taken from Evansville's Monthly Reports of Operation ("MRO") submitted to IDEM.
[38] Values shown in red text are different than values used by AECOM in its demand projections.
[39] The high demand estimate is for population growth nearly three times (0.474% annual growth vs. 0.16%) above the OUCC's best estimate based to meet IBRC's population projections (based on 2010 Census data) which have not yet been updated to reflect actual lower population growth using 2020 Census data.

Figure 2. I also show historical water sold from 1996 to 2020 and Evansville's projected 2021 to 2024 declining use. The graph visually depicts AECOM's overstated water demand assumptions that if followed will lead to construction of an oversized 50 MGD treatment plant instead of the OUCC's recommended 40 MGD plant.

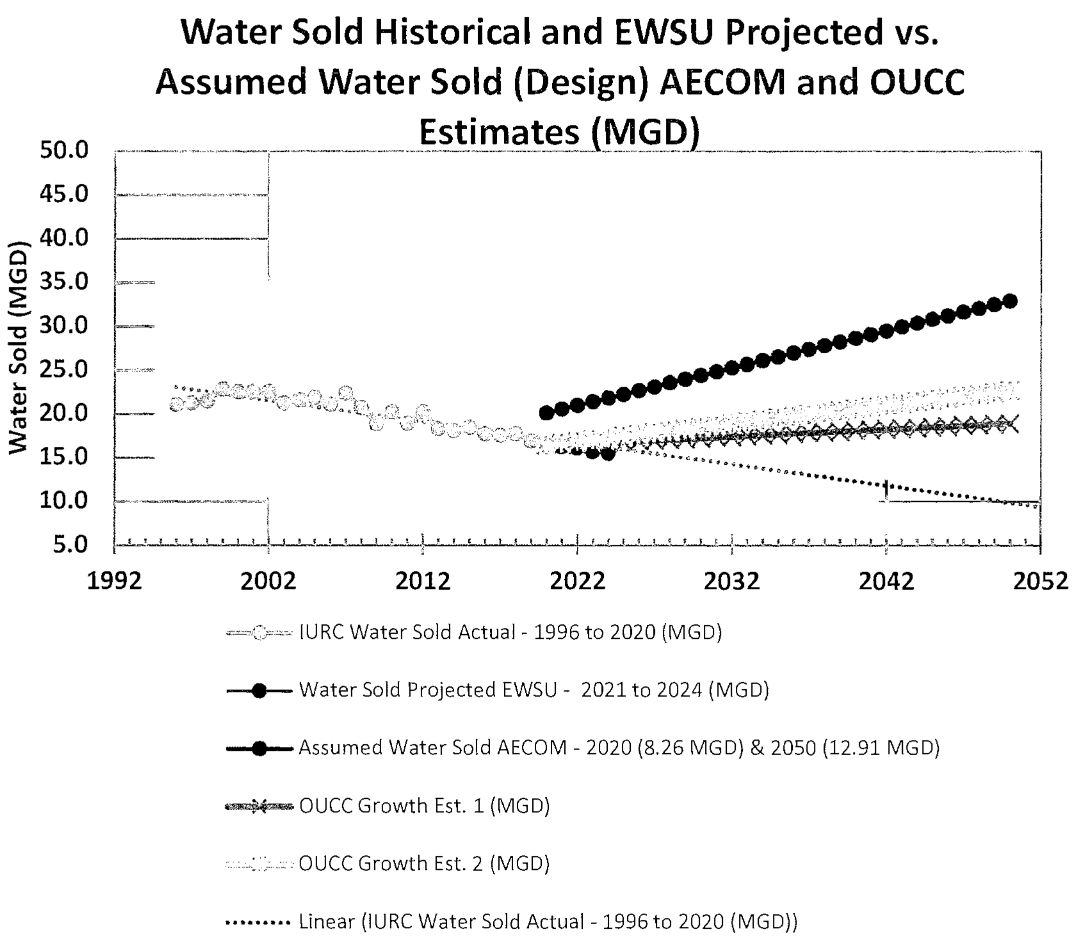

Figure 2 – Graphical presentation of historical water sold and forecasted water demands (excludes leaks and losses) by AECOM and the OUCC.

Q: What do you recommend for the new treatment plant's design capacities?

A: Petitioner's current plans to build a 50 MGD WTP are not warranted. Doing so will oversize the new surface water treatment plant ("SWTP") by 25% due to overestimated and unsupported water demand projections. I recommend that Petitioner re-evaluate AECOM's water demand forecasts, preferably using updated IBRC population forecasts based on 2020 Census data to confirm that the new treatment plant can be sized for an average day demand of 28.4 MGD in 2050 and a maximum day demand of 40 MGD instead of Evansville's proposed 50 MGD capacity. A 28.4 MGD design average day capacity is 26% higher than the 2020 average day flow, is sufficient to meet three times the IBRC forecasted population increase, and includes Petitioner's assumed higher growth rates for the industrial, wholesale, public authority classes and leaks and losses.

IV. NEW SURFACE WATER TREATMENT PLANT

Q: In Cause Nos. 44760 (2016) and 45073 (2018) what type of treatment plant did Petitioner originally propose to build?

A: Petitioner proposed to construct collector wells and new raw water mains on land along the Ohio River southeast of the existing treatment plant and a new 60 MGD groundwater treatment plant ("GWTP") at the existing City garage site using chemical oxidation of iron and manganese without softening, gravity filters and a new 6-million-gallon finished water reservoir to replace the existing Ohio River surface water treatment plant. The basis for the new groundwater plant was a 2014 Feasibility study which indicated the new GWTP and collector wells could be constructed (with a 20% contingency) for $79 million with a 20% non-construction cost of $15.8 million and a total project cost of $96 million.[40] The

[40] *New Groundwater Treatment Plant Feasibility Study*, HNTB Corporation, December 2014.

reasons for using groundwater instead of river water included protection against:

a. spills and river contamination that could force Evansville to close the river intake causing a loss of supply to utility customers;

b. water main breaks in the winter caused by near freezing river water adversely affecting the City's cast iron water mains;

c. intake structure damage during floods or barges colliding with the intake causing a loss of raw water supply; and

d. treatment variability caused by turbidity spikes and varying water quality.

AECOM discusses the groundwater benefits over river water in the Advanced Facility Plan.[41]

Q: Would a new groundwater plant address other Evansville water issues?

A: Yes. Petitioner did not mention a new GWTP would also address discharges of mercury and total suspended solids ("TSS") to the Ohio River from blowdown of sediments removed in sedimentation tanks and filter backwash water. AECOM's life cycle cost analyses looking at existing plant rehabilitation, construction of new surface water treatment or a 50:50 blend of groundwater and surface water, did not include the added construction costs and operation and maintenance cost for a residuals treatment system to address the mercury and TSS.

Q: Did Evansville previously secure funding for planning and design of the new groundwater treatment plant?

A: Yes. In 2016, under Cause No. 44760, Petitioner requested financing authority for $10 million for planning and design of the new GWTP and $650,000 for purchase of property and easements for the new Ranney collector wells and raw water

[41] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021, pp 44-45.

mains. The Commission granted financing authorization in 2016.[42] Evansville secured funding through an open market 2016A Water Bond in December 2016. The $10 million was for work in 2017 and 2018 to complete aquifer testing, planning and design of the new GWTP including plans and specifications needed for competitive bidding.[43]

Q: What is the status of the new GWTP planning and design?

A: In this Cause, Petitioner has chosen to retain using Ohio River water for its source of supply and now plans to build a new surface water treatment plant on a new site rather than pursue the new GWTP. Evansville cites well capacity testing results below the expected 15 MGD per collector well causing the number of wells needed to increase to be able to meet Petitioner's proposed 50 MGD maximum day production.

Evansville did not purchase any properties for the new wells and has only spent $2.506 million of the $10 million total that was earmarked in 2016 for planning and design. Subsequent planning focused on AECOM's preparation of the Advanced Facility Plan for continued surface water treatment but at a new offsite plant. AECOM developed and evaluated the following alternatives:

Alternative 1 – Rehabilitation of the existing surface water treatment plant;

Alternative 2A – Construct a new SWTP with conventional pretreatment, ozonation and biological filtration on the existing plant site;

Alternative 2B – Construct a new SWTP with conventional pretreatment, ozonation and biological filtration on the Evansville Street Maintenance Department garage site east of the existing SWTP; and

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[42] Cause No. 44760 Final Order, October 5, 2016, pages 11 and 13.

[43] *See* Attachment JTP-3 for Petitioner's response to Data Requests under Cause Nos. 44760 and 45073 pertaining to the status of the proposed groundwater treatment plant.

Alternative 3 – Construct a new treatment plant with a 50:50 split between groundwater treatment with softening and a new SWTP.

Q: What treatment alternative does Petitioner propose to construct?

A: Evansville proposes to construct Alternative 2B with residuals treatment at a total estimated construction cost of $175,838,000 without engineering design. Petitioner's life cycle cost analysis used to select Alternative 2B - a new surface water treatment plant did not include the added costs for residuals treatment.

Q: What is the status of the new WTP design?

A: Evansville requested Proposals for engineering planning and design services for the new WTP in November 2018. In August 2019 Evansville retained AECOM's design team to develop alternatives including evaluation and pricing of treatment equipment for the new plant and preparation of 30% design including up to 60 drawings and a specifications list. AECOM submitted a draft Advanced Facility Plan in late 2020 and a Final WTPAFP dated March 2021. This WTPAFP was included as Attachment SMB-1 to Mr. Breese's case-in-chief testimony. The March 2021 WTPAFP recommended Alternative 2B but did not discuss or analyze the need, costs, or O&M impacts for the $30 million residuals process.

Q: Was another Advanced Facility Plan prepared?

A: Yes. A revised WTPAFP including a new Chapter 10 – Residuals Management, was prepared between March and April 2021. The OUCC did not know this revised WTPAFP existed until August 25, 2021, when the OUCC obtained a copy from the Indiana Finance Authority.

Q: Why was Alternative 2B selected?

A: AECOM conducted a 30-year life cycle cost analysis ("LCCA") that included construction costs, 30 years of operation and maintenance, and replacement costs.

The LCCA was based on construction of a new plant to treat an average day demand of 36.4 MGD and a maximum day demand of 50 MGD, but the LCCA did not include the residuals management system's $29,714,000 construction cost or $43,547,000 30-year operating and replacement cost (present worth). The total 30-year life cycle dewatering cost would be $73,261,000.[44]

Q: Do you have any observations about the proposed new surface water treatment plant?

A: Yes. The new plant does not address the issues the City identified in Cause No. 44760. These issues include the cold river water contributing to increased numbers of water main breaks in the winter, the potential risk of spills and river contamination forcing Evansville to have to completely close the river intake, and the risk of damage to the intake structure caused by floods and collisions of barges with the intake. These issues remain unaddressed with the new surface water plant.

AECOM's Non-Monetary Scoring omits cold water temperatures during the winter causing increased water main breaks and the danger of barges damaging the intake structure. The Scoring matrix also appears to be skewed with equal weighting (5 points each) for the Environmental Factors of susceptibility to earthquakes, tornados, and floods. Flooding, by far the major risk, should be weighted higher than earthquakes and tornados. Environmental Factors weighting at 20 points nearly equals factors of greater importance such as turbidity spikes in

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[44] *Water Treatment Plant Advanced Facility Plan, Alternatives Rpt.*, AECOM, April 23, 2021, pp 140-142.

the river (3 points), river spills / contamination (3 points), taste and odor control (3 points), and organics and disinfection byproducts (3 points).[45]

In addition, in Cause No. 45073, Petitioner stated concerns with leakage into the 6.5 MG concrete clearwell during high river stages as a reason for a new 6.0 MG clearwell. The bottom of Petitioner's proposed 5 MG concrete clearwell (at approximate elevation 333.0 ft. based on 28 feet excavation per the Timberline estimate) appears to be 15 feet *lower* than the bottom of the existing clearwell (elevation 348.0 feet) which is located in the river levee. In addition, Petitioner's preferred site for the new plant is located in a low-lying area that is protected by Evansville's levee system. However, this area can flood when the river is at high stage if the ponding water cannot be pumped to the river.

V. NEW SURFACE WATER TREATMENT PLANT COSTS

Q: What is the estimated total project cost for Alternative 2B?

A: There are differing cost estimates for the new WTP. For purposes of the OUCC's review, we have focused on the $175,838,000 construction cost estimate listed in Mr. Baldessari's case-in-chief testimony and the Capital Improvement Plan summarized on pages 6-9 of Attachment DLB-1. Capital costs include offsite construction of a new, larger City garage, five phases of construction for the new treatment plant, a mercury/TSS treatment process, and $6.28M for construction engineering services/resident project representatives ("CES/RPR") as summarized in Table 8.

[45] *Id.*, page 149 of 291.

Table 8 Alternative 2B New Surface Water Treatment Plant Construction Cost Estimate per Attachment DLB-1[46]

Description of Work	Year	Cost Estimate	Source of Funds
City Garage Replacement Demolition and Relocation	2022	$13,200,000	Revenue Bond (non SRF eligible)
Plant Replacement, Phase I	2022	11,029,000	SRF
Mercury/TSS Treatment Process	2022	30,000,000	SRF
Plant Replacement, CES/RPR	2022	6,280,000	SRF
Plant Replacement, Phase II	2023	30,573,000	SRF
Plant Replacement, Phase III	2024	35,302,000	SRF
Plant Replacement, Phase IV	2025	37,793,000	SRF
Plant Replacement, Phase V	2026	11,661,000	SRF
Total Construction Cost		$175,838,000	

Q: What is the Estimate Class for the new WTP construction cost estimate?

A: Petitioner does not report the estimate class in its testimony. It appears that the construction cost estimates prepared to date and submitted in the case-in-chief and in the Preliminary Engineering Report should be considered AACE Class 3 estimates.[47] I consider it a Class 3 estimate for the following reasons:

a. Known water quality and treatment processes - The proposed SWTP is similar to the existing SWTP (with known river water quality, known treatment processes similar to existing, known new processes (ozone, biologically active filtration ("BAF")).

b. Components and sizing - All unit processes and system components appear to

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[46] Attachment DLB-1 to Mr. Baldessari's case-in-chief testimony, pages 6-9.

[47] AACE International cost estimate classifications range from Class 5 for planning and concept screening with 0% to 2% project definition to Class 1 for bidding, project controls and change management for up to 100% project definition. AACE stands for the Association for the Advancement of Cost Engineering. *See* Attachment JTP-4 for the cost estimate classification matrix of the AACE International Class that describes the five Classes, their project definition basis and their uses.

be identified and sized.

c. Detailed unit costs - were prepared by AECOM with Assembly Level line items. This information was provided in response to a data request and included Excel worksheets, Timberline cost estimating software output and equipment quotations.[48] The level of spreadsheet detail, the material quantities, and equipment vendors budgetary quotations is a good indication the estimate is a Class 3.

d. 30% design - AECOM's contract list preparation of a Class 4 estimate and preliminary design drawings as scope of work tasks.[49]

e. Budget and financing - EWSU has established its requested project budget and is seeking financing authorization. This is another main reason to judge the estimates as Class 3.

However, AECOM identified the construction cost estimate as a Rough Order of Magnitude ("ROM") with no AACE Class level identified.[50] In other discovery, Petitioner stated that the cost estimates were based on the alternative evaluations report, which it indicated was at the conceptual level (approximately 10% design).[51]

Q: What are the various cost estimates that have been prepared?

A: AECOM shows a $150,902,000 total estimated project cost without design costs in the Advanced Facility Plan (Table 9-9 Plant Alternative 2B Total Estimated

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[48] Petitioner response to DR 17-6 Attachment 1 (Excel file tabulating costs from the Timberline cost estimating software – 13 worksheets), Attachment 2 (pdf file of Timberline cost estimating software output, 20-018 Engineer's ROM Estimate Level 4, June 12, 2020 – 54 pages) and Attachment 3 (2020 and 2021 equipment vendors budgetary quotes and scopes of supply and details for major pieces of equipment). *See* Attachment JTP-5.
[49] Attachment JTP-6 for the Scope of Services from AECOM's Engineering Services Contract.
[50] Petitioner's response to Data Request 17-6.
[51] Petitioner's response to Data Request 17-7.

Construction Cost) including $13.691 million for a new City garage but omits existing plant demolition, renovations of existing treatment plant buildings that are to remain (unspecified but believed to include the original 1897 well and pump house and the 1912 and 1938 filters building), and the $30 million residuals treatment system.[52] The PER lists $166,925,000 for the Alternative 2B cost in Table 21 (on page 46 of 80) without design costs and omits demolition and City garage replacement costs (non SRF eligible) but includes $27,650,000 for the residuals treatment system. The WTPAFP and PER cost estimates are compared in Attachment JTP-7.

In the testimonies of Mr. Breese and Mr. Baldessari, the treatment plant construction costs are shown as $181 million and $175.838 million respectively. Both estimates include a $30 million residuals management system. In addition, Evansville's new SWTP has been initially listed on IFA's Project Priority List ("PPL") at an estimated $250 million cost (#4 priority project – 2022 1st Quarter PPL, July 19, 2021) which greatly exceeds the amount of financing Petitioner is requesting in this Cause.[53]

Q: What is the overall contingency included in Petitioner's WTPAFP and PER cost estimates for Alternative 2B?

A: Petitioner does not identify the project's overall contingency. Petitioner shows *additional* construction contingencies at 3% totaling $4,152,180 in the PER, Table 21 but does not identify the large estimating contingencies (20% up to

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[52] Table 11-3 - Total Estimated Project Cost of Preferred Alternative 2B in the WTPAFP shows a cost of $180,616,000 if residuals treatment (dewatering) is required by IDEM.

[53] See Attachment JTP-8, Indiana Finance Authority Drinking Water State Revolving Fund ("DWSRF") 2022 1st Quarter Project Priority List ("PPL"), July 19, 2021

30%) and the 5% construction contingencies embedded in most line items of the cost estimate. In the WTPAFP, Table 9-9, the *additional* construction contingencies at 3% total $3,602,000. The additional construction contingencies vary for each of the four Alternatives evaluated as summarized in Table 9. Given the cost details provided that identify the majority of project costs, I recommend that Petitioner use a standard 10% contingency in its cost estimates which matches the maximum contingency allowed by the Indiana Finance Authority.

Table 9 – Comparison of Added Construction Contingency for the Four Alternatives

Alternative Description		Added Construction Contingency		Construction Cost with Added Contingency
		%	Amount	
1	Rehabilitate the existing SWTP	15%	$14,319,000	$121,822,000
2A	New SWTP on existing site	10%	$12,096,000	$141,605,000
2B	New SWTP on City garage site	3%	$3,602,000	$140,049,000
3	New 50:50 SWTP / GWTP	10%	$14,795,000	$175,599,000

Q: Did Petitioner provide support for its cost estimates in its case-in-chief?

A: No. In the Advanced Facility Plan, AECOM provided single page construction cost estimates for process alternatives and for each of the four alternatives (Alternatives 1, 2A, 2B, and 3) but did not provide any detailed cost support, material quantities, unit costs or equipment quotations. The WTPAFP and PER cost estimates for each alternative show lump sum costs for various-line items representing individual unit processes. Additionally, the individual unit processes also show lump sum costs for various line items, again with no detail beyond the listed lump sum costs.

In response to discovery, Petitioner provided cost details from an estimating program called Timberline, but the output was in pdf format that did not link to an excel file that could be manipulated to understand how costs were developed and rolled up into the lump sum costs shown in the WTPAFP and PER. Because of this, the OUCC could not be easily see how costs rolled up for individual processes and then tied into the WTPAFP and PER cost tables.[54] Petitioner provided an Excel file of the Timberline data, but the data was hard coded making review difficult. The Timberline software includes assembly level detailed listings with entries for labor, materials, installation equipment, subcontractors, and process equipment costs.

Q: Did you review the lump sum costs listed in the WTPAFP and PER tables?

A: Yes. In reviewing the detailed estimates forming the basis for AECOM's cost estimates, I noticed WTPAFP and PER costs were always much higher than rolled-up costs generated through the Timberline cost estimating software. I reviewed AECOM's cost estimates in depth for two process components: 1) rehabilitating the river intake; and 2) constructing new high service pump station #4. Based on my review it appears costs that AECOM listed for the intake and HSP Station #4 in the total construction cost estimates are 107% and 272% higher than the total amount listed in the rolled-up Timberline estimate. The Timberline costs appear to be base costs without contingencies and the contractor's overhead and profit and general conditions.

[54] Petitioner's response to DR 17-6 and DR 17-10. *See* Attachment JTP-5.

I assembled the various cost estimates for the Intake and HSP Station #4 and summarized them in Attachments JTP-9 and JTP-10. I also summarized the cost estimate increases from the AECOM base costs generated through the Timberline estimating software to the estimated costs presented in the WTPAFP and PER. *See* Table 10.

Table 10 – Summary of Cost Estimate Increases for the Intake and HSP Station #4

Cost Estimate Source	Intake Rehab	HSP Station #4
DR 17-6 Attach. 2 Timberline estimate Total Amount (Base Cost)	$3,260,760	$2,995,741
DR 17-6 Attach. 2 Timberline estimate Total Price Amount	$4,995,583	$4,586,577
DR 17-6 Attach. 1 Grand Total Cost	$6,752,000	$7,870,000
Advanced Facility Plan Cost Estimate	$6,752,000	$11,130,000
Percent Increase above Base Cost	107%	272%
Advanced Facility Plan Cost Table	Table 7-5, page 51	Table 9-9, page 128

VI. NEW STREET DEPARTMENT MAINTENANCE GARAGE

Q: Where does Evansville plan to construct the new surface water treatment plant?

A: Petitioner plans to build its new plant on land occupied by the Evansville Street Maintenance Department's garage ("garage" or "City garage"). At an offsite location, Evansville proposes to construct a new City garage that is larger and with more amenities than the existing 1985 garage. Petitioner requests $13.2 million to fund the new garage's entire cost at water utility ratepayer expense.

Q: Has Petitioner started work to replace the City garage?

A: No. Petitioner provided a feasibility assessment for the new garage but did not document in its case-in-chief that it had acquired another property.[55] In response to discovery, Petitioner stated property acquisition has not started and that "design of the new Street Garage will start when it is known this rate case will move forward as petitioned. Anticipated construction schedule of the new Street Garage is embedded in the Gantt chart in the PER for the water treatment plant, previously submitted."[56] Figure 10-1 in the WTPAFP shows garage relocation work starting in the 3rd quarter of 2021 and ending by the 3rd quarter of 2022.[57]

Q: Who determined the new WTP site?

A: Petitioner's witness Mr. Labitzke stated "EWSU, in conjunction with its consultants, evaluated a number of potential locations" and stated AECOM's evaluation indicated the most cost-effective option is to build on or near the existing WTP, specifically preferring the City garage site as the (Alternate 2B).[58]

Q: What sites did AECOM evaluate for the new WTP?

A: Petitioner's witness Mr. Breese discusses only three sites for Alternative 2B:

Site 1 The City garage site immediately east of the existing WTP (selected).

Site 2 An undeveloped site 2.4 miles southeast of the existing WTP outside the floodplain or any wetlands.

Site 3 An undeveloped site 2,900 feet south of the existing WTP within the floodplain but unprotected by the existing levee.

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[55] Mr. Labitzke's case-in-chief testimony and Attachment ML-5 *Facility Relocation Feasibility Assessment*, for the Evansville Street Maintenance Department & Evansville Vanderburgh Levee Authority, VS Engineering, Inc., Dec. 15, 2020,

[56] Petitioner response to DR 17-9, August 9, 2021.

[57] Mr. Breese's case-in-chief testimony and Attachment SMB-1 *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, March 2021, page 138 of 276.

[58] Mr. Labitzke's case-in-chief testimony, page 12.

Q: Has Evansville considered other nearby locations for the new WTP?

A: I don't believe so. Because of benefits from being near the existing Ohio River Intake Structure (being retained) or possible well sites, Evansville was justified in only considering sites on or near the existing WTP. However, by effectively limiting its off-site review to only the adjacent Street Maintenance Department garage and Levee Authority site, Evansville failed to evaluate placing the new WTP on other unused City owned land that also sits adjacent to the existing WTP. This other adjacent 20-acre area just south of the Levee Authority and City garage would have eliminated the need to demolish and relocate the garage thereby saving $13,200,000. This city owned vacant land is shown in Figure 3.

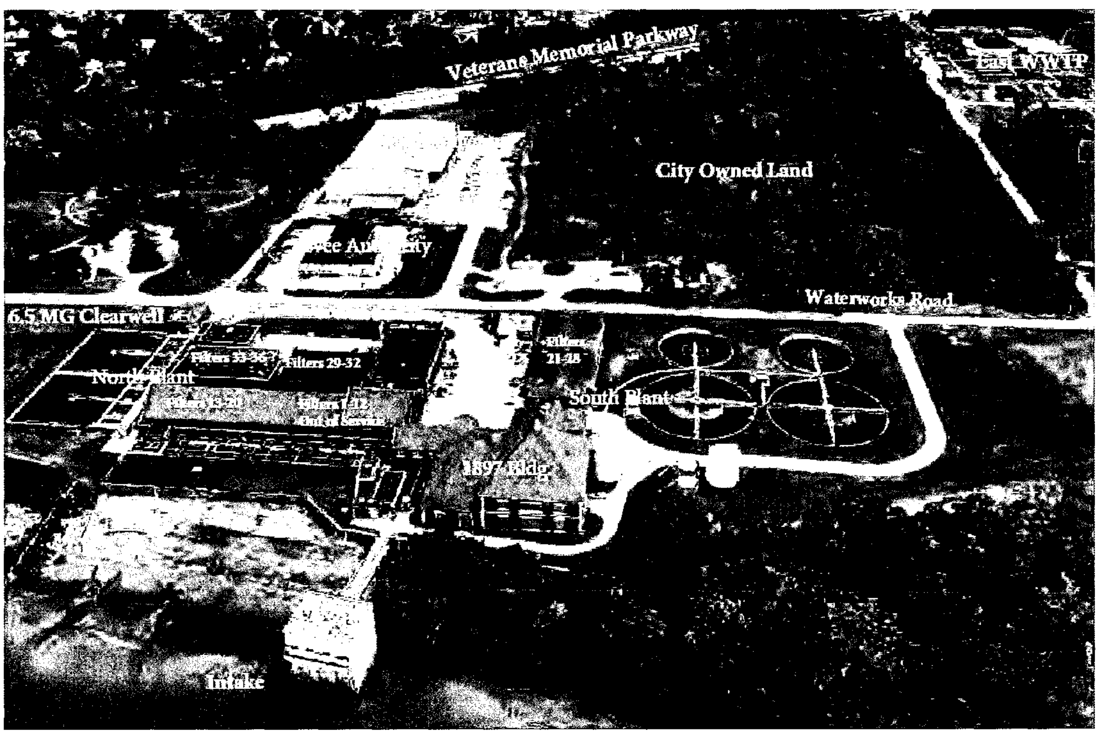

Figure 3 – View of Evansville's existing water treatment plant looking east with the City garage, the proposed site of the new plant, in the upper left. This pre 2019 photo does not show the Waterworks Road relocation across the wooded City owned land.

Q: What infrastructure exists on the property south of the Levee Authority and City garage?

A: Until 2019 it appears that the land only had a 48-inch water transmission main running east from the water plant. Evansville installed two new 36-inch water transmission mains at a construction cost of $2,625,669.[59] Evansville also relocated Waterworks Road in 2019 as part of the Sunrise Effluent Pump Station project (wastewater) at a construction cost I estimate at $1,680,000.[60]

Q: Could Evansville save time and ratepayer money by building the new WTP on the 20-acre site south of the Levee Authority?

A: Yes. I estimate Petitioner could relocate portions of the 48-inch concrete and two new 36-inch ductile iron transmission mains and the new Waterworks Road for about $5.0 million. The cost to relocate the infrastructure on the site would be less than half of the $13.2 million requested cost to relocate the City garage.[61] Costs could even be reduced from the $5 million if portions of the new road and 36-inch and 48-inch transmission mains could remain in place or be removed, inspected, and reinstalled. Evansville could also accelerate the WTP project schedule by eliminating the need to acquire an offsite property and relocate the City garage.

Q: Please describe the existing Street Maintenance Department garage.

A: The facility, constructed in 1985, consists of a 52,800 square feet single story commercial/industrial type metal frame and metal sided garage building with a 12,000 square feet two-story brick and metal exterior office with a mezzanine and

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[59] Waterworks Road – (2) 36" Water Main Relocation project (unknown Project No.). This $2,625,669 water transmission main project was not separately listed in Cause No. 45073. It is believed to be part of the $21,032,206 PER A Project No. 25, High Service Pump Station and Clearwell that was disallowed by the Commission in Cause No. 45073.

[60] Based on an OUCC estimated road construction cost of $1,200 per lineal foot (2021 cost) times 1,400 lineal feet equals $1,680,000.

[61] The cost to relocate the existing 48-inch PCCP pipe is estimated at $500 per LF for 1,250 LF equals $625,000. Total cost to relocate the road and water transmission mains would be $1,680,000 + $2,625,669 + $625,000 equals $5,000,000 (rounded up).

two metal industrial canopies on the east and south building edges.[62] The building floor and canopy floors are concrete. The existing garage is a 36-year-old commercial/industrial type building that is rated by the Assessor to be in average condition. VS Engineering listed operational deficiencies in the *Facility Relocation Feasibility Assessment*.[63] The building sits on approximately 3.5 acres of city owned land just east of Evansville's existing WTP.[64] The parking and equipment / material storage areas are primarily unpaved (gravel). There does not appear to be any storm water detention basin for runoff control. Attachment JTP-12 contains aerial photos of the existing garage site and Attachment JTP-13 contains garage photos taken during the OUCC's July 21, 2021 site visit.

Q: What does Petitioner propose for the new City garage?

A: Petitioner proposes to build a new 85,000 square feet garage / office at an offsite location with paved employee parking separated from equipment storage areas, a storm water detention pond, fencing, and other garage features listed in Attachment ML-5. The Street Maintenance Department requested the new offices be enlarged to 15,000 square feet (25% larger) and the garage be increased in size to 70,000 square feet (34% more space).[65] The new garage would have higher 24 ft. walls to better accommodate large equipment. The new garage area would be over 20% larger than a football field.[66]

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[62] The Property Record Card for the existing Street Maintenance Department garage indicates a 52,800 square feet garage and a 12,000 square feet office area. *See* Attachment JTP-11

[63] Attachment ML-5 *Facility Relocation Feasibility Assessment*, for the Evansville Street Maintenance Department & Evansville Vanderburgh Levee Authority, VS Engineering, Inc., Dec. 15, 2020.

[64] The 3.5 acres is the OUCC's estimate. Petitioner does not indicate the acreage of the City garage site.

[65] The existing garage dimensions are 352 ft. by 160 ft. equals 52,800 square feet. The proposed garage dimensions are 400 feet by 175 feet equals 70,000 square feet.

[66] Football field dimensions are 360 feet by 160 feet.

Q: Has any valuation been made of the existing City garage?

A: Yes. The Vanderburgh County Assessor determined a Replacement Cost New ("RCN") valuation of $3,115,340 for the City garage and a depreciated value of $684,900.[67] The Levee Authority building and the City garage sit on a 13.05-acre parcel valued at $566,400. The City garage parcel that I estimate to be 3.5 acres would have a prorated value of $152,000. The RCN and land value totals $3,267,340. The depreciated value of the garage and 3.5-acre site is $1,251,300.

Q: Why does Petitioner seek to include the entire cost of building a new, larger City Garage as part of the new water treatment plant project?

A: Petitioner's witness Mr. Baldessari asserts the full $13.2 million estimated construction cost of relocating and building a new City Garage is a proper acquisition cost chargeable to the new WTP project.[68] He opined the Street Maintenance Department cannot be forced to transfer the property unless the Water Utility pays for the entire replacement garage. He noted the City could simply use the condemnation process for privately owned property but cannot condemn property already dedicated to public use. He further opined that the Water Utility would have to negotiate for the purchase and that it would be reasonable to expect under such circumstances that the seller (i.e., Evansville's Street Maintenance Department) would require that Evansville's Water Utility provide the funds to acquire a new site and build a new City garage.

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[67] *See* Attachment JTP-11 for the Property Record Card from the Assessor's office

[68] VS Engineering estimated the offsite land purchase and construction cost for the new garage at $13,277,395. This cost does not include the $624,000 estimated cost to demolish the existing City garage. *See* Mr. Labitzke's case-in-chief testimony, Attachment ML-5, page 7 of 34. VS Engineering increased its cost estimate to $13,690,900 (includes the $624,000 City garage demolition cost) in the Preliminary Engineering Report, June 2021. AECOM also reported the $13,690,900 cost to acquire the City garage site and relocate the garage. *See* Mr. Breese's case-in-chief testimony, Attachment SMB-1, page 123 of 276.

Q: Did Petitioner provide any testimony about negotiations it may have held with the Street Maintenance Department?

A: No.

Q: Do you agree with Mr. Baldessari's assertion that the Water Utility must pay the entire cost of a new City garage rather than the appraised Fair Market Value of the existing garage?

A: No. Evansville's proposal to have the Water Utility absorb the replacement costs in their entirety including additional costs for a larger and more costly garage with no Street Maintenance Department funding participation is not reasonable or in the ratepayers' interest. This approach fails to account for the garage's age and condition. Both entities (Water and Street Maintenance) are City departments, but they do not have the same customer base. The Water Utility serves customers outside Evansville's city limits including wholesale customers. Approximately 32% of Petitioner's customers do not live in Evansville city limits.[69] Water Utility funds should not be used to subsidize the Street Department by replacing an aged, average condition garage with a new, improved and larger garage at a higher cost.

Q: What does the term functional replacement mean for property acquisitions?

A: Property acquisitions are based on appraised Fair Market Value. Under property acquisition rules (Federal Highway Administration and INDOT), functional replacement provides additional financial assistance when typical Fair Market Value compensation for acquiring a public facility such as the City garage may be insufficient to restore it to the level needed to provide the same services that were being provided at the acquired site. "Costs of increases in capacity and other

[69] The percentage living outside City limits is based on the reported current population served of 173,000 minus the Evansville population of 118,000 equals 55,000 people outside City boundaries or 32%. *See* Cause No. 45545 Supplemental Workpaper, *Preliminary Engineering Report – Water Treatment Plant*, VS Engineering, June 2021, page 70 of 80.

betterments or enhancements are not eligible for federal or state participation except where necessary to replace the facility's utility, unless required by existing codes, laws or zoning regulations, or related to reasonable prevailing standards for the facility being replaced."[70]

Q: Has Evansville estimated the additional costs for the increase in capacity and other betterments or enhancements the Street Maintenance Department wants for the new City garage?

A: No. Petitioner does not address this issue and did not determine the value of the existing City garage.

Q: What should Petitioner contribute to the new Street Maintenance Department garage?

A: Instead of requiring the water customers to pay the full $13.2 million requested, Petitioner should only contribute the replacement cost of the existing garage along with the value of the land or approximately $3.5 million. I calculated this value based on the Assessor determined $3,115,340 Replacement Cost New ("RCN") for the City garage $154,600 of design fees (5% of the RCN), and the $197,00 land acquisition cost (includes surveying/legal fees) rounded up to $3.5 million.

Q: Do you have other observations about the interaction between Evansville's Street Department and the Water Utility?

A: Yes. Evansville's Water Utility relocates its water mains whenever road projects require it at no expense to the Street Department. In the previous three rate cases, Evansville obtained over $45 million for water main relocation projects as summarized in Table 11. In this Cause, Petitioner is requesting financing authority for another $40 million bringing the water main relocation total to approximately $85 million since 2013.

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[70] Indiana Department of Transportation - Real Estate Division Manual August 2018, Chapter 1, pages 23-26.

Table 11 – Funding for Water Main Relocations Caused by Road Projects

Cause No.	Period	Amount
44137 (2012)	2013-2015	$ 12,000,000
44760 (2016)	2017-2020	$ 12,000,000
45073 (2018)	2019-2021	$ 21,027,800
45545 (2021)	2022-2026	$ 39,806,000
Total		$ 84,833,800

Against this backdrop of water main relocation costs imposed on the Water Utility because of road projects, Petitioner now seeks $13.2 million to fund a new City garage at no expense to the Street Maintenance Department. The OUCC does not object to a new garage but opposes Petitioner's plan to build a larger garage with betterments and to finance it entirely through water rates. Evansville Street Department interactions with the Water Utility must be a two-way street. Therefore, I recommend the Commission only authorize financing of $3.5 million for acquiring the City garage property for the WTP project and relocating the City garage to a new offsite property. All additional costs for increased capacity, betterments, and enhancements to the new City garage should be funded through the Street Department budget and not through water rates.

VII. OTHER ISSUES

Q: Did Petitioner complete all the water main replacement and relocation projects from Cause Nos. 44760 and 45073?

A: No. In Cause No. 45073, the OUCC's testimonial positions were that water main cost estimates were inflated, the replacement schedule was overly ambitious, and the financing amount authority should be reduced. The OUCC did not oppose any water main project. Petitioner rebutted by stating the only thing holding Evansville back in achieving the 1.5% water main replacement rate was funding.

Q: How many miles of water main replacements did Evansville complete annually from 2018 to 2021?

A: In response to discovery, Evansville did not indicate how many miles *were completed*. Instead, Evansville responded "In order to provide a response to this request, EWSU *assumed the list to include encumbered projects that have received a notice to proceed.*[71] (Emphasis by the OUCC). Based on the $93,494,523 amount of funds remaining as of June 1, 2021 from the 2016A, 2018A2, and 2019A Waterworks District Revenue Bonds (total amount of $151,317,000), it is clear that Evansville is behind in its water main replacement program. Some funding from Cause No. 45073 included in the amounts listed above at $5,245,024 was for the eleven treatment plant projects allowed by the Commission that have not been completed and are on hold pending the new plant.[72] Petitioner reported that some electrical work is currently under contract.

Q: What do you recommend regarding Petitioner's completion of its proposed water main projects from prior causes and from this Cause?

A: I recommend that Petitioner file annual reports (with its IURC Annual report) outlining the status of each capital improvement project. Each report should include the estimated cost of each project, the actual costs incurred by calendar year for each project, the actual total cost of each completed project, the projected completion dates for unfinished projects, and the actual completion dates for each finished project. Such a reporting requirement was included for Evansville in

[71] Petitioner responses to DRs 10-1 to 10-6.

[72] Petitioner response to DR 15-6.

Cause No. 43190.[73] I also recommend that Evansville track its water main replacements and fill in those IURC Annual Report sections detailing the work completed annually. Evansville previously provided this information in its annual reports for the city.[74] Documenting Evansville's progress addressing its aging water main infrastructure is valuable information.

VIII. RECOMMENDATIONS

Q: What do you recommend for the capacity for the new surface water treatment plant?

A: I recommend that Evansville size its new plant for 40 MGD instead of the proposed 50 MGD. This recommendation flows from my analysis of likely future water demands and is counter to AECOM's use of overly aggressive growth projections. I also recommend Petitioner conduct another life cycle cost analysis for a properly sized plant able to meet the 28.4 MGD design average day flow and the 40 MGD maximum day design considering all capital and operating costs.

Q: What do you recommend should be authorized for constructing the new City garage?

A: I recommend the Commission authorize approximately $3.5 million for acquisition of the City garage site, relocation of the City garage to a new offsite location instead of Petitioner's requested $13.2 million. In the alternative, I recommend moving the site for the new plant to just south of the proposed City garage site. This will require moving three water transmission mains and

[73] Cause No. 43190, Finding paragraph 11, Final Order, September 26, 2007, pages 11 and 12.

[74] *See* Attachment JTP-14, 1922 Water Department report regarding water mains.

Waterworks Road but the cost for this alternative site will be approximately half of Petitioner's requested $13.2 million.

Q: What do you recommend should be authorized for constructing the new treatment plant?

A: I recommend AECOM's estimated $120,055,000 construction cost for the new plant be reduced by 20% or $24,011,000 to reflect the reduced 40 MGD maximum day capacity. The new plant's total estimated construction cost with $3.5 million for the City garage would decrease from $140,049,000 to $104,885,460. With non-construction costs (7.75%), the total estimated project cost would be approximately $113,015,000 (rounded up).

Q: What do you recommend for finalizing the selection of the new treatment plant?

A: I recommend Petitioner conduct another life cycle cost analysis for a properly sized plant able to meet the 28.4 MGD design average day flow and the 40 MGD maximum day design with adjustments made to the estimated costs to correct the analysis by including demolition costs missing under some alternatives, adding in the additional costs for residuals management under the three surface water options (Alternatives 1, 2A, and 2B), and removal of some clearwell and high service pumps costs missing from the selected Alternative 2B but included in the other three Alternatives (1, 2A, and 3).

Q: What do you recommend regarding reporting by Petitioner about its water main replacement program?

A: I recommend Petitioner annually submit a capital improvements reconciliation along with its Annual report to the IURC, setting forth the projects completed, improvements actually implemented, the feet of water main replaced and the costs thereof. To the extent planned projects, including water main replacement and relocation projects, are completed for less than the estimates included in Petitioner's cases-in-chief under Cause Nos. 44760, 45073, and 45545, Petitioner should use the savings in a prudent manner toward completion of only other needed water main replacement projects identified in Petitioner's prioritized water main replacement program at the discretion of Petitioner.

Q: Does this conclude your testimony?

A: Yes.

Appendix A

Q: Please describe your educational background and experience.

A: In 1980 I graduated from Purdue University, where I received a Bachelor of Science degree in Civil Engineering, specializing in Environmental Engineering. I then worked two years with Peace Corps / Honduras as a municipal engineer on self-help rural water supply and sanitation projects funded by the U.S. Agency for International Development (U.S. AID). In 1984 I earned a Master of Science degree in Civil Engineering (Environmental) from Purdue University. I have been a Registered Professional Engineer in Indiana since 1986. In 1984, I accepted an engineering position with Purdue University, and was assigned to work as a process engineer with the Indianapolis Department of Public Works ("DPW") at the City's Advanced Wastewater Treatment Plants. I left Purdue and subsequently worked for engineering consulting firms, first as a Project Engineer for Process Engineering Group of Indianapolis and then as a Project Manager for the consulting firm HNTB in Indianapolis. In 1999, I returned to DPW as a Project Engineer working on planning projects, permitting, compliance monitoring, wastewater treatment plant upgrades, and combined sewer overflow control projects.

Q: What are the duties and responsibilities of your current position?

A: My duties include evaluating the condition, operation, maintenance, expansion, and replacement of water and wastewater facilities at utilities subject to Indiana Utility Regulatory Commission ("Commission") jurisdiction.

Q: Have you previously testified before the Commission?

A: Yes.

Appendix B - List of Attachments

Attachment JTP-1	Petitioner's responses to Data Requests 3-15 to 3-18 pertaining to annual growth assumptions used to estimate 2050 water demands for each customer class
Attachment JTP-2	Excerpts on demographics, housing, and utilities from the *Evansville-Vanderburgh County Comprehensive Plan, 2015-2035*, Evansville-Vanderburgh County Area Plan Commission, June 27, 2016
Attachment JTP-3	Petitioner's response to Data Requests under Cause Nos. 44760 and 45073 pertaining to the status of the proposed groundwater treatment plant
Attachment JTP-4	Cost estimate classification matrix - AACE International
Attachment JTP-5	Petitioner's responses to DR 17-6 and DR 17-10 regarding cost support for the new treatment plant
Attachment JTP-6	Scope of Services from AECOM's Engineering Services Contract, August 20, 2019
Attachment JTP-7	Comparisons of WTPAFP and PER Cost Estimates
Attachment JTP-8	Indiana Finance Authority Drinking Water State Revolving Fund ("DWSRF") 2022 1st Quarter Project Priority List, July 19, 2021
Attachment JTP-9	Intake cost estimates
Attachment JTP-10	High Service Pump Station #4 cost estimates
Attachment JTP-11	Property Record Card ("PRC") for the Evansville Levee Authority and Evansville Street Maintenance Department garage
Attachment JTP-12	Aerial photos of the existing Evansville Street Maintenance Department garage site.
Attachment JTP-13	Photographs of the Evansville Street Maintenance Department garage taken during the OUCC's July 21, 2021 site visit showing the conditions of the garage facilities.
Attachment JTP-14	Water Department report regarding water mains

Appendix C – Description of the Evansville Water System

Q: What are Petitioner's characteristics?

A: Petitioner currently owns and operates plant and equipment for the production, transmission and delivery of potable water to the public in and around the City of Evansville in Vanderburgh County, Indiana and to three wholesale water customers; Gibson Water, Inc., German Township Water District, and the Town of Elberfeld (two connections). Petitioner's system is connected to but does currently sell water to the Newburgh, IN operations of Indiana-American. Evansville also provides public and private fire protection service and has approximately 6,000 fire hydrants. The municipally owned Evansville Water and Sewer Utility operates as a City Department under the Water and Sewer Utility Board oversight. The five Board members are appointed by the Mayor of Evansville. Evansville provided water service in 2020 to 63,473 customers[75] representing an estimated population of 162,000, including residents in German Township, Gibson County, and the Town of Elberfeld.[76] Evansville's and Vanderburgh County's 2020 population was 117,298 and 180,136 respectively.[77] Evansville's customer base has slowly grown 0.42% annually (4.3% in the last decade), but according to Utility data from its Annual Reports to the IURC, water production and water sold have been relatively flat as summarized in Table 12.

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[75] At the end of 2020, Evansville's customers included 59,605 residential, 3,495 commercial, 129 industrial, 230 public authorities, and three wholesale customer metered accounts. 2020 Annual Report to the IURC, page W-1.

[76] The 2017 population served estimate reported to the Indiana Department of Environmental Management ("IDEM") of 162,000 people includes up to 118,930 people in the City of Evansville (based on population forecasts by the Indiana Business Research Center), 650 people in Elberfeld, Indiana and 42,420 people located outside Evansville's corporate limits.

[77] 2020 US Census.

Table 12 – Customers, Water Pumped from Wells, and Water Sold, 2008 to 2020

	Customers					Water Pumped (MGD)[78]	Water Sold (MGD)	Non-Revenue Water
Year	Resid.	Comm.	Indust.	Other	Total			
2008	58,242		2264	4	60,510	26.1	20.7	5.7
2009	58,469		2249	4	60,722	22.3	18.9	3.4
2010	58,361		2250	4	60,615	22.9	20.3	2.6
2011	58,593		2245	4	60,842	23.7	18.9	4.8
2012	58,880		2260	4	61,144	25.5	20.3	5.2
2013	59,374		2274	4	61,652	21.4	18.3	3.1
2014	58,243	3,021	89	214	61,567	22.3	18.1	4.2
2015	58,160	3,536	102	215	62,013	22.1	18.5	3.6
2016	58,618	3,548	104	221	62,491	23.2	17.7	5.5
2017	58,723	3,548	121	239	62,631	22.2	17.6	4.6
2018	58,959	3,505	132	234	62,830	22.4	17.8	4.7
2019	59,206	3,491	139	234	63,070	20.1	16.9	3.1
2020[79]	59,605	3,495	129	234	63,473	17.0	14.4	2.6
Average 2011 - 2020					62,170	21.99	17.85	4.14

Q: Where does Evansville obtain its water?

A: Evansville's Water Utility has been drawing surface water from the Ohio River at approximate river mile 791.5 just upstream of downtown since the 1870s.

Q: How does Evansville treat its surface water?

A: The raw river water is screened at the Intake Structure to remove large debris by passing through three travelling screens and pumped via six low service pumps to treatment. The plant utilizes poly-aluminum chloride, caustic (sodium hydroxide)

[78] MGD means million gallons per day. MG means million gallons.

[79] In response to 45545 DR 15-11 asking why 2020 Water Sold shown on the Annual Water Sold graph as 6.011 BG/year (Mr. Baldessari's testimony, page 34) does not agree with the 5.255 BG/year of Water Sold reported on Evansville's 2020 IURC Annual report, Petitioner stated: "The information as reported on the 2020 Annual Report does not appear to have been entered correctly. The Petitioner would need to update the figures provided for the 2020 Annual Report."

for pH control, and powder activated carbon (if needed for taste and odor control) for raw water conditioning. Potassium permanganate is added to the raw water for taste and odor control, reduction of nuisance organisms, and minimization of disinfection by-products formation. Petitioner provides conventional treatment with coagulation, flocculation, primary settling, secondary settling and rapid rate gravity filtration on twenty-four (24) dual media filters (sand, and anthracite coal over a gravel base and underdrains).

The filters remove any remaining suspended solids and the filtered or finished water is then stored temporarily in three on-site clear wells (underground reservoirs with 8.5 MG total volume) before being pumped to distribution via seven high service pumps. Treatment produces an excellent finished water with low turbidity levels consistently below 0.1 NTU that averaged 0.03 NTU in 2020 (range of 0.02 to 0.06 NTUs).[80] Evansville does not remove iron or manganese or soften its water since Ohio River water is naturally low in hardness, iron, and manganese. Evansville reports the finished water's average hardness in 2020 was 119 parts per million.[81] The finished water is also fluoridated and disinfected with chlorine gas and ammonia to form chloramines, providing residual disinfection throughout the distribution system.

Q: Please describe Evansville's finished water quality

A: Evansville consistently produces excellent quality water, as documented in its Monthly Reports of Operation for the Water Treatment Plant and its Annual

[80] Nephelometric Turbidity Units – used to express turbidity levels for water cloudiness caused by particles. The EPA's Surface Water Treatment Rule requires utilities using conventional filtration to have turbidity no higher than one NTU. Samples for turbidity must be less than 0.3 NTU in at least 95 percent of samples in any month. Evansville has monitored filtered water turbidities from each of its 24 filters since 2002.
[81] 2020 Consumer Confidence Report.

Consumer Confidence Reports. Moreover, Petitioner's monitoring reports and test results indicate compliance with the Safe Drinking Water Standards.

Q: How does Evansville distribute finished water to customers?

A: From the water filtration plant, finished water flows to three interconnected clearwells with a total volume of 8.5 MG and High Service Pump stations Nos. 2 and 3. The seven High Service Pumps push finished water from the clearwells through several large diameter transmission mains to four pressure zones in the distribution system, six Booster Stations and eight finished water storage tanks including the buried concrete 20 MG Campground Reservoir built in 1927 and the 4 MG Killian steel aboveground reservoir. Elevated water storage (and year installed) includes four 500,000-gallon tanks (Lincoln - 1967, Upper Mt. Vernon - 1971, Grimm Road - 1974, and USI - 2010), one 1 MG tank (New Harmony or Darmstadt - 1974), and one 1.5 MG tank (Volkman -1999). Total storage capacity in the distribution system is 28.5 MG. Combined with the existing clearwells at the treatment plant, finished water storage capacity totals 37 MG.

Q: Please describe Evansville's transmission and distribution mains.

A: Evansville's water transmission and distribution network includes approximately 1,015 miles of water mains ranging in diameter from 1-inch up to 60-inches. Water mains are primarily cast iron (45.3% or 460 miles) according to the 2016 *Water Master Plan.* Evansville uses ductile iron and PVC pipe currently for replacement and new development mains. Evansville reports having primarily copper service lines although it also has 1,300 lead service lines.

OUCC DR 3-15

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Showing calculations and inputs, please explain precisely how Evansville determined each of the growth estimates from page 18 of Attachment SMB-1 on:

a. City population growth rate of 1.5% per year, maintaining the same per capita demand through 2050.
b. Initial wholesale demand of 2.88 MGD with flow increase of 0.75% per year.
c. Initial industrial demand of 3.0 MGD with flow increase of 2.5% per year.
d. Initial commercial demand of 5.0 MGD and a growth rate of 2.0% per year.
e. Initial public authority demand of 1 MGD and growth rate of 0.25% per year.

Information Provided:

Initial demands were established from billing records and as presented in Table 3-5 Attachment SMB-1. The mathematical formula for calculating final values for demand or population through the 30-year period is as follows:

$$(Value_{Future}) = (Value_{Present})(1 + \%_{annual\ growth})^{\#\ of\ years}$$

A further explanation of the reasoning behind the growth values are provided in the response to the next question. However, the noted rates specifically considered the following factors:

a. City Population: Although Evansville has been experiencing decline in population since the 1960s, a goal of any major infrastructure project is to give the ability for the utility to comfortably meet demand while not providing an excessively oversized and expensive system. The 2016 Water Master Plan had assumed a somewhat aggressive growth rate, resulting in an anticipated maximum day water demand of 47 MGD by the year 2035 and proposing a 60 MGD facility (compared to 49 MGD by 2050 in the Advanced Facility Plan). As such, the proposed value being less aggressive provides a good balance of allowing for future growth while not spending excessive capital on the improvements.

b. Wholesale Demand: This is effectively like population growth in the City's service area. However, the wholesale areas have a lower population density and therefore assumed a lower growth rate through the planning period.

c. Industrial Demand: This growth rate was assumed to exceed that used for population and reflects land currently zoned and available for industrial growth in the water service area. Economic and industrial downturn surrounding the 2008 recession resulted in a loss of industry, with the goal now being to encourage development of the available industrial parks within the City.

d. Commercial Demand: This growth is complimented by the assumed industrial growth rate. Both industrial and commercial demand relate to overall economic growth of the area, for which Evansville has experienced an uptick in recent years.

e. Public Authority: Given the size of the City, most of the public authority bodies are well established and water demand and is not expected to experience considerable growth through the planning period. Therefore, this rate was reduced well below the population growth estimate.

OUCC DR 3-16

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Please identify with relevant page numbers and provide any study, report, analysis or other authority used to determine each of the percentages listed in the preceding request?

Information Provided:

Forecasting population, land use, and water demand relies on professional opinions of consultants, developers, and owners / end-users. They are performed for the planning of infrastructure and there is no exact scientific method of determining rates of future growth or decline. Rather, values are established using an agglomeration of available factors including historical population trends, availability of undeveloped land and the designated zoning of said land, and known infrastructure projects which would impact growth or decline (i.e. construction or development of a major transportation corridor or industry). The only two recent and publicly available studies proposing a potential future water demand were the 2016 Water Master Plan and the 2016 Evansville-Vanderburgh County Comprehensive Plan for 2015 through 2035. The master plan identified a 20-year maximum day demand of 47 MGD and proposed plant capacity of 60 MGD without citing any documentation for growth rates. The Comprehensive plan suggested a projected average day demand of 33.8 MGD in 2035 by assuming a net population increase of 7% through the planning period. Historical population trends are another useful tool for projections. However, census data indicates Evansville has experienced an average population decline of 3% per decade since 1960 and continuing such a trend from today's average day demand is not a good long term planning model for a new water treatment plant. Although these two 2016 studies and previous census data could be used as a citation, EWSU worked together with their consultants to establish, review, and vet the appropriateness of the assumed growth rates and demands. The end result is a more comprehensive approach to the projections which do not propose an excessively large facility (high cost and operational challenges) while at the same not taking away capacity that may be needed in the future. As a consulting firm regularly conducting water demand forecasting for utilities throughout the county and world, AECOM stands by its recommendations for the proposed 50 MGD facility.

OUCC DR 3-17

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Showing calculations and inputs, please explain precisely how Evansville determined the initial leaks and losses volume of 3.50 MGD cited on page 18 of Attachment SMB-1.

Information Provided:

The estimate of leaks and losses was effectively established by first subtracting the total volume of water sold to customers from the total water pumped to the distribution system on an annual basis. These numbers are as follows:

Year	Water Supplied	Water Purchased	Net Loss (Year)	Net Loss (Day)
2014	8147 MG	6620 MG	1527 MG	4.18 MGD
2015	8074 MG	6740 MG	1334 MG	3.65 MGD
2016	8261 MG	6410 MG	1851	5.05 MGD

As shown in the table, the annual net losses are more than 3.5 MGD and are in fact quite high compared to most water utilities. However, EWSU has been undertaking extensive capital improvement projects in recent years to replace their aging cast iron waterlines, which are a core cause of water loss, and such improvements are now starting to be realized. It was therefore assumed that leakage would continue to trend downward through the planning period and was why a value of 3.5 MGD of water loss was considered. As a net impact, altering this value by +/- 1 MGD has little or no consequence on the proposed plant capacity.

OUCC DR 3-18

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Please identify with relevant page numbers and provide any study, report, analysis or other authority used to determine initial leaks and losses volume of 3.50 MGD cited on page 18 of Attachment SMB-1.

Information Provided:

EWSU or other authority have not conducted a city-wide assessment to evaluate and publish the rate of leakage or total water loss. The 3.5 MGD value was established as part of our study as noted in the response to Question 3-17 and, in our opinion, is an accurate representation of water losses to consider through the planning period.

EVANSVILLE-VANDERBURGH COUNTY COMPREHENSIVE PLAN

2015-2035

June 27, 2016

2015 EXECUTIVE SUMMARY

Some of the highlights of the Plan include:

POPULATION

According to Census data, the population for both Vanderburgh County and the City of Evansville increased by 14,645 persons from 1990 to 2010. The Plan presents a County population projection of 202,224 people for the year 2035 as the most likely future scenario. This projection represents the high population growth scenario from the 2010 base year (a 12.53% increase) in comparison to the other population projection in the Plan calling for a moderate growth population trend (6.99%).

EMPLOYMENT

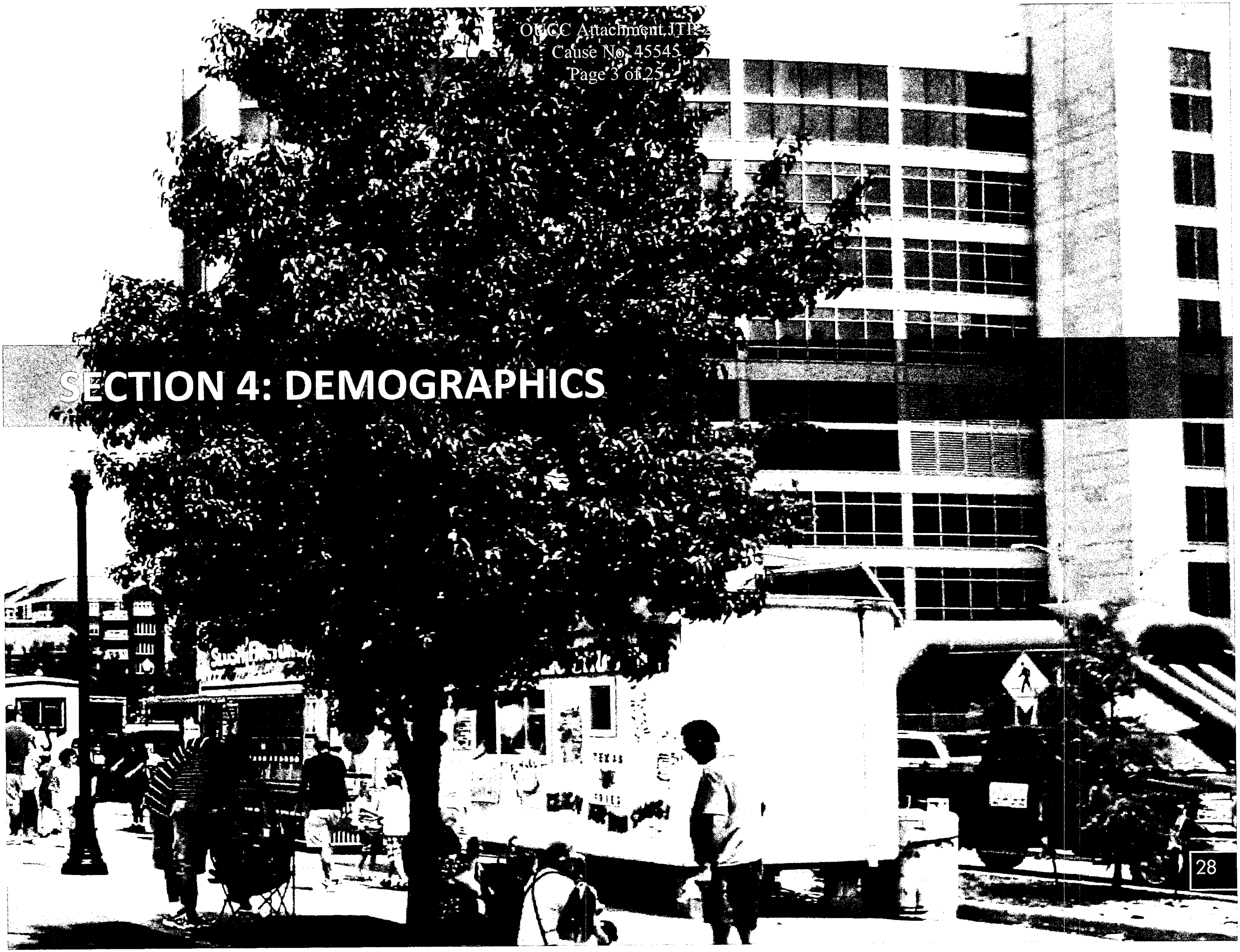
In recent years, County employment has continued to increase. By Year 2035, the County is projected to have approximately 24,699 additional employees which represents a 19.78 percent increase. Considering the major developments under construction or expected for the near future like the projects mentioned earlier, the County employment and economic outlook is bright.

FUTURE HOUSING NEEDS PROJECTIONS

The County is projected to gain approximately 10,898 more housing units by Year 2035 requiring an additional seven square miles of residential land. Due to the aging population, the type of housing in the future is expected to change from single family homes on large lots to a more dense mix of smaller single family, attached and multi-family housing. Of the many areas designated in the Plan for future residential use, the forecast used by the model in allocating new housing units showed that the City's east side is projected to experience the most residential growth, followed by northeastern Vanderburgh County outside the City.

Although these areas are one and two in residential growth, the forecasts in the Plan show a major reversal in the urban core decline trend by predicting Pigeon Township to have the third fastest growth over the next 20 years (2015 permit records show that Pigeon Township was the second fastest City/County residential growth area). It is anticipated that about 2,000 blighted homes mostly in Pigeon Township could be demolished in the next 5 to 10 years creating significant opportunities for redevelopment. The Plan also generally calls for protecting the residential character of neighborhoods from incompatible uses.

SECTION 4: DEMOGRAPHICS



POPULATION

This Section describes the local population using data from the 2010 Census. Knowing the characteristics of our local population is essential in developing a plan that is appropriate for the residents of our community.

EVANSVILLE METROPOLITAN STATISTICAL AREA

This discussion begins at the regional level, with Vanderburgh and the surrounding counties. Our region is known as the Evansville Metropolitan Statistical Area (MSA). The City of Evansville is the central city for our MSA.

> An MSA is defined by the Census Bureau as having at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.

The MSAs were established to provide statistics on geographic areas that include large urban areas and their closely interrelated surrounding counties. A map of the Evansville MSA counties is provided in Figure 11-1 in Section 11. Table 4-1 shows the growth of the counties in the Evansville MSA since 1960. The 2010 regional population was 358,676.

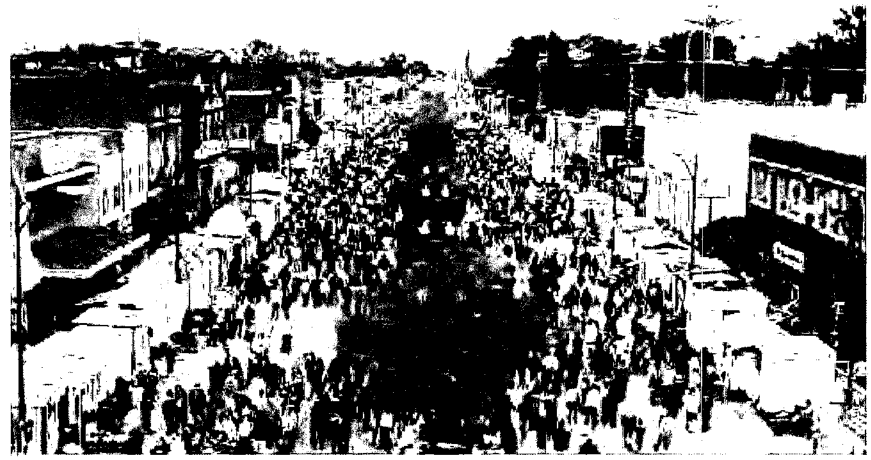


Table 4-1: Evansville Metropolitan Statistical Area (MSA) Counties and their Population: 1960 - 2010

COUNTIES	1960	1970	1980	1990	2000	2010
Gibson, IN	29,949	30,444	**33,156**	31,913	**32,500**	**33,503**
Posey, IN	19,214	21,740	26,414	**25,968**	**27,061**	**25,910**
Vanderburgh, IN	**165,794**	**168,772**	**167,515**	**165,058**	**171,922**	**179,703**
Warrick, IN	23,577	**27,970**	**41,474**	**44,920**	**52,383**	**59,689**
Henderson, KY	33,519	36,031	**40,849**	**43,044**	**44,829**	**46,250**
Webster, KY	14,244	13,282	14,832	13,955	**14,120**	**13,621**
County Total	286,297	298,239	324,240	324,858	342,815	358,676
MSA Total	**199,313**	**232,775**	**309,408**	**278,990**	**342,815**	**358,676**

Notes: BOLD numbers represent those counties that were in the MSA for that decade.
(The Evansville, Indiana-Kentucky MSA was redefined in 2013 to no longer include Gibson County, Indiana and Webster County, Kentucky)
Source: STATS Indiana, Population

VANDERBURGH COUNTY AND CITY OF EVANSVILLE

The 2010 Vanderburgh County population was 179,703 as shown on the next page on Table 4-2. There was very little change in the County population between 1960 and 1990. Between 1990 and 2010, the population grew by 8.9 percent. This is the highest level of growth the County has experienced over the last 50 years.

In regard to the City population, historical data indicates that the City continued to grow until 1960. Interpretation of this data is complicated by past annexations which resulted in added population. Figure 4-1 shows the growth in City land area by annexation from 1819 to the present. Since the City population peak in 1960, Table 4-2 shows consistent population decline to its 2010 total of 117,429. It is evident that Evansville has followed the strong national trend toward decentralization of population from the urban core into outlying areas (also known as out-migration or movement of residents from inside to areas outside the City). From 2000 to 2010, the City population decreased by 3.4 percent.

Population change results from two components: natural increase (births minus deaths) and net migration (people moving into the County minus those moving out). Table 4-3 on the next page reflects the components of population change from 1990 to 2000 and 2000 to 2010. The data shows the impact that the strong birth rate and migration had on the County population. Over the last 20 years, the out-migration trend of the 1980's reversed as the County is now strongly trending to positive net migration. As a result, contributions from both the birth rate and migration have provided a welcome boost to the County population totals over the last two decades.

Figure 4-1: City Growth By Annexation

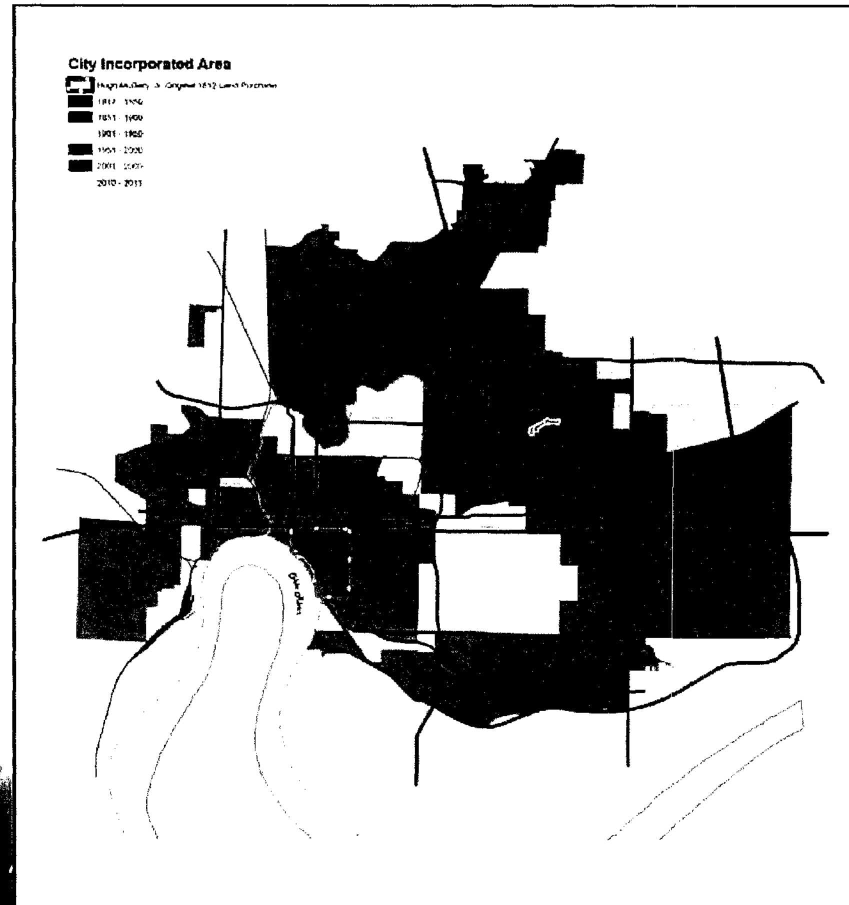


Table 4-2: Change in Population: Vanderburgh County and City of Evansville: 1950-2010

YEAR	COUNTY			CITY		
	POPULATION	AMOUNT OF CHANGE	PERCENT OF CHANGE	POPULATION	AMOUNT OF CHANGE	PERCENT OF CHANGE
2010	179,703	7,781	4.53	117,429	- 4,153	- 3.42
2000	171,922	6,864	4.16	121,582	- 4,690	- 3.71
1990	165,058	-2,457	- 1.47	126,272	- 4,224	- 3.24
1980	167,515	-1,257	- .74	130,496	- 8,268	- 5.96
1970	168,772	2,978	1.80	138,764	- 2,779	- 1.95
1960	165,794	5,372	3.35	141,543	12,907	10.03
1950	160,422			128,636		

Source: STATS Indiana, Population

Table 4-3: Components of Population Change for Vanderburgh County

YEAR	1990 to 2000		YEAR	2000 to 2010	
1990	Population	165,058	2000	Population	171,922
	Births	+ 22,787		Births	+ 28,844
	Deaths	- 17,311		Deaths	- 24,785
	Migration	+ 1,388		Migration	+ 3,772
2000	Population	171,922	2010	Population	179,703
	Net Change	+ 6,864		Net Change	+ 7,781

Source: Birth and death statistics are compiled by the Evansville-Vanderburgh County Health Department

GENERAL POPULATION CHARACTERISTICS

AGE

As shown in Table 4-4, the County population is aging. In the 2010 Census, the median age for Vanderburgh County was 37.5, which was more than 0.5 year older than the median age for the nation and state. Over the past 50 years, the median age has increased by six years, which is consistent with national and state trends. The largest increase in percentage of the overall County population was recorded in the over 65 age group, while declines in percentage occurred in the two youngest age groups shown on the Table. These trends are expected to continue in the future.

Table 4-4: Percentage of Population in Selected Age Groups: 1950-2010

YEAR	PRESCHOOL (0-4)	SCHOOL (5-17)	COLLEGE (18-24)	ADULT (25-64)	AGE 65 & OLDER	MEDIAN AGE
2010	6.47	15.72	11.80	51.60	14.41	37.5
2000	6.22	16.92	11.52	50.02	15.31	36.9
1990	6.93	16.95	10.08	50.32	15.72	34.5
1980	6.88	18.61	13.81	46.97	13.73	31.4
1970	7.48	25.39	10.81	44.75	11.56	30.3
1960	11.08	24.10	7.61	47.12	10.08	31.3
1950	10.81	18.94	10.32	51.86	8.06	30.8

Source: U.S. Census

The aging population trend results from an increase in life span and a decline in birth rate. Continuation of this trend will directly impact the City and County by affecting the types of services and facilities the population will require. Senior housing, parks and recreation, transportation, medical care, and education are only some of the services that will be affected by this age shift.

SEX

The percentage of population that is female (51.8%) is higher than that for males (48.2%). These percentages have changed very little (1%) since the 1950 census. Compared to Indiana and the nation, Vanderburgh County has had a slightly higher percentage of female population since 1950 (1%).

RACE

The U.S. Census divides population into four minority groups, including Blacks, American Indians, Asians, and other races. In the 2010 Census, the minority population in the County was 13.8 percent of the population. This was a 4 percent increase from 2000 toward diversity. Further analysis shows that 14.7 percent of the minority population lives in the unincorporated part of the County, while 85.3 percent live in the City. Historical County data on minority population is shown in Table 4-5.

Table 4-5: Percentage of County Population by Race: 1950-2010

YEAR	WHITE	BLACK	AMERICAN INDIAN	LATINO	ASIAN	OTHER
2010	85.18	9.03	.19	2.15	1.10	2.33
2000	88.68	8.15	.16	.97	.75	1.24
1990	91.25	7.51	.19	.43	.57	.05
1980	91.87	7.15	.15	.44	.36	.02
1970	93.73	6.09	.06	n/a	.05	.06
1960	94.19	5.76	.01	n/a	.02	.01
1950	94.26	5.71	.00	n/a	.01	.00

Source: U.S. Census

DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLDS

The following analysis examines demographic and housing characteristics. Data on these characteristics can shed light on the strategies and programs that are needed to have a viable housing sector in our community. This analysis of county-wide housing statistics was obtained from the 2010 Census, 2006-2010 American Community Survey 5-year estimates and from the 2010-2014 Comprehensive Housing and Community Development Plan prepared by the Department of Metropolitan Development DMD.

HOUSING UNIT TOTALS

The U.S. Census Bureau classifies living quarters as either housing units or group quarters. A housing unit is a house, an apartment, or a mobile home. The housing unit growth in Vanderburgh County and the City of Evansville over time is shown on Table 4-6. In 2010, the County had a total of 83,003 housing units, including those in the City; and Evansville had 57,799 units. This data indicates that the number of housing units has continued to increase significantly in the unincorporated County, while in the City housing units peaked in 1990 and have stayed just below that level since then. Most of the recent growth has occurred in unincorporated Center and Scott Townships. Overall, the rate of growth for housing has been exceeding the growth of the general population. Since 1990, the housing unit total in the County has grown by 14.3 percent, while the County population grew 8.9%.

TYPE OF DWELLING UNIT

There is a variety of dwelling unit types in the County from single-family homes to multi-family rental units. The most prevalent type of dwelling unit found in Vanderburgh County and in the City of Evansville is the single-family house as shown in Table 4-6. In 2010, 71.5 percent of the total units in the County were classified as single family, while the data shows that the City offers somewhat more housing options.

Table 4-6: Housing Units, Percent Single Family, Percent Built before 1939

YEAR	VANDERBURGH COUNTY			EVANSVILLE		
	TOTAL HOUSING UNITS	% SINGLE FAMILY	% BUILT BEFORE 1939	TOTAL HOUSING UNITS	% SINGLE FAMILY	% BUILT BEFORE 1939
2010	83,003	71.50	22.20	57,799	67.80	28.20
2000	76,300	70.66	21.28	57,065	66.84	25.72
1990	72,637	69.31	25.81	58,188	65.14	29.29
1980	67,502	82.77	34.21	54,210	80.88	38.90
1970	58,011	77.14	47.23	49,139	74.32	51.27
1960	55,082	84.28	59.60	47,744	81.94	62.64
1950	49,573	66.95	75.62	40,819	61.40	78.38

Source: U.S. Census

HOUSEHOLD SIZE

The U.S. Census Bureau defines a household as all persons who occupy a housing unit. The changing age structure of the population and housing supply are among many factors that will affect the size and composition of future households. Generally, household size is the lowest in the City center and climbs with distance from the center.

The 2010 household size in Evansville (2.23) and Vanderburgh County (2.31) are both lower than for the nation and state (at 2.52). Table 4-7 illustrates a downward trend for household size in Evansville/Vanderburgh County. This trend is a result of several factors including our aging population, and changes in family structure.

Table 4-7: Occupied Housing Units, Tenure and Persons Per Household

	VANDERBURGH COUNTY				EVANSVILLE			
YEAR	OCCUPIED HOUSING UNITS	PERCENT OWNER OCCUPIED	PERCENT RENTER OCCUPIED	AVERAGE PERSONS/ HOUSEHOLD	OCCUPIED HOUSING UNITS	PERCENT OWNER OCCUPIED	PERCENT RENTER OCCUPIED	AVERAGE PERSONS/ HOUSEHOLD
2010	74,454	64.50	35.50	2.31	50,588	56.00	44.00	2.23
2000	70,623	66.81	33.19	2.33	52,273	59.95	40.05	2.24
1990	66,780	64.82	35.18	2.40	52,948	58.98	41.02	2.30
1980	64,030	65.90	34.10	2.55	51,310	61.98	38.02	2.46
1970	54,771	68.69	31.31	3.00	46,404	65.01	34.99	2.90
1960	50,642	69.17	30.83	3.21	44,042	66.58	33.42	3.14
1950	47,597	58.86	41.14	3.29	39,403	54.69	45.31	3.20

Source: U.S. Census

GROUP QUARTERS

All persons not in households are classified by the Census Bureau as living in group quarters. Out of the 2010 total County population, 4.2% lived in group quarters. Table 4-8 shows the housing types of the group quarters population. Just over half of the non-institutional group quarters population are college students living in university housing managed by the University of Evansville and University of Southern Indiana. Nursing homes and the County Jail are examples of institutional group quarters.

Table 4-8: Vanderburgh Co.: Population by Type of Group Quarters

GROUP QUARTER TYPE	POPULATION	% OF GROUP QUARTER POPULATION
INSTITUTIONALIZED		
Adult Correctional Facility	691	9.2
Nursing Homes	1,497	19.9
Other	218	2.9
Total	2,406	31.9
NONINSTITUTIONALIZED		
University Housing	3,886	51.6
Other	1,239	16.5
Total	5,126	68.1
TOTAL	**7,531**	**100.0**

Source: 2010 Census

HOUSEHOLD INCOME

Household incomes since 1960 for the City and County are displayed in Table 4-9. The City median household income from the 2010 American Community Survey 5-year Estimate was $35,469, and the County estimated income was $42,369. Both of these median household income figures are well below that of the State and Nation. Generally, incomes are the lowest at the City center and climb with distance from the center. The population with income below poverty level in the County was estimated at 28,003 or 15.6% in 2010, an increase from the 11.2% living below poverty in 2000.

Table 4-9: Median Household Income

YEAR	VANDERBURGH COUNTY HOUSEHOLD INCOME	EVANSVILLE HOUSEHOLD INCOME
2010 ACS	$42,369	$35,469
2000	$36,823	$31,963
1990	$25,798	$22,936
1980	$16,070	$14,565
1970	$ 7,697	$ 7,255
1960	$ 5,405	$ 5,299

Source: Decennial Census and 2010 American Community Survey 5-year Estimates

AVERAGE MONTHLY HOUSING COST

The census definition for monthly costs attributed to housing is the sum of rent or mortgages, taxes, insurance, and utilities. The conventional public policy indicator of housing affordability in the United States is the percent of income spent on housing. These expenditures that exceed 30 percent of household income have historically been viewed as the threshold indicating a housing affordability problem, or housing that is burdened by excessive costs. For example, a family earning the median household income in the City having monthly housing costs greater than $887.00 would be considered as burdened.

The percentage of households burdened by housing costs since 1960 for the City and County are shown in Table 4-10. In 2010, 22.7 percent of owner occupied units and 53.1 percent of renter occupied units were burdened in the City, which results in an estimated total of 17,612 City households burdened affecting more than 35,000 household residents. The percentages for the County were slightly lower. The negative impacts of housing cost-burden on households can result in insufficient resources for families to cover other critical needs; the threats of mortgage default; eviction and homelessness; and unhealthy levels of stress.

Table 4-10: Percent of Households Burdened by Housing Costs

YEAR	VANDERBURGH COUNTY		EVANSVILLE	
	OWNER	RENTER	OWNER	RENTER
2010 ACS	20.7	52.8	22.7	53.1
2000	15.0	35.3	16.2	35.2
1990	13.4	37.6	14.5	38.1
1980	14.1	33.3	14.8	34.2

Source: Decennial Census and 2010 American Community Survey 5-year Estimate

DESCRIPTIVE AREAS

In analyzing the 2010 Census data for Vanderburgh County, it is apparent that certain areas have similar demographic characteristics. An effort has been made to identify and map these areas to:

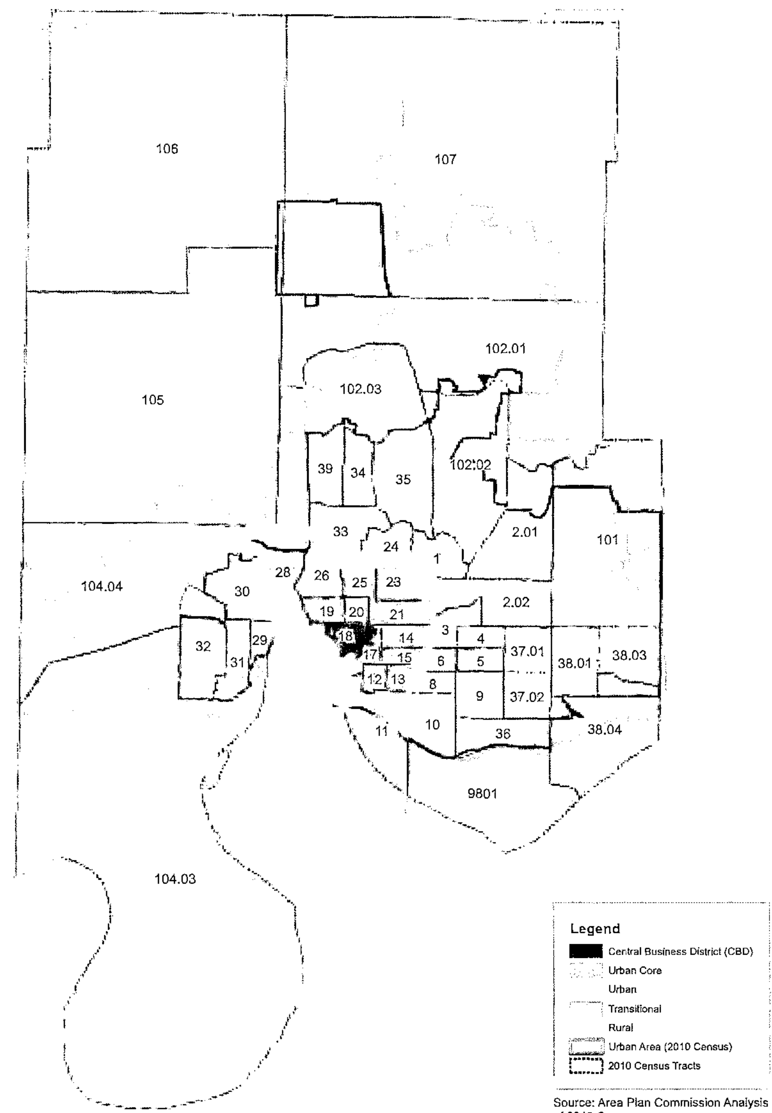
1. Better understand the demographic characteristics, similarities and differences in the Census Tracts that make up the County; and
2. Provide descriptive areas that can be referred to throughout the Plan.

The following variables and what they measure or reflect were used in identifying the descriptive areas:

- Population Density
- Longevity In The Same Residence
- Owner/Renter
- Housing Built Before 1939
- Vacancy

The analysis of Census data for these select demographic variables resulted in the identification of five distinct areas within the County. The five Descriptive Areas illustrated on Figure 4-2, were established using census tract/block group boundaries. The following is a general discussion of each descriptive area.

Figure 4-2: Descriptive Areas



Source: Area Plan Commission Analysis of 2010 Census

CENTRAL BUSINESS DISTRICT

The Central Business District (CBD), the traditional downtown area for the City of Evansville, is Census Tract 18. It is the location where the City of Evansville began in 1819. Today, the Evansville CBD can be characterized as a regional financial center with significant service, entertainment, and government sectors.

URBAN CORE

The Urban Core area can be characterized as having population densities greater than in the City as a whole. Applying other criteria, this portion of the City has a higher percentage of homes built before 1939, a higher renter-occupied housing percentage, and higher vacancy rates than found in the City as a whole. Its boundaries are nearly the same as Pigeon Township. Most of the City's redevelopment efforts focus on this area.

URBAN

The primary criterion used to identify this area was the Census Bureau's Urban Area designation. Other defining characteristics of this area include: lower vacancy rates, more owners than renters, and higher percentage of residents who have lived in the same house when compared to the City as a whole. Although this area is predominantly residential, many of the community's commercial areas are located in this zone. Most of the Urban area within the City has been annexed since 1950, and can be characterized as being suburban style development.

TRANSITIONAL

The main characteristic of this area is that it has a population density between that of the Urban Area (as defined by the Census Bureau) and that of Indiana as a whole. Land uses in the Transitional area are being converted from agricultural or open land to suburban uses, primarily residential subdivisions. This area forms a growth ring around the City. The development of this area increases the urban footprint and extends the infrastructure service area, in lieu of infill or redevelopment closer to or in the City core.

RURAL

The Rural area is identified as having a population density less than the State of Indiana as a whole, and a higher percentage of rural farm households than any other area in the County. The dominant land use in the Rural area is agriculture, along with some scattered woodlands, villages, and single-family homes. Most of the residences in this area use septic systems for sewage disposal since public sewers are not available. Growth in this area potentially presents problems such as traffic and farm versus new subdivision conflicts.

FUTURE DWELLING NEEDS ANALYSIS

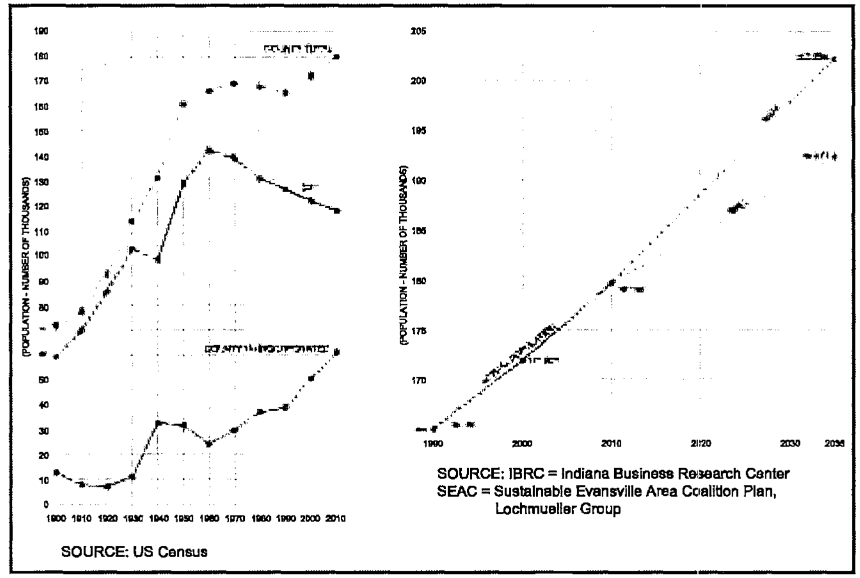
The population size of a city or county gives an indication as to the dimensions of the man-made environment. It supplies a base measurement from which current estimates of needs can be made. When planning for the future, estimates or projections of the population size are essential to quantify the "target" population for the planning process, which helps determine what tomorrow's needs might be.

As shown in the Historical Population graph on Figure 6-5, the population of the County has experienced both growth and decline. In the past 20 years (1990-2010) the County grew by 8.9%. Past trends are one of the factors considered in the methodologies used for calculating the population projections.

It is common practice for comprehensive plans to use a 20-year horizon as the planning period. To be consistent with standard planning practice and our previous comprehensive plans, this Plan projects the population to Year 2035.

There are many methods that can be used in population projections with each producing somewhat different results, and some being better or more scientific than others. For this reason, the two Vanderburgh County population projections presented below for comparison, discussion and analysis are the two most recently published projections for the County. The range of these future population figures provides a moderate and a high projection alternative for the County.

The IBRC, the demographic clearinghouse for the State of Indiana, produced population projections in 2012 for all Counties in Indiana. Their projections are developed using the Cohort Survival Method, which involves the distribution of the population into age cohorts. It forecasts the age groups forward into the future, applying past birth and death rates, and factoring the impact of migration. The results of the IBRC methodology predicts a 2035 population of 192,271 persons.



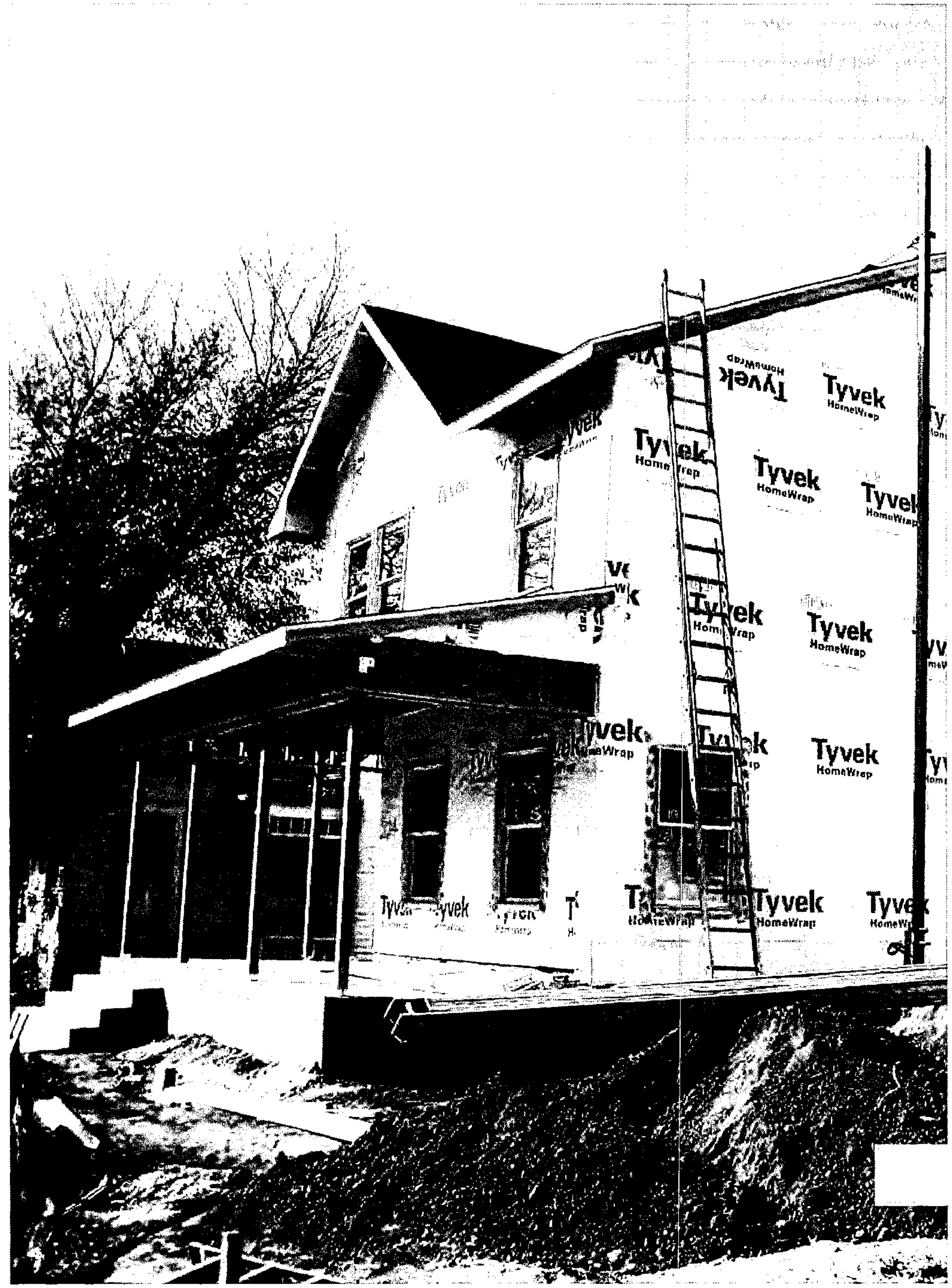
The Sustainable Evansville Area Coalition (SEAC) Regional Plan for Sustainable Development compared the projections from the IBRC, Kentucky State Data Center (KSDC), and Woods & Poole Economics, Inc. Population projections from Woods & Poole are based on trends in economics, population and employment over time. These three data sources were compared to straight-line trends for the three counties included in the SEAC Plan, and a line of best fit was calculated to produce a composite population projection for the entire three county area. A land use model was used to distribute population between all three counties based on higher or lower amounts of infill development. Of these infill scenarios, the one selected as the best fit for the future development pattern in the SEAC Plan resulted in a 2035 County population projection of 202,224 people. Table 6-4 summarizes these County population projections that provide both a moderate and high growth scenario.

IBRC	179,703	192,271	12,568 (6.99%)
SEAC	179,703	202,224	22,521 (12.53%)

Sources: Indiana Business Research Center and the Sustainable Evansville Area Coalition Regional Plan for Sustainable Development

These projections quantify our growth and show a relatively bright outlook for the County population in the future. The SEAC projection would involve significantly higher in-migration than the IBRC projects. Some of the recent and expected positive developments in regard to future population are that:

- Employment and business establishments in the County continue to steadily increase according to the IU Kelley School of Business short-term forecasts of employment and income; and the currently improving national economic trends suggest a strong local economy for the foreseeable future.
- Employment and quality of life factors will continue to attract new residents to Vanderburgh County (in-migration) and also play a role in keeping current residents here. One of the most important findings from the 2010 Census was that the County continued to grow at a steady rate even though in the later years of the last decade the economy was in a significant recession.
- A strong natural population increase is expected to continue to occur in both the County and region.
- Positive impacts are expected from the completion and opening of I-69, the downtown convention hotel, and the IU School of Medicine.

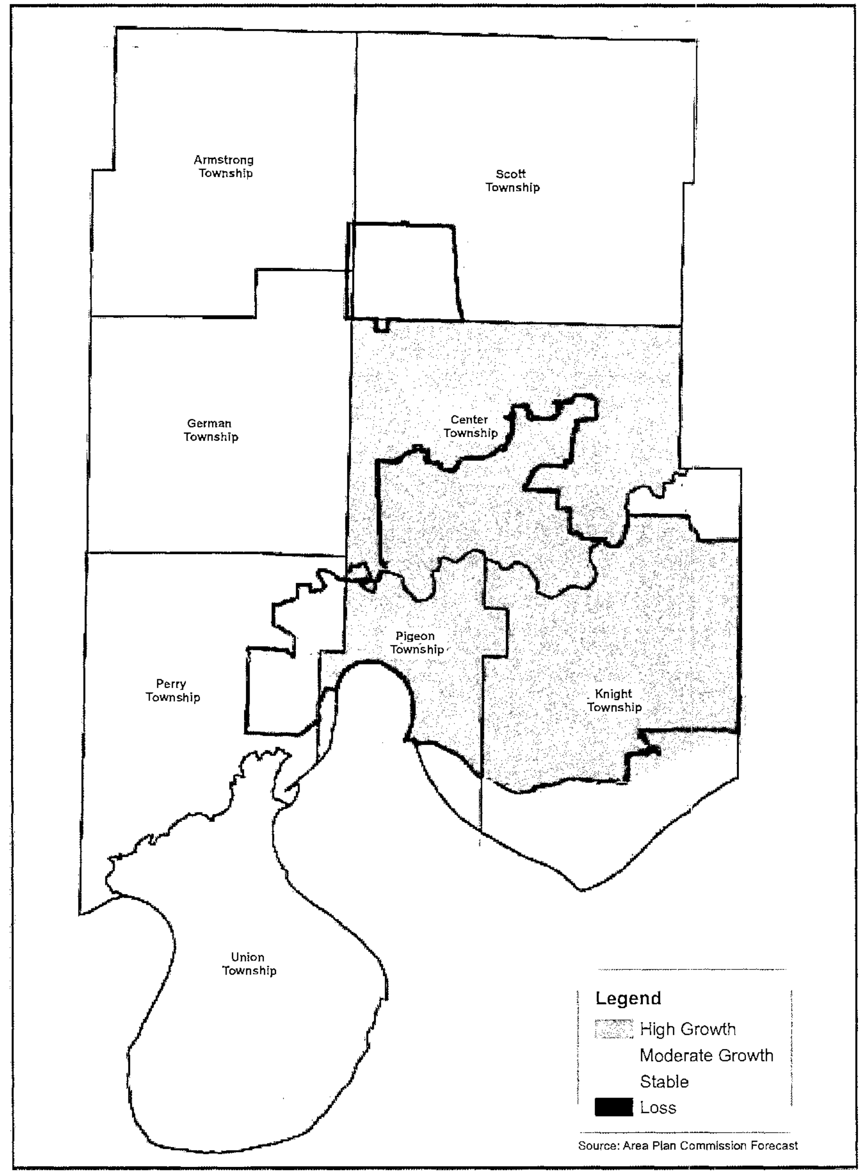


Once all of these steps are complete, CommunityViz allocates households and employment to parcels in the County based on the maximum number of households permitted or the maximum commercial square footage feasible, household and employment projections, and the suitability score of each parcel.

Based on the SEAC Plan 2035 County population total, the land use model calculated estimates for occupied housing units for each township. Table 6-5 shows the projected amount of occupied housing change between 2010 and 2035 by Township. The Table also shows the future population projections for Townships based on the occupied housing projections from the land use model, and an APC analysis assigning population into the projected 2035 housing. The assumptions used in these calculations were based upon recent Census data trends and the following assumptions:

- The percentage of occupied housing to the total number of housing units will stay consistent with the current trend;
- The number of institutional and group quarter residents will remain the same;
- Average household size will continue to decline;
- The estimate of total housing units needed for the 2035 population is for occupied units (projecting volatile vacancy rates is problematic); and
- The density of new single and multi-family housing (measured by average housing units per acre) will increase.

The final results of the modeling process are shown in Table 6-5 and Figure 6-6, which illustrate the projected amount of change in occupied housing units between 2010-2035 by Township. Comparing the historic growth data for residential units on Figure 6-1 with the anticipated growth shown on Figure 6-6, it is evident that growth trends are expected to change somewhat. Knight Township, located mostly within the City but also partially in the unincorporated County, is expected to be the fastest growing area through Year 2035 with a gain of 3,808 households (or almost a 13 percent increase) and an additional 7,133 new residents. Center Township, which has been the leading growth area in the County for many years, is projected to have the second highest gain. The majority of this growth is still projected to be single-family houses, although it is expected to also include a variety of housing types.



For other areas, this forecast shows significant growth projected for the City, while Armstrong, German and Union Townships are to remain stable. In Pigeon Township, the trend of decline is expected to transition to infill growth for the neighborhoods surrounding the downtown. Instead of the decline that has gripped the Urban Core since the late 1950's, Pigeon Township is projected to add almost 2,000 new households representing a 16 percent increase from the 2010 total, and over 4,000 additional residents by Year 2035. This projected change would be both exciting and refreshing news, as past perceptions of the Urban Core would become invalid once major redevelopment and new construction begins to transform the area. The current options for buying new housing are nearly all located in the unincorporated County. However, as redevelopment occurs in the Urban Core, the options for new housing in the City will also increase, expanding the residential market in that area. Revitalizing Pigeon Township is the biggest challenge facing the future of Evansville.

Vanderburgh	179,703	202,224	22,697	12.63%	74,454	85,352	10,898	14.64%
Armstrong TWP	1,599	1,817	218	13.63%	604	695	91	15.07%
Center TWP	39,007	43,842	4,835	12.39%	15,478	17,691	2,213	14.30%
German TWP	7,441	8,145	704	9.46%	2,791	3,096	305	10.93%
Knight TWP	67,945	75,078	7,133	10.50%	30,070	33,878	3,808	12.66%
Perry TWP	25,092	27,777	2,685	10.70%	9,904	11,253	1,349	13.62%
Pigeon TWP	29,797	33,836	4,039	13.55%	12,275	14,262	1,987	16.19%
Scott TWP	8,528	11,437	2,909	34.11%	3,191	4,336	1,145	35.88%
Union TWP	292	292	0	0%	141	141	0	0%

Source: 2010 Census; Housing Projections from Land Use Model and Population Projections from APC Analysis

SECTION 17: PUBLIC UTILITIES

PUBLIC UTILITIES

The public utilities addressed in this section are water, sanitary sewer, storm sewer/ drainage, and solid waste. The other utilities that serve the community such as cable (television and internet), electric, trash collection, natural gas, and telephone (land and cell) are private. The location and availability of water and sewer utilities are essential in order for land development to occur. Therefore, the capacity and extension of public utilities are effective tools to allow for and guide growth.

The Evansville Water & Sewer Utility mission is:

> *To provide the Evansville metro area with high quality, safe, dependable water and sewer service at rates which encourage economic development. The Utility will manage land and water resources to ensure quality for future generations.*

WATER

The Evansville Water Utility has a service area of approximately 100 square miles. Figure 17-1 shows the Evansville Utility Direct Water Service Area. Water is provided to approximately 93 percent of the residents within Vanderburgh County. The population served is approximately 163,000, and the Water Utility has a total of 60,000+ residential and commercial customers. It also has four wholesale customers: the German Township Water District in Vanderburgh County and three others in Gibson and Warrick Counties. The German Township Water District also serves Armstrong Township and some of Posey County.

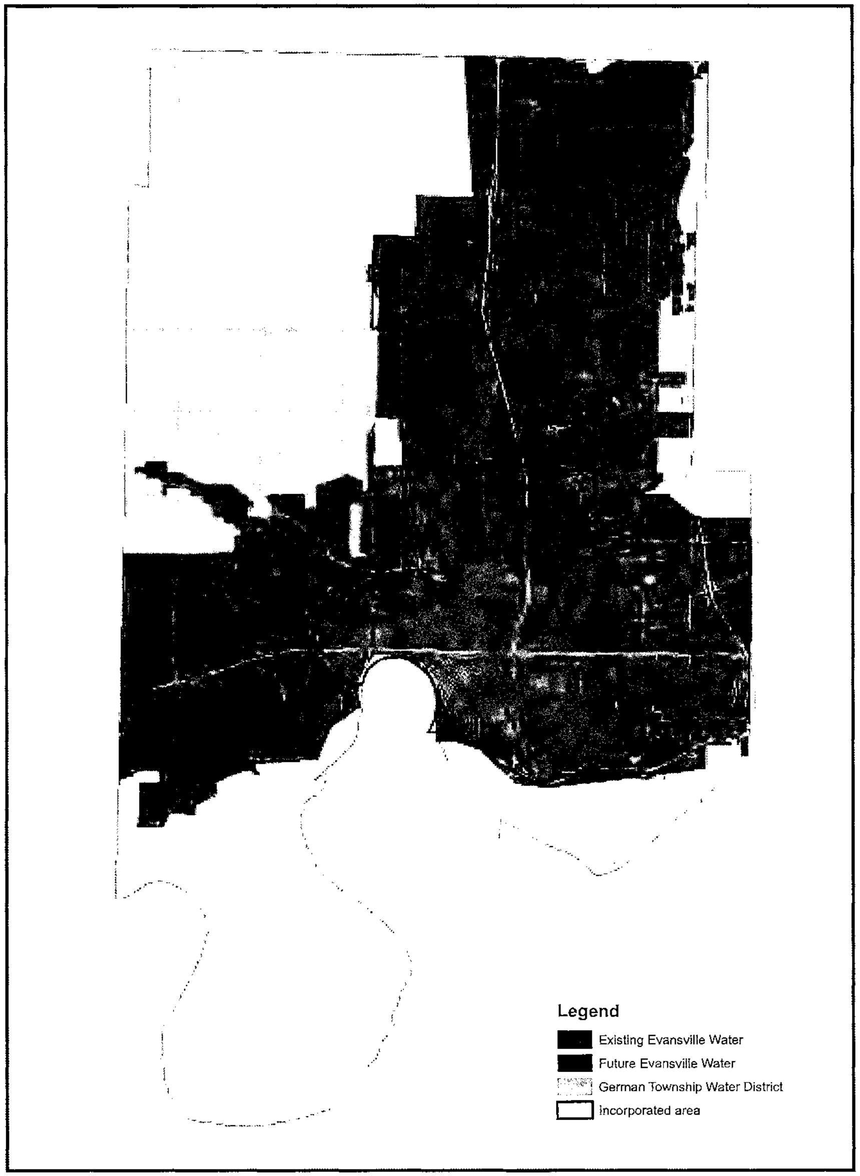
EXISTING FACILITIES

The source of water for the system is the Ohio River. The intake water is treated to potable standards in a treatment plant located just southeast of and upriver from downtown Evansville. The Evansville Water Treatment Plant first supplied treated water to the City in 1912. Since then, the plant has been expanded and modernized several times. The treatment processes must comply with the federal standards and requirements of the Safe Drinking Water Act. This plant has a filtering capacity of 60 million gallons per day (MGD). The average daily amount of water processed and treated is 35 MGD, while the average pumped to customers is 29 MGD. In 2014, it had a one day maximum of 45.4 MGD of water filtered. The plant's seven existing raw water supply pumps have an 80 MGD capacity, greatly exceeding projected needs.

The distribution system includes approximately 1,000 miles of water mains, seven existing pumping stations of varying capacity, and approximately 6,000 fire hydrants. The Evansville water system contains eight water storage facilities ranging in size from 500,000 gallons to 20 MG. The total system storage capacity is 37 MG.

One of the major challenges the Utility faces is its aging infrastructure and equipment. This, in fact, is a national challenge facing most communities across the United States. The Evansville water system was constructed in the early 1900s. Most of the water lines are cast iron, which are at the end of their life and increasingly require maintenance and expensive repairs to stay operational. Line breaks often cause collapse of the street. These necessary repairs continue to increase the Utility operating costs. The state of the system is due to years of under investment and lack of a long term capital plan for system-wide older water line replacement.

Figure 17-1: Water Service Area (approximate)



FUTURE CAPACITY

Table 17-1 illustrates the projected amount of water that will be required on a daily basis to meet future demands on the Evansville water system. The 10-year projection from the 2009 Water Master Plan was based on the areas designated for future growth in the 2004 Evansville-Vanderburgh County Comprehensive Plan. The 2035 projected water demand will need to accommodate the areas planned for development on the Future Land Use Map in Appendix I. The projected rate of population growth of about seven percent through 2035 should be a good indicator of future water needs. The table below shows that the 2035 daily water use is projected to increase by 4 MGD from the 2014 level to a total of 33.8 MGD.

Table 17-1: Projected Average Day User Demand in MGD (Million Gallons per Day)

Existing Filtering Capacity	2014	2018 Projected	2035 Projected*
60	29.7	31.5	33.8

Note: * Projection from Water Master Plan extended at same growth rate to 2035

RECOMMENDED WATER SYSTEM IMPROVEMENTS

The primary responsibility of the Evansville Water Utility is to provide customers with an adequate supply of high quality water at acceptable pressures. In order to evaluate whether the system is accomplishing this responsibility, periodic hydraulic analyses are conducted. These identify deficiencies in the distribution system and facilitate the establishment of an improvement program designed to reinforce the existing system, keep pace with growth, assure high quality water service, and provide a reliable base for commercial and industrial development.

A Capital Improvement Projects (CIP) list was developed to address the improvement needs through Year 2018. The total cost of the capital water projects proposed to 2018 is $90 million dollars. With the current and projected demands, the CIP developed for the water filtration plant and the distribution system will keep the system at least 20 percent ahead of demand through Year 2018. The 2035 projected daily user demand of 33.8 MGD is well below the existing 52.5 MGD filtering capacity at the Water Plant. Therefore, unless water demand is much higher than currently anticipated, there should be adequate excess water capacity in 2035. A new 30-year Water Master Plan will be completed in 2016 which will explore and make recommendations for plant capacity and distribution system improvements.

SEWER

The area where sewer service is currently available includes the City of Evansville and the portions of Vanderburgh County shown on Figure 17-2. This area contains approximately 60 square miles. Buildings in the portions of the County located outside of the existing sewer service area are on individual septic systems. The Town of Darmstadt's pressurized sewer system connects to and discharges sewage through the Evansville wastewater collection and treatment system.

EXISTING TREATMENT FACILITIES

The Water and Sewer Utility owns, operates, and maintains the City sewer system including two wastewater treatment plants (WWTP) referred to as the East and West Plants. Built in 1954 and 1956 respectively, the WWTP's have undergone several improvement and upgrade projects over the years. Table 17-2 describes the two plants' capabilities.

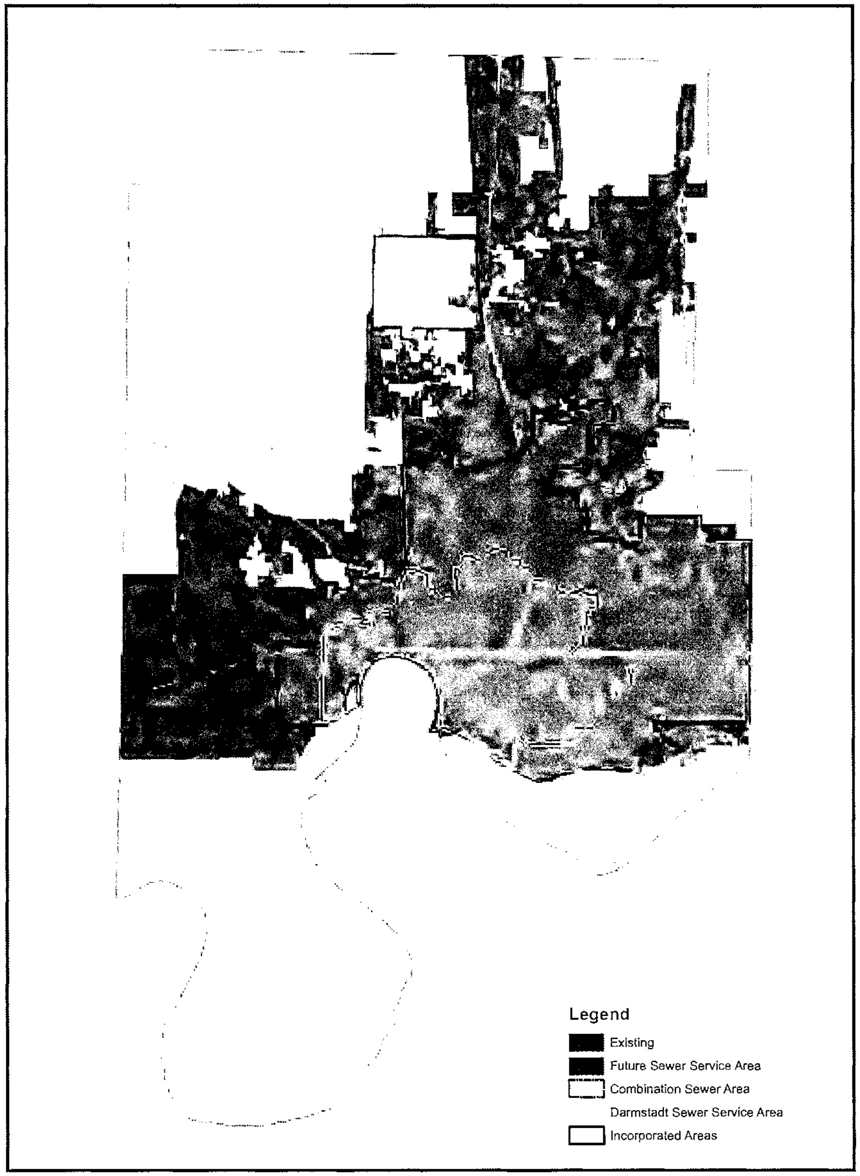
Table 17-2: Treatment Plant Statistics
in MGD (Million Gallons per Day)

Plant	Treatment	Design Capacity	2014 Process Average Flows
East	Secondary	22.5	12
West	Secondary	30.6	12

COLLECTION

The collection system contains approximately 890 miles of sewer collector lines and 93 lift stations. Some of these collectors carry separated wastewater and some carry combined wastewater and storm water. The construction of separate systems has been required for all new development since the mid 1970's.

Figure 17-2: Sewer Service Area (approximate)



COMBINED SEWERS

The first wastewater collectors to be installed were the combination storm water and sanitary sewers. These combined sewers were made of brick and many of them were built over 100 years ago. There are over 500 miles of combination sewer lines in the system. The majority of the older areas of the City (south of Pigeon Creek, roughly west of Vann Avenue and east of Tekoppel Avenue) are served by the combined collectors. This area is shown in the Sewer Service Area Map in Figure 17-2.

During heavy rainfall, Evansville residents are all too familiar with the problems associated with the combined system. These problems include local street flooding, reduced capacity and efficiency of the treatment plant operations caused by treating storm water, sewers backing up into basements, and direct sewage overflow discharge. When the amount of storm water in the system exceeds plant capacity, the overflow gates open to allow the contents of the combined sewers to discharge directly into the Ohio River and Pigeon Creek. These gates and discharges are known as combination sewer overflows (CSOs). There are a total of 22 permitted CSO outfalls in the collection system -- nine discharge into the Ohio River, nine into Pigeon Creek and four into Bee Slough. To provide a quantitative figure on the magnitude of this problem, the Utility estimates that 2 billion gallons of sewer overflow are discharged on an average annual basis.

The City has made progress over the years to separate the sewer systems. In conjunction with major road widening projects, the City has separated the storm and sanitary sewers along corridors such as St. Joseph Avenue, Weinbach Avenue, Fulton Avenue, Diamond Avenue, and Vann Avenue. Areas that will benefit from future separation projects include both sides of Diamond Avenue, the State Hospital, and around Akin Park.

More than a thousand cities throughout the United States have or have had combined systems similar to Evansville's. To meet U.S. Clean Water Act standards, these cities must eventually eliminate combination sewers, and many of them are currently going through the process of making system changes to comply with this mandate. The list includes cities in Indiana such as Indianapolis, Fort Wayne and South Bend.

To this end, the City of Evansville Water and Sewer Utility entered into a Consent Decree with the federal government and the State of Indiana in February, 2011 on a plan to address the combination sewer overflow volumes through remedial actions. Consent Decree modifications were agreed to by the parties in February, 2016 in final negotiations that resulted in additional projects being included in the CSO plan at an estimated total cost of $729 million to be phased in over the next 24.5 years. The effort to comply with the Consent Decree and the specific mandates of the agreement with state and federal regulators is known as "Renew Evansville". In accordance with the agreement, the Utility developed an integrated set of specific planning documents creating:

- An overall capital improvements plan for the Combined Sewer and Sanitary Sewer Systems, referred to as an Integrated Overflow Control Plan (IOCP), which proposes to remedy the capacity, operation and maintenance deficiencies in the Sewer Systems and the East and West Treatment Plants. The IOCP contains two distinct parts: the Sanitary Sewer Remedial Measures Plan (SSRMP); and the Long Term Control Plan (LTCP).
  - The SSRMP is a prioritized set of projects focused on identifying and addressing any recurring capacity-related sanitary sewer overflows, system defects, and deficiencies that could potentially cause or contribute to overflows; and
  - The new LTCP identifies strategies to reduce the frequency and duration of overflows from the combined sewer system.

Major IOCP Projects and Consolidated Cost Estimates (in millions)

• Work at CSO Locations	$284.06
• Treatment Plant Improvements	$107.00
• Seventh Avenue Lift Station	$110.79
• Wetland at Bee Slough	$151.20
• Downtown Green Infrastructure	$ 18.03
• Sanitary Sewer Upgrades	$ 53.56

Under the new modified terms of the Consent Decree, 98 percent of the sewage overflow that currently goes into the Ohio River will be captured, allowing Evansville to comply with the Clean Water Act. Additionally, EWSU will create one of the largest wetland treatment systems in the U.S., replacing Bee Slough with a sustainable, green infrastructure solution. Other upgrades include the addition of several storage facilities, improvements to the wastewater treatment facilities, and the separation of combined storm water and sanitary sewers.

The City will use a combination of options to eliminate sanitary sewer and combination sewer overflows by: continuing to separate storm sewers from the combined sewers; reducing the amount of storm water entering the system; increasing storage prior to treatment; increasing treatment plant capacity; and adding satellite treatment. As part of the last option mentioned, the Utility's strategy will also involve a Green Infrastructure (GI) component. The GI initiative will include ways to eliminate storm water from entering the combined sewers by increasing infiltration (green areas allowing percolation of water into the soil), interception/ absorption by new trees and other plantings; and storm water reuse. Implementation of the GI initiative will likely involve policy and ordinance changes.

Given the importance of the Consent Decree, complying will be a major emphasis of the Water and Sewer Department for the foreseeable future. The City's goal is to accomplish compliance in a manner that minimizes sewer rate increases needed to fund system improvements. Achieving this goal, however, will be complicated by the fact that Renew Evansville will be the most extensive and costly capital improvements initiative ever undertaken by the City.

RECOMMENDED WASTEWATER IMPROVEMENTS

A system-wide wastewater plan was prepared for the City in 2009 by a consultant. This Plan addressed existing deficiencies and future needs by identifying a list of recommended long-range capital improvement projects to be implemented. This plan will expire in 2018 and a new master plan effort is underway to run parallel with the Consent Decree. A new 30-year Wastewater Master Plan will be completed in 2016 which will explore and make recommendations for non-Consent Decree projects including lift station rehabilitation, waste treatment plant modification for pending additional regulations, collection system rehabilitation, and collection system expansion for projected growth.

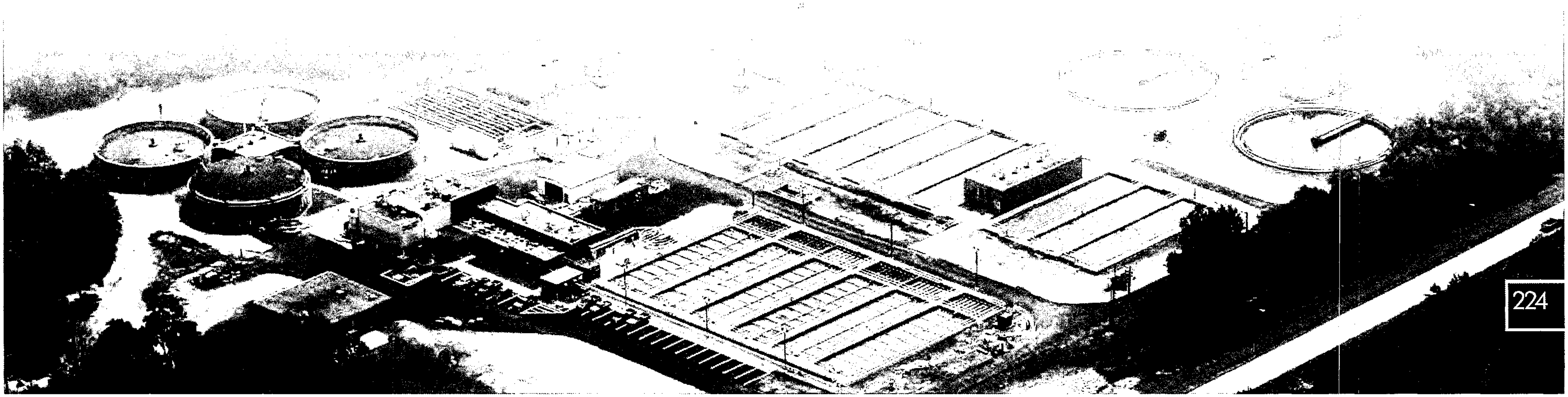
There are several projects related to CSOs currently underway or in the planning stage involving the addition of green infrastructure, underground storage and infiltration of storm water, inflow and infiltration reduction projects in the sanitary sewer system, large interceptor cleaning, and the addition of inlets in Bee Slough. Aside from these current projects, the final approved IOCP, along with the non-IOCP project list, will contain a well defined project list of improvements for the City to work from. Implementation of these improvements by the City will fulfill the federal mandate.

Extensions of the existing sewer service area are expected to occur in the future to serve new development. Figure 17-2 shows the recommended 2035 future service area. This area is based upon past growth patterns, the results of the land use model and the Area Plan Commission 2035 growth projections.

The areas recommended for sewer service extension are:

- The remaining un-served pockets in the City;
- The remaining un-served portions of unincorporated Center Township;
- The areas around the Boonville-New Harmony/I-69 and S.R. 57/I-69 interchanges due to growth expected from the I-69 project; and
- Western unincorporated Perry Township including the area around the University Parkway south of Upper Mt. Vernon Road.

Sanitary sewer improvements must be in place for extensive development to occur. Proper utility planning is needed to guide utility extensions to serve these growth areas.



WATER AND SEWER UTILITY ACTION PLAN

Source: Water and Sewer Utility, community input and Area Plan Commission

GOAL

- Provide the Evansville metro area with high quality, safe, dependable water and sewer service at rates which encourage economic development. The Utility will manage land and water resources to ensure quality for future generations.

OBJECTIVES

- To improve treatment plant facilities and processing to meet the needs of the community while simultaneously achieving compliance with Federal and State regulations, particularly Clean Water and Safe Drinking Water Act Amendments.
- To keep a 20 percent capacity surplus so that the system can stay ahead of the demand for new water and sewer service.
- To increase the system's reliability and maintain minimum residual pressure of 20 pounds per square inch under maximum hour demand conditions.

POLICIES

- A financing mechanism should be developed for extending and connecting service to all unserved structures within the water and sanitary sewer service areas.
- Implement the recommendations of the Water and Sewer Master Plan.
- All costs associated with extending and/or accessing the water and sanitary sewer network for new service to a development are the responsibility of the developer.
- After inspection and acceptance, the Utility shall assume ownership and maintenance of all water and wastewater facilities installed in the service area.
- Unaccepted facilities not meeting adopted standards shall be privately maintained and their expansion shall be prohibited until standards can be met.
- Ensure that the water and sewer system improvements necessary to accommodate new development are in place when needed to mitigate development impacts.

OBJECTIVE

- Phase out the flow of storm water through the combined sewer system to reduce the clear water volume reaching the treatment plants.

POLICIES

- Give priority to the use of green infrastructure concepts and other cost effective alternatives to meet the requirements of the Consent Decree in a manner that minimizes structural improvements and substantial sewer fee increases.
- To help lessen the quantity of storm water entering the system, encourage land owners/developers to add green space and plantings including trees that intercept and absorb water, and allow for infiltration of runoff into the ground.

OUCC DR 1-005

DATA INFORMATION REQUEST 04/02/2016
City of Evansville, Indiana

Cause No. 44760

Information Requested:

Petitioner's proposed capital improvement plan includes $10.0 million for Preliminary Engineering for Treatment Plant. What is the basis for the $10.0 million estimate? Please provide a copy of any documents prepared by or for Petitioner to support it proposed estimate. Please provide a copy of any bids Petitioner has received to support its proposed estimate.

Information Provided:

The basis for the $10.0 million estimate is the December 2014 document prepared by HNTB Corporation titled *New Groundwater Treatment Plant Feasibility Study* and that document is attached. Specifically, see Table 5.1 on page 32 of that document. The $10 million estimate represents the design portion (typically referred to as preliminary engineering) of the $15.8 million figure and it does not include the construction engineering (layout) and resident representative (inspection) services which would not occur until the eventual construction of any project. Professional services for preliminary engineering have not yet been solicited and will be dependent on the availability of funding.

Attachment:

Attachment to OUCC DR 1-5.pdf

New Groundwater Treatment Plant Feasibility Study, HNTB, December 2014

OUCC DR 2-001

04/13/2016

DATA INFORMATION REQUEST
City of Evansville, Indiana

Cause No. 44760

Information Requested:

On page 6 of Exhibit DLB-1, Umbaugh Accounting Report, Petitioner provides a Schedule of Estimated Project Costs and Funding. Petitioner estimates it will incur $10,650,000 for Engineering and property acquisition (NWTP and Raw Water Line) costs. That total cost is broken down on Petitioner's Exhibit No. 2, Attachment PRK-8, page 1 of 2. Please answer the following related questions:

a. Please explain how Petitioner estimated the $10 million cost for "Preliminary Engineering for the Treatment Plant". If Petitioner has retained an engineering firm to complete the Preliminary Engineering for the Treatment Plant, please provide a copy of the letter of engagement or contract for services. Please provide any documentation that supports the $10 million estimated cost.

b. Please explain how Petitioner estimated the $650,000 cost for "Raw Water Main and Treatment Plant Property Acquisition". Please provide any documentation that supports the $650,000 estimated cost.

Information Provided:

a. The industry-standard method for estimating the cost of engineering services is to base the cost of those services on the estimated construction costs, with preliminary design engineering services typically ranging from 8% to 15% of the estimated construction costs. In this instance, the estimated construction costs of the new treatment plant are $79.0 million, as detailed in Table 5.1 on page 32 of the December 2014 document titled *New Groundwater Treatment Plant Feasibility Study*. That document is attached and was previously provided as OUCC DR 1.5 in response to the OUCC Data Request 1. Please note, that the estimated costs of construction, engineering and resident representative services have been deducted from the $15.8 million figure detailed in Table 5.1, as those services would not be incurred until the commencement of actual construction. After deducting these costs, the remaining $10.0 million represents the design portion estimate, which is 12.7% of the estimated construction cost of $79.0 million. An engineering firm has not been retained for preliminary engineering, as performance of these services would be contingent on the availability of funding.

b. The basis for the estimated $650,000 cost of the "Raw Water Main and Treatment Plant Property Acquisition" is the above referenced and attached *New Groundwater Treatment Plant Feasibility Study.* The cost is detailed on pages 30 and 31 of that document and is summarized as follows:

$260,000 -	Well field evaluation
$300,000 -	Property acquisition cost for wells
$ 60,000 -	Permanent easement cost for raw water main
<u>$ 30,000</u> -	Contingency
$650,000 -	**Total**

<u>Attachment</u>:

Attachment to OUCC DR 2-1.pdf

New Groundwater Treatment Plant Feasibility Study, HNTB, December 2014

EVANSVILLE, INDIANA
EVANSVILLE WATER AND SEWER UTILITY

Evansville
WATER AND SEWER UTILITY

NEW GROUNDWATER TREATMENT PLANT FEASIBILITY STUDY

December 2014

HNTB

EVANSVILLE, INDIANA
EVANSVILLE WATER AND SEWER UTILITY

NEW GROUNDWATER TREATMENT PLANT FEASIBILITY STUDY

December 2014

Prepared by:

The HNTB Companies
Infrastructure Solutions

HNTB CORPORATION
111 MONUMENT CIRCLE, SUITE 1200
INDIANAPOLIS, INDIANA 46204
(317) 636-4682

HNTB Job No. 61237

TABLE OF CONTENTS

PAGE NO.

LIST OF EXHIBITS

LIST OF WATER WELL RECORDS

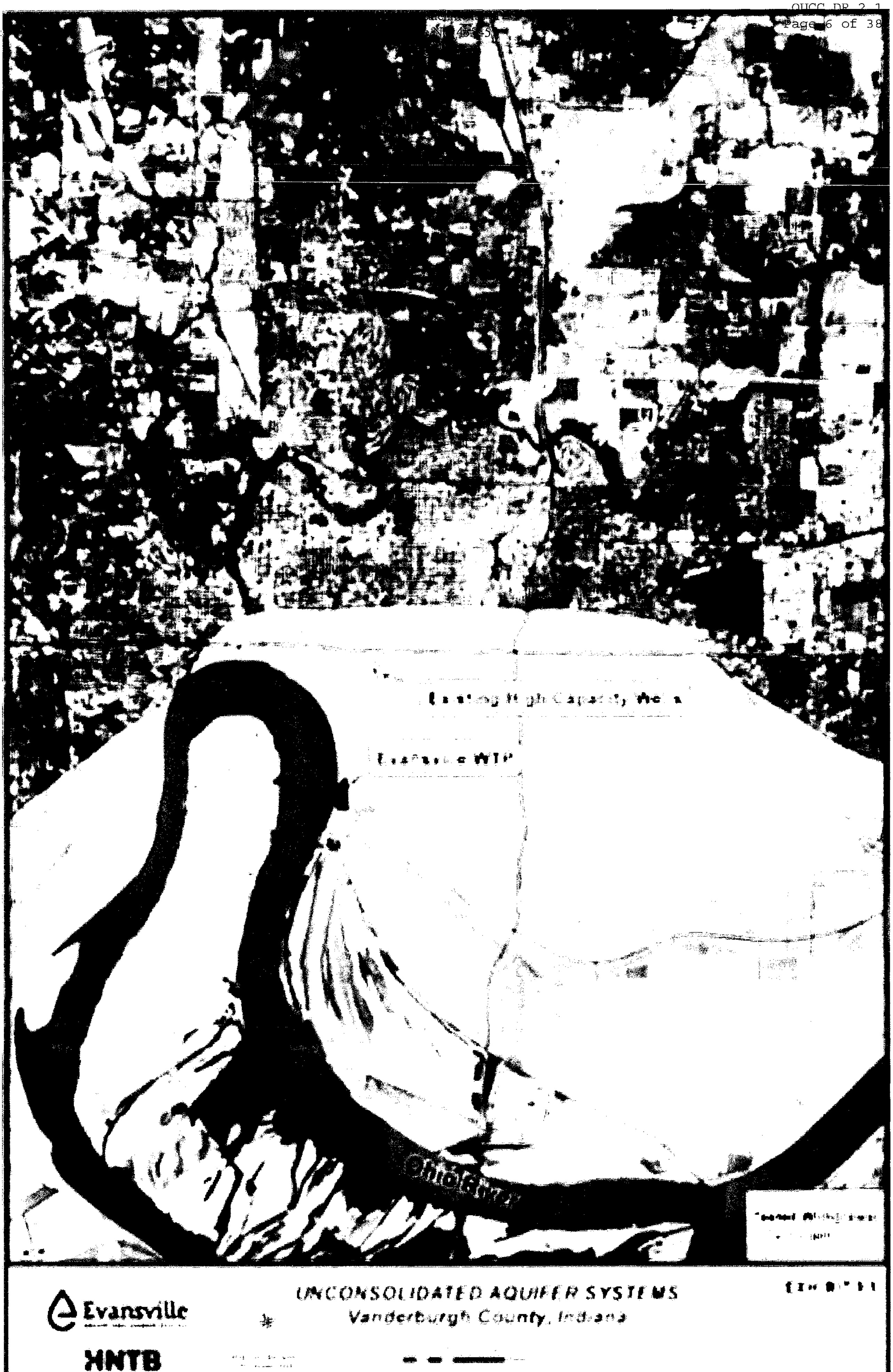
LIST OF TABLES

1.1 GROUNDWATER AVAILABILITY

Available information from the Indiana Department of Natural Resources (DNR), Division of Water was reviewed to develop **Exhibit 1-1**. **Exhibit 1-1** includes the general areas in Evansville where a high-capacity groundwater well could produce in excess of 2,000 gallons per minute (gpm). Also included on **Exhibit 1-1** are registered high-capacity wells defined by the DNR as wells that produce over 100,000 gallons of groundwater per day.

Exhibit 1-2 is a similar map including floodplain, floodway and wetlands information. To construct wells in the floodway or floodplain, the well casing must be sealed to a minimum of three (3) feet above the 100-year flood elevation. This means the wells will be elevated with platforms, and at certain times access to the wells will only be available by boat. An additional permit will also be required to construct wells in the floodway.

As a further confirmation of aquifer characteristics, well records were researched with locations shown on **Exhibit 1-3**. Following **Exhibit 1-3** are the individual records by reference number. Of the included records, 338815, 338804 and 224459 were drilled to the full depth of the unconsolidated aquifer as indicated by the presence of sandstone or shale. The depth of the aquifer for these locations range from 120 feet below grade to 136 feet below grade. This available depth, along with the medium to large gravel near the bottom of the aquifer, provide confirmation that a large quantity of groundwater is available.


Ohio River
Evansville
HNTB
UNCONSOLIDATED AQUIFER SYSTEMS
Vanderburgh County, Indiana

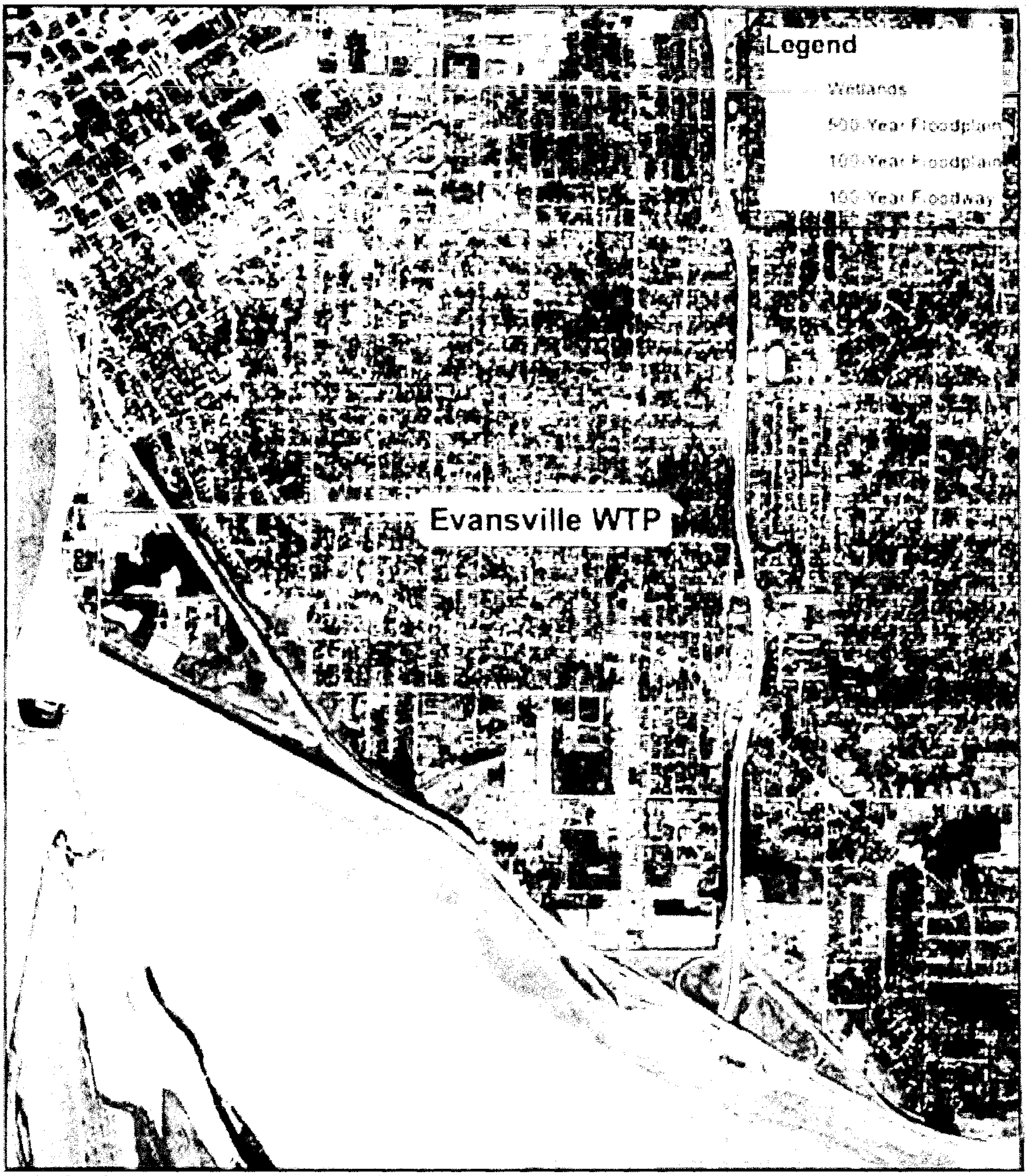


EXHIBIT 1-2

Wetlands and Floodplain Mapping

Evansville
WATER AND SEWER UTILITY

HNTB

N
W E
S

Date Last Revised:
December 2014

0 1,000 2,000 4,000 Feet


EXHIBIT 1-3
Evansville
WATER AND SEWER UTILITY
HNTB
N
W
E
S
Date Last Revised:
November 2014
Record of Water Wells
0 1,000 2,000 4,000 Feet

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**	**Date completed**
338815	EAST SEWER PLANT	Oct 29, 1991

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	I.G.S.		
Driller	HARDESTY DRLG & TESTING CO	RR 2 BOX 651 LINTON IN	(812) 847-2296
Operator	DALE D HARDESTY	License: 867	

Construction Details

Well	**Use:** Test **Depth:** 118.3	**Drilling method:** Rotary **Pump setting depth:**	**Pump type:** **Water quality:**
Casing	**Length:** 110.5	**Material:** PVC	**Diameter:** 2.0
Screen	**Length:** 2.0	**Material:** WELL SCREEN	**Diameter:** 2.0 **Slot size:** .040

Well Capacity Test	**Type of test:** **Drawdown:** ft.	**Test rate:** gpm for hrs. **Static water level:** ft.	**BailTest rate:** gpm for hrs. **Bailer Drawdown** ft.

Grouting Information	**Material:** **Installation Method:**	**Depth:** from to **Number of bags used:**
Well Abandonment	**Sealing material:** **Installation Method:**	**Depth:** from to **Number of bags used:**

Administrative

County: VANDERBURGH
Township: 6S **Range:** 10W
Topo map: EVANSVILLE SOUTH,IN-KY
Section: SE of the NW of Section 31
Grant Number:
Field located by: **on:**
Courthouse location by: **on:**
Location accepted w/o verification by: **on:**
Subdivision name: **Lot number:**
Ft W of EL: **Ft N of SL:** **Ft E of WL:** **Ft S of NL:**
Ground elevation: **Depth to bedrock:** **Bedrock elevation:** **Aquifer elevation:**
UTM Easting: **UTM Northing:**

Well Log

Top	Bottom	Formation
0.0	5.0	SURFACE FILL
5.0	6.0	CLAY & FILL MED BROWN W/FILL
6.0	10.0	CLAY-GRAY
10.0	15.0	CLAY-BROWN/GRAY MXD,SILTY,SAND
15.0	25.0	CLAY-BROWN, SILTY/SLIGHT GRIT
25.0	35.0	SNAD-BROWN/GRAY MXD-MED TO CRS
35.0	45.0	SAND-BROWN MED TO FINE GRAIN
45.0	61.0	SAND-BROWN FINE GRAIN TO SILTY

61.0	88.0	S&G SMOOTH SURFACE GRAVEL SLIG
88.0	106.1	GRAVEL 1/2" DOWN TO 1/4" SIZE
106.1	118.3	SANDSTONE LT GRAY W/SHALE BNDS
118.3		TD

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number
240197

Driving directions to well
WELL IN ? OF INLAND MARINA, DEPENDS ON RIVER WHETHER OR NOT IT IS IN KY OR IND

Date completed

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	INLAND MARINA	HENDERSON KY	
Driller	I L LITTLE	EVANSVILLE IND	
Operator	I L	License: null	

Construction Details

Well	**Use:** Industry	**Drilling method:** Cable Tool	**Pump type:**
	Depth: 81.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 7.0	**Material:**	**Diameter:** 6.63
Screen	**Length:** 10.0	**Material:**	**Diameter:** 4.0 **Slot size:** .020

Well Capacity Test	**Type of test:**	**Test rate:** gpm for hrs.	**BailTest rate:** 60.0 gpm for 1.0 hrs.
	Drawdown: ft.	**Static water level:** 20.0 ft.	**Bailer Drawdown** 5.0 ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**
Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: VANDERBURGH		**Township:** 7S **Range:** 10W	
Section: of Section 6		**Topo map:** EVANSVILLE SOUTH,IN-KY	
Grant Number:			
Field located by:		**on:**	
Courthouse location by:		**on:**	
Location accepted w/o verification by:		**on:**	
Subdivision name:		**Lot number:**	
Ft W of EL:	**Ft N of SL:**	**Ft E of WL:**	**Ft S of NL:**
Ground elevation:	**Depth to bedrock:**	**Bedrock elevation:**	**Aquifer elevation:**
UTM Easting:		**UTM Northing:**	

Well Log

Top	Bottom	Formation
0.0	8.0	CLAY
8.0	60.0	SAND, RIVER
60.0	85.0	SAND AND SM GRAV MIXED

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number 338804
Driving directions to well LANDFILL HWY 41
Date completed Oct 31, 1991

Owner-Contractor	Name	Address	Telephone
Owner	IGS		
Driller	HARDESTY DRLG & TESTING CO	RR 2 BOX 651 LINTON IN	(812) 847-2296
Operator	DALE D HARDESTY	License: 867	

Construction Details

Well	**Use:**	**Drilling method:** Rotary	**Pump type:**
	Depth: 146.5	**Pump setting depth:**	**Water quality:** UNKNOWN
Casing	**Length:** 134.5	**Material:** PVC	**Diameter:** 2.0
Screen	**Length:** 2.0	**Material:** WELL SCREEN	**Diameter:** 2.0 **Slot size:** .010

Well Capacity Test
Type of test: **Test rate:** gpm for hrs. **BailTest rate:** gpm for hrs.
Drawdown: ft. **Static water level:** ft. **Bailer Drawdown** ft.

Grouting Information
Material: **Depth:** from to
Installation Method: **Number of bags used:**

Well Abandonment
Sealing material: **Depth:** from to
Installation Method: **Number of bags used:**

Administrative
County: VANDERBURGH **Township:** 7S **Range:** 10W
Section: SE of the NW of Section 4 **Topo map:** EVANSVILLE NORTH
Grant Number:
Field located by: **on:**
Courthouse location by: **on:**
Location accepted w/o verification by: **on:**
Subdivision name: **Lot number:**
Ft W of EL: **Ft N of SL:** **Ft E of WL:** **Ft S of NL:**
Ground elevation: **Depth to bedrock:** **Bedrock elevation:** **Aquifer elevation:**
UTM Easting: **UTM Northing:**

Well Log

Top	Bottom	Formation
0.0	1.9	SURFACE/TOPSOIL
1.9	3.0	CLAY-GRAY/BROWN MXD
3.0	9.0	TRASH/CLAY-LT BROWN CLAY
9.0	10.0	CLAY-GRAY
10.0	30.0	TRASH/CLAY (MOSTLY TRASH)
30.0	40.0	TRASH/CLAY (LOST CIRCULATION)
40.0	65.0	SAND-FINE GRAIN, MED GRAY
65.0	72.0	GRAVEL 1/4"SM, SMOOTH SURFACE

72.0	96.0	SAND-DK GRAY
96.0	114.0	CLAY-GRAY, SOFT
114.0	121.0	GRAVEL-1/4"-1/8" SMOOTH SURFAC
121.0	136.5	S&G/SAND CONTENT 50%
136.5	138.0	SHALE-GRAY,SOFT

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**			**Date completed**
224518				May 01, 1962

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	LOEWS THEATHER		
Driller	D.L. LITTLE	2509 KORING,RD.	
Operator	D.L. LITTLE	License: null	

Construction Details

Well	**Use:** Industry	**Drilling method:** Cable Tool	**Pump type:**
	Depth: 104.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 85.0	**Material:**	**Diameter:** 6.63
Screen	**Length:** 20.0	**Material:**	**Diameter:** 8.0 **Slot size:** .020

Well Capacity Test	**Type of test:** Pumping	**Test rate:** 350.0 gpm for 4.0 hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** 44.0 ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: VANDERBURGH		**Township:** 6S **Range:** 10W
Section: NW of the SE of the NE of Section 30		**Topo map:** EVANSVILLE SOUTH,IN-KY
Grant Number:		
Field located by: RJW		**on:** Oct 20, 1964
Courthouse location by:		**on:**
Location accepted w/o verification by:		**on:**
Subdivision name:		**Lot number:**
Ft W of EL: 850.0	**Ft N of SL:** 3600.0	**Ft E of WL:** **Ft S of NL:**
Ground elevation: 385.0	**Depth to bedrock:**	**Bedrock elevation:** **Aquifer elevation:** 285.0
UTM Easting: 450033.0		**UTM Northing:** 4202757.0

Well Log

Top	Bottom	Formation
0.0	12.0	SUBSOIL & CLAY
12.0	100.0	S & G

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**	**Date completed**
224459	AT NORTH END OF NW PROPERTY ADJACENT TO SHOWNEE DRIVE APPROX. 260 FEET FROM RIVER	Jan 01, 1950

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	EVANSVILLE WATER WORKS		
Driller	DIEHL PUMP & SUPPLY	EVANSVILLE	

Construction Details

Well	**Use:** Test	**Drilling method:**	**Pump type:**
	Depth: 120.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:**	**Material:**	**Diameter:** 6.0
Screen	**Length:**	**Material:**	**Diameter:** **Slot size:**

Well Capacity Test	**Type of test:**	**Test rate:** gpm for hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** 31.1 ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: VANDERBURGH

Township: 6S **Range:** 10W

Section: SE of the NW of the NE of Section 31

Topo map: EVANSVILLE SOUTH,IN-KY

Grant Number:

Field located by: **on:**

Courthouse location by: **on:**

Location accepted w/o verification by: USGS **on:** May 01, 1963

Subdivision name: **Lot number:**

Ft W of EL: **Ft N of SL:** **Ft E of WL:** **Ft S of NL:**

Ground elevation: **Depth to bedrock:** **Bedrock elevation:** **Aquifer elevation:**

UTM Easting: **UTM Northing:**

Well Log

Top	Bottom	Formation
0.0	16.0	TOPSOIL
16.0	50.0	CLAY
50.0	65.0	QUICKSAND
65.0	76.0	FINE SAND COARSE GRAVEL
76.0	80.0	MED SAND
80.0	90.0	COARSE SAND, GRAVEL BLUE CLAY
90.0	107.0	MED. CRS SAND W/ SOME FINE SAN
107.0	112.0	CRS. SAND & GRAVEL
112.0	114.0	LARGE GRAVEL PEA GRAVEL & CRS.
114.0	120.0	LARGE GRAVEL CRS SAND MED SAND

	120.0	BLUE STONE
Comments	TEST WELL #1	

2.1 POTENTIAL NEW GROUNDWATER TREATMENT PLANT LOCATIONS

Once the viability of developing a 60-MGD groundwater supply was confirmed, the next step was to identify potential locations for the collector wells and the treatment plant. **Exhibit 2-1** includes the original four options where sufficient water supply and available property appear to be available. **Exhibits** 2-2, 2-3, 2-4 **and** 2-5 provide additional details for each location. Of these original four, Option D located at the former Roberts Stadium site was quickly ruled out because it is close to the boundary where sufficient raw water quantity is expected to be available and high-capacity wells will have a large radius of influence potentially pulling in contaminants from old industrial facilities, gas stations or dry cleaners.

Evansville
WATER AND SEWER UTILITY

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Date Last Revised:
December 2014

EXHIBIT 2-1

Potential Groundwater Treatment Plant Locations

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

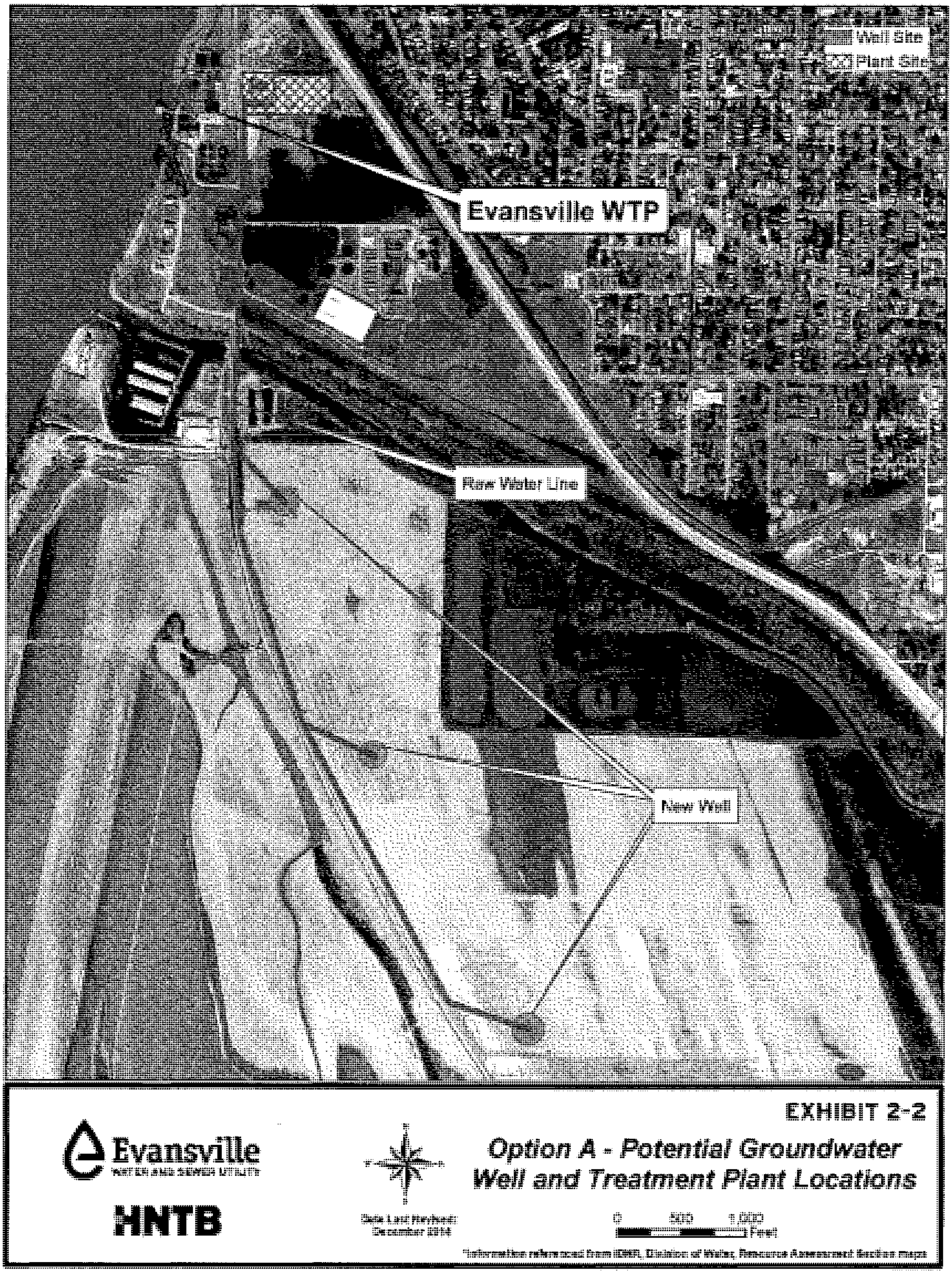
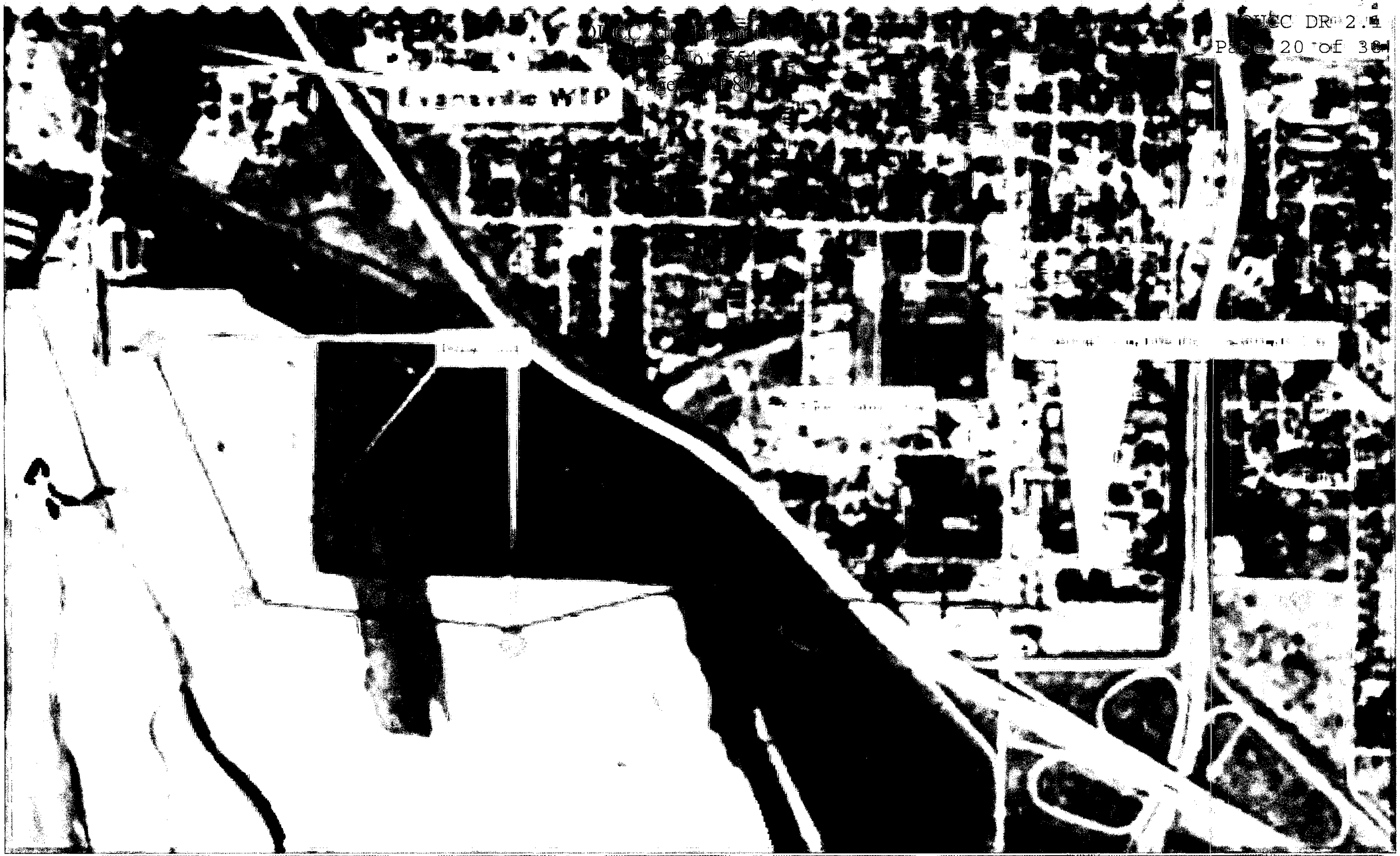


EXHIBIT 2-2

Option A - Potential Groundwater Well and Treatment Plant Locations



Evansville WATER AND SEWER UTILITY

HNTB

N
W E
S

Date Last Revised:
September 2014

EXHIBIT 2-3

Option B - Potential Groundwater Well and Treatment Plant Locations

0 500 1,000
Feet

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps


EXHIBIT 2-4
Evansville
WATER AND SEWER UTILITY
HNTB
N
S
W
E
Option C - Potential Groundwater Well and Treatment Plant Locations
Date Last Revised: September 2014
0
350
700
1,400
Feet
*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

EXHIBIT 2-5

Evansville
WATER AND SEWER UTILITY

HNTB

N
W E
S

Date Last Revised:
September 2014

Option D - Potential Groundwater Well and Treatment Plant Locations

0 212.5 425 850
Feet

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

3.1 POTENTIAL CONNECTIONS TO DISTRIBUTION SYSTEM

In addition to the new treatment plant and wells, water mains must be installed from the wells to the plant and from the plant to provide adequate flow and pressure of finished water into the distribution system. **Exhibits 3-1, 3-2 and 3-3** include potential locations and lengths of water main required as determined utilizing the existing WaterCAD model.

For all three options, the length and size of raw water main is essentially the same. To provide redundancy, the exhibits include dual, 48-inch-diameter mains from the wells to the new plant location. Depending on the final layout, the length may vary, but will not be enough to significantly impact the overall project cost.

From this evaluation, the primary difference between the options is the site and length of the finished water main required to provide up to 60 MGD into the system while allowing for potential breaks in major transmission mains. With the proximity to the existing plant, Option A is the least-cost option with no major finished water mains required. The new high-service pumps can be directly connected to the 36-inch and 48-inch transmission mains near the existing plant. **Exhibit 3-1** includes potential locations for the collector wells, raw water main and new water treatment plant. Table 3.1 includes the estimated cost of almost $14,000,000 for the raw water main.

The model results for Option B included on **Exhibit 3-1** indicate the high-service pumps would need to provide slightly more pressure, approximately 10 feet total dynamic head, to provide the same level of service into the distribution system. Option B would also require a significant investment in finished water mains estimated to include:

- 13,000 feet of 48-inch
- 16,000 feet of 30-inch

As can be seen on **Table 3.2**, the Option B total water main cost is estimated to be approximately $36,000,000, over $22,000,000 more than Option A.

By being located further from the largest transmission main in the system, Option C is even more challenging to tie into the distribution system. As indicated on **Exhibit 3-3**, the finished water mains required to provide the same level of service into the distribution system include:

- 24,000 feet of 48-inch
- 25,000 feet of 30-inch

As expected, the cost estimate included in **Table 3.3** is significantly higher than either Option A or B coming in at just over $51,000,000.

Because of the significant difference in costs associated with the water main installation, Option A is the recommended alternative to be further evaluated.


EXHIBIT 3-1
Evansville
WATER AND SEWER UTILITY
HNTB
Option A - Distribution System Tie-In
Data Last Revised: December 2014
0 500 1,000 2,000
Feet


Evansville
WATER AND SEWER UTILITY
HNTB
Option B - Distribution System Tie-In
EXHIBIT 3-2
Date Last Revised: December 2014
0 1,000 2,000 4,000 Feet

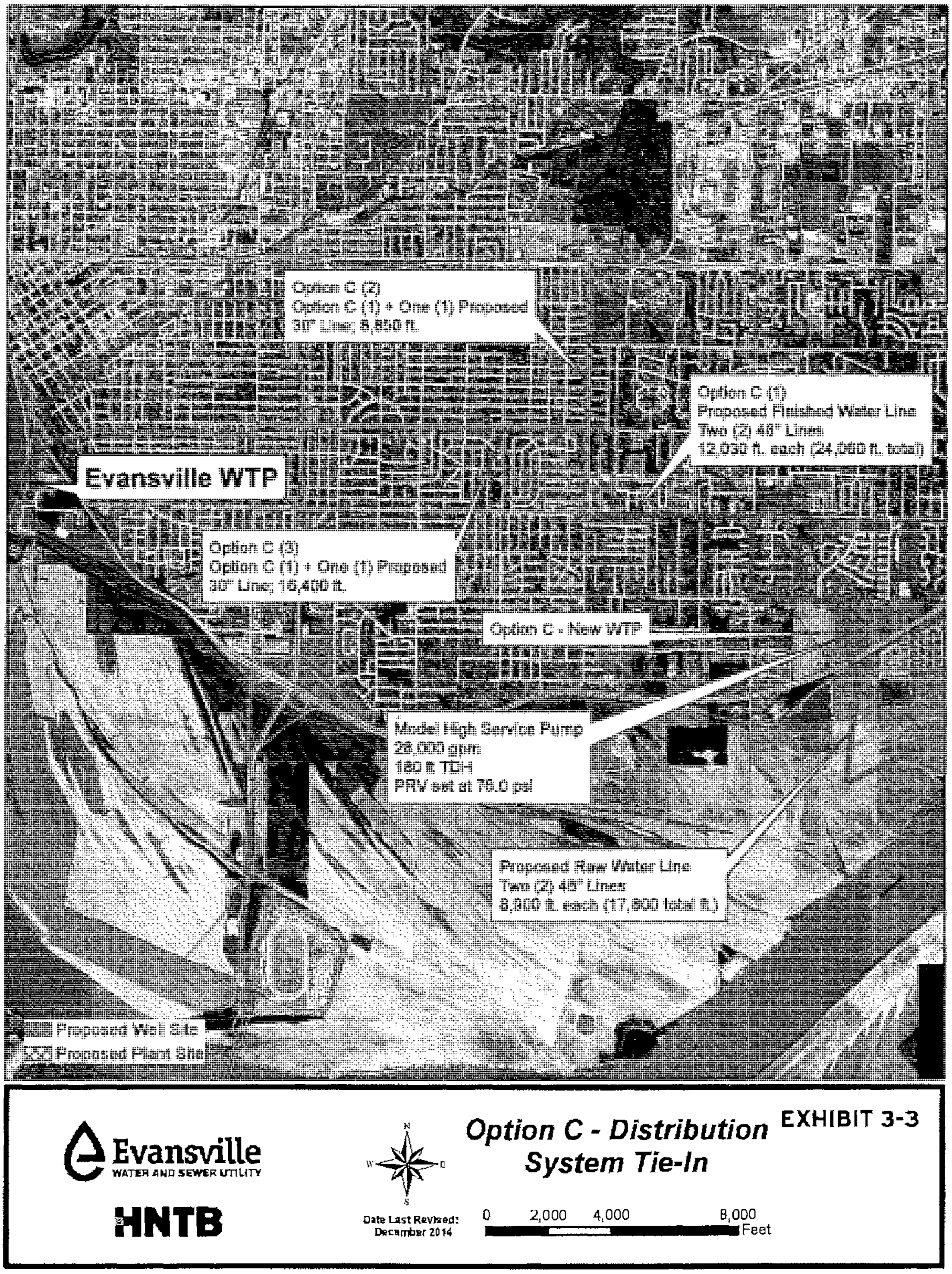

Option C (2)
Option C (1) + One (1) Proposed
30" Line; 8,850 ft.
Option C (1)
Proposed Finished Water Line
Two (2) 48" Lines
12,030 ft. each (24,060 ft. total)
Evansville WTP
Option C (3)
Option C (1) + One (1) Proposed
30" Line; 16,400 ft.
Option C - New WTP
Model High Service Pump
28,000 gpm
180 ft TDH
PRV set at 78.0 psi
Proposed Raw Water Line
Two (2) 48" Lines
8,900 ft. each (17,800 total ft.)
Proposed Well Site
Proposed Plant Site
Evansville
WATER AND SEWER UTILITY
HNTB
Date Last Revised:
December 2014
0
2,000
4,000
8,000
Feet
Option C - Distribution System Tie-In
EXHIBIT 3-3

TABLE 3.1
OPTION A

HNTB	CONSTRUCTION COST ESTIMATE				
OPTION A - WTP ADJACENT TO EXISTING					
PROJECT NO.: 61237-PL-001-001	PREPARED BY:		SAL	DATE:	11/24/2014
PROJECT NAME: Evansville WTP Planning	CHECKED BY:		RTP	DATE:	11/24/2014
	CHECKED BY:			DATE:	
PROJECT MGR.: JAT					
ITEM / DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT PRICE**	**ESTIMATED CONS. COST**	**REMARKS**
Construction Costs					
DIVISION 2 - SITE WORK					
Erosion and sedimentation control	1	LS	$5,000	$5,000	
Excavation for raw water mains	49,100	CY	$50	$2,455,000	
48" DI pipe for dual raw water mains- installed	17,200	LF	$400	$6,880,000	
Backfill for water mains	33,200	CY	$35	$1,162,000	
SUBTOTAL				**$10,502,000**	
Mobilization/Demobilization (5%)	1	LS	$526,000	$526,000	
Site restoration (3% of site work)	1	LS	$316,000	$316,000	
SUBTOTAL				**$11,344,000**	
Contingency @ 20%				$2,270,000	
TOTAL				**$13,614,000**	

NOTE ! This estimate represents our judgment as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from this estimate.

TABLE 3.2
OPTION B

HNTB	CONSTRUCTION COST ESTIMATE				
OPTION B - WTP NEAR US 41/VETERAN'S MEMORIAL PARKWAY INTERCHANGE					
PROJECT NO.: 61237-PL-001-001	PREPARED BY:		SAL	DATE:	11/24/2014
PROJECT NAME: Evansville WTP Planning	CHECKED BY:		RTP	DATE:	11/24/2014
	CHECKED BY:			DATE:	
PROJECT MGR.: JAT					
ITEM / DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT PRICE**	**ESTIMATED CONS. COST**	**REMARKS**
Construction Costs					
DIVISION 2 - SITE WORK					
Erosion and sedimentation control	1	LS	$5,000	$5,000	
Excavation for raw water mains	52,700	CY	$50	$2,635,000	
48" DI pipe for dual raw water mains- installed	19,800	LF	$400	$7,920,000	
Backfill for raw water mains	34,400	CY	$35	$1,204,000	
Excavation for finished water mains	60,000	CY	$50	$3,000,000	
48" DI pipe for dual finished water mains-installed	12,900	LF	$600	$7,740,000	
30" DI pipe for finished water mains-installed	16,300	LF	$250	$4,075,000	
Backfill for finished water mains	40,000	CY	$35	$1,400,000	
DIVISION 9 - FINISHES					
Coatings	1	LS	$10,000	$10,000	
SUBTOTAL				**$27,989,000**	
Mobilization/Demobilization (5%)	1	LS	$1,400,000	$1,400,000	
Site restoration (3% of site work)	1	LS	$840,000	$840,000	
SUBTOTAL				**$30,229,000**	
Contingency @ 20%				$6,046,000	
TOTAL				**$36,275,000**	

NOTE ! This estimate represents our judgement as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from this estimate.

TABLE 3.3
OPTION C

HNTB	CONSTRUCTION COST ESTIMATE				
OPTION C - WTP ON EAST SIDE OF CITY					
PROJECT NO.: 61237-PL-001-001	PREPARED BY: SAL			DATE:	11/24/2014
PROJECT NAME: Evansville WTP Planning	CHECKED BY: RTP			DATE:	11/24/2014
	CHECKED BY:			DATE:	
PROJECT MGR.: JAT					
ITEM / DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED CONS. COST	REMARKS
Construction Costs					
DIVISION 2 - SITE WORK					
Erosion and sedimentation control	1	LS	$5,000	$5,000	
Excavation for raw water mains	47,500	CY	$50	$2,375,000	
48" DI pipe for dual raw water mains-installed	17,800	LF	$400	$7,120,000	
Backfill for raw water mains	31,000	CY	$35	$1,085,000	
Excavation for finished water mains	110,000	CY	$50	$5,500,000	
48" DI pipe for dual finished water mains-installed	24,100	LF	$600	$14,460,000	
30" DI pipe for finished water main- installed	25,000	LF	$250	$6,250,000	
Backfill for finished water mains	75,000	CY	$35	$2,625,000	
DIVISION 9 - FINISHES					
Coatings	1	LS	$10,000	$10,000	
SUBTOTAL				$39,430,000	
Mobilization/Demobilization (5%)	1	LS	$1,972,000	$1,972,000	
Site restoration (3% of site work)	1	LS	$1,183,000	$1,183,000	
SUBTOTAL				$42,585,000	
Contingency @ 20%				$8,517,000	
TOTAL				$51,102,000	

NOTE ! This estimate represents our judgement as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from this estimate.

4.1 GROUNDWATER TREATMENT PLANT DESCRIPTION AND PROCESS SCHEMATIC

Raw water quality and the treatment approach are the two aspects that would be most impacted should Evansville change their raw water source from the Ohio River to groundwater from the aquifer southeast of the existing water treatment plant (WTP) site. This narrative describes the anticipated raw groundwater quality and the treatment facilities anticipated to efficiently treat it to potable water standards (following Ten States Standards).

Raw water would be higher in iron, manganese and hardness as compared to surface water, in the approximate ranges tabulated in Table 4.1.

TABLE 4.1
RAW WATER QUALITY ESTIMATE

Constituents	*Units*	*Anticipated Concentrations*	
		Groundwater	*Surface Water*
Hydrogen Sulfide	mg/L	Detectable Odor	Undetectable
Iron	mg/L	2.0 - 2.5	Trace
Manganese	mg/L	0.5 - 0.8	Trace
Hardness (as $CaCO_3$)	mg/L	180 - 400	150

The treatment processes described below are designed to produce water meeting the following finished water quality goals:

- Compliance with secondary standard goals for maximum concentrations of iron (0.3 mg/L) and manganese (0.05 mg/L).
- Filtered water turbidity below 0.1 NTU.
- Stable water that will comply with the Lead and Copper Rule and minimize corrosion, precipitation and deposition within the water distribution system.
- Reduction of taste and odor to the lowest acceptable level.
- Maintaining a free chlorine residual of 1.0 mg/L through the treatment process and provide adequate disinfection protection in the distribution system by meeting the TSS standard of 1.0 to 2.0 mg/L throughout the system.
- Maintaining minimum finished water pH of 7.5.
- Planning WTP layout and hydraulics to allow a softening process to be added in the future (producing finished water with hardness in the 120-150 mg/L range).
- Providing WTP with a firm treatment capacity of 60 MGD and an onsite finished water storage capacity of 6 million gallons (MG), in a two-train arrangement so that 30 MGD can be filtered, stored and pumped with half the filters and clearwell out-of-service.

The basic treatment process schematic, included as **Exhibit 4-1**, illustrates the primary features of a groundwater treatment plant applicable for the Evansville groundwater. Following metering of the raw water, chemical oxidation of iron and manganese with chlorine and potassium permanganate will result in the formation of insoluble iron and manganese hydroxides precipitates. The incoming water will be conditioned to a pH of about 7.5 while maintaining a chlorine residual of 0.5 to 1.0 mg/L.

The chemically conditioned raw water will be conveyed by gravity and distributed to the filters, where those oxidized metals solids will be removed by adsorption and entrapment within the filter media. Media will consist of anthracite and sand in a deep-bed gravity arrangement with modern block or plate underdrain media supports.

Ten State Standards recommend filtering rates with regard to raw water quality, pretreatment and filter media. The recommended range is from 2 to 4 gallons per minute per square foot of filter media surface (gpm/sf). In using the maximum filtering rate of 4 gpm/sf with a firm capacity of 60 MGD (one filter out-of-service), 10 filters will be required. Each 1,200 sf filter is recommended to be a two-cell arrangement (with each cell 600 sf, with an approximate geometry of 20 ft by 30 ft).

Following filtration, the water will be disinfected with chlorine and chemically conditioned with sodium hydroxide (for pH adjustment), hydrofluorosilic acid (for fluoridation) and a corrosion inhibitor, if warranted.

Finished water will be stored in an onsite ground storage reservoir prior to the distribution to the Evansville system via high-service finished water pumps. The clearwell will consist of two 3 MG baffled compartments and interconnected with three pumping wells (two for finished water pumps and one for the filter backwash pumps).

Each filter cell will be backwashed separately but sequentially (one backwashed while the other cell-isolated). The maximum backwash flow rate is approximately 9,000 gpm, which represents a filter cell with an area of 600 sf and Ten States Standards maximum wash rate of 15 gpm/sf. The backwash pumps will be adjustable speed so that backwashing flow rates can be fine-tuned as the WTP transitions from a new to established facility, as well as adjustments for seasonal operation.

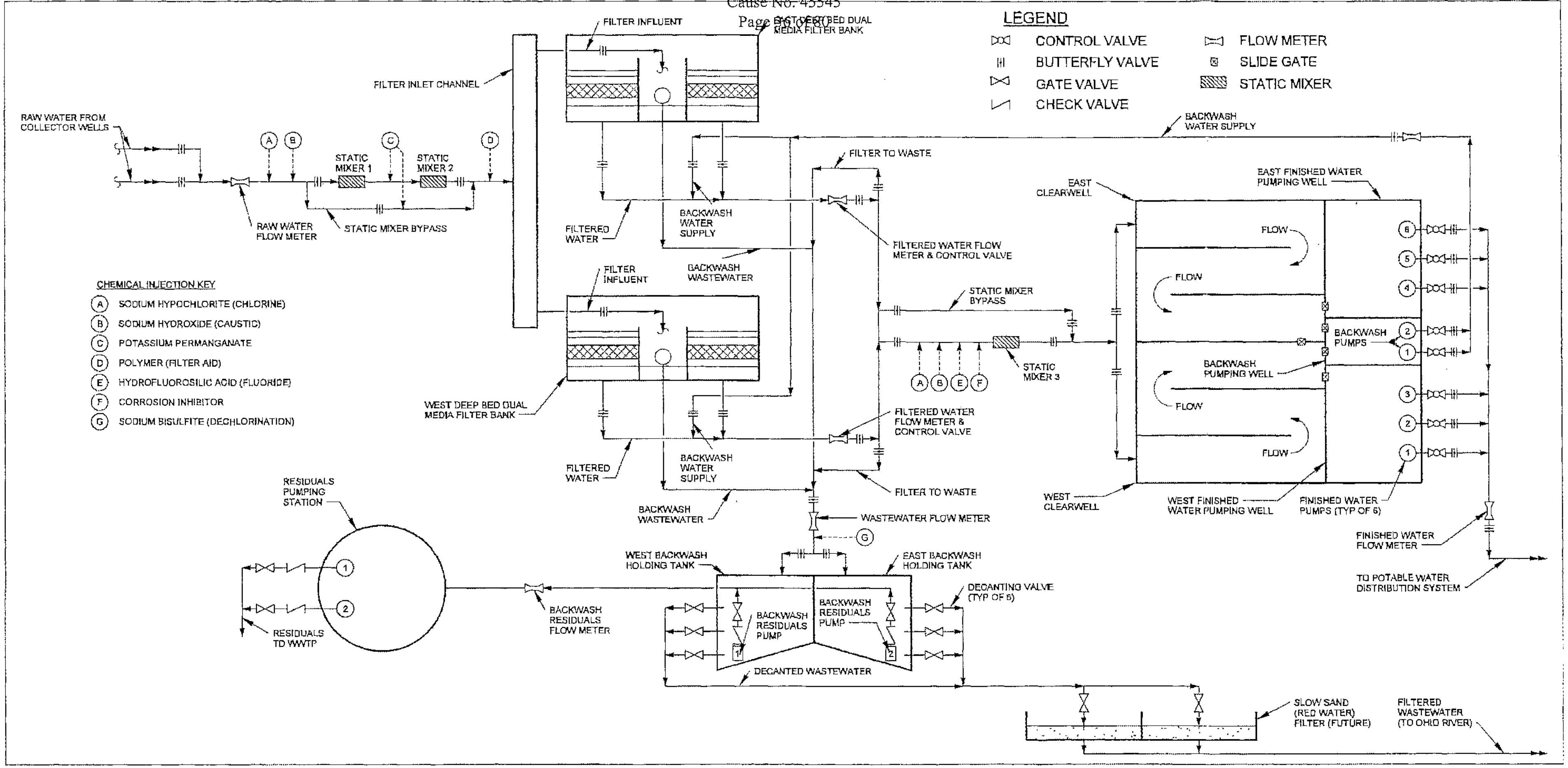
Per Ten States Standards, the filters will have a backup backwash water supply system consisting of a pressure-reducing valve between the finished water pump discharge main and the backwash water supply header. This secondary system takes finished water going from the discharge main, and reduces its pressure to an acceptable level for backwashing prior to entering the filters.

The iron and manganese residuals removed from the treated water will be collected in a two-compartment backwash water holding tank. Residuals settled in the tank will be pumped to the sanitary sewer system. The spent backwash water drawn off the holding tanks will be chemically conditioned to eliminate its chlorine residual and filtered through a slow sand filter to reduce any solids, prior to being discharged to the Ohio River.

Table 4.2 shows the cost estimate for the plant, as described.

TABLE 4.2
GROUNDWATER TREATMENT PLANT
COST ESTIMATE SUMMARY FOR 60 MGD WTP

Description	*2014 Total Cost*
Site Work and Residuals Pump Station	$ 3,000,000
Treatment and Chemical Building Equipment	$14,300,000
Treatment and Chemical Building Piping and Fittings	$ 6,400,000
Yard Piping and Fittings	$ 2,600,000
Concrete	$ 9,100,000
Building Components	$ 2,400,000
HVAC Components	$ 800,000
Plumbing Components	$ 200,000
Electrical Components	$ 3,400,000
Instrumentation and Controls	$ 1,200,000
Subtotal	$43,400,000
Mobilization and Bonds (8% of Subtotal)	$ 3,500,000
Contingency (20% of Subtotal)	$ 8,700,000
Escalation for 2 Years (6% of Total)	$ 2,600,000
TOTAL ESTIMATED CONSTRUCTION COST	$58,000,000



Evansville
WATER AND SEWER UTILITY

HNTB

EXHIBIT 4-1

Basic Process Schematic
New Evansville Groundwater Treatment Plant

5.1 RECOMMENDED LOCATION AND COST SUMMARY

As described in Section 4, the determining factor in choosing a location for the new groundwater treatment plant is the ability to efficiently pump water into the distribution system. With the difference in cost of at least $20,000,000 for finished water main design and construction, Option A along Waterworks Road is the recommended location for the new groundwater treatment plant. **Exhibit** 5-1 includes a basic layout for the new facilities to be located at the existing Levee Authority office and DPW garage site. **Exhibit** 5-2 provides a potential layout for the three (3) collector wells, raw water main and treatment facilities along with the estimated amount of land to be purchased or for permanent easements.

5.2 SUMMARY OF COSTS TO COMPLETE WELL FIELD EVALUATION, WELL, RAW WATER MAIN, NEW GROUNDWATER TREATMENT PLANT AND FINISHED WATER DISTRIBUTION DESIGN AND CONSTRUCTION

5.2.1 Well Field Evaluation

Obtain options on approximately 40 acres to conduct exploratory test drilling program. Estimated cost $500 per acre, total: $20,000.

Complete exploratory test drilling to verify subsurface conditions, collect formation and water samples for analysis and conduct tests to determine transmissivity. Estimated cost of $20,000 per location for three locations, total: $60,000.

Conduct detailed aquifer testing to refine aquifer characteristics, predict well yield and gather information for final well design, including installation and test pumping of a temporary production well. Estimated cost: $150,000.

Complete data analysis and final report with well design criteria. Estimated cost: $30,000.

TOTAL ESTIMATED COST FOR WELL FIELD EVALUATION: **$260,000**

5.2.2 Well Field Property Acquisition Collector Well Design and Construction

Purchase property for wells. Approximately 10 acres are required for each of 3 wells for a total of 30 acres at $10,000 per acre. Total property cost for wells: $300,000.

Design and construct collector wells complete with pumps, buildings, and auxiliary equipment. Three (3) wells at $3,000,000 each would be a total of $9,000,000. Add design, bidding, construction engineering and resident representative services at 20 percent of the estimated construction cost for a total estimated cost of $10,800,000. Cost estimate for wells provided by Ranney Collector Wells, a division of Layne Henry Civil.

TOTAL ESTIMATED COST FOR PROPERTY ACQUISITION, WELL DESIGN AND CONSTRUCTION: **$11,100,000**

5.2.3 Raw Water Main from Well Field to New Water Treatment Plant

Acquire easements to install raw water main. Estimated distance from furthest well to new plant site is 9,200 feet with 30-foot-wide permanent easement and 100-foot-wide temporary easement required. Permanent easement will require approximately 6 acres at $10,000 per acre for a total of $60,000.

Design and construct new raw water main from well field to new water treatment plant. To provide redundancy, install dual 48-inch-diameter ductile iron mains. Estimated construction cost for dual 48-inch ductile iron main is $11,500,000. Add design, bidding, construction engineering and resident representative services at 20 percent of estimated construction cost for a total cost of $13,800,000.

TOTAL ESTIMATED COST FOR THE RAW WATER MAIN DESIGN, PROPERTY ACQUISITION AND CONSTRUCTION: $13,900,000

5.2.4 New Water Treatment Plant

Locate new plant and finished water reservoir on existing City-owned property now consisting of Levee Authority offices and Department of Public Works (DPW) facilities. No costs are expected to acquire the property; however, costs will be incurred to demolish the existing buildings and prepare the site for construction. The estimated cost to prepare the site is $250,000, plus additional costs to relocate the Levee Authority and DPW depending on the arrangement with the City. For the purpose of this report, it is estimated the Evansville Water and Sewer Utility (EWSU) will contribute $250,000 towards moving the Levee Authority and DPW for a total property cost of $500,000.

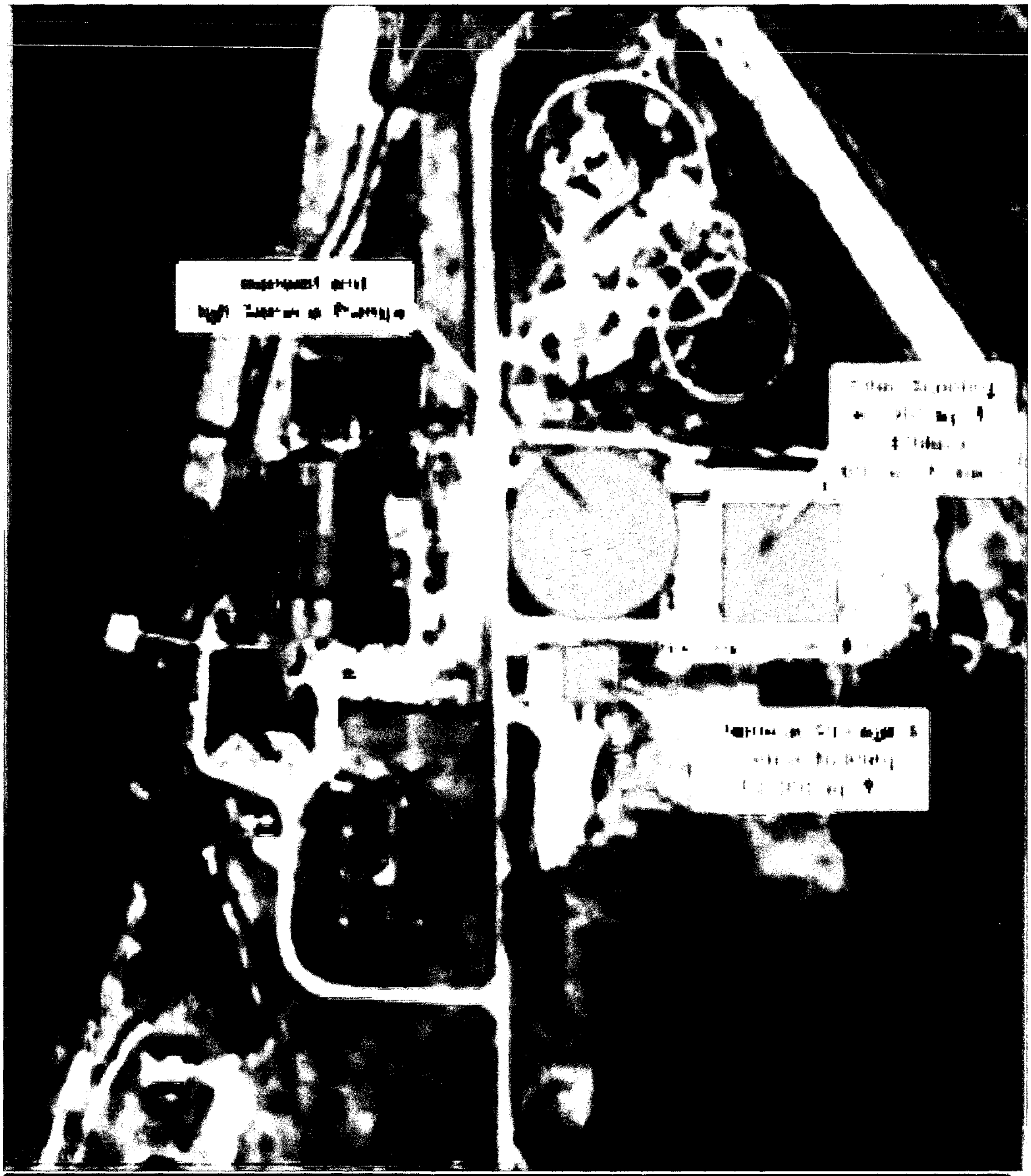
Design and construct a new 60 million gallons per day (MGD) groundwater treatment plant utilizing chemical oxidation of iron and manganese, gravity filters and a new 6-million-gallon finished water reservoir. The total estimated construction cost for the plant and reservoir is $58,000,000. Adding 20 percent for design, bidding, construction engineering and resident representative services, brings the total estimated project cost to $70,000,000.

5.2.5 Finished Water Mains and Connections into Existing Distribution System

By locating the new plant at the site of the existing Levee Authority and DPW garage, minimal improvements are necessary to connect the new high-service pumps into the distribution system. For this estimate, the total cost of this effort is not expected to exceed $500,000.

TABLE 5.1
SUMMARY

Well Field Evaluation	$ 260,000
Property Acquisition	
• Well Field	$ 300,000
• Raw Water Main	$ 60,000
• Treatment Plant	$ 500,000
Construction	
• Collector Wells	$ 9,000,000
• Raw Water Main	$ 11,500,000
• Water Treatment Plant	$ 58,000,000
• Finished Water Main Connection to Distribution System	$ 500,000
Total Estimated Construction Cost with 20% Contingency	$ 79,000,000
Engineering (Design, Bidding, Construction Engineering and Resident Representative Services) at 20% of Total Construction	$ 15,800,000
TOTAL ESTIMATED PROJECT COST	**$ 96,000,000**



Evansville WATER AND SEWER UTILITY

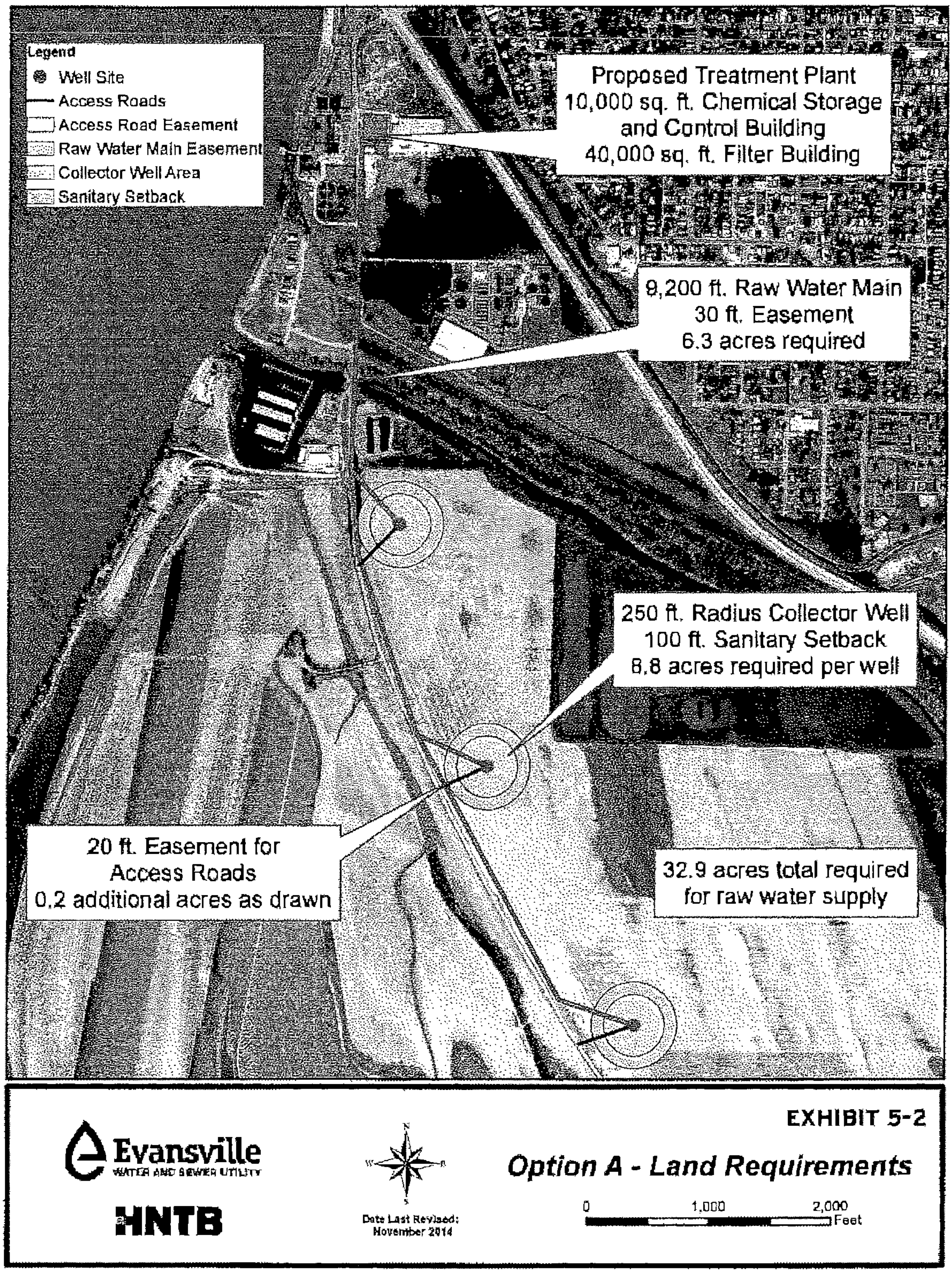
HNTB

Option A - Proposed WTP Layout

EXHIBIT 5-1

Date Last Revised: December 2014

0 100 200 400 Feet


Legend
Well Site
Access Roads
Access Road Easement
Raw Water Main Easement
Collector Well Area
Sanitary Setback
Proposed Treatment Plant
10,000 sq. ft. Chemical Storage and Control Building
40,000 sq. ft. Filter Building
9,200 ft. Raw Water Main
30 ft. Easement
6.3 acres required
250 ft. Radius Collector Well
100 ft. Sanitary Setback
8.8 acres required per well
20 ft. Easement for Access Roads
0.2 additional acres as drawn
32.9 acres total required for raw water supply
EXHIBIT 5-2
Option A - Land Requirements
Evansville
WATER AND SEWER UTILITY
HNTB
Date Last Revised: November 2014
0
1,000
2,000
Feet

OUCC DR 8-001

06/20/2016

DATA INFORMATION REQUEST
City of Evansville, Indiana

Cause No. 44760

Information Requested:

In response to OUCC data request 1-5, Petitioner indicates that the basis for the $10 million dollar estimate for "Preliminary Engineering for Treatment Plant" is the New Groundwater Treatment Plant Feasibility Study, Table 5.1, on page 32 (prepared by HNTB Corporation). Petitioner stated that the $10 million estimate "represents the design portion (typically referred to as preliminary engineering) of the $15.8 million figure …" Please answer the following questions:

a. Please list and explain what services will be provided for the $10 million figure.
b. Please provide the cost for each service described above.
c. Please explain how the costs associated with each service were determined or developed.
d. Please explain the need for each service to be provided.
e. Will any construction be funded by the $10 million?

Information Provided:

a. The services to be provided would consist of the design and preparation of detailed construction drawings and specifications for:

   1. a new facility utilizing the existing source water (Ohio River); or

   2. a new facility utilizing groundwater as the source water; or

   3. upgrade of the existing facility (originally constructed in the late 1800's) and continuing to utilize the existing source water; or

   4. conversion of the existing facility to utilize ground water as the source water.

   The determination of which option is to be designed will be made based on the studies identified in the response to Request 8-003 below.

OUCC DR 8-001 (Cont'd)

DATA INFORMATION REQUEST 06/20/2016

City of Evansville, Indiana

Cause No. 44760

Information Provided (cont'd):

b. The cost of the aforementioned design and preparation of construction drawings and specifications would be lump sum and the eventual amount of these professional services (currently estimated at $10 million) would be negotiated with the consultant eventually selected.

c. The cost was estimated as detailed in OUCC DR 2-001.

d. The existing facility is approximately 120 years old and is Petitioner's sole source of supply to provide water to over 60,000 service connections and a population of approximately 200,000 individuals. Continued reliance on this aging facility is not an option. Petitioner must do something (i.e. replace or refurbish the existing facility) to address the age of the facility and mitigate risks related to barge traffic, chemical spills, etc. The completion of the studies identified in the response to Request 8-003 will allow Petitioner to determine the preferred recommended course of action.

e. The $10 million figure does not include any construction.

OUCC DR 8-002

DATA INFORMATION REQUEST 06/20/2016

City of Evansville, Indiana

Cause No. 44760

Information Requested:

Please describe or explain what studies Petitioner has performed in its effort to determine the long-term source of supply and water treatment option Petitioner will pursue (i.e. (1) upgrade existing plant to continue treating surface water; (2) upgrade / modify existing plant to treat ground water; or (3) construct new groundwater treatment plant to treat groundwater).

Information Provided:

The only formal study to-date that has been performed towards this effort is the document titled *New Groundwater Treatment Plant Feasibility Study* (previously provided in response to OUCC DR 1.5)

OUCC DR 8-003

DATA INFORMATION REQUEST 06/20/2016

City of Evansville, Indiana

Cause No. 44760

Information Requested:

Please describe or explain what studies Petitioner still needs to perform in its effort to determine the long-term source of supply and water treatment option Petitioner will pursue (i.e. (1) upgrade existing plant to continue treating surface water; (2) upgrade / modify existing plant to treat ground water; or (3) construct new groundwater treatment plant to treat groundwater).

Information Provided:

Studies remaining to be performed in order to determine which option will be pursued are the pending master plan update that will detail the needs to keep the existing plant in operation for the next 30 years and the estimated $650,000 project titled *Raw Water Main and Treatment Plant Property Acquisition* that was discussed in the response to OUCC DR 2-001.

OUCC DR 3-15

06/29/2018

DATA REQUEST

City of Evansville
Cause No. 45073

Information Requested:

On page 3 of Mr. Keepes rebuttal testimony in Cause No. 44760, he said "we should analyze the costs and benefits of the various options and present it as part of our next case when we recommend financing for whatever choice is made." This is also referenced in the Commission's order on the top of page 7. Has Evansville performed this analysis? If so, please provide this analysis.

Information Provided:

The analysis of the costs and benefits of the various options has commenced and been ongoing since the October 5, 2016 Order of the Commission and subsequent availability of funding for the wellfield evaluation. A part of that effort is attached in the form of the document titled *Preliminary Test Drilling Results-September 8, 2017* (Attachment OUCC DR 3-15.pdf). As was outlined in direct testimony, that document details the fact that potential quantities were not as promising as was hoped. However, the magnitude of importance of a thorough investigation and the long-term impacts of the eventual decision dictated that the preliminary professional recommendations in that report be followed, and easement acquisition efforts commenced to perform additional test borings. This has, unfortunately, resulted in delays to the overall analysis. Specifically, additional time was required for acquisition of these easements, and unusually high river levels resulting in inundation of the additional sites delayed the actual drilling until March 22nd, 23rd and 25th of this year. Three borings (one on each of those dates) were performed when unusually high river levels once again forced demobilization of the drilling crew. When conditions permitted, two more test borings were performed, one on May 21st and another on May 23rd. The results of these five additional borings are not yet complete but are anticipated by July 2018. As discussed in the Direct Testimony of Patrick R. Keepes in Cause No. 44760, at pg. 5, the CIP is a 4-year plan which extends until 2020. As stated previously, Evansville is currently only in Year 2 of the 4-year plan.

Attachments:

OUCC DR 3-15.pdf

Layne WATER · MINERAL · ENERGY

MEMO

Ranney Collector Wells
Columbus, Ohio
614.888.6263

To: Joe Thais, HNTB

From: Henry Hunt

Date: September 8, 2017

Subject: Preliminary results from test drilling, Evansville, IN

Test drilling was performed in accordance with our proposal of July 22, 2016 for Phase 2 –Test Drilling and Preliminary Testing during the period from July 25, 2017 – August 11, 2017. Six test borings were installed in the easement area along Waterworks Road, generally south and east from the existing City water treatment plant. The approximate locations of these six borings are shown on the attached Figure 1.

The test area consists of a wide floodplain south and east from the existing water treatment plant (WTP) that extends upriver past Route 41 to within about 3 miles of Newburgh, Indiana. The entire area consists of reworked channel and riverbank deposits of the Ohio River that have evolved over many years. The last major change in the course of the Ohio River was reportedly in the 1800's possibly as the result of seismic activity. This change resulted in the present-day course of the Ohio River which may have shifted the river about 1 mile to the south and west from its' previous northern (Indiana) bank located in the vicinity of Waterworks Road, which follows the approximate current boundary between Kentucky and Indiana. This Phase of the investigation was confined to drilling sites within the State of Indiana, along Waterworks Road a distance of about 2 miles from the WTP.

Boring location, coordinates, depths and other pertinent information is presented following table.

Test Boring/Observation Well Summary

Boring ID	Date Drilled	State Plane Coordinates Indiana West Zone 1302		Grade Elevation (NAVD88)	Total Depth Drilled [1]	Depth to Bedrock [1]	Bedrock Surface Elevation (NAVD88)	Static Water Elevation (NAVD88)	Screen Setting for Well/ Piezometer [1]
		Easting	Northing						
		(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
TB2017-1	7/26/2017	2,811,850	983,909.5	364.83	116	110	254.8	348.9	90 - 100
TB2017-2	7/28/2017	2,812,054	983,066.7	365.20	115	111	254.2	348.7	Abandoned
TB2017-3	7/30/2017	2,812,973	981,202.4	365.82	114	112	253.8	349.1	Abandoned
TB2017-4	8/9/2017	2,813,390	980,386.3	366.42	113	111	255.4	350.2	65 - 75
TB2017-5	8/1/2017	2,814,267	979,149.1	367.24	113	110	257.2	351.3	90 - 100
TB2017-6	8/8/2017	2,815,413	977,792.8	367.39	112	110	257.4	351.6	75 - 85

Notes: (1) All depths are referenced from land surface at boring location.

In general, sandy soil conditions were encountered in all six borings, common in alluvial sediments found along the Ohio River. The stratigraphic column showed layers of soils typical of the alluvial-related deposition that would have occurred over the years as a result of glacial activity and the river migration reported in this area. TB2017-5 and TB2017-6 encountered increased amounts of coarser deposits, including coarser sands and gravels.

All test drilling sites indicated aquifer materials that could be utilized to develop a groundwater supply to wells. The finer-grained deposits encountered in borings TB2017-1 through TB2017-4 showed generally fine to coarse sands with some silt. TB2017-6 showed a similar sequence of sand but contained gravel deposits over the interval from 55 to 86 feet. TB2017-5 showed a higher percentage of coarse gravel deposits that extended over the interval from 54 to 104 feet below grade (with a sequence of sand from 80 to 90 feet).

While each boring encountered aquifer formation deposits suitable for developing a groundwater supply, the yield for each well will vary according to the hydraulic characteristics of the aquifer formation that would be screened by each well. From our preliminary evaluation of the test data, we would expect that a collector well constructed at the locations of TB2017-1 through TB2017-4 could develop a capacity ranging from about 4-6 MGD. A collector well located at TB2017-5 would be expected to be in the range of 10 MGD, while a collector well constructed at the location of TB2017-6 would be expected to be in the range of 5-6 MGD. Site specific aquifer testing (Phase 3) is required to develop firm estimates of the aquifer characteristics necessary to verify expected well capacities and develop well design parameters. Typically, the detailed aquifer test is conducted at the boring site with the most indicated potential, in this case TB2017-5.

The boring sites were located along Waterworks road, and the distance from the borings to the Ohio River (recharge source) varied from about 2000 feet at TB2017-1 to over a mile at TB2017-4, 5 and 6. This distance from the river would likely result in wells that pump largely groundwater from storage within the floodplain area. Wells constructed closer to the Ohio River would be expected to develop some percentage of water that would recharge the aquifer through induced (e.g. riverbank) infiltration which would be expected to support 30% to 50% higher individual well yields. Additionally, wells located near the river would be expected to produce water lower in mineral content than wells constructed further back, such as along Waterworks Road.

As part of the preliminary testing of the test borings, a short pumping test was conducted and water samples were collected and submitted to a laboratory for preliminary screening purposes. A general summary of the laboratory results for each boring is presented in the following table.

Laboratory Water Quality Results

Constituent	Units	TB2017-1 90-100 ft	TB2017-2 90-100 ft	TB2017-3 70-76 ft	TB2017-4 65-75 ft	TB2017-5 90-100 ft	TB2017-6 75-85 ft
Arsenic	mg/l	0.009	0.008	ND	ND	0.008	0.005
Iron	mg/l	3.63	3.38	1.75	1.70	4.46	1.49
Manganese	mg/l	0.276	0.398	2.260	3.390	0.359	1.950
Hardness, (Total)	mg/l	410	420	360	310	590	350
pH	S.U.	6.9	6.8	6.8	6.6	6.9	6.8
Total Dissolved Solids	mg/l	480	480	430	380	700	390
Chloride	mg/l	15	17	21	23	43	36
Nitrate as N	mg/l	ND	ND	ND	ND	ND	ND
Nitrite as N	mg/l	ND	ND	ND	ND	ND	ND
Sulfate	mg/l	100	120	86	71	200	30

These concentrations are reflective of groundwater quality in alluvial aquifers along the Ohio River. If the wells could be constructed closer to the river, we would expect recharge from the river would result in lower concentrations in some parameters. For comparison, concentrations of hardness observed in several collector wells located along the riverbank of the Ohio River have been observed at:

Industry in Brandenburg, KY – 300 mg/l
Industry in Henderson, KY – 180 mg/l
Louisville Water Company – 200-250 mg/l

Additional Investigation

Based upon the preliminary testing conducted in Phase 2 to date, it will require multiple collector wells to develop a firm capacity of 40 MGD, or more. If sites can be identified that have more favorable aquifer characteristics, higher individual well capacities would be expected and fewer wells would be required to meet the projected demand. The test borings at TB2017-5 and TB2017-6 encountered the most favorable aquifer deposits at the southeastern end of the line of borings. It appears that formation deposits may be improving in that direction, suggesting that further exploratory test drilling could identify additional sites, and sites with better potential to meet higher well capacities.

Four additional areas (Figure 2) have been tentatively identified as possible sites where additional exploration is warranted:

> **A**: area away from the river, generally to the east of Waterworks Road. Since the property owner where TB2017-5 and 6 were installed appears amenable to allowing site access, perhaps areas on that property should be considered.

B: area toward the river, on property within the State of Kentucky. As mentioned above, higher individual well capacities and improved raw water quality are anticipated from wells located closer to the river.

C: areas continuing down the easement along Waterworks Road across and past Route 41 (this becomes Shawnee Drive), possibly extending down as far as the intersection of Shawnee Road and the Ohio River.

D: areas where Shawnee Road reaches the Ohio River. If favorable geologic deposits exist and a hydraulic connection exists between the aquifer the river, wells in this area could offer the benefit of developing higher percentages of infiltrated water which should provide increased well capacities and improved raw water quality.

Preliminary Recommendations

The test drilling has identified suitable aquifer formation deposits to develop a groundwater supply to meet future demands for EWSU. The results of the test drilling showed improving geologic conditions as the borings progressed down Waterworks Road, suggesting that more favorable locations may exist outside of the area designated for the preliminary test drilling. It is critical to locate the most favorable sites to minimize the number of wells needed. Wells located closer to the river will have higher yields as well as better water quality, especially in regard to dissolved solids and hardness. By locating wells within 300 feet of the river, yield increases of 30- 50 % are possible, along with quality improvements.

It is recommended that additional test borings be made in one or more of the areas listed above to identify the most favorable site (or sites) for the detailed aquifer testing proposed for Phase 3.

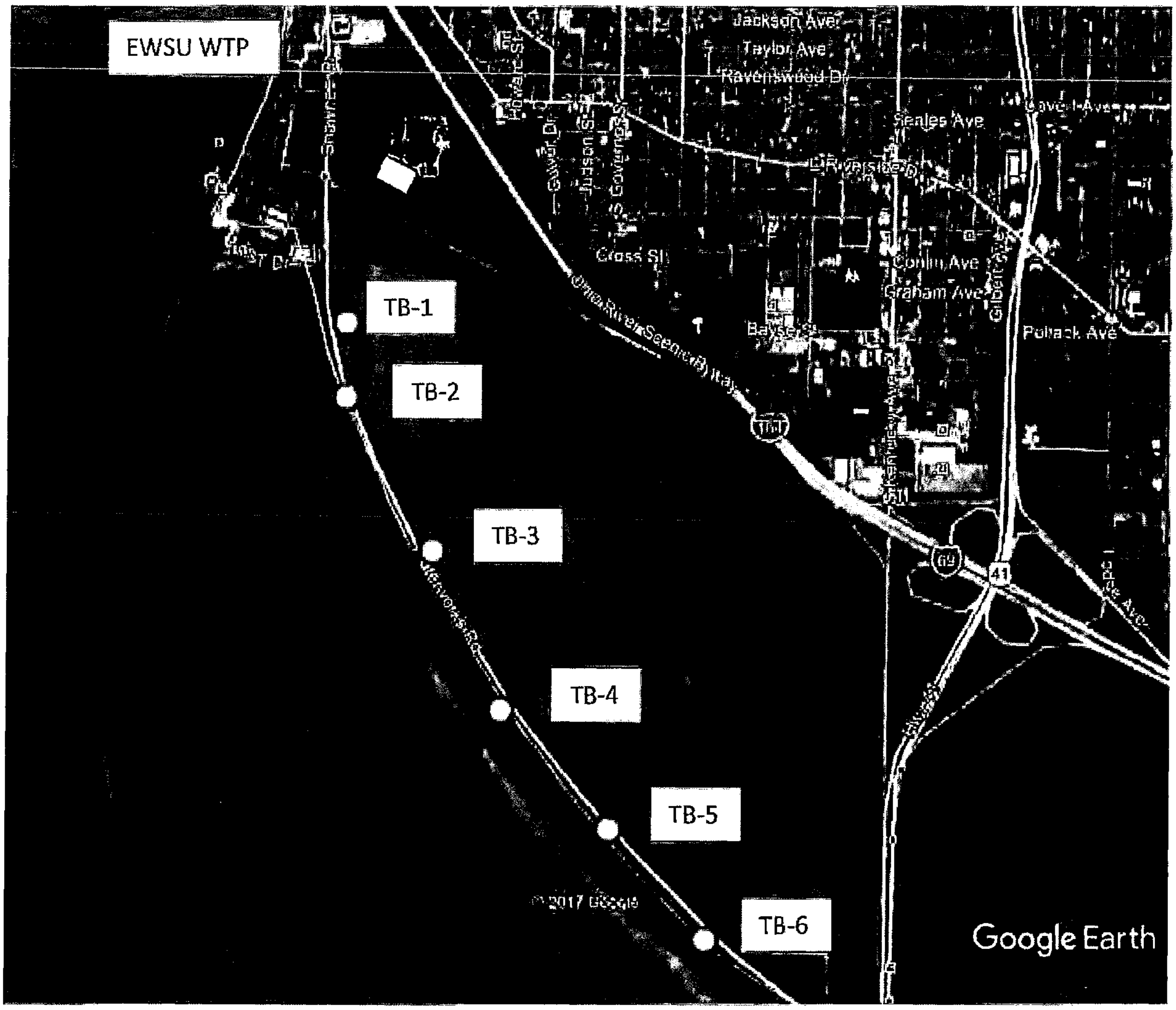


Figure 1 - Location of Test Borings

Evansville Water & Sewer Utility, Evansville, IN

Layne Christensen - 6360 Huntley Road Columbus OH 43229 614-888-6263

Layne® Ranney Collector Wells

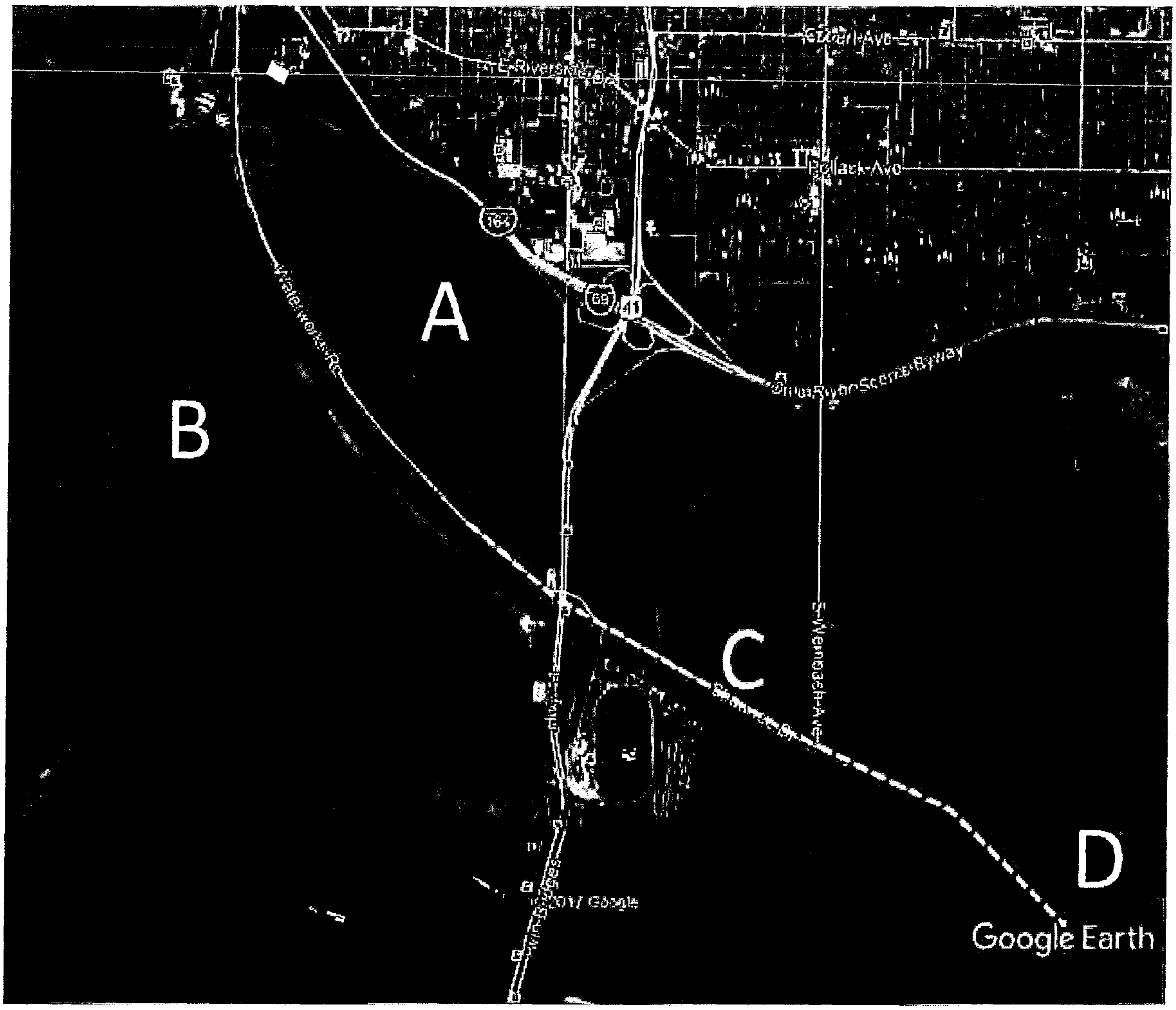


Figure 2 – Potential Additional Testing Areas

Evansville Water & Sewer Utility, Evansville, IN

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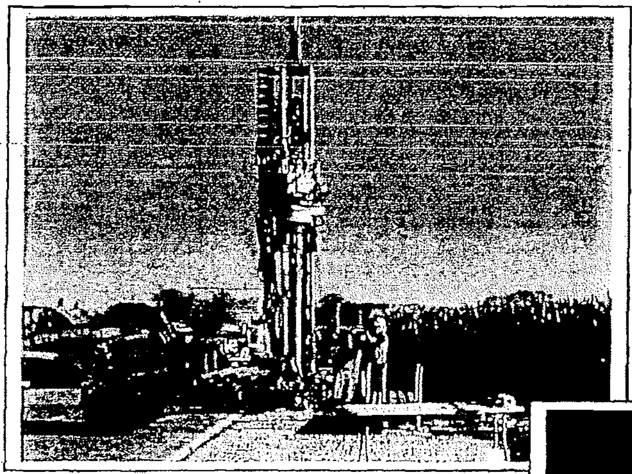
Report of Findings
Collector Well Feasibility Investigation

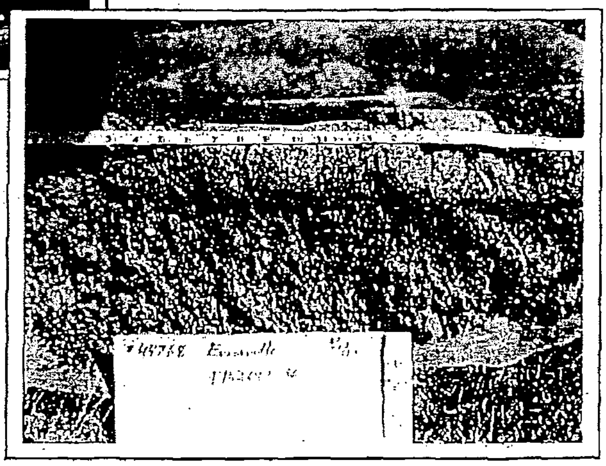


Prepared for:

Evansville Water & Sewer Utility (EWSU)

and

HNTB



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Prepared By:

Layne

Ranney Collector Wells

Columbus, Ohio
August 3, 2018

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TABLE OF CONTENTS

PAGE

LIST OF FIGURES (REAR OF REPORT)

DRAFT

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES (REAR OF REPORT)

LIST OF APPENDICES (REAR OF REPORT) EXCERPT OF APPENDIX A INCLUDED ONLY

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1 INTRODUCTION

Ranney Collector Wells (Ranney), a division of Layne Christensen (Layne) was contracted by the HNTB Corporation (HNTB) to assist with a hydrogeological investigation along the Ohio River to locate a groundwater supply of up to 40 million gallons per day (MGD) for the City of Evansville Water and Sewer Utility (EWSU). The purpose of this investigation was to determine the potential for developing a riverbank filtration (RBF) water supply using horizontal collector well technology. The focus area of this investigation was located along Waterworks Road to the southeast of the EWSU Waterworks (Figure 1). The work was conducted in accordance with the Ranney proposal dated July 22, 2016 as authorized by the Professional Services Agreement between Ranney and HNTB for HNTB Project No. 62609 dated October 2016.

1.1 BACKGROUND

The focus area for Phase 1 consists of a wide floodplain within the Green River Island area. The surficial geology along the Ohio River valley in this area consists of a variety of glacial and interglacial lithologic sequences characterized by alluvial and lake depositional events (USGS, 2011). The only aquifer in the area potentially capable of yielding the desired quantity and quality of water is the unconsolidated alluvium and glacial outwash deposits that fill the Ohio River bedrock valley. The thickness of these deposits can exceed 100 feet in the Evansville area. The fill is mainly fine to medium-grained lithic quartz sand, interbedded with lenses of clay, clayey silt, silt, coarse sand, and gravel (USGS, 2009). Typically, the lower part of the fill is gravelly sand to sandy gravel, the middle part is mostly sand, and the upper part consists of a surficial veneer of silt and clay interspersed with sandy levee deposits (USGS, 2009). These deposits conceal Pennsylvanian age bedrock consisting of interbedded shale and sandstone.

In 1951, an evaluation of the alluvial deposits at the Evansville Waterworks was conducted to determine the feasibility of developing a groundwater supply. This evaluation indicated the depth to bedrock at the Waterworks was over 100 feet with about 70 feet of saturated sand and gravel deposits (Mikels, 1951). Aquifer testing was completed and indicated that alluvial aquifer is hydraulically connected with the Ohio River, which would provide a source of recharge to the aquifer through induced RBF infiltration. The evaluation of the Waterworks site concluded that substantial groundwater development was possible in the area (Mikels, 1951). A review of the aquifer test data from this evaluation indicated an aquifer transmissivity in the range of 150,000 to 180,000 gallons per day per foot of drawdown (gpd/ft). Based upon this information and the close proximity to the Ohio River (recharge), it is estimated that a collector well could yield up to 15 MGD at this location.

1.2 SCOPE OF WORK

The scope of the Phase 1 evaluation was divided into two Tasks.

- Task 1 – Exploratory Test Drilling and Hydraulic Interval Testing
- Task 2 – Data Analysis and Reporting

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Task 1 involved field activities consisting of the drilling and sampling of ten (10) exploratory test holes to collect site-specific hydrogeological data to evaluate the character of the aquifer for horizontal collector well development. The Task 1 activities have been completed and are the subject of this report (Task 2).

1.3 LIMITATIONS

This report was prepared for the exclusive use of EWSU and HNTB. This report was prepared for the specific application of developing a ground water supply using horizontal collector well technology. Ranney makes no warranty, whether expressed or implied, as to the actual water supply or quality available. Conclusions reached in this report are based upon the objective data made available to Ranney at the time this work was performed and the accuracy of the report depends upon the accuracy of these data. Ranney's responsibility is to apply its hydrogeology expertise, and collector well experience to provide an opinion regarding the development of water supplies of adequate capacity from horizontal collector wells developed in the alluvial aquifer along the Ohio River.

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2 FIELD PROCEDURES

The yield of a collector well will be dependent upon the water transmitting properties of the aquifer present, well design and recharge. The aquifer targeted for evaluation is the unconsolidated alluvium and glacial outwash deposits that fill the Ohio River bedrock valley. Initially for Task 1 of this investigation, the evaluation of the water transmitting properties of this aquifer was conducted by the drilling and sampling of six (6) exploratory test borings (TB2017-1 through TB2017-6) (Figure 1) in July and August 2017. A follow-up investigation was conducted in March and May 2018 by the drilling of four (4) additional exploratory test borings (TB2018-7 through TB2018-10). To date a total of ten (10) exploratory test borings have been drilled and hydraulically tested for Task 1 of this investigation.

2.1 TEST DRILLING

HNTB/EWSU arranged for access to and selected the test drilling locations along a 4½ mile stretch of Waterworks Road. The borings were generally drilled within the right-of-way for Waterworks Road as local property owners were reluctant to provide permission to drill on their properties within the State of Indiana. Access was granted for one boring (TB2018-7) that was drilled along a farm lane about 2,600 feet east of Waterworks Road. Prospective sites on the south side of Waterworks Road were suggested, but not pursued due to being on the Kentucky side of the border. The drilling was directed by a Ranney Hydrogeologist experienced in collector well evaluations. The test borings were drilled by the Layne Specialty Drilling Division using rotasonic drilling technology. In rotasonic drilling, a drill casing is advanced into the ground using rotary/vibrosonic techniques. The rotasonic drilling method produces a nearly continuous core of the subsurface materials penetrated by the sample tube. This method does not require the use of drilling mud, so there is no mud to dispose of, and disturbance of the ground surface is minimal.

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Each boring was advanced until bedrock was encountered. Lithologic samples were generally obtained every five feet and at each change in formation materials. The lithologic samples were placed in suitable containers, plainly identified as to date of collection, hole number, and depth of stratum. Sieve analyses were performed on selected lithologic samples collected from the test borings to help characterize aquifer materials and evaluate hydraulic conductivity. Upon completion of the project, all samples not selected for sieve analysis were turned over to EWSU.

Hydraulic interval tests (discussed below) were completed on both test holes. Following completion of the hydraulic interval testing, the test holes were either converted to 2-inch PVC observation wells or properly abandoned by filling the boreholes with bentonite grout.

Following the completion of the drilling and testing activities, HNTB arranged for surveying of the drilling locations. The horizontal coordinates and ground surface elevations at the drilling locations were surveyed.

2.2 HYDRAULIC INTERVAL TESTING

Hydraulic interval testing was completed at each of the boring locations. The vertical interval tested in the test holes was selected by the hydrogeologist on the basis of the drilling and sampling results. Upon

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reaching the total completion depth of the test boring, the casing was pulled back to the bottom of the interval to be tested, and a temporary well was constructed by installing a 10-foot length of well screen (4-inch diameter, wire-wrapped continuous slot) using the pullback method. The screen slot size was selected based on the grain size of the formation materials, with 0.020 inch to 0.060 inch slot screens utilized during the testing.

Development of the test interval was accomplished by air lifting for a two hour period after which the water produced was visibly clear and contained little or no sediment. The temporary well was equipped with a temporary pump capable of pumping up to 100 gallons per minute (gpm). An in-line electromagnetic flow meter (4-inch diameter Omega FMG1000 Series) was used to measure the pumping rates during the testing. The selected interval was pumped for a minimum of two (2) hours, with the pumping period divided into four (4) steps of at least thirty (30) minutes duration. During each step, the pumping was maintained at a constant rate.

Depths to water were measured to the nearest 0.01 foot in the temporary well prior to and during the pumping period. The elapsed time of pumping to the nearest minute and the pumping rate associated with each water level measurement were recorded.

During each step of the pumping period, water level measurements in the temporary well were made on approximately the following schedule:

- Every 1 minute for 0 to 6 minutes from the start of the step;
- Every 2 minutes for 6 to 12 minutes from the start of the step;
- Every 5 minutes after 15 minutes from the start of the step.

During the hydraulic interval testing, water samples were field screened for pH, conductivity, total hardness, iron and temperature. Additionally, water samples taken at the end of the pumping period were submitted to National Testing Laboratories (NTL) of Ypsilanti, Michigan for laboratory analysis and general quality screening.

3 TASK 2 RESULTS

This section presents the findings of the field activities. From this information, preliminary collector well yield and conceptual design elements can be developed.

3.1 DRILLING RESULTS

Ten (10) test borings (TB2017-1 through TB2017-6 & TB2018-7 through TB2018-10) were drilled to evaluate the aquifer properties (Figure 1) along the right-of-way for Waterworks Road. Logs for the test borings and photographs of the lithologic samples are presented in Appendix A and a summary of information on the test holes is presented in Table 1. A generalized northwest to southeast cross-section A-A' (Figure 2) was developed from the test boring lithologic information. The cross-section is presented in Figure 3.

The total drilled depths of the test borings varied from 64 to 116 feet. The depths at which the top of bedrock was encountered generally varied from 100 to 112 feet. The exception to this was the eastern most boring (TB2018-10), which encountered bedrock much shallower at a depth of 60 feet. TB2018-10 was located near the Ohio River and directly across from the edge of the valley (bedrock high) located on the opposite side of the river. It is likely that this bedrock high continues across the river into Indiana at the TB2018-10 location. Based on the surveyed ground surface elevations and the depths at which the bedrock surface was encountered, the bedrock surface is relatively uniform across the other drilling sites. The bedrock surface elevations in the test holes varied from a minimum of 254 feet NAVD88 at TB2017-3 to a maximum of 261 feet NAVD88 at TB2018-9. While the bedrock surface elevation at the shallow TB2018-10 location was 310 feet NAVD88.

The alluvial materials above the bedrock are generally comprised of a fining upward sequence comprised predominantly of fine to medium-grained lithic sand, interbedded with lenses of clay, clayey silt, silt, coarse sand, and gravel. Typically, the lower portion of the alluvial materials encountered were generally comprised of coarse-grained materials including gravelly sand and sandy gravel with occasional cobbles. The middle portion is mostly fine to medium-grained lithic sand. Occasional thin, layers of clay were encountered in each of the test drilling locations. The upper part consists of finer overbank surficial deposits of sandy silt and clay. The bedrock encountered in the borings consisted of Pennsylvanian aged mudstone/shale and fine to medium grained sandstone. The bedrock is considered to be non-water bearing.

The two rounds of test drilling were conducted under substantially different river and groundwater level conditions. The groundwater level elevations in the test holes drilled in July-August 2017 (TB2017-1 through TB2017-6) ranged from 348.7 to 351.6 feet NAVD88 and indicated a west to northwest groundwater flow direction towards the river. The normal river pool elevation for this stretch of the Ohio River is 342 feet. During the 2017 test drilling program, the Ohio River level elevations reported at the Evansville gage (USGS 03322000) ranged from 342.1 to 349.6 feet NAVD88. The groundwater levels

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observed in the test borings at the time of the drilling were within depths at which the formation material was predominantly sand to silty sand indicating that the aquifer is under unconfined to semi-confined conditions.

The groundwater level elevations in the test holes drilled in March 2018 (TB2018-8 and TB2018-9) were considerably higher ranging from 360.0 feet NAVD88 (TB2018-8) to 361.6 feet NAVD88 (TB2018-9). The elevated groundwater levels observed in these borings were due the recent flooding of the Ohio River. The Ohio River level elevations at the Evansville gaged during the March 2018 drilling ranged from 351.9 to 356.7 feet and had recently been as high as 375 feet. Flood waters prevented access to the TB2018-7 location until May 22, 2018. During the testing of TB2018-7, the groundwater level was found to be flowing to at least 3 feet above grade under artesian pressure (grade elevation 356.6 feet). The flowing artesian conditions were likely the result of the recent Ohio River flooding.

3.2 GRAIN SIZE DISTRIBUTION ANALYSIS

Lithologic samples from each boring were selected for sieve analysis to determine the grain size distributions. The sieve analysis results are summarized in Table 2 and the sieve analysis data and grain size distribution graphs are presented in Appendix B.

As shown in Table 2, the range of the 60% passing grain diameter (D_{60}) of the samples analyzed varies from a minimum of 0.008 inch to a maximum of 0.202 inch. The uniformity coefficients ($C_u = D_{60}/D_{10}$) for the selected samples ranged from 1.5 to 16.9, with the majority having uniformity coefficients less than 4. Material with a C_u less than 4 is considered poorly graded or uniform.

Using the sieve analysis results, hydraulic conductivity values were estimated from grain size distribution based on equations presented in Vukovic and Soro (1992). These equations relate hydraulic conductivity to the effective grain size, grain size distribution and degree of sorting in the lithologic samples. It should be noted that hydraulic conductivity estimates based on grain size distribution are considered to have a low level of accuracy. They are presented in Table 2 to allow comparison of the vertical and horizontal variations within the aquifer materials and for comparison with the hydraulic conductivity values determined from the hydraulic interval tests.

3.3 HYDRAULIC INTERVAL TEST RESULTS

The data obtained from the hydraulic interval tests were utilized to calculate the aquifer transmissivity and hydraulic conductivity. Due to the short duration of the hydraulic interval tests and because they are single well pumping tests, the results for the aquifer parameters should be considered as approximate and are intended primarily to allow comparison of the test hole locations.

The transmissivity and hydraulic conductivity of the aquifer can be estimated from data collected during the interval tests. Transmissivity of an aquifer can be estimated from specific capacity using the following equation (Driscoll, 1986):

$$T = 1500 * Q/s \quad \text{(unconfined)}$$

or

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$$T = 2000 * Q/s \quad \text{(confined)}$$

Where: T = transmissivity, gpd/ft
Q/s = specific capacity, gpm/ft

Hydraulic conductivity is related to transmissivity by the following equation:

$$K = T/b$$

Where: K = hydraulic conductivity, gpd/ft^2
b = aquifer thickness, feet

For the hydraulic interval tests, the temporary small diameter wells were used to evaluate the permeability of the selected interval in the borings. The specific capacity data from the test were adjusted for well loss and the effects of partial penetration effects using an equation by Kozeny (Driscoll, 1986), such that:

$$T = \frac{1500 \cdot Q/s}{X \cdot E}$$

$$X = L \cdot \left[1 + 7 \cdot \sqrt{\frac{r}{2 \cdot b \cdot L}} \cdot \cos\left(\frac{\pi \cdot L}{2}\right) \right]$$

Where: r = well radius, in feet
b = aquifer thickness, feet
L = well screen length as a fraction of aquifer thickness
and E = efficiency, obtained from analysis of the step test

The Kozeny equation to adjust for partial penetration is based on the assumption that the aquifer is homogeneous and isotropic. Because the aquifer materials have a fining upward character at the sites tested, the partial penetration adjustment could result in an overestimate of the transmissivity and hydraulic conductivity values. For the transmissivity estimates, only the coarser deposits of sand to sandy gravel were considered in determining the saturated thickness of the alluvial aquifer at the sites.

The hydraulic interval testing results are presented in the following discussion and summarized in Table 3, with the water level data being included in Appendix C. Semi-logarithmic plots showing the time-drawdown relationships during the individual hydraulic interval tests are depicted in Figures 4 through 12.

Following the drilling of TB2017-1, a temporary well screen (0.020-inch slot openings) was set between depths of 90 and 100 feet for hydraulic interval testing. The TB2017-1 temporary well was pumped at rates of 40, 55, 70 and 88 gpm, with the observed drawdown at the end of the 4th step being 6.44 feet

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equating to a specific capacity of 14 gallons per minute per foot of drawdown (gpm/ft). The transmissivity of the aquifer materials at TB2017-1 was estimated to be 116,000 gallons per day per foot (gpd/ft) and the hydraulic conductivity was estimated to be 1,400 gpd/ft^2, based upon an unconfined aquifer thickness of 81 feet. Following testing, the boring was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 90 to 100 feet. The observation well was completed with a flush-mount protective cover.

For TB2017-2, the temporary well screen (0.020-inch slot openings) was also set between depths of 90 and 100 feet for hydraulic interval testing. The temporary well was pumped at rates of 44, 60, 74 and 91 gpm, with the observed drawdown at the end of the 4th step being 8.67 feet equating to a specific capacity of 11 gpm/ft. The transmissivity of the aquifer materials at TB2017-2 was estimated to be 113,000 gpd/ft and the hydraulic conductivity was estimated to be 1,600 gpd/ft^2, based upon an aquifer thickness of 71 feet. TB2017-2 was abandoned with bentonite following testing.

With the consistent results from the first two tests, a zone of coarser deposits located in the middle of the aquifer was selected for testing at TB2017-3. The temporary well screen (0.040-inch slot openings) was set from 69 to 76 feet at TB2017-3. The temporary well was pumped at rates of 37, 61, 72 and 92 gpm, with the observed drawdown at the end of the 4th step being 12.24 feet equating to a specific capacity of 8 gpm/ft. The transmissivity of the aquifer materials at TB2017-3 was estimated to be 94,000 gpd/ft and the hydraulic conductivity was estimated to be 1,400 gpd/ft^2, based upon an aquifer thickness of 67 feet. TB2017-3 was abandoned with bentonite following testing.

For TB2017-4, the temporary well screen (0.060-inch slot openings) was also set between depths of 65 and 75 feet for hydraulic interval testing. The temporary well was pumped at rates of 36, 61, 75 and 93 gpm, with the observed drawdown at the end of the 4th step being 7.21 feet equating to a specific capacity of 13 gpm/ft. The transmissivity of the aquifer materials at TB2017-4 was estimated to be 101,000 gpd/ft and the hydraulic conductivity was estimated to be 1,900 gpd/ft^2, based upon an aquifer thickness of 54 feet. Following testing, TB2017-4 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 65 to 75 feet.

At TB2017-5, the temporary well screen (0.060-inch slot openings) was set from 90 to 100 feet in a coarse zone of sandy gravel. The well was pumped at rates of 38, 61, 75 and 93 gpm, with the observed drawdown at the end of the 4th step being 2.10 feet equating to a specific capacity of 44 gpm/ft. The transmissivity of the aquifer materials at TB2017-5 was estimated to be 241,000 gpd/ft and the hydraulic conductivity was estimated to be 3,800 gpd/ft^2, based upon an aquifer thickness of 63 feet. Following testing, the boring was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 90 to 100 feet.

For TB2017-6, the temporary well screen (0.060-inch slot openings) was set between depths of 75 and 85 feet for hydraulic interval testing. The temporary well was pumped at rates of 42, 62, 77 and 94 gpm, with the observed drawdown at the end of the 4th step being 4.67 feet equating to a specific capacity of 20 gpm/ft. The transmissivity of the aquifer materials at TB2017-6 was estimated to be 143,000 gpd/ft

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and the hydraulic conductivity was estimated to be 3,000 gpd/ft^2, based upon an aquifer thickness of 48 feet. After testing was completed, TB2017-6 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 75 to 85 feet.

For TB2018-7, the temporary well screen (0.020-inch slot openings) was set between depths of 85 and 95 feet for hydraulic interval testing. Prior to testing, the well was flowing under artesian conditions at about 1 to 2 gpm. The temporary well was pumped at rates of 40, 60, 82 and 99 gpm, with the observed drawdown at the end of the 4th step being 27.17 feet equating to a specific capacity of 4 gpm/ft. The transmissivity of the aquifer materials at TB2018-7 was estimated to be 34,000 gpd/ft and the hydraulic conductivity was estimated to be 500 gpd/ft^2, based upon an aquifer thickness of 66 feet. After testing was completed, TB2017-6 was abandoned with bentonite.

At TB2018-8, the interval selected for hydraulic testing was from 60 to 70 feet (0.040-inch slot openings). The temporary well was pumped at rates of 48, 66, 86 and 105 gpm, with the observed drawdown at the end of the 4th step being 7.52 feet equating to a specific capacity of 14 gpm/ft. The transmissivity of the aquifer materials at TB2018-8 was estimated to be 90,000 gpd/ft and the hydraulic conductivity was estimated to be 2,000 gpd/ft^2, based upon an aquifer thickness of 45 feet. After testing was completed, TB2017-8 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 60 to 70 feet.

For TB2018-9, the temporary well screen (0.040-inch slot openings) was set between depths of 80 and 90 feet for hydraulic interval testing. The temporary well was pumped at rates of 37, 60, 77 and 103 gpm, with the observed drawdown at the end of the 4th step being 7.80 feet equating to a specific capacity of 13 gpm/ft. The transmissivity of the aquifer materials at TB2018-9 was estimated to be 113,000 gpd/ft and the hydraulic conductivity was estimated to be 1,600 gpd/ft^2, based upon an aquifer thickness of 69 feet. After testing was completed, TB2018-9 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 80 to 90 feet.

Hydraulic interval testing was not conducted at TB2018-10 due the shallow depth to bedrock and limited thickness of sand and gravel deposits. This boring was abandoned immediately following drilling.

3.4 FIELD WATER QUALITY RESULTS

Field testing of the water discharged from the temporary wells was conducted. The discharge water was tested for temperature, pH, specific conductance, iron and total hardness. The field water quality results are presented in Table 4.

Specific conductance is a useful indicator of the total dissolved solids concentration of water because it is proportional to the dissolved ion concentrations. The specific conductance values from the discharge ranged from a low of 617 microsiemens per centimeter (µS/cm) for the average of samples from TB2018-8 to a high of 1,088 µS/cm for the samples from TB2017-5. In general, the deeper the sampled interval the higher the specific conductance value. The average pH values ranged from 6.9 to 7.4

standard units (SU). The average temperature of the water discharged from the wells ranged from 54.7 to 61.7° F.

The average of field test results for iron ranged from 0.3 to 7.6 milligrams per liter (mg/l). The high value of 7.6 mg/l (TB2017-5) exceeded the range of the test kit. In order to estimate the iron content from TB2017-5 a 50% solution of distilled water was used and the result doubled to estimate the iron content. This method could have introduced some error into the field iron result for TB2017-5. The field hardness values varied from 360 mg/l to over 400 mg/l, which exceeded the range of the field kit. Overall these concentrations are reflective of groundwater quality in alluvial aquifers along the Ohio River.

3.5 LABORATORY WATER QUALITY RESULTS

Water samples were collected from the temporary wells and submitted to NTL for laboratory analysis of selected parameters. The laboratory results confirmed the field quality analyses, indicating that the groundwater is relatively hard and high in iron, manganese and total dissolved solids (TDS). The total hardness values ranged from 310 mg/l at TB2017-3 to 590 mg/l TB2017-5. The concentrations in the samples from each of the borings exceeded the USEPA secondary maximum contaminant levels (SMCLs) for iron (SMCL = 0.3 milligrams per liter (mg/l)), with the exception of TB2018-8 (0.12 mg/l). The samples from each boring exceeded SMCL of 0.05 mg/l) for manganese. The samples from TB2017-5, TB2018-7 and TB2018-9 exceeded the SMCL for TDS (SMCL = 500 mg/l). None of the VOCs or any pesticides/herbicides that were analyzed for were detected at or above the minimum reporting limits.

For quick comparison of the water quality differences between the samples, a summary table of selected general groundwater quality parameters is presented below. A complete listing of all the parameters analyzed for is presented in Table 5 with the laboratory reports included in Appendix D.

Laboratory Water Quality Results

Constituent	Units	TB2017-1 90-100 ft	TB2017-2 90-100 ft	TB2017-3 70-76 ft	TB2017-4 65-75 ft	TB2017-5 90-100 ft	TB2017-6 75-85 ft	TB2018-7 85-95 feet	TB2018-8 60-70 ft	TB2018-9 80-90 ft
Arsenic	mg/l	0.009	0.008	ND	ND	0.008	0.005	0.016	ND	ND
Iron	mg/l	3.63	3.38	1.75	1.70	4.46	1.49	3.83	0.12	5.17
Manganese	mg/l	0.276	0.398	2.260	3.390	0.359	1.950	0.478	2.720	2.440
Hardness	mg/l	410	420	360	310	590	350	540	320	540
pH	S.U.	6.9	6.8	6.8	6.6	6.9	6.8	6.8	6.7	6.6
TDS	mg/l	480	480	430	380	700	390	650	370	580
Chloride	mg/l	15	17	21	23	43	36	33	23	9.6
Nitrate as N	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfate	mg/l	100	120	86	71	200	30	120	48	110

As shown, the overall water quality from the lower intervals tested was poorer than the shallower intervals tested. The only exception was for the manganese levels, which were generally higher in the shallower interval tests.

The water quality results represent the groundwater quality in the aquifer under the ambient conditions. Given the distances of the sites from the Ohio River, the overall water quality is unlikely to change significantly if collector wells were to be installed at these locations. If collector wells were installed adjacent to the river and pumped continuously at sufficient rates, the quality of water produced from the wells should improve due to the recharge from induced infiltration from the river, whose quality is lower in most dissolved parameters.

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4 COLLECTOR WELL YIELD ESTIMATES

The results of the drilling and hydraulic interval testing allow the estimation of potential collector well yield under conditions that vary from those observed during testing. The theoretical drawdown under steady-state pumping conditions in a collector well near a stream can be calculated using the following equation developed by Hantush and Papadopulos (1962):

$$s_{cs} \geq \left(\frac{Q}{2\pi Kb}\right) \mathrm{Ln} \left(\frac{\Gamma^{\Gamma}}{\varepsilon^{\varepsilon}} \left(\frac{\left(\frac{b}{\pi r_w}\right)^2}{2\left(1 - \cos\frac{\pi}{b}\left(2z_l + r_w\right)\right)} \right)^{\frac{b}{4l}} \right)$$

where:	s_{cs}	= Drawdown in collector well, ft
	Q	= Yield of collector, gal/day
	K	= Hydraulic Conductivity, gal/day/ft^2
	b	= Saturated thickness of aquifer, ft
	Γ	= (2 (a - rc))/l
	a	= Effective distance to a line of recharge, ft
	l	= Average length of laterals, ft
	r_c	= Radius of collector caisson, ft
	ε	= (2a - rc - l)/l
	r_w	= Effective radius of each lateral, ft
	z_l	= Depth of lateral below static water level, ft

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For the purposes of estimating the potential collector well yields, the effective "a" distance to the recharge boundary represented by the Ohio River was set to the physical distance of the test sites to the river bank. The static water level was conservatively set to the normal pool elevation of 342 feet for this stretch of the Ohio River. The centerline of the collector well laterals was assumed to be in the lower portion of the intervals hydraulically tested at each boring. The average lateral length was assumed to be 200 feet and the available drawdown was set to maintain at least 20 feet of water above the laterals.

Table 6 summaries the preliminary collector well yields estimated using the above equation and site-specific information collected during the recent test drilling program. As listed the individual yields for collector wells installed at the test boring locations are estimated to range from 1.6 to 11 MGD.

The test borings are located distances of 2,000 to 7,300 feet from the Ohio River (recharge source). These distances from the river would likely result in wells that pump largely groundwater from storage within the floodplain area. Collector wells constructed closer to the river would be expected to develop a significant percentage of water through induced (e.g. riverbank) infiltration which would be expected to support 30% to 50% higher individual well yields assuming similar aquifer deposits.

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5 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

Ranney Collector Wells, under subcontract to HNTB, recently completed a hydrogeological investigation along the Ohio River in the Green River Island area south of Evansville, Indiana. The objective of the project was to evaluate the feasibility of obtaining a groundwater supply of at least 40 MGD for the City of Evansville Water and Sewer Utility. The scope of work for Ranney's portion of the project consisted of the test borings, hydraulic interval testing and data analysis reporting.

The Phase 1 investigation, which included the drilling and sampling of ten (10) test borings and conducting hydraulic tests in these test borings. The majority of test holes were located within the right-of-way for Waterworks Road, generally south and to the east of the City's water treatment plant. The exception to this was TB2017-7, which was located down a farm access lane 2,600 feet east of Waterworks Road.

The drilling results indicated that the alluvial aquifer along the Ohio River at the test boring locations is comprised predominantly of a fining upward sequence comprised fine to medium-grained lithic sand, interbedded with lenses of clay, clayey silt, silt, coarse sand, and gravel. The lower portion of the alluvial materials is generally comprised of coarse-grained materials including sand and gravel with occasional cobbles. Occasional thin, layers of clay were encountered at the test drilling locations.

The total drilled depths of the ten (10) test borings varied from 64 to 116 feet. The depths at which the top of bedrock was encountered generally varied from 110 to 112 feet. The exception was TB2018-10, which encountered a bedrock high at a depth of 60 feet. Excluding TB2018-10, the bedrock elevation showed little variation ranging from about 254 to about 261 feet. Results of hydraulic interval tests indicated aquifer transmissivities ranged from 33,000 to 240,000 gpd/ft, with hydraulic conductivity values ranging from 500 to 3,800 gpd/ft^2. The water quality results indicated that the water is relatively hard with significant levels of iron, manganese and total dissolved solids.

The results of the test drilling and hydraulic interval testing program indicate that the materials present are of sufficient thickness and permeability to be considered for the development of collector wells. Preliminary collector well yields were estimated for each of the test boring locations. The individual yields for collector wells installed at the test boring locations are estimated to range from 1.6 to 11 MGD.

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5.2 RECOMMENDATIONS

Based upon the preliminary testing completed in Phase 1 to date, it will require multiple collector wells to develop a firm capacity of 40 MGD, or more. If EWSU desires to move forward with the potential development of a water supply utilizing RBF with collector well technology it is recommended that additional sites located adjacent to the Ohio River be evaluated. Collector wells located within 300 feet of the river would be expected to develop a significant portion of water through RBF and would be expected to support 30% to 50% higher individual well yields than those sites tested so far, along with water quality improvements. It is recommended that the area to the south of Evansville Waterworks along the Ohio River be evaluated (Figure 12). Existing information indicates that the bedrock surface elevation in this area ranges from approximately 240 to 260 feet (IGS, 1986 & USGS 2009). This indicates that there would be over 100 feet on unconsolidated materials at these locations, with the potential of up to 80 feet of saturated sand and gravel deposits.

It is also recommended that the site of the 1951 investigation of the Evansville Waterworks be evaluated to confirm their findings. A review of the available data from the 1951 investigation indicated an aquifer transmissivity in the range of 150,000 to 180,000 gpd/ft for the Waterworks site. Based upon this information and the close proximity to the Ohio River (recharge), it is estimated that a collector well could yield up to 15 MGD at this location. Water produced from the collector well at the Waterworks location could be used to augment the existing supply or blend with the existing surface water supply to possibly simplify treatment. Water produced from a collector well would be significantly lower in suspended solids than the existing surface water supply. Additionally, the water produced by a collector well would have a lower range of seasonal temperature fluctuations. The seasonal temperature range for a collector well at the Waterworks location would be expected to range from about 50° F to 65° F, which could be blended with the existing surface water supply to help mitigate the large temperature fluctuations observed with the existing supply.

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IN0043117
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June 28, 2019

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IDEM/OWQ

Attn: Branch Chief
Indiana Department of Environmental Management
Office of Water Quality
Compliance Evaluation Section
100 North Senate Avenue
Indianapolis, Indiana 46204

Subject: **Evansville Water and Sewer Utility (EWSU) – Water Treatment Plant Vanderburgh County, Indiana - NPDES Permit No. IN0043117**

The following information is provided in regards to the above referenced subject and pursuant to the *SCHEDULE OF COMPLIANCE* in *Part I D.1:* that states "*This schedule of compliance shall not commence until a final determination on the mercury variance submittal is made by the Commissioner. Until a final determination on the variance request is made, the permittee shall continue to evaluate whether additional control technologies or pollution prevention measures exist to comply with the final effluent limitations or reduce the level of those pollutants currently being discharged by the plant. This evaluation shall be submitted to IDEM, OWQ, Compliance Evaluation Section every nine (9) months from the effective date of the permit. Monitoring and reporting of influent and effluent is required during the interim period*":

1) **Update on control technologies/pollution prevention** - no further feasible treatment or control technologies have been identified beyond those evaluated as part of the submitted *APPLICATION FOR A VARIANCE FROM INDIANA WATER QUALITY STANDARDS (MERCURY)* dated September 27, 2016.

2) **Summary of influent and effluent mercury data** – except for the current month (June) which is pending and will be provided once available, the following table summarizes the mercury concentrations as reported on the Monthly Monitoring Reports (MMR's) and Discharge Monitoring Reports (DMR's) for the previous nine (9) month period:

Mercury ng/L				
Date (collection)	Effluent			Influent
	Outfall 002	Outfall 004	Outfall 005	River
10/2018	7.13	6.22	44.5	<5.00
12/2018	<5.00	<5.00	<5.00	<5.00
02/2019	<5.00	<5.00	<5.00	<5.00
04/2019	262.00	16.3	7.40	6.89
06/2019				

A summary of the influent (river) and effluent (outfalls 002, 004 & 005) flow data for the corresponding period is attached with this update.

3) **Update on status of plant upgrades/source water transition (surface water to ground water)** - As was mentioned in the last report (a copy of which is attached for ease of reference), an extensive investigation of an alternate water source has been ongoing. Twelve test borings have been performed and preliminary water quality and quantity data has been obtained. The draft briefing memorandum of that effort is also attached with this report.

Concurrent with that wellfield evaluation was the development of a Request for Proposals (RFP) for Advanced Facility Planning (AFP) which was issued in November 2018 and proposals were received in January of this year. Responders to the RFP were subsequently interviewed and a professional team headed by AECOM was recently selected. The scope of that agreement is being finalized and fees are being negotiated as of this writing. The formal agreement is expected to be executed at any time. For information and reference, a copy of that RFP is also attached to this report

A subsequent update will be provided when the review of that draft report is completed and the next steps are decided upon or within nine (9) months as outlined above. In the interim, please feel free to contact me or the individuals copied below with any questions or if any additional information is needed.

Sincerely,

Patrick Keepes
Water Superintendent

Cc: Richard Glover – EWSU Water Production Manager
Timothy Hall – EWSU Water Quality Manager
File

Attachments

INFLUENT (RIVER) AND EFFLUENT (OUTFALLS 002, 004 & 005) FLOW DATA

	Oct-18				Dec-18			
	Influent (MG)	Effluent (MG)			Influent (MG)	Effluent (MG)		
Daily	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005
Min.	19.58	1.2710	0.2730	0.6700	20.51	0.1273	0.0050	0.7980
Ave.	25.71	1.2918	0.7870	0.7999	24.27	1.2355	0.3148	0.8151
Max.	30.01	1.3010	1.8530	0.8780	29.88	1.2780	0.6710	0.8260
1st	27.12	1.2950	0.3170	0.8760	21.72	1.2780	0.0550	0.8210
2nd	27.33	1.2960	0.4200	0.8780	25.12	1.2780	0.0412	0.8230
3rd	28.99	1.2710	0.7680	0.7910	26.52	1.2770	0.0379	0.8210
4th	28.17	1.3010	0.4610	0.7500	26.11	1.2750	0.4340	0.8220
5th	27.06	1.3000	0.3260	0.7500	29.88	1.2750	0.5590	0.8200
6th	28.97	1.2960	0.5690	0.7500	22.38	1.2740	0.4220	0.8160
7th	28.66	1.2970	0.8580	0.7510	24.30	1.2740	0.5120	0.8190
8th	28.01	1.2970	1.1110	0.7510	25.65	1.2730	0.1020	0.8210
9th	28.95	1.2970	1.1640	0.7190	24.01	1.2740	0.0110	0.7980
10th	30.01	1.2970	0.9500	0.6970	25.66	1.2730	0.1510	0.8260
11th	25.70	1.2970	1.1290	0.6700	26.29	1.2740	0.3570	0.8250
12th	24.65	1.2960	0.6800	0.8190	26.68	0.1273	0.6660	0.8240
13th	23.55	1.2960	0.3750	0.8170	24.70	1.2740	0.5770	0.8240
14th	24.86	1.2960	0.2730	0.8180	25.11	1.2750	0.2480	0.8250
15th	24.46	1.2940	0.6440	0.8170	23.94	1.2730	0.3670	0.8240
16th	25.04	1.2910	0.6100	0.8160	22.81	1.2750	0.0920	0.8250
17th	28.79	1.2900	1.6630	0.8170	25.26	1.2730	0.1010	0.8210
18th	26.04	1.2900	1.6510	0.8190	24.64	1.2730	0.0670	0.8250
19th	23.70	1.2870	1.8530	0.8190	27.06	1.2700	0.0050	0.8200
20th	23.60	1.2880	0.7120	0.8190	25.38	1.2690	0.1540	0.8160
21st	23.31	1.2890	0.7740	0.8220	23.82	1.2680	0.5740	0.8120
22nd	25.36	1.2860	1.6670	0.8220	21.87	1.2680	0.3060	0.8070
23rd	26.72	1.2880	0.8800	0.8220	22.98	1.2690	0.2030	0.8070
24th	27.13	1.2880	0.6760	0.8220	23.83	1.2690	0.5460	0.8060
25th	25.09	1.2880	0.4740	0.8220	21.88	1.2700	0.5050	0.8070
26th	23.19	1.2890	0.5180	0.8230	23.73	1.2700	0.5750	0.8060
27th	21.98	1.2890	0.4890	0.8240	23.72	1.2700	0.4310	0.8030
28th	19.58	1.2890	0.3470	0.8240	20.51	1.2720	0.3810	0.8040
29th	23.89	1.2890	0.6850	0.8240	22.45	1.2700	0.3810	0.8010
30th	24.13	1.2890	0.7050	0.8240	21.32	1.2700	0.2260	0.8020
31st	22.82	1.2890	0.649	0.8240	23.10	1.2700	0.6710	0.7980

	Feb-19				Apr-19			
	Influent (MG)	Effluent (MG)			Influent (MG)	Effluent (MG)		
Daily	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005
Min.	21.09	1.1040	0.0016	0.6030	11.95	1.2171	0.0843	0.5007
Ave.	24.37	1.2003	0.2949	0.6787	23.86	1.2938	0.3081	0.6207
Max.	28.03	1.2700	1.0770	0.8246	28.12	1.2997	0.6654	0.7251
1st	21.17	1.2700	0.5180	0.7042	25.06	1.2934	0.3429	0.6524
2nd	28.03	1.2690	0.6790	0.7058	25.40	1.2938	0.4358	0.7251
3rd	24.72	1.2660	0.0337	0.7069	26.85	1.2935	0.3709	0.6712
4th	25.90	1.2630	0.1044	0.7076	22.92	1.2946	0.1625	0.6359
5th	27.08	1.2640	0.2697	0.6579	24.67	1.2948	0.3222	0.6126
6th	27.50	1.2640	0.2510	0.6400	24.00	1.2952	0.1566	0.6110
7th	26.25	1.2630	0.0435	0.6417	11.95	1.2937	0.0953	0.6142
8th	23.87	1.2630	0.0560	0.6390	16.27	1.2951	0.3922	0.6136
9th	25.40	1.2600	0.4590	0.6210	26.54	1.2946	0.4398	0.6153
10th	25.30	1.2590	0.3110	0.6030	16.21	1.2956	0.3441	0.6403
11th	26.26	1.2580	0.3961	0.6466	25.95	1.2967	0.2074	0.7185
12th	26.87	1.2340	0.3397	0.6596	26.63	1.2969	0.2032	0.7126
13th	26.71	1.1830	0.2546	0.6585	24.19	1.2971	0.1610	0.7094
14th	23.80	1.1450	0.2537	0.6567	22.97	1.2966	0.0965	0.7063
15th	21.77	1.1250	0.2718	0.6589	26.23	1.2964	0.3944	0.6965
16th	22.66	1.1150	0.2106	0.7098	26.50	1.2983	0.3907	0.6549
17th	21.38	1.1180	0.1336	0.7155	28.12	1.2997	0.4006	0.5519
18th	22.68	1.1280	0.3076	0.7177	26.04	1.2995	0.2322	0.5967
19th	22.37	1.1470	0.1982	0.7176	21.84	1.2981	0.2453	0.5947
20th	26.00	1.1650	0.2535	0.7198	23.41	1.2969	0.0843	0.5660
21st	23.26	1.1890	0.3163	0.7191	23.25	1.2963	0.1105	0.5472
22nd	21.09	1.2020	1.0770	0.8246	23.96	1.2960	0.6654	0.5007
23rd	23.46	1.1990	0.4992	0.6393	26.32	1.2964	0.5538	0.5756
24th	23.34	1.1880	0.0016	0.7217	27.00	1.2971	0.5060	0.5813
25th	24.19	1.1720	0.2858	0.6860	22.87	1.2973	0.1763	0.5866
26th	23.54	1.1040	0.2013	0.6393	25.16	1.2972	0.2611	0.5859
27th	22.61	1.1400	0.2490	0.6425	23.46	1.2978	0.3840	0.5866
28th	25.21	1.1550	0.2816	0.6431	24.16	1.2984	0.0864	0.5859
29th					23.66	1.2996	0.4092	0.5855
30th					24.09	1.2171	0.6137	0.5855
31st								

GROUNDWATER INVESTIGATION AND TEST DRILLING BRIEFING MEMORANDUM MARCH 2019 UPDATE

DRAFT

INTRODUCTION

Over the last 20 months, HNTB and the Ranney Collector Wells (Ranney) division of Layne Christensen (Layne), completed a test drilling program to explore the possibility of replacing the current surface water supply with groundwater. This effort included the installation of 12 test borings along Waterworks Road from the north side of the Water Treatment Plant (WTP) to the point where the road intersects the Ohio River as can be seen on Figure 1. Figure 2 provides a closer look at the locations of the most recent borings 11 and 12.

The goal of this phase of the test drilling program was to identify potential locations with a sufficient aquifer to produce 15 million gallons per day (MGD) each from three or four collector wells to provide a total of 45 to 60 MGD groundwater. Test drilling consisted of completing borings to bedrock while taking continuous formation samples. If a promising zone was found, a 4-inch diameter casing and screen were installed, the temporary well was developed and a pumping test was completed to measure the specific capacity and estimate the aquifer transmissivity and hydraulic conductivity. These values are then utilized to predict the capacity of a collector well installed at the location of the test boring.

RESULTS TO DATE

The following table summarizes the results of the test boring program to date:

Table No. 1 – Boring Results

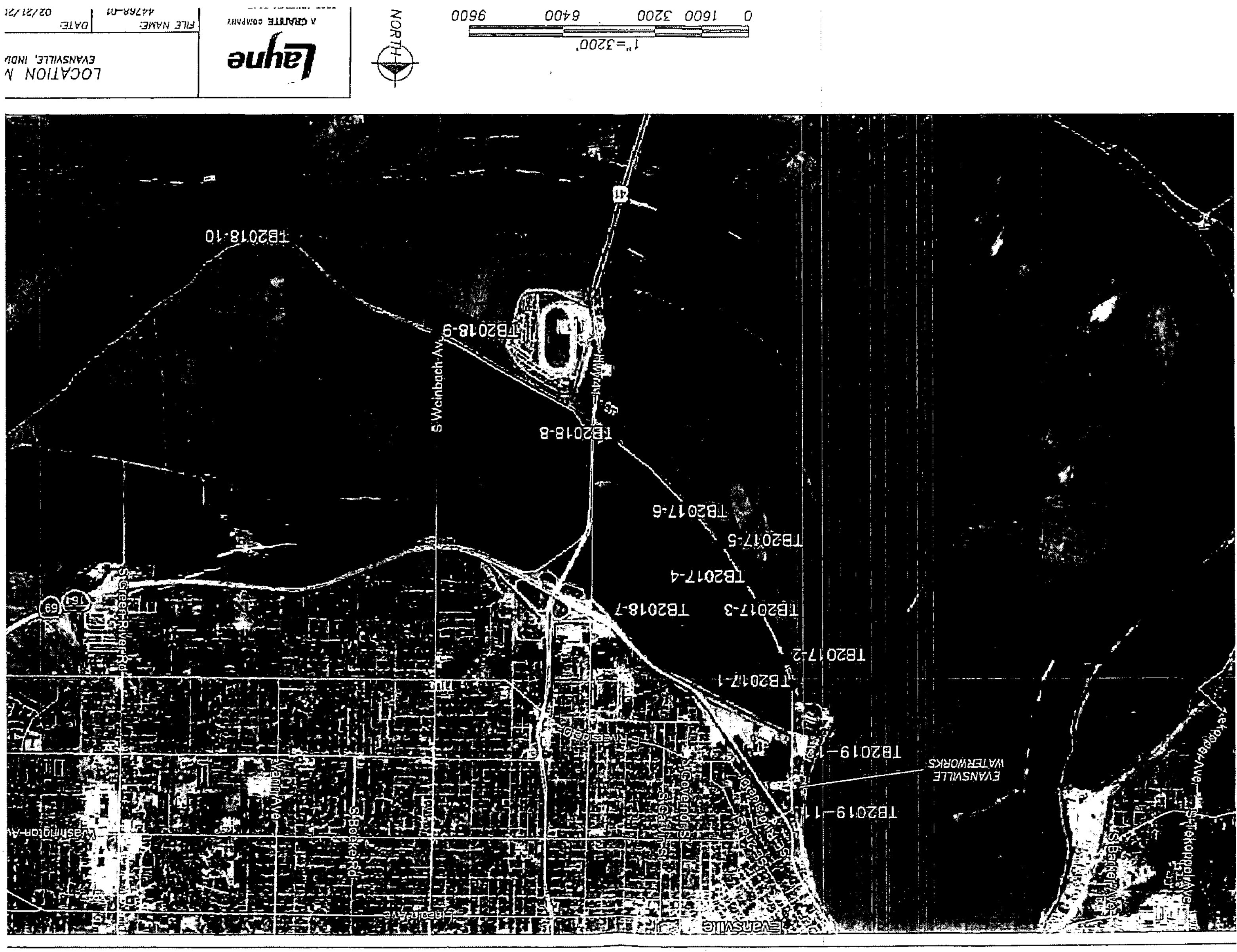
Boring #	Screened Internal	Transmissivity GPD/FT	Hydraulic Conductivity GPD/FT	Specific Capacity GPM/FT	Potential Yield MGD
1	90'-100'	116,000	1,400	14	5.0
2	90'-100'	113,000	1,600	11	6.0
3	69'-76'	94,000	1,400	8	3.4
4	65'-75'	102,000	1,900	13	3.2
5	90'-100'	240,000	3,800	44	11.0
6	75'-80'	143,000	3,000	20	5.3
7	85'-95'	33,000	500	4	1.6
8	60'-70'	90,000	2,000	14	2.2
9	80'-90'	113,000	1,600	13	6.2
10	No pump test due to shallow depth to bedrock				
11	90'-100'	110,000	1,400	10	8.5
12	80'-90'	111,000	1,500	10	8.7

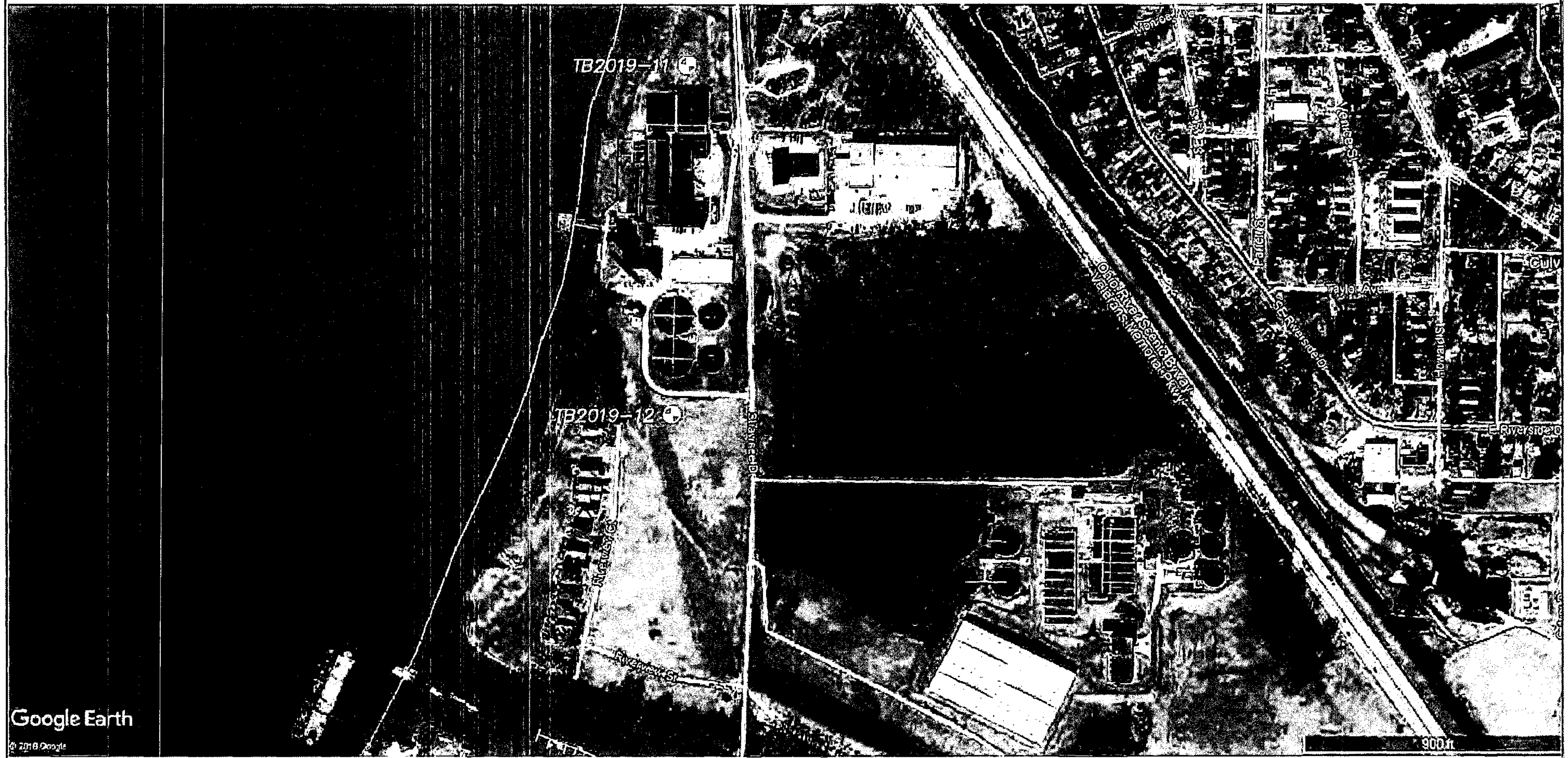
As can be seen in Table No. 1, the potential yield of collector wells installed in the sample area ranged from 1.6 MGD to 11.0 MGD, with borings #11 and #12 producing a combined total of an estimated 17 MGD. While less than the original stated goal, the boring results from #11 and #12 are promising and could be a good choice for a blending option at the plant replacing 70% of the average daily demand.

RECOMMENDED NEXT STEPS

To confirm the potential capacity of the area along the river in the area of borings #11 and #12, it is recommended that the test drilling program be continued to the next phase including completing a test production well located near the WTP and additional borings south of the marina in Kentucky. Earlier this year, approval was given by the EWSU to investigate completing additional borings along the Ohio River in Kentucky. As part of this effort, HNTB was tasked with and obtained access to the Staub property immediately south of the marina to allow the installation of additional test borings and possibly a test production well. With the extensive flooding along the river this winter, access to the Staub property was not possible at the time #11 and #12 were completed. It is recommended additional test borings located within the Staub property be completed during the test production well installation near the WTP.

HNTB still has $136,000 remaining in the original test drilling budget. To complete the additional borings, the test production well and their analysis, Layne's estimated total cost is $175,000. In addition to Layne's cost, HNTB expects to expend some time to plan and oversee their efforts and allowing for contingency, the EWSU should budget $200,000 to finalize the drilling program. Given that there is still $136,000 remaining in the original test drilling budget, an amendment of $64,000 will be required to complete the remainder of the program.


LOCATION MAP
EVANSVILLE, INDIANA
Layne
A GRANITE COMPANY
FILE NAME: 44768-01
DATE: 02/21/21
NORTH
0 1600 3200 6400 9600
1"=3200'
TB2018-10
TB2018-9
TB2018-8
TB2018-7
TB2017-6
TB2017-5
TB2017-4
TB2017-3
TB2017-2
TB2017-1
TB2019-11
EVANSVILLE WATERWORKS
S Weinbach Ave



SCALE IN FEET

0 250 500 1000 1500

NORTH

Layne
A GRANITE COMPANY
6360 HUNTLEY RD
COLUMBUS, OHIO 43229
(614) 888-6263 / FAX (614) 888-0208

TEST BORING LOCATIONS
EVANSVILLE, INDIANA

FIGURE 2

PROJECT NUMBER	DATE	FILE NAME	SCALE
44768	02/21/2019	44768-05	1" = 500'

LLOYD WINNECKE
MAYOR

EVANSVILLE WATER & SEWER UTILITY

ALLEN R. MOUNTS
DIRECTOR

1 NW Martin Luther King Blvd. Room 104 • Evansville, Indiana 47708
P O Box 19, Evansville, Indiana 47740-0001
(812) 436-7846 • FAX (812) 436-7863

November 29, 2018

Re: RFP 2018-11
Advanced Facility Planning
Water Filtration Plant

The Evansville Water and Sewer Utility (EWSU) is seeking proposals for professional engineering services to perform Advanced Facility Planning for its Water Filtration Plant at 1301 Waterworks Road.

Your firm had previously expressed interest in EWSU Anticipated Service Needs in Filtration Plant Component Design, Task 2.42. As part of the continuing water supply management program, EWSU is seeking advanced facility planning services that will consist of:

- Evaluation of Master Plan, existing asset inventory, existing Plant processes and capability, planned short term improvements (based on existing asset inventory results), groundwater study results, and potential operational cost savings related to needed plant upgrades to ensure water quality and resilience
- Development of treatment alternatives ranging from use of all surface water to blended surface and groundwater to all groundwater
- Treatment alternatives to address maintaining water production through sequencing, decommissioning, and constructability during development of alternatives
- Examination and presentation of alternatives to provide information to allow the Utility management to select a preferred alternative, including opportunity for public input, evaluation by Plant Operations and engineering evaluation
- Survey
- Geotechnical Investigation
- Preparation of preliminary engineering report, opinion of probable cost and 20 percent level construction set for selected alternative
- Coordination of Permitting and Land Use with following potential agencies:
    - City of Evansville Transportation and Service Department
    - City of Evansville Engineering Department

- Evansville-Vanderburgh County Levee Authority
- US Army Corps of Engineers (USACE)
- Indiana Department of Environmental Management
- Indiana Department of Natural Resources
- Kentucky Energy and Environment Cabinet

- Identification of additional property needs as indicated by selected option.

Please submit your firm's proposal, identifying your project team qualifications for this type of work. Proposals will be evaluated with the following criteria:

1. Relevant Experience
2. Staff Resumes
3. Project Approach
4. Anticipated Project Schedule

All projects identified under Relevant Experience shall be projects that were completed within the last 5 years, and include contact names and direct phone numbers of client references. Please do not include any EWSU projects under Relevant Experience. The quality of service and value of service from your team to the EWSU on past projects will be evaluated internally by the selection committee. Please only show staff resumes of team members that you anticipate will have billable hours on this project.

Additional items that may be taken into consideration during the evaluation process include:

1. Typical Percent of work completed in Evansville
2. Typical Percent of work completed in Indiana
3. Typical Percent of work to WBE and MBE team members

Please be aware that there is a 7 percent WBE and 12 percent MBE goal established by the City of Evansville Purchasing Department, and the EWSU is eager to meet or exceed these goals whenever possible.

Proposals shall not exceed forty single-sided pages, including appendices. Proposals should include four separate sections, as identified under the evaluation criteria. Please include the three additional items for consideration, listed above, in a summary box within the proposal. Please include the office location(s) where the work will be completed, company history, team history, or any other information that you feel would be beneficial to the selection committee.

All firms submitting a proposal are welcome to interview and discuss proposal contents with Utility staff prior to the submission date. Once submission is complete, all proposing firms shall observe a "black out" period of communication with members of the selection committee for this proposal until a final selection is made.

Please submit one electronic version of your proposal to:

J. Cris Cottom, P.E.
Water Capital Projects Manager
1931 Allens Lane
Evansville, IN 47720

jcottom@ewsu.com

All digital proposals are due no later than 3 P.M. Thursday, January 10, 2019. It is the submitter's responsibility to ensure electronic delivery of the proposal in a timely manner. Digital proposals will not be accepted if received after the time and date specified above, even if a delivery problem existed within a Sharepoint, FTP, or Dropbox delivery method. The EWSU will send a confirmation email to the submitter once the proposal is downloaded into the EWSU system. If the proposal is delivered by email, please note the maximum attachment size is 10 MB. Proposal copy delivered by hand are due no later than 3 P.M. Friday, January 11, 2019.

The EWSU selection process will be used to select the successful professional service providers. All companies that submit a proposal will receive notification of the results upon completion of the selection process. It is expected that a shortlist will be created and proposal team interviews will be scheduled at a later date. If you have any questions, please feel free to contact J. Cris Cottom at 812-421-2120, Ext: 2203.

Sincerely,

Michael D. Labitzke, P.E.
Deputy Director of Utilities, Program Management Office

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Note: From the AACE (Association for Advancement of Cost Estimating) International Recommended Practice No. 18R-97

OUCC DR 17-6

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

For Evansville's preferred new water treatment plant Alternate 2B, please provide cost support documentation for each major component lump sum cost listed in Table 9-9 Plant Alternative 2B Total Estimated Construction Cost on pages 126 and 127 of the Advanced Facility Plan (Attachment SMB-1 to Mr. Breese's case-in-chief testimony in this cause). Please provide copies of the Excel worksheets detailing quantities, unit costs, equipment costs, other data used to establish costs, and all assumptions and cost allowances. Please also provide copies of budgetary cost proposals provided by equipment vendors and material suppliers.

Information Provided:

The spreadsheet is attached as OUCC DR 17-6 - Alt 2B.xlsm. Also attached is OUCC DR 17-6 Timberline Output.pdf (developed in Timberline Cost estimating software) which presents further detail for cost estimates performed early in the development of the alternatives report. All equipment proposals are attached as "Budgetary Quotes.pdf".

Attachments:

OUCC DR 17-6 Attachment 1.xlsm
OUCC DR 17-6 Attachment 2.pdf
OUCC DR 17-6 Attachment 3.pdf

OUCC Note: DR 17-6 Attachment 3.pdf (budgetary quotes) is not included here due to its length (449 pages)

Cause No. 45545
OUCC DR 17-6 Attachment 1

Evansville Water and Sewer Utility
WTP Upgrade - Plant Alternative 2B (New Site) - Capital Cost

Component Description	Cost
Civil Site Work (Roads, Drainage, Fencing etc.)	$2,853,000
Rehabilitate River Intake	$6,752,000
Raw Water Piping, Metering Vault	$1,610,000
New Conventional Pretreatment System	$17,377,000
New Ozone Facility (Generation, Basin, LOX)	$19,630,000
New Biologically Active Filters & Building	$33,912,000
New Chemical Facilities (all)	$6,612,000
New Clearwell	$8,804,000
New High Service Pump Station	$11,130,000
Residual Pump Station Forcemain	$1,575,000
Filter Washwater Tank	$950,000
New Administration Building	$1,810,000
New Maintenance Building	$1,040,000
Interconnecting Site Utility / Electrical Work	$3,500,000
New Electric service entrance	$1,000,000
New Generator (2,000 KW)	$1,500,000
Subtotal	**$120,055,000**
Additional Construction Contingencies (3%)	$3,602,000
Other Misc. Plant-Wide Improvements (1%)	$1,201,000
Allowances	$500,000
Maintenance Building Relocation	$13,691,000
Startup and Commissioning	$1,000,000
Total Estimated Construction Cost	**$140,049,000**
Construction Adminstration and Bidding (2.5%)	$3,501,000
Inspection and Materials Testing (2%)	$2,801,000
Interest Incurred through Financing (2.25%)	$3,151,000
Permitting Fees and Legal Expenses (1%)	$1,400,000
Total Project Cost	**$150,902,000**

Notes:

1. New site assumed to be ready for construction through other City projects
2. Provide cost of WTP demolition and relocation of levee building and maintenance garage as sepa

Original Costs from Estimator

Description	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Demolition Work	$49,600	$75,000	1.512
Roof Repair / Replacement	$7,000	$10,500	1.500
Doors & Hardware Rehab	$13,000	$19,700	1.515
Building Finishes & Specialties	$34,200	$50,500	1.477
Structure and Walkway Rehabilitation	$50,000	$75,500	1.510
Process Piping and Accessories	$209,000	$317,800	1.521
Pump Replacement	$1,335,500	$2,020,400	1.513
Screen Replacement	$666,000	$1,019,100	1.530
Potassium Permanganate System	$249,000	$366,000	1.470
HVAC Replacement	$115,000	$172,000	1.496
Electrical Systems	$200,000	$302,000	1.510
Instrumentation	$84,000	$126,900	1.511
Totals	**$3,012,300**	**$4,555,400**	

Adjusted for Report

Table B1.1 - River Intake Rehabilitation, Low Service PS

Description		Estimated Cost	Cost Adjust Comments
Demolition Work		$75,000	
Roof Repair / Replacement (3,000 sf)		$60,000	X - City noted a whole new roof
Doors & Hardware Rehab		$13,000	
Building Finishes & Specialties		$35,000	
Structure and Walkway Rehabilitation		$50,000	
Process Piping and Accessories		$209,000	
Pump Replacement (6 units)		$1,336,000	
Intake Screens (3 units)		$1,300,000	X - quote of $750k for 3 screens - estimate seems to be pneumatic screens so updated
Potassium Permanganate System (1 unit)		$400,000	X - estimate seemed low - need to run piping over, hopper, storage, etc.
HVAC Replacement (3,000 sf)		$115,000	
Misc. Electrical (MCC Upgrades are Underway)		$150,000	X - MCC's are getting some upgrades
Instrumentation		$100,000	
Subtotal		**$3,843,000**	
Estimating Contingency	30%	$1,152,900	
Escalation to Midpoint	3%	$115,290	
Construction Subtotal		**$5,111,190**	
Contractor General Conditions	10%	$511,119	
Contractor Overhead and Profit	12%	$613,343	
Construction Contingencies	5%	$255,560	
Allowance: Dredge River		$260,000	
Grand Total Cost		**$6,752,000**	

Original Costs from Estimator

	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Building & Structure	$2,445,033	$3,782,475	1.547
Dewatering	$194,067	$305,891	1.576
Foundation and Earthwork	$1,922,075	$2,955,862	1.538
Baffle Walls	$529,091	$809,914	1.531
Process Piping, Valves, Meters, I	$269,608	$411,340	1.526
Flocculators & Mixers	$1,160,771	$1,769,373	1.524
Settlement Equipment	$3,389,594	$5,158,378	1.522
Slide Gate w/ Operator	$117,632	$178,380	1.516
Electrical	$315,783	$477,528	1.512
Instrumentation & Controls	$94,735	$143,258	1.512
Grand Total Capital Constructio	**$10,438,389**	**$15,992,399**	

Adjusted for Report

Table B2.2 - New Plate Settler Pretreatment

Description		Estimated Cost	Cost Adjust Comments
Building & Structure		$2,446,000	
Site Dewatering		$195,000	
Foundation and Earthwork		$1,923,000	
Baffle Walls (530 lf)		$530,000	
Process Piping, Valves, Meters, Etc.		$500,000	Increased
Flocculators & Mixers w/VFD (36 units)		$1,300,000	Increased
Plate Settlers & Sludge Collection		$3,390,000	
Slide Gate w/ Operator (4 units)		$118,000	
Electrical (10% Equip Cost)		$481,000	X - Use 10% of equipment cost
Instrumentation & Controls (5% Equip Cost)		$241,000	X - Use 5% of equipment cost
Subtotal		**$11,124,000**	
Estimating Contingency	20%	$2,225,000	
Escalation to Midpoint	3%	$334,000	
Construction Subtotal		**$13,683,000**	
Contractor General Conditions	10%	$1,368,000	
Contractor Overhead and Profit	12%	$1,642,000	
Construction Contingencies	5%	$684,000	
Allowances:			
Grand Total Cost		**$17,377,000**	

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
	Ozone Facility w/ Contact Basins			
31.01 Dewatering	Dewatering	$212,734	$334,118	1.571
	Contact Basins	$2,523,808	$3,901,587	1.546
	Foundation and Earthwork	$1,501,212	$2,304,234	1.535
	Building Structure	$496,909	$762,532	1.535
	Process Piping	$301,560	$463,000	1.535
40.02 Valves, Meters, Etc.	Valves, Meters, Etc.	$12,895	$19,571	1.518
43.10 Ozone Equipment	Ozone Equipment	$3,497,647	$5,295,271	1.514
22.00 Plumbing	Plumbing	$55,865	$84,370	1.510
23.00 HVAC	HVAC	$352,530	$532,404	1.510
	Electrical	$257,000	$388,130	1.510
26.02 Instrumentation & Controls	Instrumentation & Controls	$33,000	$49,838	1.510
	LOX Equipment			
	Slab, Pads, Curbs, Fences/Gates	$23,462	$36,190	1.542
32.01 Fencing & Gates	Fencing & Gates	$5,142	$7,776	1.512
	Process Piping	$31,588	$48,964	1.550
40.02 Valves, Meters, Etc.	Valves, Meters, Etc.	$20,611	$31,273	1.517
43.17 LOX Equipment	LOX Vaporizor, Tank, Station	$890,881	$1,347,884	1.513
26.01 Above Ground Electrical	Electrical	$43,160	$65,267	1.512
26.02 Instrumentation & Controls	Instrumentation & Controls	$12,948	$19,580	1.512
Grand Total Capital Construction Cost	**Grand Total Capital Construction**	**$10,272,952**	**$15,691,989**	

Adjusted for Report

Table B3.4 - Ozonation in New Basins, New BAF

Description		Estimated Cost	Cost Adjust Comments
Ozone Facility w/ Contact Basins			
Site Dewatering		$213,000	
Ozone Contact Basins		$2,524,000	
Access Hatches (8 units)		$120,000	X - Added item
Foundation and Earthwork		$1,502,000	
Building Structure (7,834 sf)		$497,000	
Process Piping		$377,000	X - Low, increase to match rehab option
Sampling System (pumps, piping, Analyzers)		$100,000	X - Added this item
Valves, Meters, etc.		$133,000	X - assume 35 valves (9 pumps)+10K for small valves
Ozone System, quench, destruct (2 units)		$4,498,000	X - Add 30% (1 Mill) for install
Plumbing (9,309 sf)		$56,000	
HVAC (7,834 sf)		$353,000	
Electrical (7,834 sf)		$900,000	X - 150K for Bldg and 750K for Ozone
Instrumentation & Controls (1 % Equip Cost)		$225,000	X - Ozone I&C would be higher; use higher
LOX Equipment			
Building Structure (1,462 sf)		$35,000	X - Make 35K based on 12" slab and $600/cy
Fencing & Gates		$9,000	X - Use $60/ft
Process Piping		$32,000	
Valves, Meters, Etc.		$42,000	X - Double estimator number
LOX Vaporizer, Tank, Station (2 units)		$891,000	
Electrical (5% Equip Cost)		$45,000	
Instrumentation & Controls (1.5% Equip Cost)		$14,000	
Subtotal		**$12,566,000**	
Estimating Contingency	20%	$2,513,200	
Escalation to Midpoint	3%	$376,980	
Construction Subtotal		**$15,456,180**	
Contractor General Conditions	10%	$1,545,618	
Contractor Overhead and Profit	12%	$1,854,742	
Construction Contingencies	5%	$772,809	
Allowances:			
Grand Total Cost		**$19,630,000**	

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
	Building Structure	$5,154,603	$7,954,116	1.543
31.01 Dewatering	Dewatering	$212,734	$334,535	1.573
	Foundation and Earthwork	$2,080,983	$3,201,747	1.539
	Process Piping	$2,449,864	$3,744,641	1.529
40.02 Valves, Meters, Etc.	Valves, Meters, Etc.	$1,665,261	$2,522,303	1.515
41.22 Hoists & Cranes	Hoists & Cranes	$146,529	$221,680	1.513
43.05 Filtration Equipment	Filtration Equipment	$4,318,188	$6,667,928	1.544
22.00 Plumbing	Plumbing	$101,220	$153,065	1.512
23.00 HVAC	HVAC	$1,138,500	$1,721,642	1.512
	Electrical	$571,901	$864,830	1.512
26.02 Instrumentation & C	Instrumentation & Controls	$21,944	$33,184	1.512
Grand Total Capital Const	**Grand Total Capital Construct**	**$17,861,727**	**$27,419,671**	

Deeper filters for BAF

Total Filter Area =	8,681 sq.ft.
Number of filters =	10
Area each filter =	965 sq.ft.
Length each Filter =	50.0 ft
Width each Filter =	20.0 ft
Perimeter each Filter =	140 ft
Additional Conc (3-ft taller) =	233 cu.ft.
Concrete Adder =	$233,333
Media Adder =	$500,000

Adjusted for Report

Table X.X - New GAC Biologically Active Filters

Description		Estimated Cost	Cost Adjust Comments	
Filter Building and Structure (25,300 sf)		$5,405,000	X - added additional 3-ft tall walls concrete and media J.Krinks email 7/16/20	
Site Dewatering		$213,000		
Foundation and Earthwork		$2,081,000		
Process Piping		$2,800,000		
Valves, Meters, Etc.		$1,666,000		
Hoists & Cranes		$147,000		
Filtration Equipment		$5,320,000	X - Additional Media cost is added to conv. Filters	
Plumbing (25,300 sf)		$911,000		
HVAC (25,300 sf)		$911,000		
Air Scour Blowers		$850,000		
Electrical		$925,000	X - Electrical would probably be higher; use 1.5X estimator number	
Instrumentation & Controls		$480,000	X - Filter I&C would be much higher	
Subtotal		**$21,709,000**		
Estimating Contingency	20%	$4,341,800		
Escalation to Midpoint	3%	$651,270		
Construction Subtotal		**$26,702,070**	$8,316,000	is filter system cost that Leopold quoted $8.2 million for this equip
Contractor General Conditions	10%	$2,670,207		
Contractor Overhead and Profit	12%	$3,204,248		
Construction Contingencies	5%	$1,335,104		
Allowances:				
Grand Total Cost		**$33,912,000**		

Original Costs from Estimator - for a 6 MG clearwell (using smaller so use 75% quantities)

	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Structural Components	$3,507,453	$5,415,382	1.544
Dewatering	$109,646	$167,526	1.528
Piles	$1,133,796	$1,727,195	1.523
Excavation	$1,734,001	$2,658,794	1.533
Soil and Backfill	$523,109	$828,067	1.583
Grand Total Capital Construction Cost	**$7,008,005**	**$10,796,964**	

Adjusted for Report

Table B5.1a - Large Clearwell (4 MG) Option

Description		Estimated Cost
Structure		$2,631,000
Dewatering (2 pumps, 4 mo)		$110,000
Piles (26,975 vf)		$851,000
Excavation, Shoring		$1,301,000
Soil and Backfill		$393,000
Misc. Clearwell accessories and instruments		$300,000
Misc Site Restoration		$50,000
Subtotal		**$5,636,000**
Estimating Contingency	20%	$1,127,200
Escalation to Midpoint	3%	$169,080
Construction Subtotal		**$6,932,280**
Contractor General Conditions	10%	$693,228
Contractor Overhead and Profit	12%	$831,874
Construction Contingencies	5%	$346,614
Allowances:		
Grand Total Cost		**$8,804,000**

Keeping this the same (quantity is same for either)

Original Costs from Estimator

	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Building Structure	$855,407	$1,318,619	1.542
Dewatering	$70,384	$107,754	1.531
Foundation and Earthwork	$317,103	$486,388	1.534
Process Piping	$157,812	$242,437	1.536
Valves, Meters, Etc.	$166,356	$252,319	1.517
Pumps	$682,455	$1,033,923	1.515
Swift Water Chemical Injectic	$52,570	$79,566	1.514
Air Compressor	$36,696	$55,602	1.515
Plumbing	$30,606	$46,283	1.512
HVAC	$127,525	$192,844	1.512
Electrical	$234,647	$354,833	1.512
Instrumentation & Controls	$264,180	$399,494	1.512
Grand Total Capital Construc	**$2,995,741**	**$4,570,062**	

Adjusted for Report

Table B6.2 - New High Service Pumps Option

Description		Estimated Cost	Cost Adjust Comments
Pump Building (5,100 sf)		$513,600	Reduce to 3,000 SF
Dewatering			No dewatering - build on top of clearwell
Foundation and Earthwork		$159,000	Reduced - built on top of clearwell
Process Piping		$158,000	
Valves, Meters, etc.		$167,000	
Vertical Turbine Pumps (4 units at 800ea)		$3,200,000	
			X - Not to be included
			X - Not to be included
Plumbing (5,100 sf)		$18,600	
HVAC (5,100 sf)		$76,800	Reduce to 3000 SF
Electrical (15% equipment)		$480,000	
Instrumentation & Controls		$265,000	
Subtotal		**$5,038,000**	
Estimating Contingency	20%	$1,007,600	
Escalation to Midpoint	3%	$151,140	
Construction Subtotal		**$6,196,740**	
Contractor General Conditions	10%	$619,674	
Contractor Overhead and Profit	12%	$743,609	
Construction Contingencies	5%	$309,837	
Allowances:			
Grand Total Cost		**$7,870,000**	

Cost to use for alt 2B $11,130,000.00 Original Estiamte was for effectiveltly replacing high service #2

Chemicals include 1) sodium hypochlorite, 2) sodium hydoxide, 3) sodium bisfulfite, 4) fluoride, 5) coagulant, 6) PAC, 7) ammonia

	UNIT	Quanity	Unit Cost	Total Cost	Notes
Building Area	SF	6,400	$180	$1,152,000	
HVAC	SF	6,400	$60	$384,000	
Plumbing	SF	6,400	$10	$64,000	
Fire Protection - Wet pipe	SF	6,400	$13	$83,200	
Gratings and handrail	SF	40,000	$15	$600,000	Use 40' long x 5' wide (200 SF per room in 5 room (not PAC or ammonia)
Bulk tanks & level transmitter	EA	10	$20,000	$200,000	
PAC supersac feeder	LS	1	$300,000	$300,000	Unit is about $200 k
Ammonia system	LS	1	$250,000	$250,000	Located ouside
Day tanks, scale, equip	EA	5	$6,500	$32,500	
Chemical Pump Skids	EA	10	$20,000	$200,000	2 for hypo, 1 for NaOH, 2 for bisulfite, 1 for fluoirde, 4 for coag,
Motive Water Pump Systems	EA	4	$20,000	$80,000	1 set for hypo, 1 for bisulfite, 1 for PAC, 1 for ammonia
Water Softeners	EA	1	$15,000	$15,000	1 set for hypo
Vent piping	LF	200	$150	$30,000	Assume 40' for each system besides ammonia and PAC
Fill Piping	LF	300	$150	$45,000	Assume 60' for each system besides ammonia and PAC
Vent and fill piping accessories	LS	1	$10,000	$10,000	
Transfer Pumps	EA	10	$7,500	$75,000	2 for each system besides ammonia and PAC
Feed Piping	LS	1	$300,000	$300,000	
Misc. Chem & Building Accessories	LS	1	$100,000	$100,000	
Electrical & Instrumentation	% proc	30%	$345,750	$345,750	% of process equip
Subtotal				**$4,266,450**	
Estimating Contingency	25%			$1,066,613	
Escalation	1%			$42,665	
Construction Subtotal				**$5,375,727**	
Contractor General Conditions	10%			$537,572.70	
Contractor Overhead and Profit	12%			$645,087.24	
Construction Contingencies	1%			$53,757.27	
Total Cost				**$6,612,144**	

Note: The individual components (pretreat, ozone, filters, clearwell, etc.) all include dewatering and CIVIL

	UNIT	Quanity	Unit Cost	Total Cost	Notes
Pavement	SY	9,800	$40	$392,000	
Fencing	LF	1,500	$65	$97,500	
Gate / Card Access	EA	3	$30,000	$90,000	
8-inch storm piping	LF	1,500	$100	$150,000	
Larger Storm Piping & MHs/CBs	LS	1	$150,000	$150,000	
Additional Excavation / Hauling	CY	5,600	$60	$336,000	
Additional Dewatering	LS	1	$300,000	$300,000	
Site Grading & Seeding	LS	1	$120,000	$120,000	
Landscaping Allowance	LS	1	$250,000	$250,000	
Subtotal				**$1,885,500**	
Estimating Contingency	20%			$377,100	
Escalation	3%			$56,565	
Construction Subtotal				**$2,319,165**	
Contractor General Conditions	10%			$231,916.50	
Contractor Overhead and Profit	12%			$278,299.80	
Construction Contingencies	1%			$23,191.65	
Total Cost				**$2,853,000**	

Raw water piping

	UNIT	Quanity	Unit Cost	Total Cost
Raw water piping	LF	1,205	$580	$698,900
Road crossing	LS	1	$45,000	$45,000
Utility Re-routing	LS	1	$190,000	$190,000
Misc. Site Grading/restoration	LS	1	$50,000	$50,000
Misc. Fittings & Pipe Accessories	LS	1	$80,000	$80,000
Subtotal				**$1,063,900**
Estimating Contingency	20%			$212,780
Escalation	3%			$31,917
Construction Subtotal				**$1,308,597**
Contractor General Conditions	10%			$130,859.70
Contractor Overhead and Profit	12%			$157,031.64
Construction Contingencies	1%			$13,085.97
Total Cost				**$1,610,000**

Cost Component	Unit	Quantity	Unit Cost	Project Cost
Cast in place concrete	CY	225	$800	$180,000
Residuals Pump Station - Pumps	EA	3	$55,000	$165,000
Valves	EA	8	$4,000	$32,000
Elec & Controls	LS	1	$340,000	$340,000
Forcemain & Discharge Piping	LF	1370	$200	$274,000
Extension into Ohio River	LF	50	$500	$25,000
Misc. Restoration / Grading	LS	1	$25,000	$25,000
Subtotal				**$1,041,000**
Estimating Contingency	20%			$208,200
Escalation	3%			$31,230
Construction Subtotal				**$1,280,430**
Contractor General Conditions	10%			$128,043.00
Contractor Overhead and Profit	12%			$153,651.60
Construction Contingencies	1%			$12,804.30
Total Cost				**$1,575,000**

Original Costs from Estimator

	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Building and Structure	$5,213,525	$8,046,664	1.543
Dewatering	$212,734	$334,535	1.573
Foundation and Earthwork	$2,080,983	$3,201,747	1.539
Process Piping	$2,449,864	$3,744,641	1.529
Valves, Meters, Etc.	$1,665,261	$2,522,303	1.515
Hoists & Cranes	$146,529	$221,680	1.513
Filtration Equipment	$4,318,188	$6,667,928	1.544
Plumbing	$101,220	$153,065	1.512
HVAC	$1,138,500	$1,721,642	1.512
Electrical	$615,800	$931,214	1.512
Instrumentation & Controls	$34,830	$52,670	1.512
Grand Total Capital Construct	**$17,977,434**	**$27,598,089**	

Adjusted for Report

Table B3.2 - New Dual Media Gravity Filters

Description		Estimated Cost	Cost Adjust Comments
Filter Building and Structure (25,300 sf)		$5,214,000	
Site Dewatering		$213,000	
Foundation and Earthwork		$2,081,000	
Process Piping		$2,800,000	X adding 350k for air scour piping
Valves, Meters, Etc.		$1,666,000	
Hoists & Cranes		$147,000	
Filtration Equipment (12 units)		$4,820,000	Leopold quote of 8.2 million for everything (inc. blowers, I&C, valves, troughs, media, 30 days of install overshight) - those are included in cost as separate line items - adding 10% for install after those - taking out $500k for not having GAC
Plumbing		$102,000	
HVAC		$911,000	X - seems high, use 80%
Air Scour Blowers		$850,000	
Electrical		$925,000	X - Electrical would probably be higher; use 1.5X estimator number
Instrumentation & Controls		$480,000	X - Filter I&C would be higher
Subtotal		**$20,209,000**	
Estimating Contingency	20%	$4,041,800	
Escalation to Midpoint	3%	$606,270	
Construction Subtotal		**$24,857,070**	
Contractor General Conditions	10%	$2,485,707	
Contractor Overhead and Profit	12%	$2,982,848	
Construction Contingencies	5%	$1,242,854	
Grand Total Cost		**$31,569,000**	

Washwater Tank

Item	Unit	Quantity	Unit Cost	Total Cost	
Fluted column tank	GAL	400,000	$2	$800,000	Estimate per discussion w/ caldwell for low height tank, do not add contingecies
Tank Bollards	EA	10	$2,000	$20,000	
Piping Extension to Filters	LF	150	$500	$75,000	
Misc Site Resoration, Grading	LS	1	$20,000	$20,000	
Electrical Service	LS	1	$35,000	$35,000	
Total				**$950,000**	

Adminstration Building

	Unit	Quantity	Unit Cost	Total
Building Size	SF	7500	$180	$1,350,000
Laboratory Equipment	LS	1	$300,000	$300,000
Workstations / Printers	LS	1	$50,000	$60,000
Networks/Security	LS	1	$100,000	$100,000
Total				$1,810,000

Maintenance Building

Building Size	SF	5000	$110	$550,000
Specialized HVAC Adder	LS	1	$90,000	$90,000
Compressed air system	LS	1	$50,000	$50,000
Tools / Hardware	LS	1	$350,000	$350,000
				$1,040,000

Misc Electrical (Note electrical is included in most of the other individual estiamtes)

Service	LF	200	$5,000	$1,000,000
Generator	LS	1	$1,500,000	$1,500,000

CONSTANTS - INPUTS	
Estimating Contingency (Rehab)	30%
Estimating Contingency (New)	20%
Escalation to Midpoint	3%
Contractor General Conditions	10%
Contractor Overhead and Profit	12%
Permitting	0.0%
Construction Contingencies	5%
Effective Multiplier Used (Rehab)	1.69
Effective Multiplier Used (New)	1.56

EWSU Water Treatment Plant- Advanced Facility Plan
Evansville Water and Sewer Utility Department, Indiana
20-018 Engineer's ROM Estimate Level 4, 6/12/20

Project name	EWSU Water Treatment Plant- Advanced Facility Plan Evansville IN USA
Client	EWSU Evansville IN
Engineer	AECOM
Estimator	Bruce Pietkiewicz
Labor rate table	1 AECOM RATES 20
Equipment rate table	Equip - ACM 20ld wrk
Duration	6 mo
Project	Water Line
Division	Water
Office	Columbus, Ohio
Principal Party	John Krinks
Estimating Office	Greenville
Contact 1	Bruce Pietkiewicz
Contact 2	Martin Hammer
Estimate Class Lvl	4
Purpose of Estimat	EE
FY Estimate	2020
Estimate Number	20-018
Notes	*This project involves developing an Advanced Facility Plan to provide alternatives to consider for improvements at the EWSU water treatment plant. The proposed finished water capacity for all alternatives is 50 MGD, and the evaluated alternatives consider rehabilitation of the existing facility, construction of new infrastructure, and a combination of the two. Plant-wide improvements are considered within these alternatives, including options for water supply, pre-treatment, filtration, disinfection, and pumping.* *This Engineer's Estimate is only an estimate of possible construction costs for budgeting purposes. This estimate is limited to the conditions existing at issuance and is not a guarranty of actual price or cost. Uncertain market conditions such as, but not limited to, local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions etc. may affect the accuracy of this estimate. AECOM is not responsible for any varience from this estimate or actual prices and conditions obtained.*
Report format	Sorted by 'WBS Lvl 1/WBS Lvl 2/WBS Lvl 3/WBS Lvl 4' 'Detail' summary Paginate
Cost Index	SC, Greenville (Labor only)
Alternates	01A, 01B, 02A, 02B, 02C, 03A, 03B, 03C, 03D, 03E, 03F, 04A, 04B, 04C, 05A, 05B, 05C, 06A, 06B, 07A, 08A, 09A, 10A, 2A, 2B, 2C, 3A, 3B, 3C, 3D, 3E, 3F, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7A, 8A, 9A

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
01				River Intake & Low Service Pump Station															
	1A			River Intake & LSPS Rehab															
		02		Modify Existing Structure & Services															
			02.01	Demolition Work															
				Non-Hazardous Waste Transport and Disposal	1 ls			-	-	-	-	500.00	500	-	-	-	-	500	759
				Demo Entrance Sidewalk & Handrail	6 cy	0.300 ch / cy	4	88.76 /ch	160	-	-	-	-	12.69	76	-	-	236	374
				Demo Single Door & Frame	3 ea	1.000 ch / ea	9	117.52 /ch	353	-	-	-	-	28.26	85	-	-	437	693
				Demo Double Door & Frame	2 ea	1.333 ch / ea	8	117.52 /ch	313	-	-	-	-	37.68	75	-	-	389	616
				Demo HVAC System (Includes Exhaust Fans, Heaters, Louvers & Ductwork)	3,000 sf			-	-	-	-	10.00	30,000	-	-	-	-	30,000	45,531
				Demo Electrical System (Includes I&C System & Lights)	3,000 sf			/sf				6.00	18,000					18,000	27,319
				02.01 Demolition Work	1 ls		21		826			48,500.00	48,500	236.28	236			49,562	75,292
			02.10	Intake Pipe Rehab															
				Temporary support ex. 42" pipe discharge	3 ea	3.000 ch / ea	45	194.58 /ch	1,751	-	-	-	-	839.05	2,517	-	-	4,268	6,778
				Demo Conc Ftg/Pier	3 ea	1.000 cd / ea	48	679.61 /cd	2,039	-	-	-	-	2,149.16	6,447	-	-	8,486	13,488
				Neoprened Pad	3 ea	2.500 mh / ea	8	45.62 /mh	342	60.00	180	-	-	-	-	-	-	522	815
				CIP Footing - 5'w x 2'w x 2'd	3 cy			-	-	-	-	1,500.00	4,500	-	-	-	-	4,500	6,830
				CIP Pier - 5'w x 2'w x 4'd	5 cy			-	-	-	-	1,500.00	7,500	-	-	-	-	7,500	11,383
				Gasket/Nuts/Bolt Kit 42"	9 ea	1.000 mh / ea	9	45.62 /mh	411	425.00	3,825	-	-	-	-	-	-	4,236	6,455
				Carbon Steel Flange Thurst Assemblies - 42" interior	9 ea	6.000 mh / ea	54	45.62 /mh	2,464	500.00	4,500	-	-	-	-	-	-	6,964	10,729
				02.10 Intake Pipe Rehab	3 ea		164		7,006	2,835.00	8,505	4,000.00	12,000	2,988.21	8,965			36,476	56,477
			07.01	Roofing															
				Inspect & Patch Roof System (Patchwork Voids Warranty)	3,300 sf			/sf				1.50	4,950					4,950	7,513
				Patch Aluminum Downspouts	40 lf			/lf				18.00	720					720	1,093
				Patch Aluminum Coping @ Roof Parapet 12" wide	257 lf			/lf				5.00	1,285					1,285	1,950
				07.01 Roofing	3,300 sf							2.11	6,955					6,955	10,556
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	5 ea	1.000 mh / ea	5	39.18 /mh	196	180.04	900	-	-	-	-	-	-	1,096	1,676
				HM Door Leafs- 3'x7' 20 ga. half glass	7 ea	1.500 ea / mh	5	39.18 /mh	183	450.09	3,151	-	-	-	-	-	-	3,333	5,071
				Finish Hardware by Leaf- Allowance	7 ea	8.002 mh / ea	56	39.18 /mh	2,194	900.18	6,301	-	-	-	-	-	-	8,496	13,036
				08.00 Doors, Frames & Hardware	7 ea		66		2,573	1,478.87	10,352							12,925	19,784
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	5 ea			/ea		-	-	100.02	500	-	-	-	-	500	759
				Paint HM Doors - primer (2) coats	7 ea			/ea		-	-	140.03	980	-	-	-	-	980	1,488
				Paint CMU Block - block filler & (2) coat	6,300 sf			-	-	-	-	1.35	8,505	-	-	-	-	8,505	12,908
				Upgrade Architectural Finishes	1 ls			-	-	-	-	4,000.00	4,000	-	-	-	-	4,000	6,071
				Paint 8" Pipe	505 lf	0.140 mh / lf	71	27.53 /mh	1,947	0.69	350	-	-	4.24	2,141	-	-	4,437	7,018
				Paint 18" Pipe	85 lf	0.200 mh / lf	17	27.53 /mh	468	2.08	177	-	-	6.06	515	-	-	1,159	1,828
				Paint 24" Pipe	7 lf	0.350 mh / lf	2	27.53 /mh	67	2.77	19	-	-	7.07	48	-	-	136	215
				Paint 30" Pipe	54 lf	0.438 mh / lf	24	27.53 /mh	650	3.46	187	-	-	4.12	223	-	-	1,060	1,667
				Paint 36" Pipe	34 lf	0.525 mh / lf	18	27.53 /mh	491	4.15	141	-	-	4.95	168	-	-	801	1,260
				Paint 42" Pipe	223 lf	0.525 mh / lf	117	27.53 /mh	3,223	4.85	1,081	-	-	4.95	1,103	-	-	5,407	8,497
				09.00 Finishes	3,300 ls		249		6,848	0.59	1,955	4.24	13,985	1.27	4,198			26,986	41,711
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	5 ea			/ea				30.01	150	-	-	-	-	150	228
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	3,300 ls							1.23	4,051					4,051	6,148
			23.00	HVAC															
				Replace HVAC System (Includes Exhaust Fans, Heaters, Louvers & Ductwork)	3,000 sf			/sf		-	-	25.01	75,015	-	-	-	-	75,015	113,851
				Replace Ancillary Building Systems	3,000 sf			/sf		-	-	13.00	39,000	-	-	-	-	39,000	59,191
				23.00 HVAC	3,300 sf							34.55	114,015					114,015	173,042
			31.00	Dredging															
				Hydraulic Dredging- Allowance	1 ls			-	-	-	-	250,000.00	250,000	-	-	-	-	250,000	379,429
				31.00 Dredging	1 ls							250,000.00	250,000					250,000	379,429
			32.00	Site Improvements															
				Replace Entrance Sidewalks & Handrail	1 ls			/ls				1,200.00	1,200					1,200	1,821
				32.00 Site Improvements	1 ls							1,200.00	1,200					1,200	1,821
				02 Modify Existing Structure & Services	1 ls		499		17,253	20,811.62	20,812	450,706.22	450,706	13,399.15	13,399			502,170	764,261
		26		Electrical & Instrumentation															
			26.01	Above Ground Electrical															
				Electrical Work For New Pumps & Lights	1 ls			/ls				200,000.00	200,000					200,000	303,543
				26.01 Above Ground Electrical	1 ls							200,000.00	200,000					200,000	303,543
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Pumps	1 ls			/ls				84,000.00	84,000					84,000	127,488
				26.02 Instrumentation & Controls	1 ls							84,000.00	84,000					84,000	127,488
				26 Electrical & Instrumentation	3,300 ls							86.06	284,000					284,000	431,031
		40		Process Piping															
			40.01	Above Ground Process Piping															
				Replace Water Supply, PCC, Chlorine Solution and Potassium Permanganate Piping	600 lf	0.900 mh / lf	540	45.62 /mh	24,636	47.39	28,432	-	-	-	-	-	-	53,068	82,143
				40.01 Above Ground Process Piping	600 lf		540		24,636	47.39	28,432							53,068	82,143
			40.02	Valves, Meters, Etc.															
				Backflow Preventer Fig 6"	1 ea	12.170 mh / ea	12	45.62 /mh	555	5,000.00	5,000	-	-	-	-	-	-	5,555	8,457
				Magnetic Flow Meter, Inline - 30" w/ transmitter	2 ea	38.000 mh / ea	76	43.67 /mh	3,319	19,000.00	38,000	-	-	-	-	-	-	41,319	62,926
				Resurface All Large Discharge Valves & Replace Actuators 24"	6 ea	10.000 mh / ea	60	30.57 /mh	1,834	7,800.00	46,800	-	-	-	-	-	-	48,634	73,932
				Resurface All Large Discharge Valves & Replace Actuators 36"	1 ea	14.000 mh / ea	14	30.57 /mh	428	11,700.00	11,700	-	-	-	-	-	-	12,128	18,435
				Resurface All Large Discharge Valves & Replace Actuators 42"	3 ea	17.000 mh / ea	51	30.57 /mh	1,559	14,950.00	44,850	-	-	-	-	-	-	46,409	70,537
				40.02 Valves, Meters, Etc.			213		7,695		146,350							154,045	234,297
				40 Process Piping	600 lf		753		32,331	291.30	174,782							207,113	316,440
		43		Process Equipment															
			43.00	Pumps															
				Pump Inspection	6 ea	24.000 mh / ea	144	42.40 /mh	6,105	-	-	2,200.00	13,200	-	-	-	-	19,305	29,696
				Freight On Pumps To Jobsite	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Verified Performance Test	6 day	8.000 ch / day	48	29.43 /ch	1,413			-	-	-	-	1,500.00	9,000	10,413	15,896
				Vendor Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Vendor Witnessed, Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				System Disinfection	1 day	8.000 ch / day	8	29.43 /ch	235	750.00	750							985	1,511
				Equipment Unloading	6 ea	4.000 ch / ea	132	182.62 /ch	4,383	500.00	3,000	-	-	381.61	2,290	-	-	9,673	15,134

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			43.00	Pumps															
				Equipment Rigging / Rough Set - Pumps	6 ea	4.000 ch / ea	144	195.85 /ch	4,709	500.00	3,000	-	-	401.59	2,410	-	-	10,110	15,827
				Equipment - Final Setting Grout Base - Pumps	6 ea	4.000 ch / ea	72	103.33 /ch	2,480	50.00	300	-	-	346.16	2,077	-	-	4,857	7,686
				Variable Frequency Drives 150 HP	6 ea	40.000 mh / ea	240	28.14 /mh	6,753	31,995.00	191,970	-	-	-	-	-	-	198,723	302,044
				Replace Vertical Turbine Can Low Service Pumps 150 HP	6 ea			/ea								165,000.00	990,000	990,000	1,502,538
				Demo Existing Low Service Pumps 150 hp	6 ea	30.000 mh / ea	180	34.45 /mh	6,200				-		-			6,200	9,813
				Add Large Sump Pump To Lower Level	1 ea	32.000 mh / ea	32	34.45 /mh	1,102	-	-	-	-	-	-	45,000.00	45,000	46,102	70,042
				43.00 Pumps	1 ls		1,000		33,372	199,020.00	199,020	13,200.00	13,200	6,776.18	6,776	1,071,000.00	1,071,000	1,323,368	2,011,165
			43.08	Intake Screens															
				3-Man Dive Team - (1) Diver, (1) Tender, (1) Standby Diver	180 ch			-	-	-	-	560.00	100,800	555.56	100,000	-	-	200,800	312,137
				Rebuild Intake Screens	3 ea	60.000 mh / ea	180	32.90 /mh	5,923	-	-	-	-	6,657.60	19,973	47,875.00	143,625	169,521	259,143
				43.08 Intake Screens	3 ea		180		5,923			33,600.00	100,800	39,990.93	119,973	47,875.00	143,625	370,321	571,280
			43.09	Potassium Permanganate System															
				Purchase Chemicals: Potassium Permangnate By Owner)	*1 ls*			-	-			-	-	-	-	-	-		
				Automated Potassium Permanganate w/ Mixing Tank (by Carus Corp)	1 ls	50.000 mh / ls	50	45.62 /mh	2,281	-	-					10,000.00	10,000	12,281	18,787
				43.09 Potassium Permanganate System			50		2,281								10,000	12,281	18,787
				43 Process Equipment	1 ls		1,230		41,576	199,020.00	199,020	114,000.00	114,000	126,748.98	126,749	1,224,625.00	1,224,625	1,705,970	2,601,233
				1A River Intake & LSPS Rehab	1 ls		2,482		91,159	394,613.41	394,613	848,706.22	848,706	140,149.13	140,148	1,224,625.00	1,224,625	2,699,252	4,112,965
	1B			New River Intake & LSPS															
		00		Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	650 lf	0.050 mh / lf	33	39.49 /mh	1,284	0.67	437	-	-	-	-	-	-	1,721	2,695
				Mat Foundation Edge Form 24"	366 sf	0.350 mh / sf	128	39.49 /mh	5,058	1.31	480	-	-	-	-	-	-	5,540	8,737
				Mat Foundation Edge Form 30"	510 sf	0.350 mh / sf	179	39.49 /mh	7,050	1.31	670	-	-	-	-	-	-	7,720	12,174
				Waterstop 6" Flat	650 lf	0.110 mh / lf	72	39.18 /mh	2,802	2.10	1,365	-	-	-	-	-	-	4,167	6,505
				Strip & Oil Mat Found. Form	876 sf	0.005 mh / sf	4	39.17 /mh	172	0.03	26	-	-	-	-	-	-	198	311
				Rebar- Foundation Mat (100 #/cy)	13 tn	28.006 mh / tn	368	43.53 /mh	16,030	997.70	13,120	-	-	-	-	-	-	29,150	45,283
				Rebar Support - bricks (.12/sf)	368 ea	0.002 mh / ea	1	43.53 /mh	32	0.26	97	-	-	-	-	-	-	129	197
				Finish- Hard Trowel	3,070 sf	0.023 mh / sf	71	39.17 /mh	2,766	-	-	-	-	-	-	-	-	2,766	4,378
				Pump Place Mat Foundation 24"	83 cy	0.500 mh / cy	42	41.39 /mh	1,719	-	-	-	-	4.59	381	-	-	2,098	3,325
				Pump Place Mat Foundation 30"	180 cy	0.500 mh / cy	90	41.39 /mh	3,725	-	-	-	-	4.59	826	-	-	4,551	7,210
				4000 psi Concrete	263 cy			/cy		142.00	37,346	-	-	-	-	-	-	37,346	56,681
				Liquid Curing Compounds	3,946 sf	0.003 mh / sf	12	39.17 /mh	464	0.06	232	-	-	-	-	-	-	696	1,086
				6 Mil. Vapor Barrier	4,400 sf	0.002 mh / sf	9	43.53 /mh	383	0.05	231	-	-	-	-	-	-	614	957
				03.00 Foundation Mat			1,007		41,484		54,004				1,207			96,694	149,540
			03.03	Columns															
				Form Rectangle Columns 14' & 25.33' h	1,525 sf	0.165 mh / sf	252	39.49 /mh	9,936	1.60	2,434	-	-	-	-	-	-	12,371	19,421
				Chamfer	1,144 lf	0.015 mh / lf	17	39.49 /mh	678	0.57	649	-	-	-	-	-	-	1,326	2,057
				Strip & Oil Column Form	1,525 sf	0.005 mh / sf	8	39.17 /mh	299	0.03	46	-	-	-	-	-	-	344	542
				Superplasticizers @ Columns	19 cy			/cy		8.40	160	-	-	-	-	-	-	160	242
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	23	43.53 /mh	993	997.70	1,137	-	-	-	-	-	-	2,130	3,297
				Finish- Float	69 sf	0.017 mh / sf	1	39.17 /mh	46	-	-	-	-	-	-	-	-	46	73
				Pump Place Columns 18 ea	19 cy	1.600 mh / cy	30	41.39 /mh	1,258	-	-	-	-	7.50	142	-	-	1,401	2,218
				4000 psi Concrete	19 cy			/cy		142.00	2,698	-	-	-	-	-	-	2,698	4,095
				Grind/Patch Columns	1,525 sf	0.013 mh / sf	20	39.17 /mh	777	0.03	46	-	-	-	-	-	-	822	1,299
				Rub Columns	1,525 sf	0.065 mh / sf	99	39.17 /mh	3,882	0.06	92	-	-	-	-	-	-	3,974	6,284
				Liquid Curing Compounds	1,525 sf	0.003 mh / sf	5	39.17 /mh	179	0.06	90	-	-	-	-	-	-	269	420
				03.03 Columns			454		18,048		7,351				142			25,541	39,948
			03.04	Walls															
				Brick Ledge Forms	257 lf	0.300 mh / lf	77	39.49 /mh	3,045	2.21	567	-	-	-	-	-	-	3,612	5,680
				Keyway 6"	1,004 lf	0.050 mh / lf	50	39.49 /mh	1,983	0.67	675	-	-	-	-	-	-	2,657	4,162
				Vertical Wall Keyway 6"	272 lf	0.110 mh / lf	30	39.49 /mh	1,182	0.67	183	-	-	-	-	-	-	1,365	2,148
				Panel Form System 12-16'	2,250 sf	0.170 mh / sf	383	39.49 /mh	15,104	1.84	4,134	-	-	-	-	-	-	19,239	30,180
				Panel Form System > 16' h	12,695 sf	0.190 mh / sf	2,413	39.49 /mh	95,266	1.84	23,332	-	-	-	-	-	-	118,598	186,190
				Waterstop 6" Flat	1,276 lf	0.110 mh / lf	140	39.18 /mh	5,500	2.10	2,680	-	-	-	-	-	-	8,180	12,772
				Strip & Oil Wall Forms	14,495 sf	0.005 mh / sf	72	39.17 /mh	2,839	0.03	435	-	-	-	-	-	-	3,274	5,154
				Superplasticizers @ Walls	553 cy			/cy		8.40	4,646	-	-	-	-	-	-	4,646	7,051
				Rebar- Walls (125 #/cy)	35 tn	15.003 mh / tn	525	43.53 /mh	22,856	997.70	34,920	-	-	-	-	-	-	57,776	89,173
				Finish- Top of Wall	2,008 sf	0.008 mh / sf	16	39.17 /mh	629	-	-	-	-	-	-	-	-	629	996
				Pump Place Walls 24"	553 cy	1.150 mh / cy	636	41.39 /mh	26,327	-	-	-	-	6.65	3,677	-	-	30,004	47,520
				Pump Place Brick Ledge	14 cy	2.001 mh / cy	28	41.39 /mh	1,159	-	-	-	-	14.42	202	-	-	1,361	2,156
				4000 psi Concrete	567 cy			/cy		142.00	80,514	-	-	-	-	-	-	80,514	122,197
				Grind/Patch Walls	14,495 sf	0.013 mh / sf	188	39.17 /mh	7,382	0.03	435	-	-	-	-	-	-	7,817	12,344
				Rub Walls	7,473 sf	0.058 mh / sf	433	39.17 /mh	16,976	0.06	448	-	-	-	-	-	-	17,425	27,549
				Liquid Curing Compounds	15,303 sf	0.002 mh / sf	31	39.17 /mh	1,199	0.06	900	-	-	-	-	-	-	2,099	3,264
				03.04 Walls			5,023		201,447		153,868				3,879			359,195	558,536
			03.05	Slab On Grade															
				Slab Edge Form 28"	249 sf	0.350 mh / sf	87	39.49 /mh	3,442	1.31	327	-	-	-	-	-	-	3,769	5,944
				Rebar- SOG (125 #/cy)	2 tn	14.003 mh / tn	22	43.53 /mh	951	997.70	1,556	-	-	-	-	-	-	2,507	3,867
				Mesh Support - bricks (.12/sf)	75 ea	0.002 mh / ea	0	43.53 /mh	7	0.26	20	-	-	-	-	-	-	26	40
				Finish- Hard Trowel	624 sf	0.015 mh / sf	9	39.17 /mh	367	-	-	-	-	-	-	-	-	367	580
				Pump Place Slab on Grade 8" @ Electrical Room	16 cy	0.500 mh / cy	8	41.39 /mh	331	-	-	-	-	3.67	59	-	-	390	618
				Pump Place Thickened Slab 28" x 20"	10 cy	0.500 mh / cy	5	41.39 /mh	207	-	-	-	-	3.67	37	-	-	244	386
				4000 psi Concrete	26 cy			/cy		142.00	3,692	-	-	-	-	-	-	3,692	5,603
				Saw Cut S-O-G (.08/sf)	50 lf	0.030 mh / lf	2	39.17 /mh	59	0.17	9	-	-	0.95	48	-	-	115	182
				Liquid Curing Compounds	873 sf	0.002 mh / sf	2	39.17 /mh	68	0.06	51	-	-	-	-	-	-	120	186
				Seal Floors	624 sf	0.002 mh / sf	1	39.17 /mh	49	0.09	58	-	-	-	-	-	-	107	165
				6 Mil. Vapor Barrier	700 sf	0.002 mh / sf	1	43.53 /mh	61	0.05	37	-	-	-	-	-	-	98	152
				Gravel Fill Under Slab 4"	8 cy	0.004 cd / cy	1	1,412.15 /cd	43	29.26	234	-	-	3.84	31	-	-	308	472
				03.05 Slab On Grade			138		5,584		5,983				174			11,741	18,196
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	2,312 sf	0.180 mh / sf	416	39.49 /mh	16,437	2.18	5,050			-	-	-	-	21,487	33,680
				Slab Edge Form 12"	207 sf	0.250 mh / sf	52	39.49 /mh	2,044	5.17	1,070			-	-	-	-	3,114	4,860
				Strip & Oil Suspended Slab Forms	2,519 sf	0.005 mh / sf	13	39.17 /mh	493	0.04	103			-	-	-	-	597	938
				Superplasticizers	57 cy			-	-	8.40	479			-	-	-	-	479	727
				Rebar- Suspended Slab (225 #/cy)	6 tn	20.004 mh / tn	128	43.53 /mh	5,581	997.70	6,395	-	-	-	-	-	-	11,977	18,540
				Finish- Hard Trowel	2,312 sf	0.030 mh / sf	69	39.17 /mh	2,717	-	-			-	-	-	-	2,717	4,301
				Pump Place Suspended Slab 12"	57 cy	1.800 mh / cy	103	41.39 /mh	4,247	-	-			6.65	379	-	-	4,627	7,326
				4000 psi Concrete	57 cy			-	-	142.00	8,094			-	-	-	-	8,094	12,284
				Liquid Curing Compounds	4,831 sf	0.003 mh / sf	14	39.17 /mh	568	0.68	3,298			-	-	-	-	3,866	5,904

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				03.06 Suspended Flat Slab			795		32,087		24,490				379			56,957	88,558
			03.07	Suspended Beams															
				Beam Side Forms	2,173 sf	0.210 mh / sf	456	39.49 /mh	18,023	2.21	4,792	-	-	-	-	-	-	22,816	35,799
				Beam Bottom Forms	778 sf	0.210 mh / sf	163	39.49 /mh	6,453	2.21	1,716	-	-	-	-	-	-	8,169	12,817
				Chamfer	1,170 lf	0.015 mh / lf	18	39.49 /mh	693	0.57	664	-	-	-	-	-	-	1,357	2,104
				Strip & Oil Beam Forms	2,951 sf	0.005 mh / sf	15	39.17 /mh	578	0.03	89	-	-	-	-	-	-	667	1,049
				Superplasticizers @ Beams	54 cy			/cy		8.40	454	-	-	-	-	-	-	454	689
				Rebar- Beams (250 #/cy)	7 tn	15.003 mh / tn	101	43.53 /mh	4,408	997.70	6,734	-	-	-	-	-	-	11,142	17,198
				Finish- Top of Beam	778 sf	0.008 mh / sf	6	39.17 /mh	244	-	-	-	-	-	-	-	-	244	386
				Pump Place Beams @ Roof	54 cy	2.001 mh / cy	108	41.39 /mh	4,472	-	-	-	-	14.42	779	-	-	5,251	8,318
				4000 psi Concrete	54 cy			/cy		142.00	7,668	-	-	-	-	-	-	7,668	11,638
				Grind/Patch Beams	2,951 sf	0.013 mh / sf	38	39.17 /mh	1,503	0.03	89	-	-	-	-	-	-	1,591	2,513
				Rub Beams	2,951 sf	0.085 mh / sf	251	39.17 /mh	9,824	0.06	177	-	-	-	-	-	-	10,002	15,818
				Liquid Curing Compounds	3,729 sf	0.002 mh / sf	7	39.17 /mh	292	0.06	219	-	-	-	-	-	-	511	795
				03.07 Suspended Beams			1,164		46,491		22,601				779			69,871	109,123
			03.08	Pads & Curbs															
				Pad Form	1,267 sf	0.120 mh / sf	152	39.49 /mh	6,005	1.37	1,730	-	-	-	-	-	-	7,734	12,129
				Chamfer	447 lf	0.015 mh / lf	7	39.49 /mh	265	0.57	254	-	-	-	-	-	-	518	804
				Strip & Oil Equipment Pad Forms	1,267 sf	0.005 mh / sf	6	39.17 /mh	248	0.03	38	-	-	-	-	-	-	286	450
				Rebar- Pads (100 #/cy)	2 tn	18.003 mh / tn	33	43.53 /mh	1,450	997.70	1,846	-	-	-	-	-	-	3,295	5,096
				Finish- Float	1,444 sf	0.017 mh / sf	25	39.17 /mh	961	-	-	-	-	-	-	-	-	961	1,522
				Pump Place Pads	37 cy	1.601 mh / cy	59	41.39 /mh	2,451	-	-	-	-	7.49	277	-	-	2,728	4,320
				4000 psi Concrete	37 cy			/cy		142.00	5,254	-	-	-	-	-	-	5,254	7,974
				Liquid Curing Compounds	2,711 sf	0.003 mh / sf	8	39.17 /mh	319	0.06	159	-	-	-	-	-	-	478	746
				03.08 Pads & Curbs			290		11,699		9,280				277			21,256	33,042
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	3,109 sf	0.020 mh / sf	62	42.24 /mh	2,627	8.80	27,365	-	-	0.35	1,094	-	-	31,086	47,431
				03.20 Precast Planks	1 sf		62		2,627	27,364.65	27,365			1,094.10	1,094			31,086	47,431
			04.00	Masonry															
				12" CMU + Rigid Insulation Backup To Brick, 22' h	5,478 sf			/sf		-	-	24.00	131,472	-	-	-	-	131,472	189,537
				12" CMU Interior Partition 20' h	660 sf			/sf		-	-	20.00	13,200	-	-	-	-	13,200	20,034
				Brick Veneer	5,976 sf			-	-	-	-	9.00	53,795	-	-	-	-	53,795	81,645
				04.00 Masonry	1 sf							198,466.74	198,467					198,467	301,216
			05.01	Misc Metals															
				Floor Grating Structural Support (13 #/sf)	9 tn	8.002 ch / tn	355	214.54 /ch	15,242	1,200.24	10,657	-	-	829.17	7,362	-	-	33,261	52,015
				Floor Grating Edge Angle Support (5 #/sf)	3 tn	2.000 ch / tn	34	214.54 /ch	1,468	1,200.24	4,105	-	-	207.29	709	-	-	6,282	9,681
				Metal Checkered Plate Stair Landings 4' x 8'	6 ea	4.000 mh / ea	24	42.08 /mh	1,010	1,200.00	7,200	-	-	-	-	-	-	8,210	12,526
				Metal Checkered Plate Steps	94 rs	1.000 mh / rs	94	42.08 /mh	3,956	367.50	34,545	-	-	-	-	-	-	38,501	58,690
				Alum Stair Wall Handrail	10 lf	0.150 mh / lf	2	42.08 /mh	63	16.80	168	-	-	-	-	-	-	231	355
				Aluminum Handrail @ Stair Landing	96 lf	0.234 mh / lf	22	42.08 /mh	946	44.11	4,234	-	-	-	-	-	-	5,180	7,923
				Aluminum Handrail @ Stairs	188 lf	0.234 mh / lf	44	42.08 /mh	1,852	44.11	8,292	-	-	-	-	-	-	10,144	15,516
				Alum Grate Cover .75" @ 4'x4' Sump	1 ea	0.600 mh / ea	1	42.08 /mh	25	185.04	185	-	-	-	-	-	-	210	321
				Alum Platform Grating 1"	1,367 sf	0.035 mh / sf	48	42.08 /mh	2,014	12.39	16,941	-	-	-	-	-	-	18,954	28,898
				Alum Grating Banding	42 lf			/lf		23.70	995	-	-	-	-	-	-	995	1,511
				Aluminum Roof Hatch 6.33' x 6.33'	1 ea	8.002 mh / ea	8	39.18 /mh	313	5,001.00	5,001	-	-	-	-	-	-	5,314	8,086
				05.01 Misc Metals	1 ls		632		26,889	92,323.61	92,324			8,071.10	8,071			127,263	195,523
			06.00	Wood															
				Misc Nailers & Blocking	3,400 sf	0.010 mh / sf	34	39.67 /mh	1,349	0.40	1,365	-	-	-	-	-	-	2,714	4,206
				06.00 Wood	1 ls		34		1,349	1,364.53	1,365							2,714	4,206
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	537 lf			/lf				4.00	2,148	-	-	-	-	2,148	3,261
				Caulking @ Masonry Wall Joints- Interior	537 lf			/lf				4.00	2,148	-	-	-	-	2,148	3,261
				07.00 Moisture Protection	1 ls							4,296.86	4,297					4,297	5,521
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	3,400 sf			/sf				3.00	10,202					10,202	15,484
				Aluminum Downspouts, 6 ea x 20' each	120 vf			/vf				18.00	2,160					2,160	3,279
				Aluminum Coping @ Roof Parapet 20" wide	260 lf			/lf				25.01	6,501					6,501	9,867
				Roof Hatch 4'0" x 4'0"	1 ea			/ea				2,500.50	2,501					2,501	3,795
				Translucent Panel Skylight Frame & Panels 7' x 7', 6 ea	216 sf			/sf				38.01	8,210					8,210	12,460
				07.01 Roofing	1 sf							29,573.90	29,574					29,574	44,885
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	2 ea	1.000 mh / ea	2	39.18 /mh	78	180.03	360	-	-	-	-	-	-	438	670
				HM Double Frames- 16 ga. 6'x7'	3 ea	1.500 mh / ea	5	39.18 /mh	176	210.04	630	-	-	-	-	-	-	806	1,235
				HM Door Leafs- 3'x7' 20 ga. half glass	8 ea	1.500 ea / mh	5	39.18 /mh	209	450.09	3,601	-	-	-	-	-	-	3,810	5,796
				Overhead Doors- 10'x10' 24 ga steel manual 1" insulation 26 ga back-up panel	1 ea			-	-	-	-	2,255.00	2,255	-	-	-	-	2,255	3,422
				Finish Hardware by Leaf- Allowance	8 ea	8.002 mh / ea	64	39.18 /mh	2,508	900.18	7,201	-	-	-	-	-	-	9,709	14,899
				08.00 Doors, Frames & Hardware	1 ea		76		2,971	11,792.35	11,792	2,255.00	2,255					17,019	26,023
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	5 ea			/ea		-	-	100.02	500	-	-	-	-	500	759
				Paint HM Doors - primer (2) coats	8 ea			/ea		-	-	140.03	1,120	-	-	-	-	1,120	1,700
				Paint CMU Block - block filler & (2) coat	6,300 sf			-	-	-	-	1.35	8,505	-	-	-	-	8,505	12,908
				Misc Architectural Finishes	1 ls			-	-	-	-	6,000.00	6,000	-	-	-	-	6,000	9,106
				Paint 6" Pipe	505 lf	0.140 mh / lf	71	27.53 /mh	1,947	0.69	350	-	-	4.24	2,141	-	-	4,437	7,018
				Paint 18" Pipe	85 lf	0.200 mh / lf	17	27.53 /mh	468	2.08	177	-	-	6.06	515	-	-	1,159	1,828
				Paint 24" Pipe	7 lf	0.350 mh / lf	2	27.53 /mh	67	2.77	19	-	-	7.07	49	-	-	136	215
				Paint 30" Pipe	54 lf	0.438 mh / lf	24	27.53 /mh	650	3.46	187	-	-	4.12	223	-	-	1,060	1,667
				Paint 36" Pipe	34 lf	0.525 mh / lf	18	27.53 /mh	491	4.15	141	-	-	4.95	168	-	-	801	1,260
				Paint 42" Pipe	223 lf	0.525 mh / lf	117	27.53 /mh	3,223	4.85	1,081	-	-	4.95	1,103	-	-	5,407	8,497
				09.00 Finishes	1 ls		249		6,848	1,954.56	1,955	16,125.32	16,125	4,198.25	4,198			29,126	44,959
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	5 ea			/ea				30.01	150	-	-	-	-	150	228
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	1 ls							4,050.82	4,051					4,051	6,148
			22.00	Plumbing															
				Plumbing Subcontract	6,000 sf			/sf				6.00	36,007					36,007	54,649
				22.00 Plumbing	1 ls							36,007.19	36,007					36,007	54,649
			23.00	HVAC															
				Ventilation & Unit Heater System	6,000 sf			/sf		-	-	25.01	150,030	-	-	-	-	150,030	227,703

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				23.00 HVAC	1 sf							150,029.95	150,030					150,030	227,703
			31.00	Dredging															
				Hydraulic Dredging- Allowance	1 ls			-	-	-	-	250,000.00	250,000	-	-	-	-	250,000	379,429
				31.00 Dredging	1 ls							250,000.00	250,000					250,000	379,429
			31.01	Dewatering															
				Dewatering @ Building Excavation	1 ea	240.000 ch / ea	960	159.35 /ch	38,244	7,500.00	7,500	-	-	33,592.77	33,593	-	-	79,336	125,375
				Dewatering @ Cofferdams For Intake Construction	3 ea	120.000 ch / ea	1,440	159.35 /ch	57,365	7,500.00	22,500	-	-	16,796.52	50,390	-	-	130,255	205,137
				31.01 Dewatering	1 ls		2,400		95,609	30,000.00	30,000			83,982.33	83,982			209,591	330,512
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 32 ea (1 per 64 sf)	800 vf	0.002 cd / vf	90	2,146.97 /cd	3,436	35.16	28,125	-	-	2.58	2,064	-	-	33,625	51,409
				31.02 Piles	32 ea		90		3,436	878.91	28,125			64.51	2,064			33,625	51,409
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (246' x 60' deep)	14,760 sf	0.001 cd / sf	728	2,465.38 /cd	28,031	16.00	236,207	-	-	0.75	11,098	-	-	275,336	420,522
				Tie Backs (1 per 80 sf of Sheeting, 246' x 45'= 11,070 sf)	138 ea			-	-	-	-	2,377.47	328,091	-	-	-	-	328,091	497,950
				31.03 Excavation Shoring	12,300 sf		728		28,031	19.20	236,207	27.89	343,094	0.90	11,098			618,430	941,242
			31.10	Structure Excavation															
				Exc Clay-Backhoe/Truck	6,345 cy	499.900 cy / cd	457	1,410.06 /cd	17,897	-	-	-	-	6.58	41,776	-	-	59,673	94,813
				31.10 Structure Excavation	6,345 cy		457		17,897					6.58	41,776			59,673	94,813
			31.12	Structure Backfill															
				BackFill Earth-Backhoe/Truck	2,722 cy	0.002 cd / cy	176	1,327.72 /cd	7,300			-	-	4.69	12,757	-	-	20,058	31,858
				31.12 Structure Backfill	2,722 cy		176		7,300					4.69	12,757			20,058	31,858
			31.13	Soil Disposal															
				Spoils to Waste	3,623 cy	0.003 day / cy	326	1,410.06 /day	12,774	-	-	-	-	8.23	29,819	-	-	42,593	67,675
				31.13 Soil Disposal	3,623 cy		326		12,774					8.23	29,819			42,593	67,675
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 3.070 sf x 4"	38 cy	0.003 cd / cy	5	1,609.56 /cd	185	28.28	1,075	-	-	10.02	381	-	-	1,641	2,530
				31.20 Structure Stone Base	38 cy		5		185	28.28	1,075			10.02	381			1,641	2,530
			32.00	Site Improvements															
				Misc Site Improvement ALLOWANCE	1 ls			/ls				10,000.00	10,000					10,000	15,177
				32.00 Site Improvements	1 ls							10,000.00	10,000					10,000	15,177
				00 Building & Structure Construction	5,000 gsf		14,106		562,756	117.96	707,785	173.98	1,043,900	33.68	202,077			2,516,518	3,870,851
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				Ext Fixtures - Elec - ductbank Conduit/Cable/Wire	100 lf	0.250 mh / lf	25	45.53 /mh	1,138	2.72	272			5.00	500	-	-	1,910	3,010
				Building Electrical System	6,000 sf			/sf				16.00	96,019					96,019	145,730
				26.00 UG Electrical	1 ls		25		1,138	272.00	272	95,019.16	96,019	500.00	500			97,929	148,740
			26.01	Above Ground Electrical															
				Building Electrical System	6,000 sf			/sf				8.00	48,010					48,010	72,865
				Process Electrical System	6,000 sf			/sf				30.01	180,036					180,036	273,243
				Ext Light Pole (stl), Base and Fixture, high pressure sodium 400w, 30' high	4 ea	44.000 mh / ea	176	45.53 /mh	8,013	2,300.00	9,200	-	-	-	-	-	-	17,213	26,645
				26.01 Above Ground Electrical	1 ls		176		8,013	9,200.00	9,200	228,045.52	228,046					245,259	372,754
			26.02	Instrumentation & Controls															
				Controls & Instrumentation	1 ls			/ls				310,800.00	310,800					310,800	471,706
				26.02 Instrumentation & Controls	1 ls							310,800.00	310,800					310,800	471,706
				26 Electrical & Instrumentation	6,000 ls		201		9,151	1.58	9,472	105.81	634,865	0.08	500			653,988	993,200
		40		Process Piping															
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0-4'	783 lf	600.000 lf / cd	73	2,539.31 /cd	3,314			-	-	1.88	1,475	-	-	4,789	7,592
				Stone Pipe Bedding	58 cy	200.000 cy / cd	21	2,896.43 /cd	840	23.29	1,351	-	-			-	-	2,191	3,380
				DI Pipe Push - Class 52 6	505 lf	0.220 mh / lf	111	24.05 /mh	2,672	22.53	11,379	-	-	-	-	-	-	14,052	21,500
				DI Pipe Push - Class 52 8	0 lf	0.250 mh / lf	0	51.34 /mh	0	32.00	0	-	-	-	-	-	-	0	1
				DI Pipe Push - Class 52 12	0 lf	0.310 mh / lf	0	51.34 /mh	0	52.00	1	-	-	-	-	-	-	1	1
				DI Pipe Push - Class 52 30	54 lf	0.440 mh / lf	24	51.34 /mh	1,220	167.28	9,033	-	-	-	-	-	-	10,253	15,640
				DI Pipe Push - Class 52 36	0 lf	0.500 mh / lf	0	51.34 /mh	0	225.00	2	-	-	-	-	-	-	3	4
				DI Pipe Push - Class 52 42	224 lf	0.570 mh / lf	128	51.34 /mh	6,555	290.93	65,169	-	-	-	-	-	-	71,724	109,282
				DI Pipe Push - Class 52 48	0 lf	0.640 mh / lf	0	51.34 /mh	0	365.00	4	-	-	-	-	-	-	4	6
				Hydrostatic Testing	783 lf	0.021 ch / lf	66	182.49 /ch	3,001	0.16	125	-	-	-	-	-	-	3,126	4,938
				Chlorination	783 lf			/lf		0.10	78	-	-	-	-	-	-	78	119
				42" DI Slab Thimble 24" long	3 ea	3.500 ch / ea	42	182.49 /ch	1,916	1,800.00	5,400	-	-	842.80	2,528	-	-	9,845	15,252
				DI 90 ell 42"	6 ea	23.120 mh / ea	139	30.57 /mh	4,240	4,949.10	29,695	-	-	-	-	-	-	33,935	51,779
				40.00 Under Ground Process Piping	783 lf		603		23,759	156.11	122,236			5.11	4,003			149,999	229,495
			40.01	Above Ground Process Piping															
				Stencil Exposed Piping <20"	85 lf			-	-	-	-	10.00	850	-	-	-	-	850	1,290
				Stencil Exposed Piping >20"	260 lf			-	-	-	-	25.01	6,501	-	-	-	-	6,501	9,867
				Pipe Supports	18 ea	4.001 mh / ea	72	45.62 /mh	3,285	250.05	4,501	-	-	-	-	-	-	7,786	12,031
				Hydrostatic Testing	345 lf	0.021 ch / lf	29	182.49 /ch	1,322	0.16	55	-	-	-	-	-	-	1,377	2,176
				Chlorination	345 lf			/lf		0.10	35	-	-	-	-	-	-	35	52
				Cross Fitting 6"	1 ea	2.400 ch / ea	10	182.49 /ch	438	170.00	170	-	-			-	-	608	951
				Dresser Couplings 18"	5 ea	10.352 ch / ea	207	163.14 /ch	8,444	510.00	2,550	-	-			-	-	10,994	17,235
				Dresser Couplings 24"	6 ea	13.803 ch / ea	331	182.49 /ch	15,113	684.14	4,105	-	-			-	-	19,218	30,150
				Dresser Couplings 42"	2 ea	24.000 mh / ea	48	40.79 /mh	1,958	3,500.00	7,000	-	-	-	-	-	-	8,958	13,723
				14" DI Slab Thimble 12" long	0 ea	1.501 ch / ea	0	182.49 /ch	3	325.00	3	-	-	361.00	4	-	-	10	15
				30" DI Wall Thimble 24" long	2 ea	2.500 ch / ea	20	182.49 /ch	912	1,286.26	2,573	-	-	602.00	1,204	-	-	4,689	7,265
				Gasket/Nuts/Bolt Kit 18"	32 ea	1.000 mh / ea	32	45.62 /mh	1,460	37.54	1,201	-	-	-	-	-	-	2,661	4,134
				Gasket/Nuts/Bolt Kit 24"	7 ea	2.501 mh / ea	18	45.62 /mh	799	175.03	1,225	-	-	-	-	-	-	2,024	3,123
				Gasket/Nuts/Bolt Kit 36"	9 ea	2.600 mh / ea	23	45.62 /mh	1,068	175.04	1,575	-	-	-	-	-	-	2,643	4,081
				Gasket/Nuts/Bolt Kit 42"	11 ea	1.000 mh / ea	11	32.89 /mh	362	350.00	3,850	-	-	-	-	-	-	4,212	6,416
				DI Flanged Joint Pipe 6"	0 lf	0.900 mh / lf	0	45.62 /mh	0	50.00	1	-	-	-	-	-	-	1	1
				DI Flanged Joint Pipe 6"	0 lf	0.900 mh / lf	0	30.57 /mh	0	50.00	1	-	-	-	-	-	-	1	1
				DI Flanged Joint Pipe 18"	85 lf	2.270 mh / lf	193	30.57 /mh	5,898	183.93	15,634	-	-	-	-	-	-	21,532	33,062
				DI Flanged Joint Pipe 24"	7 lf	2.670 mh / lf	19	30.57 /mh	571	267.83	1,875	-	-	-	-	-	-	2,446	3,750
				DI Flanged Joint Pipe 36"	34 lf	3.470 mh / lf	118	30.57 /mh	3,606	426.54	14,502	-	-	-	-	-	-	18,109	27,718
				DI Flanged 90 ell 6"	14 ea	4.830 mh / ea	68	45.62 /mh	3,085	105.30	1,474	-	-	-	-	-	-	4,559	7,120
				DI Flanged 90 ell 18"	18 ea	13.250 mh / ea	239	30.57 /mh	7,290	729.00	13,122	-	-	-	-	-	-	20,412	31,454
				DI Flanged 90 ell 36"	6 ea	20.520 mh / ea	123	45.62 /mh	5,617	2,989.00	17,934	-	-	-	-	-	-	23,551	36,109
				DI Flanged Tee 36"	6 ea	20.520 mh / ea	123	30.57 /mh	3,763	0.00	0	-	-	-	-	-	-	3,763	5,956
				DI Flanged Tee 42"	7 ea	23.120 mh / ea	162	30.57 /mh	4,947			-	-	-	-	-	-	4,947	7,830

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			40.01	**Above Ground Process Piping**															
				PAC Piping & Accessories 3 ea- ALLOWANCE	600 LF	0.240 mh / LF	144	45.62 /mh	6,571	55.01	33,007	-	-	-	-	-	-	39,577	60,494
				Chlorine Piping & Accessories 3 ea- ALLOWANCE	300 LF	0.240 mh / LF	72	45.62 /mh	3,285	55.01	16,503	-	-	-	-	-	-	19,789	30,247
				40.01 Above Ground Process Piping	1,026 lf		2,061		79,799	139.27	142,895	7.17	7,351	1.18	1,208			231,253	356,252
			40.02	**Valves, Meters, Etc.**															
				Backflow Preventer Flg 6"	1 ea	12.170 mh / ea	12	45.62 /mh	555	5,000.00	5,000	-	-	-	-	-	-	5,555	8,467
				Magnetic Flow Meter - Inline - 30" w/ transmitter	2 ea	30.000 mh / ea	60	48.85 /mh	2,931	15,000.00	30,000	-	-	-	-	-	-	32,931	50,170
				Swing Check Valve 6"	3 ea	4.669 mh / ea	14	45.62 /mh	639	1,100.00	3,300	-	-	-	-	-	-	3,939	6,020
				Swing Check Valve 18"	6 ea	13.713 mh / ea	82	30.71 /mh	2,527	10,800.00	64,800	-	-	-	-	-	-	67,327	102,347
				6" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	6.200 mh / ea	25	30.57 /mh	758	2,850.00	11,400	-	-	-	-	-	-	12,158	18,502
				24" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	6 ea	19.204 mh / ea	115	45.62 /mh	5,257	12,502.50	75,015	-	-	-	-	-	-	80,272	122,171
				36" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	1 ea	28.800 mh / ea	29	30.57 /mh	880	19,781.00	19,781	-	-	-	-	-	-	20,661	31,415
				42" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	3 ea	33.600 mh / ea	101	30.57 /mh	3,081	23,078.00	69,234	-	-	-	-	-	-	72,315	109,954
				40.02 Valves, Meters, Etc.	1 ls		438		16,628	278,529.97	278,530							295,158	449,047
			40.04	**Hydropneumatic Piping System**															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				15,000.00	15,000					15,000	22,766
				40.04 Hydropneumatic Piping System	1 ls							15,000.00	15,000					15,000	22,766
				40 Process Piping	1,809 lf		3,102		120,186	300.53	543,662	12.36	22,351	2.88	5,211			691,410	1,057,560
		43		**Process Equipment**															
			43.00	**Pumps**															
				Pump Inspection	6 ea	24.000 mh / ea	144	42.40 /mh	6,105	-	-	2,200.00	13,200	-	-	-	-	19,305	29,696
				Freight On Pumps To Jobsite	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Verified Performance Test	6 day	8.000 ch / day	48	29.43 /ch	1,413			-	-	-	-	1,500.00	9,000	10,413	15,896
				Vendor Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Vendor Witnessed, Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				System Disinfection	1 day	8.000 ch / day	8	29.43 /ch	235	750.00	750							985	1,511
				Equipment Unloading	6 ea	4.000 ch / ea	132	182.62 /ch	4,383	500.00	3,000	-	-	381.61	2,290	-	-	9,673	15,134
				Equipment Rigging / Rough Set - Pumps	6 ea	4.000 ch / ea	144	195.85 /ch	4,700	500.00	3,000	-	-	401.59	2,410	-	-	10,110	15,827
				Equipment - Final Setting Grout Base - Pumps	6 ea	4.000 ch / ea	72	103.33 /ch	2,480	50.00	300	-	-	346.16	2,077	-	-	4,857	7,686
				Variable Frequency Drives 150 HP	6 ea	40.000 mh / ea	240	28.14 /mh	6,753	31,995.00	191,970	-	-	-	-	-	-	198,723	302,044
				Vertical Turbine Can Low Service Pumps 150 HP	6 ea			/ea								165,000.00	990,000	990,000	1,502,538
				Large Sump Pump To Lower Level	1 ea	32.000 mh / ea	32	34.45 /mh	1,102	-	-	-	-	-	-	45,000.00	45,000	46,102	70,042
				43.00 Pumps	1 ls		820		27,172	199,020.00	199,020	13,200.00	13,200	6,776.18	6,776	1,071,000.00	1,071,000	1,317,168	2,001,352
			43.08	**Intake Screens**															
				Cofferdam Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting From Barge (246' x 50' deep)	12,300 sf	0.001 cd / sf	1,102	2,465.38 /cd	42,454	16.00	196,839	-	-	1.63	20,038	-	-	259,331	397,830
				Installation Team Working From Barge	90 ch			-	-	-	-	560.00	50,400	1,111.11	100,000	-	-	150,400	235,644
				River Intake Screen 54" OD x 19' long, 35 mgd/ Screen (Pneumatically Cleaned)	3 ea	60.000 mh / ea	180	32.90 /mh	5,923					6,657.60	19,973	70,958.00	212,874	238,770	364,243
				43.08 Intake Screens	1 ea		1,282		48,377	196,839.24	196,839	65,403.00	65,403	140,011.08	140,011	212,874.00	212,874	663,504	1,020,498
			43.19	**Hydroburst System**															
				Field Service For Startup	1 ls			-	-	-	-					4,500.00	4,500	4,500	6,830
				Johnson Hydroburst System	1 ls			/ls								114,952.00	114,952	114,952	174,464
				Install Package Air Compressor 20 hp	2 ea	40.000 mh / ea	80	30.57 /mh	2,445					900.00	1,800			4,245	6,735
				Install Air Dryer	1 ea	35.000 mh / ea	35	30.57 /mh	1,070					200.00	200			1,270	2,012
				Install Horizontal Air Receiver Tank 19.33' x 5' diameter, 2500 gallon	1 ea	20.000 mh / ea	20	30.57 /mh	611					3,750.00	3,750			4,361	6,935
				Misc Items	1 ea	40.000 mh / ea	40	30.57 /mh	1,223	4,000.00	4,000							5,223	8,006
				43.19 Hydroburst System	1 ls		175		5,349	4,000.00	4,000			5,750.00	5,750	119,452.00	119,452	134,551	204,982
				43 Process Equipment	1 ls		2,277		80,898	399,859.24	399,859	78,603.00	78,603	162,537.26	152,537	1,403,326.00	1,403,326	2,115,223	3,226,823
				1B New River Intake & LSPS	50 mgd		19,686		772,991	33,215.55	1,660,778	35,594.39	1,779,719	7,206.51	360,326	28,066.52	1,403,326	5,977,139	9,148,434
				01 River Intake & Low Service Pump Station	1 ls		22,168		864,150	2,055,390.92	2,055,391	2,628,425.62	2,628,426	500,473.71	500,474	2,627,951.00	2,627,951	8,676,391	13,261,399

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
02				**Pretreatment**															
	2A			Pretreament - Retrofit North w/ Plate Settlers															
		02		**Modify Existing Structure & Services**															
			02.01	**Demolition Work**															
				Non-Hazardous Waste Transport and Disposal	1 ls			-	-	-	-	6,000.00	6,000	-	-	-	-	6,000	9,106
				Demo Concrete Walls 12"	50 cy	0.100 ch / cy	10	84.95 /ch	425	-	-	-	-	26.87	1,343	-	-	1,768	2,810
				Cut Opg In Existing Conc Wall 12'x20"x12" h @ Basin Wall	24 ea	1.000 ch / ea	48	84.95 /ch	2,039	-	-	-	-	26.87	645	-	-	2,684	4,253
				Demo All Piping & Equipment From North Plant Basins	1 ls	32.000 ch / ls	128	167.66 /ch	5,365	-	-	-	-	103.03	103	-	-	5,468	8,655
				Demo Electrical System @ Basins	1 ls			/ls				2,000.00	2,000					2,000	3,035
				Pressure Wash Basin Walls	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Pressure Washing Basin Slab	20,059 sf	200.000 sf / ch	201	53.11 /ch	5,327	0.35	7,021	-	-	0.39	7,849	-	-	20,196	31,578
				02.01 Demolition Work	1 ls		888		24,353	18,089.75	18,090	8,000.00	8,000	25,440.44	26,440	-	-	76,883	120,221
			03.03	**Columns**															
				Form Rectangle Columns 19' h	5,472 sf	0.165 mh / sf	903	39.49 /mh	35,653	1.60	8,735	-	-	-	-	-	-	44,388	69,686
				Chamfer	3,650 lf	0.015 mh / lf	55	39.49 /mh	2,162	0.57	2,070	-	-	-	-	-	-	4,232	6,564
				Strip & Oil Column Form	5,472 sf	0.005 mh / sf	27	39.17 /mh	1,072	0.03	164	-	-	-	-	-	-	1,236	1,946
				Superplasticizers @ Columns	76 cy			/cy		8.40	638	-	-	-	-	-	-	638	969
				Column Rebar (120 #/cy)	5 tn	20.004 mh / tn	92	43.53 /mh	4,005	997.70	4,589	-	-	-	-	-	-	8,595	13,305
				Finish- Float	86 sf	0.017 mh / sf	1	39.17 /mh	57	-	-	-	-	-	-	-	-	57	91
				Pump Place Columns 48 ea	76 cy	1.600 mh / cy	122	41.39 /mh	5,034	-	-	-	-	7.50	570	-	-	5,604	8,874
				4000 psi Concrete	76 cy			/cy		142.00	10,792	-	-	-	-	-	-	10,792	16,379
				Grind/Patch Columns	5,472 sf	0.013 mh / sf	71	39.17 /mh	2,787	0.03	164	-	-	-	-	-	-	2,951	4,660
				Rub Columns	5,472 sf	0.065 mh / sf	356	39.17 /mh	13,931	0.06	328	-	-	-	-	-	-	14,259	22,547
				Liquid Curing Compounds	5,472 sf	0.003 mh / sf	16	39.17 /mh	643	0.06	322	-	-	-	-	-	-	965	1,506
				03.03 Columns	76 cy		1,643		65,344	365.83	27,803			7.50	570			93,717	145,525
			03.04	**Walls**															
				Keyway 6"	1,718 lf	0.050 mh / lf	86	39.49 /mh	3,393	0.67	1,155	-	-	-	-	-	-	4,547	7,122
				Vertical Wall Keyway 6"	653 lf	0.110 mh / lf	72	39.49 /mh	2,837	0.67	439	-	-	-	-	-	-	3,276	5,156
				Panel Form System 8-12'	13,893 sf	0.150 mh / sf	2,084	39.49 /mh	82,291	1.84	25,528	-	-	-	-	-	-	107,819	168,988
				Panel Form System > 16' h	28,431 sf	0.190 mh / sf	5,403	39.49 /mh	213,352	1.84	52,252	-	-	-	-	-	-	265,605	416,981
				Waterstop 6" Flat	2,371 lf	0.110 mh / lf	261	39.18 /mh	10,219	2.10	4,980	-	-	-	-	-	-	15,199	23,733
				Strip & Oil Wall Forms	42,324 sf	0.005 mh / sf	212	39.17 /mh	8,290	0.03	1,270	-	-	-	-	-	-	9,560	15,048
				Superplasticizers @ Walls	2,097 cy			/cy		8.40	17,617	-	-	-	-	-	-	17,617	26,737
				Rebar- Walls (125 #/cy)	131 tn	15.003 mh / tn	1,965	43.53 /mh	85,548	997.70	130,699	-	-	-	-	-	-	216,246	333,761
				Finish- Top of Wall	3,805 sf	0.008 mh / sf	30	39.17 /mh	1,193	-	-	-	-	-	-	-	-	1,193	1,887
				Pump Place Walls	2,097 cy	1.150 mh / cy	2,412	41.39 /mh	99,832	-	-	-	-	6.65	13,944	-	-	113,776	180,197
				4000 psi Concrete	2,097 cy			/cy		142.00	297,774	-	-	-	-	-	-	297,774	451,935
				Grind/Patch Walls	42,324 sf	0.013 mh / sf	550	39.17 /mh	21,554	0.03	1,270	-	-	-	-	-	-	22,824	36,042
				Rub Walls	42,324 sf	0.058 mh / sf	2,455	39.17 /mh	96,147	0.06	2,539	-	-	-	-	-	-	98,686	155,027
				Liquid Curing Compounds	46,129 sf	0.002 mh / sf	92	39.17 /mh	3,614	0.06	2,713	-	-	-	-	-	-	6,327	9,838
				03.04 Walls	2,097 cy		15,622		628,270	256.67	538,236			6.65	13,944			1,180,450	1,833,454
			03.05	**Slab On Grade**															
				S.O.G. Edge Form < 1'	68 sf	0.240 mh / sf	16	39.49 /mh	644	1.22	83	-	-	-	-	-	-	727	1,146
				Rebar- SOG (125 #/cy)	0 tn	16.000 mh / tn	3	43.53 /mh	139	997.70	200	-	-	-	-	-	-	339	523
				Mesh Support - bricks (.12/sf)	15 ea	0.002 mh / ea	0	43.53 /mh	1	0.26	4	-	-	-	-	-	-	5	8
				Finish- Hard Trowel	126 sf	0.025 mh / sf	3	39.17 /mh	123	-	-	-	-	-	-	-	-	123	195
				Pump Place Slab on Grade 6" @ Sludge Control Vault	3 cy	0.500 mh / cy	2	41.39 /mh	62	-	-	-	-	3.67	11	-	-	73	116
				4000 psi Concrete	3 cy			/cy		142.00	426	-	-	-	-	-	-	426	647
				Liquid Curing Compounds	194 sf	0.002 mh / sf	0	39.17 /mh	15	0.06	11	-	-	-	-	-	-	27	41
				Seal Floors	126 sf	0.002 mh / sf	0	39.17 /mh	10	0.09	12	-	-	-	-	-	-	22	33
				6 Mil Vapor Barrier	126 sf	0.002 mh / sf	0	43.53 /mh	11	0.05	7	-	-	-	-	-	-	18	27
				Gravel Fill Under Slab 4"	2 cy	0.004 cd / cy	0	1,412.15 /cd	11	29.26	59	-	-	3.84	8	-	-	77	118
				03.05 Slab On Grade	3 cy		25		1,017	266.83	800			6.23	19			1,836	2,855
			03.06	**Suspended Flat Slab**															
				Form Suspended Slab Bottom	2,041 sf	0.220 mh / sf	449	39.49 /mh	17,731	2.18	4,458			-	-	-	-	22,189	34,830
				Slab Edge Form 8" & 12"	841 sf	0.250 mh / sf	210	39.49 /mh	8,304	5.17	4,349			-	-	-	-	12,653	19,743
				Strip & Oil Suspended Slab Forms	2,882 sf	0.005 mh / sf	14	39.17 /mh	565	0.04	118			-	-	-	-	683	1,073
				Superplasticizers	368 cy			-	-	8.40	3,092			-	-	-	-	3,092	4,692
				Rebar- Suspended Slab (225 #/cy)	41 tn	20.004 mh / tn	828	43.53 /mh	36,048	997.70	41,305	-	-	-	-	-	-	77,352	119,742
				Finish- Hard Trowel	2,041 sf	0.035 mh / sf	71	39.17 /mh	2,798	-	-			-	-	-	-	2,798	4,428
				Pump Place Suspended Slab	368 cy	2.160 mh / cy	795	41.39 /mh	32,899	-	-			6.65	2,449	-	-	35,348	55,967
				4000 psi Concrete	368 cy			-	-	142.00	52,256			-	-	-	-	52,256	79,310
				Liquid Curing Compounds	4,923 sf	0.003 mh / sf	15	39.17 /mh	579	0.68	3,361			-	-	-	-	3,939	6,016
				03.06 Suspended Flat Slab	368 cy		2,383		98,923	296.03	108,938			6.65	2,449			210,310	325,801
			03.11	**Topping Slab**															
				Mesh Support (.12/sf)	75 ea	0.002 mh / ea	0	43.53 /mh	7	0.26	20	-	-	-	-	-	-	26	40
				WWM 4X4- W 2.9 Flats	20,059 sf	0.014 mh / sf	281	43.53 /mh	12,224	0.50	10,057	-	-	-	-	-	-	22,281	34,610
				Finish- Hard Trowel	20,059 sf	0.015 mh / sf	301	39.17 /mh	11,787	-	-	-	-	-	-	-	-	11,787	18,656
				Pump Place Topping Slab	1,114 cy	0.750 mh / cy	836	28.06 /mh	23,446	-	-	-	-	6.65	7,411	-	-	30,857	48,903
				4000 psi Concrete	1,114 cy			/cy		142.00	158,188	-	-	-	-	-	-	158,188	240,084
				Liquid Curing Compounds	20,059 sf	0.002 mh / sf	40	39.17 /mh	1,572	0.06	1,180	-	-	-	-	-	-	2,751	4,278
				Seal Floors	624 sf	0.002 mh / sf	1	39.17 /mh	49	0.09	58	-	-	-	-	-	-	107	165
				03.11 Topping Slab	1,114 cy		1,459		49,083	152.16	169,502			6.65	7,411			225,997	346,736
			03.30	**Patch Cracks and Resurface Concrete**															
				Patch Cracks & Resurface Walls	2,120 sf	10.000 sf / ch	424	53.11 /ch	11,259	0.11	231	-	-	-	-	-	-	11,490	18,171
				Patch Cracks & Resurface Slab	848 sf	6.764 sf / ch	251	53.11 /ch	6,659	0.07	63	-	-	-	-	-	-	6,721	10,634
				Pressure Washing Walls	2,120 sf	33.333 sf / ch	127	53.11 /ch	3,378	0.35	742	-	-	2.37	5,028	-	-	9,147	14,474
				Pressure Washing Basin Slab	848 sf	16.667 sf / ch	102	53.11 /ch	2,702	0.35	297	-	-	4.70	3,982	-	-	6,981	11,065
				03.30 Patch Cracks and Resurface Concrete	2,968 sf		904		23,988	0.45	1,332			3.04	9,010			34,340	54,343
			05.01	**Misc Metals**															
				Aluminum 2 Line Rail @ Basin Walkways	2,908 lf	0.200 mh / lf	582	38.76 /mh	22,541	32.20	93,638	-	-	-	-	-	-	116,179	177,792
				Replace Alum Handrail @ Existing Influent Channel	106 lf	0.200 mh / lf	21	38.76 /mh	822	32.20	3,413	-	-	-	-	-	-	4,235	6,481
				Replace Alum Platform Grating 1" @ Existing Influent Channel	848 sf	0.035 mh / sf	30	42.06 /mh	1,249	12.39	10,509	-	-	-	-	-	-	11,758	17,927
				Alum Hatch Cover & Frame 2.5'x2.5' @ Sludge Valve Vault	6 ea	2.000 mh / ea	12	39.18 /mh	470	900.00	5,400	-	-	-	-	-	-	5,870	8,940
				05.01 Misc Metals			644		25,082		112,960							138,042	211,139
				02 Modify Existing Structure & Services	1 ls		23,489		916,071	977,662.64	977,663	8,000.00	8,000	59,842.38	59,842			1,961,576	3,041,075
		26		**Electrical & Instrumentation**															
			26.01	**Above Ground Electrical**															
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				315,783.00	315,783					315,783	479,269

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				26.01 Above Ground Electrical	1 ls							315,783.00	315,783					315,783	479,269
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work ForNew Equipment (1.5% Equipment Cost)	1 ls			/ls				94,735.00	94,735					94,735	143,781
				26.02 Instrumentation & Controls	1 ls							94,735.00	94,735					94,735	143,781
				26 Electrical & Instrumentation	1 ls							410,518.00	410,518					410,518	623,050
		40		Process Piping															
			40.01	Above Ground Process Piping															
				Misc Pipe Work- ALLOWANCE	1 ls	40.000 mh / ls	40	45.62 /mh	1,825	2,000.00	2,000	-	-	-	-	-	-	3,825	5,924
				40.01 Above Ground Process Piping	1 lf		40		1,825	2,000.00	2,000							3,825	5,924
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				15,000.00	15,000					15,000	22,766
				40.04 Hydropneumatic Piping System	1 ls							15,000.00	15,000					15,000	22,766
				40 Process Piping	1 lf		40		1,825	2,000.00	2,000	15,000.00	15,000					16,825	28,689
		43		Process Equipment															
			43.01	Flocculators & Mixers															
				Freight On Mixers & Flocculators To Jobsite	24 ea			/ea								1,500.00	36,000	36,000	54,638
				Equipment Unloading	24 ea	4.000 ch / ea	528	182.62 /ch	17,532	500.00	12,000	-	-	381.61	9,159	-	-	38,691	60,537
				Equipment Rigging / Rough Set	24 ea	6.000 ch / ea	864	195.85 /ch	28,202	500.00	12,000	-	-	401.59	9,638	-	-	49,840	78,187
				Variable Frequency Drives (Included)	*24 ea*			*/ea*											
				Rapid Mixer w/7.33' Shaft & Dual 2.33' Blades, 2 HP	6 ea	45.000 mh / ea	270	42.40 /mh	11,447	100.02	600					13,700.00	82,200	94,247	143,764
				Flocculator w/19' Shaft & 9' Blades, 3 HP	18 ea	60.000 mh / ea	1,080	42.40 /mh	45,787	100.00	1,800	-	-	-	-	35,400.00	637,200	684,787	1,042,287
				43.01 Flocculators & Mixers	1 ls		2,742		102,967	26,400.12	26,400			18,796.90	18,797	755,400.00	755,400	903,564	1,379,433
			43.02	Settlement Equipment															
				Freight On Sedimentation System To Jobsite	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Verified Performance Test (2 days per System x 6 ea)	12 day	8.000 ch / day	96	29.43 /ch	2,826			-	-	-	-	1,500.00	18,000	20,826	31,791
				Vendor Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Vendor Witnessed, Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Equipment Unloading	6 ea	16.000 ch / ea	528	182.62 /ch	17,532	500.00	3,000	-	-	381.61	2,290	-	-	22,822	35,945
				Equipment Rigging / Rough Set	6 ea	96.000 ch / ea	3,456	195.85 /ch	112,807	500.00	3,000	-	-	401.59	2,410	-	-	118,216	186,929
				Equipment - Final Setting	6 ea	360.000 ch / ea	6,480	103.33 /ch	223,202	50.00	300	-	-	346.16	2,077	-	-	225,579	357,027
				Inclined Plate Settlers w/ Flow Control Deck 55' x 86' x 8.2'	6 ea			/ea								474,375.00	2,846,250	2,846,250	4,319,798
				43.02 Settlement Equipment	1 ls		10,560		356,367	6,300.00	6,300			6,776.18	6,776	2,891,250.00	2,891,250	3,260,693	4,972,469
			43.03	Baffle Walls															
				Flow Control Diffuser Wall SS 304/304L SS 19' h, 12 ea, 6,840 sf	360 lf	6.000 mh / lf	2,160	30.57 /mh	66,024					28.00	10,080	680.56	245,000	321,104	492,380
				43.03 Baffle Walls	6,840 sf		2,160		66,024					1.47	10,080	35.82	245,000	321,104	492,380
			43.13	Chemical System Equipment															
				Totes	6 ea	1.000 mh / ea	6	45.62 /mh	274			-	-	-	-	-	-	274	433
				Chemical Feed Package Units	6 ea	24.000 mh / ea	144	42.40 /mh	6,105			-	-	-	-	75,000.00	450,000	456,105	692,634
				Activation Units	6 ea	10.002 mh / ea	60	42.40 /mh	2,544			-	-	-	-	25,004.99	150,030	152,574	231,730
				Batch Tank	2 ea	10.002 mh / ea	20	42.40 /mh	848			-	-	-	-	15,002.99	30,006	30,854	46,883
				43.13 Chemical System Equipment	1 ls		230		9,771							630,035.93	630,036	639,807	971,680
			43.20	Slide Gate w/ Operator															
				Slide Gates 36" x 36" w/ 16' Operators @ Influent Chamber	6 ea	30.006 mh / ea	180	47.77 /mh	8,601	500.00	3,000	-	-			20,000.00	120,000	131,601	200,292
				43.20 Slide Gate w/ Operator	1 ls		180		8,601	3,000.00	3,000					120,000.00	120,000	131,601	200,292
				43 Process Equipment	1 ls		15,872		543,730	35,700.12	35,700			35,653.08	35,653	4,641,685.93	4,641,686	5,256,769	8,016,254
				2A Pretreament - Retrofit North w/ Plate Settlers	1 ls		39,401		1,461,626	1,015,362.76	1,015,363	433,518.00	433,518	95,495.46	95,495	4,641,685.93	4,641,686	7,647,688	11,709,068
	2B			Pretreament - Retrofit North w/ Ballasted Flocculation															
		00		Building & Structure Construction															
			03.03	Columns															
				Form Rectangle Columns 12' h	960 sf	0.165 mh / sf	158	39.49 /mh	6,255	1.60	1,532	-	-	-	-	-	-	7,787	12,226
				Chamfer	720 lf	0.015 mh / lf	11	39.49 /mh	427	0.57	408	-	-	-	-	-	-	835	1,295
				Strip & Oil Column Form	960 sf	0.005 mh / sf	5	39.17 /mh	188	0.03	29	-	-	-	-	-	-	217	341
				Superplasticizers @ Columns	12 cy			/cy		8.40	101	-	-	-	-	-	-	101	153
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	14	43.53 /mh	627	997.70	718	-	-	-	-	-	-	1,345	2,082
				Finish- Float	27 sf	0.017 mh / sf	0	39.17 /mh	18	-	-	-	-	-	-	-	-	18	28
				Pump Place Columns 15 ea	12 cy	1.600 mh / cy	19	41.39 /mh	795	-	-	-	-	7.50	90	-	-	885	1,401
				4000 psi Concrete	12 cy			/cy		142.00	1,704	-	-	-	-	-	-	1,704	2,586
				Grind/Patch Columns	960 sf	0.013 mh / sf	12	39.17 /mh	489	0.03	29	-	-	-	-	-	-	518	817
				Rub Columns	960 sf	0.065 mh / sf	62	39.17 /mh	2,444	0.06	58	-	-	-	-	-	-	2,502	3,956
				Liquid Curing Compounds	960 sf	0.003 mh / sf	3	39.17 /mh	113	0.06	56	-	-	-	-	-	-	169	264
				03.03 Columns			286		11,355		4,636				90			16,080	25,150
			03.07	Suspended Beams															
				Beam Side Forms	1,780 sf	0.210 mh / sf	374	39.49 /mh	14,764	2.21	3,926	-	-	-	-	-	-	18,689	29,325
				Beam Bottom Forms	592 sf	0.210 mh / sf	124	39.49 /mh	4,910	2.21	1,306	-	-	-	-	-	-	6,216	9,753
				Chamfer	890 lf	0.015 mh / lf	13	39.49 /mh	527	0.57	505	-	-	-	-	-	-	1,032	1,601
				Strip & Oil Beam Forms	2,372 sf	0.005 mh / sf	12	39.17 /mh	465	0.03	71	-	-	-	-	-	-	536	843
				Superplasticizers @ Beams	44 cy			/cy		8.40	370	-	-	-	-	-	-	370	561
				Rebar- Beams (250 #/cy)	6 tn	15.003 mh / tn	83	43.53 /mh	3,592	997.70	5,487	-	-	-	-	-	-	9,079	14,013
				Finish- Top of Beam	592 sf	0.008 mh / sf	5	39.17 /mh	186	-	-	-	-	-	-	-	-	186	294
				Pump Place Beams @ Roof	44 cy	2.001 mh / cy	88	41.39 /mh	3,644	-	-	-	-	14.42	635	-	-	4,279	6,777
				4000 psi Concrete	44 cy			/cy		142.00	6,248	-	-	-	-	-	-	6,248	9,483
				Grind/Patch Beams	2,372 sf	0.013 mh / sf	31	39.17 /mh	1,208	0.03	71	-	-	-	-	-	-	1,279	2,020
				Rub Beams	2,372 sf	0.085 mh / sf	202	39.17 /mh	7,897	0.06	142	-	-	-	-	-	-	8,039	12,714
				Liquid Curing Compounds	2,372 sf	0.002 mh / sf	5	39.17 /mh	186	0.06	140	-	-	-	-	-	-	325	506
				03.07 Suspended Beams			936		37,378		18,265				635			56,277	87,889
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	3,283 sf	0.020 mh / sf	66	42.24 /mh	2,774	8.80	28,896	-	-	0.35	1,155	-	-	32,826	50,085
				03.20 Precast Planks	1 sf		66		2,774	28,896.16	28,896			1,155.33	1,155			32,826	50,085
			04.00	Masonry															
				12" CMU + Rigid Insulation Backup To Brick, 22' h	5,316 sf			/sf	-	-	-	24.00	127,584	-	-	-	-	127,584	193,636
				Brick Veneer	5,316 sf			-	-	-	-	9.00	47,854	-	-	-	-	47,854	72,628
				04.00 Masonry	1 sf							175,437.55	175,438					175,438	266,264
			05.01	Misc Metals															
				Metal Checkered Plate Stair Landings 4' x 8'	1 ea	4.000 mh / ea	4	42.08 /mh	168	1,200.00	1,200	-	-	-	-	-	-	1,368	2,088
				Metal Checkered Plate Steps	26 rs	1.000 mh / rs	26	42.08 /mh	1,094	367.50	9,555	-	-	-	-	-	-	10,649	16,233
				Alum Stair Wall Handrail	10 lf	0.150 mh / lf	2	42.08 /mh	63	16.80	168	-	-	-	-	-	-	231	355
				Aluminum Handrail @ Stair Landing	16 lf	0.234 mh / lf	4	42.08 /mh	158	44.11	706	-	-	-	-	-	-	863	1,321

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			05.01	Misc Metals															
				Aluminum Handrail @ Stairs	56 lf	0.234 mh / lf	13	42.08 /mh	552	44.11	2,470	-	-	-	-	-	-	3,022	4,622
				Alum Grate Cover .75" @ 4'x4' Sump	1 ea	0.600 mh / ea	1	42.08 /mh	25	185.04	185	-	-	-	-	-	-	210	321
				Aluminum Roof Hatch 6.33' x 6.33'	1 ea	8.002 mh / ea	8	39.18 /mh	313	5,001.00	5,001	-	-	-	-	-	-	5,314	8,086
				05.01 Misc Metals	1 ls		57		2,373	19,284.90	19,285							21,658	33,025
			06.00	Wood															
				Misc Nailers & Blocking	3,623 sf	0.010 mh / sf	36	39.67 /mh	1,438	0.40	1,454	-	-	-	-	-	-	2,892	4,482
				06.00 Wood	1 ls		36		1,438	1,454.02	1,454							2,892	4,482
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	3,623 sf			/sf				3.00	10,871					10,871	16,499
				Aluminum Downspouts, 6 ea x 20' each	120 vf			/vf				18.00	2,160					2,160	3,279
				Aluminum Coping @ Roof Parapet 20" wide	272 lf			/lf				25.01	6,801					6,801	10,323
				Roof Hatch 4'0" x 4'0"	1 ea			/ea				2,500.50	2,501					2,501	3,795
				Translucent Panel Skylight Frame & Panels 7' x 7', 4 ea	196 sf			/sf				38.01	7,449					7,449	11,306
				07.01 Roofing	1 sf							29,782.95	29,783					29,783	45,202
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	2 ea	1.000 mh / ea	2	39.18 /mh	78	180.03	360	-	-	-	-	-	-	438	670
				HM Door Leafs- 3'x7' 20 ga, half glass	2 ea	1.500 ea / mh	1	39.18 /mh	52	450.09	900	-	-	-	-	-	-	952	1,449
				Overhead Doors- 10'x10' 24 ga steel manual 1" insuation 26 ga back-up panel	1 ea			-	-	-	-	2,255.00	2,255	-	-	-	-	2,255	3,422
				Finish Hardware by Leaf- Allowance	2 ea	8.002 mh / ea	16	39.18 /mh	627	900.18	1,800	-	-	-	-	-	-	2,427	3,725
				08.00 Doors, Frames & Hardware	1 ea		19		758	3,060.60	3,061	2,255.00	2,255					6,073	9,267
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	2 ea			/ea		-	-	100.02	200	-	-	-	-	200	304
				Paint HM Doors - primer (2) coats	2 ea			/ea		-	-	140.03	280	-	-	-	-	280	425
				Paint CMU Block - block filler & (2) coat	5,316 sf			-	-	-	-	1.35	7,177	-	-	-	-	7,177	10,892
				Misc Architectural Finishes	1 ls			-	-	-	-	2,000.00	2,000	-	-	-	-	2,000	3,035
				Paint 8" Pipe	214 lf	0.140 mh / lf	30	27.53 /mh	825	0.92	198	-	-	4.24	907	-	-	1,930	3,049
				Paint 10" Pipe	295 lf	0.140 mh / lf	41	27.53 /mh	1,137	1.15	340	-	-	5.65	1,667	-	-	3,145	4,970
				09.00 Finishes	1 ls		71		1,962	537.94	538	9,656.69	9,657	2,574.44	2,574			14,731	22,675
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	2 ea			/ea				30.01	60	-	-	-	-	60	91
				Fire Extinguisher CO2 10 lbs	2 ea			/ea				225.05	450					450	683
				10.00 Specialty Items	1 ls							3,510.70	3,511					3,511	5,328
			22.00	Plumbing															
				Plumbing Subcontract	3,623 sf			/sf				6.00	21,742					21,742	32,999
				22.00 Plumbing	1 ls							21,742.34	21,742					21,742	32,999
			23.00	HVAC															
				Ventilation & Unit Heater System	3,623 sf			/sf		-	-	25.01	90,593	-	-	-	-	90,593	137,495
				23.00 HVAC	1 sf							90,593.08	90,593					90,593	137,495
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 1,310 sf x 4"	20 cy	0.003 cd / cy	2	1,609.56 /cd	98	28.28	566	-	-	10.02	200	-	-	863	1,332
				31.20 Structure Stone Base			2		98		566				200			863	1,332
			32.00	Site Improvements															
				Asphalt Pavement, 10" Subgrade, 9" Base, 1-1/2" Topping @ Access Drive	236 sy			-	-	-	-	21.80	5,145	-	-	-	-	5,145	7,808
				Misc Site Improvement ALLOWANCE	1 ls			/ls				10,000.00	10,000					10,000	15,177
				32.00 Site Improvements	1 ls							15,144.80	15,145					15,145	22,986
				00 Building & Structure Construction	3,623 gsf		1,474		58,135	21.17	76,700	96.09	348,123	1.29	4,655			487,612	744,179
		02		Modify Existing Structure & Services															
			02.01	Demolition Work															
				Non-Hazardous Waste Transport and Disposal	1 ls				-	-	-	2,000.00	2,000	-	-	-	-	2,000	3,035
				Misc Demolition	1 ls	8.000 ch / ls	16	84.95 /ch	680	-	-	-	-	26.86	27	-	-	706	1,118
				Demo All Piping & Equipment From North Plant Basins	1 ls	16.000 ch / ls	64	167.66 /ch	2,683	-	-	-	-	103.03	103	-	-	2,786	4,410
				Demo Electrical System @ Basins	1 ls			/ls				2,000.00	2,000					2,000	3,035
				Pressure Wash Basin Walls	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Pressure Washing Basin Slab	10,000 sf	200.000 sf / ch	100	53.11 /ch	2,656	0.35	3,500	-	-	0.39	3,913	-	-	10,069	15,743
				02.01 Demolition Work	1 ls		602		17,215	14,569.10	14,569	4,000.00	4,000	20,543.23	20,543			56,328	88,125
			03.04	Walls															
				Keyway 6"	2,200 lf	0.050 mh / lf	110	39.49 /mh	4,345	0.67	1,479	-	-	-	-	-	-	5,823	9,120
				Vertical Wall Keyway 6"	524 lf	0.110 mh / lf	58	39.49 /mh	2,277	0.67	352	-	-	-	-	-	-	2,629	4,138
				Panel Form System 4-8'	2,427 sf	0.130 mh / sf	316	39.49 /mh	12,459	1.84	4,460	-	-	-	-	-	-	16,918	26,487
				Panel Form System > 16' h	33,825 sf	0.190 mh / sf	6,428	39.49 /mh	253,830	1.84	62,166	-	-	-	-	-	-	315,996	495,091
				Waterstop 6" Flat	2,724 lf	0.110 mh / lf	300	39.18 /mh	11,741	2.10	5,722	-	-	-	-	-	-	17,462	27,266
				Strip & Oil Forms	36,252 sf	0.005 mh / sf	181	39.17 /mh	7,101	0.03	1,088	-	-	-	-	-	-	8,189	12,889
				Superplasticizers @ Walls	1,675 cy			/cy		8.40	14,072	-	-	-	-	-	-	14,072	21,357
				Rebar- Walls (125 #/cy)	105 tn	15.003 mh / tn	1,575	43.53 /mh	68,569	997.70	104,758	-	-	-	-	-	-	173,327	267,518
				Finish- Top of Wall	2,173 sf	0.008 mh / sf	17	39.17 /mh	681	-	-	-	-	-	-	-	-	681	1,078
				Pump Place Walls 12"	110 cy	1.150 mh / cy	127	41.39 /mh	5,237	-	-	-	-	6.65	731	-	-	5,968	9,452
				Pump Place Walls 24"	766 cy	1.150 mh / cy	881	41.39 /mh	36,467	-	-	-	-	6.65	5,094	-	-	41,560	65,823
				Pump Place Walls 30"	85 cy	1.150 mh / cy	98	41.39 /mh	4,047	-	-	-	-	6.65	565	-	-	4,612	7,304
				Pump Place Walls 36"	714 cy	1.150 mh / cy	821	41.39 /mh	33,991	-	-	-	-	6.65	4,748	-	-	38,739	61,355
				4000 psi Concrete	1,675 cy			/cy		142.00	237,850	-	-	-	-	-	-	237,850	360,989
				Grind/Patch Walls	36,252 sf	0.013 mh / sf	471	39.17 /mh	18,462	0.03	1,088	-	-	-	-	-	-	19,550	30,871
				Rub Walls	36,252 sf	0.058 mh / sf	2,103	39.17 /mh	82,353	0.06	2,175	-	-	-	-	-	-	84,528	133,643
				Liquid Curing Compounds	38,425 sf	0.002 mh / sf	77	39.17 /mh	3,011	0.06	2,260	-	-	-	-	-	-	5,270	8,195
				03.04 Walls	1,675 cy		13,562		544,569	261.18	437,469			6.65	11,138			993,175	1,543,577
			03.05	Slab On Grade															
				Slab Edge Form 28"	526 sf	0.350 mh / sf	184	39.49 /mh	7,271	1.31	691	-	-	-	-	-	-	7,962	12,556
				Strip & Oil Forms	526 sf	0.005 mh / sf	3	39.17 /mh	103	0.03	16	-	-	-	-	-	-	119	187
				Rebar- SOG (125 #/cy)	3 tn	14.003 mh / tn	42	43.53 /mh	1,829	997.70	2,993	-	-	-	-	-	-	4,822	7,437
				Mesh Support - bricks (.12/sf)	157 ea	0.002 mh / ea	0	43.53 /mh	14	0.26	41	-	-	-	-	-	-	55	84
				Finish- Hard Trowel	1,310 sf	0.015 mh / sf	20	39.17 /mh	770	-	-	-	-	-	-	-	-	770	1,218
				Pump Place Slab on Grade 8" @ Electrical Room	32 cy	0.500 mh / cy	16	41.39 /mh	662	-	-	-	-	3.67	117	-	-	780	1,235
				Pump Place Thickened Slab 28" x 20"	17 cy	0.500 mh / cy	9	41.39 /mh	352	-	-	-	-	3.67	62	-	-	414	656
				4000 psi Concrete	49 cy			/cy		142.00	6,958	-	-	-	-	-	-	6,958	10,560
				Saw Cut S-O-G (.08/sf)	105 lf	0.030 mh / lf	3	39.17 /mh	123	0.17	18	-	-	0.95	100	-	-	241	382
				Liquid Curing Compounds	1,836 sf	0.002 mh / sf	4	39.17 /mh	144	0.06	108	-	-	-	-	-	-	252	392
				Seal Floors	1,310 sf	0.002 mh / sf	3	39.17 /mh	103	0.09	121	-	-	-	-	-	-	224	346
				6 Mil Vapor Barrier	1,310 sf	0.002 mh / sf	3	43.53 /mh	114	0.05	69	-	-	-	-	-	-	183	285

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.05	Slab On Grade															
				Gravel Fill Under Slab 4"	39 cy	0.004 cd / cy	5	1,412.15 /cd	209	29.26	1,141	-	-	3.84	150	-	-	1,499	2,300
				03.05 Slab On Grade	49 cy		290		11,693	248.07	12,155			8.76	429			24,278	37,639
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	2,016 sf	0.220 mh / sf	444	39.49 /mh	17,514	2.18	4,404			-	-	-	-	21,918	34,403
				Slab Edge Form 8" & 12"	435 sf	0.250 mh / sf	109	39.49 /mh	4,295	5.17	2,249			-	-	-	-	6,545	10,212
				Strip & Oil Suspended Slab Forms	2,451 sf	0.005 mh / sf	12	39.17 /mh	480	0.04	101			-	-	-	-	581	912
				Superplasticizers	67 cy				-	8.40	563			-	-	-	-	563	854
				Rebar- Suspended Slab (225 #/cy)	8 tn	20.004 mh / tn	151	43.53 /mh	6,556	997.70	7,513	-	-	-	-	-	-	14,069	21,778
				Finish- Hard Trowel	2,016 sf	0.035 mh / sf	71	39.17 /mh	2,764	-	-			-	-	-	-	2,764	4,374
				Pump Place Suspended Slab	67 cy	2.160 mh / cy	145	41.39 /mh	5,990	-	-			6.65	446	-	-	6,436	10,190
				4000 psi Concrete	67 cy				-	142.00	9,514			-	-	-	-	9,514	14,440
				Liquid Curing Compounds	4,467 sf	0.003 mh / sf	13	39.17 /mh	525	0.68	3,049			-	-	-	-	3,574	5,459
				03.06 Suspended Flat Slab	67 cy		944		38,124	408.85	27,393			6.65	446			65,962	102,623
			03.08	Pads & Curbs															
				Pad Form	68 sf	0.120 mh / sf	8	39.49 /mh	322	1.37	93	-	-	-	-	-	-	415	651
				Chamfer	136 lf	0.015 mh / lf	2	39.49 /mh	81	0.57	77	-	-	-	-	-	-	158	245
				Strip & Oil Equipment Pad Forms	68 sf	0.005 mh / sf	0	39.17 /mh	13	0.03	2	-	-	-	-	-	-	15	24
				Rebar- Pads (100 #/cy)	0 tn	18.003 mh / tn	2	43.53 /mh	78	997.70	100	-	-	-	-	-	-	178	275
				Finish- Float	120 sf	0.017 mh / sf	2	39.17 /mh	80	-	-	-	-	-	-	-	-	80	126
				Pump Place Pads	2 cy	1.601 mh / cy	3	41.39 /mh	132	-	-	-	-	7.49	15	-	-	147	234
				4000 psi Concrete	2 cy			/cy		142.00	284	-	-	-	-	-	-	284	431
				Liquid Curing Compounds	187 sf	0.003 mh / sf	1	39.17 /mh	22	0.06	11	-	-	-	-	-	-	33	52
				03.08 Pads & Curbs	2 cy		18		729	283.39	557			7.49	15			1,311	2,038
			03.11	Topping Slab															
				Mesh Support (.12/sf)	1,199 ea	0.002 mh / ea	2	43.53 /mh	104	0.26	315	-	-	-	-	-	-	419	643
				WWM 4X4- W 2.9 Flats	9,994 sf	0.014 mh / sf	140	43.53 /mh	6,090	0.50	5,011	-	-	-	-	-	-	11,101	17,244
				Finish- Hard Trowel	9,994 sf	0.015 mh / sf	150	39.17 /mh	5,873	-	-	-	-	-	-	-	-	5,873	9,295
				Pump Place Topping Slab	555 cy	0.750 mh / cy	416	28.06 /mh	11,681	-	-	-	-	6.65	3,692	-	-	15,373	24,364
				4000 psi Concrete	555 cy			/cy		142.00	78,810	-	-	-	-	-	-	78,810	119,611
				Liquid Curing Compounds	9,994 sf	0.002 mh / sf	20	39.17 /mh	783	0.06	588	-	-	-	-	-	-	1,371	2,131
				Seal Floors	9,994 sf	0.002 mh / sf	20	39.17 /mh	783	0.09	924	-	-	-	-	-	-	1,707	2,641
				03.11 Topping Slab	555 cy		748		25,314	154.32	85,647			6.65	3,692			114,653	175,928
			03.30	Patch Cracks and Resurface Concrete															
				Patch Cracks & Resurface Walls	2,120 sf	10.000 sf / ch	424	53.11 /ch	11,259	0.11	231	-	-	-	-	-	-	11,490	18,171
				Patch Cracks & Resurface Slab	848 sf	6.764 sf / ch	251	53.11 /ch	6,659	0.07	63	-	-	-	-	-	-	6,721	10,634
				Pressure Wash Basin Walls	2,120 sf	33.333 sf / ch	127	53.11 /ch	3,378	0.35	742	-	-	2.37	5,028	-	-	9,147	14,474
				Pressure Washing Basin Slab	848 sf	16.667 sf / ch	102	53.11 /ch	2,702	0.35	297	-	-	4.70	3,982	-	-	6,981	11,065
				03.30 Patch Cracks and Resurface Concrete	2,968 sf		904		23,998	0.45	1,332			3.04	9,010			34,340	54,343
			05.01	Misc Metals															
				Floor Grating Structural Support (4 #/sf)	6 tn	8.002 ch / tn	228	214.54 /ch	9,785	1,200.24	6,841	-	-	829.17	4,726	-	-	21,353	33,392
				Aluminum 2 Line Rail @ Basin Walkways	366 lf	0.200 mh / lf	73	38.76 /mh	2,837	32.20	11,785	-	-	-	-	-	-	14,622	22,377
				Replace Alum Handrail @ Existing Influent Channel	106 lf	0.200 mh / lf	21	38.76 /mh	822	32.20	3,413	-	-	-	-	-	-	4,235	6,481
				Replace Alum Platform Grating 1"	2,837 sf	0.035 mh / sf	99	42.08 /mh	4,179	12.39	35,157	-	-	-	-	-	-	39,337	59,974
				05.01 Misc Metals	1 ls		422		17,623	57,197.21	57,197			4,726.25	4,726			79,547	122,223
			31.12	Structure Backfill															
				Engineered Fill 22.5' @ Coagulation Basins, 2ea	335 cy	0.003 cd / cy	32	1,327.72 /cd	1,334	12.00	4,020	-	-	4.69	1,570	-	-	6,924	10,712
				Engineered Fill 19' @ Flocculation Basins, 2 ea	3,652 cy	0.003 cd / cy	351	1,327.72 /cd	14,547	12.00	43,824	-	-	4.69	17,116	-	-	75,486	116,775
				Engineered Fill 19' @ Sedimentation Basin, 1 ea	6,516 cy	0.003 cd / cy	626	1,327.72 /cd	25,954	12.00	78,192	-	-	4.69	30,539	-	-	134,685	208,354
				31.12 Structure Backfill	10,503 cy		1,008		41,835	12.00	126,036			4.69	49,224			217,096	335,841
				02 Modify Existing Structure & Services	1 ls		18,498		721,101	762,354.84	762,365	4,000.00	4,000	99,224.01	99,224			1,586,689	2,462,337
		26		Electrical & Instrumentation															
			26.01	Above Ground Electrical															
				Electrical Work For Equipment	1 ls			/ls				200,000.00	200,000					200,000	303,543
				26.01 Above Ground Electrical	1 ls							200,000.00	200,000					200,000	303,543
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment	1 ls			/ls				84,000.00	84,000					84,000	127,488
				26.02 Instrumentation & Controls	1 ls							84,000.00	84,000					84,000	127,488
				26 Electrical & Instrumentation	1 ls							284,000.00	284,000					284,000	431,031
		40		Process Piping															
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 8-10'	152 lf	405.000 lf / cd	21	2,270.14 /cd	852	-	-	-	-	2.79	424	-	-	1,276	2,024
				Stone Pipe Bedding	23 cy	200.000 cy / cd	8	2,896.43 /cd	333	23.29	536	-	-	-	-	-	-	869	1,340
				DI Pipe Push - Class 52 6	0 lf	0.220 mh / lf	0	24.05 /mh	0	23.00	0	-	-	-	-	-	-	0	0
				DI Pipe Push - Class 52 8	0 lf	0.250 mh / lf	0	51.34 /mh	0	32.00	0	-	-	-	-	-	-	0	1
				DI Pipe Push - Class 52 12	0 lf	0.310 mh / lf	0	51.34 /mh	0	52.00	1	-	-	-	-	-	-	1	1
				DI Pipe Push - Class 52 30	0 lf	0.440 mh / lf	0	51.34 /mh	0	167.00	2	-	-	-	-	-	-	2	3
				DI Pipe Push - Class 52 36	0 lf	0.500 mh / lf	0	51.34 /mh	0	225.00	2	-	-	-	-	-	-	3	4
				DI Pipe Push - Class 52 42	0 lf	0.570 mh / lf	0	51.34 /mh	0	291.00	3	-	-	-	-	-	-	3	5
				DI Pipe Push - Class 52 48	45 lf	0.640 mh / lf	29	51.34 /mh	1,479	365.30	16,439	-	-	-	-	-	-	17,917	27,289
				DI Pipe Push - Class 52 60	82 lf	0.800 mh / lf	66	51.34 /mh	3,368	555.00	45,510	-	-	-	-	-	-	48,878	74,402
				DI Pipe Push - Class 52 72	25 lf	0.960 mh / lf	24	51.34 /mh	1,232	700.00	17,500	-	-	-	-	-	-	18,732	28,510
				Hydrostatic Testing	152 lf	0.021 ch / lf	13	182.49 /ch	583	0.16	24	-	-	-	-	-	-	607	959
				Chlorination	152 lf			/lf		0.10	15	-	-	-	-	-	-	15	23
				DI 90 ell 48"	2 ea	25.710 mh / ea	51	30.57 /mh	1,572	6,633.90	13,268	-	-	-	-	-	-	14,840	22,624
				DI 90 ell 60"	1 ea	32.420 mh / ea	32	30.57 /mh	991	1.62	2	-	-	-	-	-	-	993	1,571
				DI 90 ell 72"	1 ea	40.000 mh / ea	40	30.57 /mh	1,223	37,224.00	37,224	-	-	-	-	-	-	38,447	58,431
				DI Tee 48"	2 ea	25.710 mh / ea	51	30.57 /mh	1,572	24,816.96	49,634	-	-	-	-	-	-	51,206	77,818
				DI Tee 60"	1 ea	32.420 mh / ea	32	30.57 /mh	991	3.36	3	-	-	-	-	-	-	994	1,574
				DI Con Red 60x48"	2 ea	32.420 mh / ea	65	30.57 /mh	1,982	3.36	7	-	-	-	-	-	-	1,989	3,147
				40.00 Under Ground Process Piping	152 lf		433		16,177	1,185.32	180,169			2.79	424			196,771	299,725
			40.01	Above Ground Process Piping															
				Stencil Exposed Piping <20"	509 lf			-	-	-	-	10.00	5,091	-	-	-	-	5,091	7,727
				Pipe Supports	25 ea	4.001 mh / ea	100	45.62 /mh	4,563	250.05	6,251	-	-	-	-	-	-	10,814	16,710
				Hydrostatic Testing	509 lf	0.021 ch / lf	43	182.49 /ch	1,951	0.16	81	-	-	-	-	-	-	2,032	3,211
				Chlorination	509 lf			/lf		0.10	51	-	-	-	-	-	-	51	77
				Gasket/Nuts/Bolt Kit 8"	20 ea	1.000 mh / ea	20	32.89 /mh	658	22.00	440	-	-	-	-	-	-	1,098	1,709
				Gasket/Nuts/Bolt Kit 10"	30 ea	1.000 mh / ea	30	32.89 /mh	987	37.53	1,126	-	-	-	-	-	-	2,113	3,271
				DI Flanged Joint Pipe 8"	214 lf	0.980 mh / lf	210	30.57 /mh	6,410	67.30	14,402	-	-	-	-	-	-	20,813	32,004
				DI Flanged Joint Pipe 10"	295 lf	1.240 mh / lf	366	30.57 /mh	11,181	88.24	26,031	-	-	-	-	-	-	37,213	57,205

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			40.01	Above Ground Process Piping															
				DI Flanged 90 ell 8"	12 ea	5.050 mh / ea	61	30.57 /mh	1,852	170.10	2,041	-	-	-	-	-	-	3,894	6,030
				DI Flanged 90 ell 10"	18 ea	6.360 mh / ea	114	30.57 /mh	3,499	267.30	4,811	-	-	-	-	-	-	8,311	12,841
				DI Flanged Tee 10"	4 ea	6.360 mh / ea	25	30.57 /mh	778	0.01	0	-	-	-	-	-	-	778	1,231
				DI Flanged Con Red 6x4"	24 ea	4.830 mh / ea	116	30.57 /mh	3,543	168.00	4,032	-	-	-	-	-	-	7,575	11,727
				Microsand Feed Piping & Accessories- ALLOWANCE	400 LF	0.240 mh / LF	96	45.62 /mh	4,381	55.01	22,004	-	-	-	-	-	-	26,385	40,330
				Polymer Feed System Piping & Accessories- ALLOWANCE	400 LF	0.240 mh / LF	96	45.62 /mh	4,381	55.01	22,004	-	-	-	-	-	-	26,385	40,330
				40.01 Above Ground Process Piping	509 lf		1,277		44,184	202.90	103,275	10.00	5,091					152,551	234,401
			40.02	Valves, Meters, Etc.															
				8" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	6.400 mh / ea	26	30.57 /mh	783	3,800.00	15,200	-	-	-	-	-	-	15,983	24,308
				48" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	2 ea	39.000 mh / ea	78	30.57 /mh	2,384	26,400.00	52,800	-	-	-	-	-	-	55,184	83,909
				40.02 Valves, Meters, Etc.	1 ls		104		3,167	68,000.00	68,000							71,167	108,217
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				32,000.00	32,000					32,000	48,567
				40.04 Hydropneumatic Piping System	1 ls							32,000.00	32,000					32,000	48,567
				40 Process Piping	661 lf		1,813		63,528	531.69	351,445	56.11	37,091	0.64	424			452,489	680,910
		43		Process Equipment															
			43.00	Pumps															
				Pump Inspection	8 ea	24.000 mh / ea	192	42.40 /mh	8,140	-	-	2,200.00	17,600	-	-	-	-	25,740	39,595
				Freight On Pumps To Jobsite	8 ea			/ea								1,500.00	12,000	12,000	18,213
				Verified Performance Test	8 day	8.000 ch / day	64	29.43 /ch	1,884			-	-	-	-	1,500.00	12,000	13,884	21,194
				Vendor Verified Performance Test	8 ea			/ea								1,500.00	12,000	12,000	18,213
				Vendor Witnessed, Verified Performance Test	8 ea			/ea								1,500.00	12,000	12,000	18,213
				System Disinfection	1 day	8.000 ch / day	8	29.43 /ch	235	750.00	750							985	1,511
				Equipment Unloading	8 ea	4.000 ch / ea	176	182.62 /ch	5,844	500.00	4,000	-	-	381.61	3,053	-	-	12,897	20,179
				Equipment Rigging / Rough Set - Pumps	8 ea	4.000 ch / ea	192	195.85 /ch	6,267	500.00	4,000	-	-	401.59	3,213	-	-	13,480	21,103
				Equipment - Final Setting Grout Base - Pumps	8 ea	4.000 ch / ea	96	103.33 /ch	3,307	50.00	400	-	-	346.16	2,769	-	-	6,476	10,248
				Variable Frequency Drives	8 ea	20.000 mh / ea	160	28.14 /mh	4,502	15,000.00	120,000	-	-	-	-	-	-	124,502	189,251
				Sludge Return Pumps	6 ea	40.000 mh / ea	240	34.45 /mh	8,267			-	-	-	-	50,000.00	300,000	308,267	468,389
				Sump Pump @ Ancillary Building Lower Level	1 ea	20.000 mh / ea	20	34.45 /mh	689	-	-	-	-	-	-	30,000.00	30,000	30,689	46,622
				43.00 Pumps	1 ls		1,148		39,134	129,150.00	129,150	17,600.00	17,600	9,034.92	9,035	378,000.00	378,000	572,919	872,739
			43.01	Flocculators & Mixers															
				Freight On Mixers & Flocculators To Jobsite	12 ea			/ea								1,500.00	18,000	18,000	27,319
				Equipment Unloading	12 ea	4.000 ch / ea	264	182.62 /ch	8,766	500.00	6,000	-	-	381.61	4,579	-	-	19,345	30,268
				Equipment Rigging / Rough Set	12 ea	6.000 ch / ea	432	195.85 /ch	14,101	500.00	6,000	-	-	401.59	4,819	-	-	24,920	39,094
				Variable Frequency Drives (Included)	*12 ea*			*/ea*											
				Rapid Mixer w/7.33' Shaft & Dual 8' Blades, 2 HP (Hydro-Cyclone)	4 ea	45.000 mh / ea	180	42.40 /mh	7,631	100.02	400					0.00	0	8,031	12,685
				Flocculator w/19' Shaft & 10.5' Blades, 3 HP	8 ea	60.000 mh / ea	480	42.40 /mh	20,350	100.00	800	-	-	-	-	0.00	0	21,150	33,422
				43.01 Flocculators & Mixers	1 ls		1,356		50,848	13,200.08	13,200			9,398.44	9,398	18,000.00	18,000	91,446	142,788
			43.02	Settlement Equipment															
				Freight On Sedimentation System To Jobsite	4 ea			/ea								1,500.00	6,000	6,000	9,106
				Verified Performance Test (2 days per System x 6 ea)	16 day	8.000 ch / day	128	29.43 /ch	3,768			-	-	-	-	1,500.00	24,000	27,768	42,388
				Vendor Verified Performance Test	4 ea			/ea								1,500.00	6,000	6,000	9,106
				Vendor Witnessed, Verified Performance Test	4 ea			/ea								1,500.00	6,000	6,000	9,106
				Equipment Unloading	4 ea	16.000 ch / ea	352	182.62 /ch	11,688	500.00	2,000	-	-	381.61	1,526	-	-	15,214	23,964
				Equipment Rigging / Rough Set	4 ea	96.000 ch / ea	2,304	195.85 /ch	75,205	500.00	2,000	-	-	401.59	1,606	-	-	78,811	124,619
				Equipment - Final Setting	4 ea	660.000 ch / ea	7,920	103.33 /ch	272,803	50.00	200	-	-	346.16	1,385	-	-	274,388	434,277
				ACTIFLO- Lamella Tube Plate Settler System w/ (4) 21' Troughs/ System 12.5 MGD	4 ea			/ea								776,750.00	3,107,000	3,107,000	4,715,542
				43.02 Settlement Equipment	1 ls		10,704		363,463	4,200.00	4,200			4,517.46	4,517	3,149,000.00	3,149,000	3,521,181	5,368,109
			43.13	Chemical System Equipment															
				Totes	8 ea	1.000 mh / ea	8	45.62 /mh	365			-	-	-	-	-	-	365	578
				Microsand Feed System	4 ea	10.002 mh / ea	40	42.40 /mh	1,696			-	-	-	-	75,014.98	300,060	301,756	458,090
				Polymer Feed System	4 ea	10.002 mh / ea	40	42.40 /mh	1,696			-	-	-	-	0.00	0	1,696	2,685
				Activation Units	8 ea	10.002 mh / ea	80	42.40 /mh	3,392			-	-	-	-	291,875.00	2,335,000	2,338,392	3,549,235
				Batch Tank	4 ea	10.002 mh / ea	40	42.40 /mh	1,696			-	-	-	-	15,002.99	60,012	61,708	93,766
				43.13 Chemical System Equipment			208		8,846								2,695,072	2,703,918	4,104,353
			43.20	Slide Gate w/ Operator															
				Slide Gates 36" x 36" w/ 16' Operators @ Influent Chamber	4 ea	30.006 mh / ea	120	47.77 /mh	5,734	500.00	2,000	-	-			20,000.00	80,000	87,734	133,528
				43.20 Slide Gate w/ Operator			120		5,734		2,000						80,000	87,734	133,528
				43 Process Equipment	1 ls		13,536		468,025	148,650.08	148,550	17,600.00	17,600	22,950.92	22,951	6,320,071.86	6,320,072	6,977,198	10,621,517
				2B Pretreament - Retrofit North w/ Ballasted Flocculation	1 ls		35,321		1,310,788	1,339,060.36	1,339,050	690,814.13	690,814	127,253.60	127,254	6,320,071.86	6,320,072	9,787,988	14,949,975
2C				Pretreatment - Construct New Facility															
		00		Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	474 lf	0.050 mh / lf	24	39.49 /mh	936	0.67	319	-	-	-	-	-	-	1,255	1,965
				Mat Foundation Edge Form 24"	1,306 sf	0.350 mh / sf	457	39.49 /mh	18,054	1.31	1,714	-	-	-	-	-	-	19,768	31,176
				Mat Foundation Bulkhead Form	948 sf	0.350 mh / sf	332	39.49 /mh	13,102	1.52	1,443	-	-	-	-	-	-	14,545	22,927
				Waterstop 6" Flat	474 lf	0.110 mh / lf	52	39.18 /mh	2,043	2.10	996	-	-	-	-	-	-	3,039	4,745
				Strip & Oil Mat Found. Form	2,254 sf	0.005 mh / sf	11	39.17 /mh	442	0.03	68	-	-	-	-	-	-	509	801
				Rebar- Foundation Mat (100 #/cy)	97 tn	28.006 mh / tn	2,722	43.53 /mh	118,487	997.70	96,976	-	-	-	-	-	-	215,463	334,714
				Rebar Support - bricks (.12/sf)	3,149 ea	0.002 mh / ea	6	43.53 /mh	274	0.26	827	-	-	-	-	-	-	1,101	1,689
				Finish- Hard Trowel	26,244 sf	0.023 mh / sf	604	39.17 /mh	23,646	-	-	-	-	-	-	-	-	23,646	37,425
				Pump Place Mat Foundation 24"	1,944 cy	0.500 mh / cy	972	41.39 /mh	40,230	-	-	-	-	4.59	8,920	-	-	49,150	77,869
				4000 psi Concrete	1,944 cy			/cy		142.00	276,048	-	-	-	-	-	-	276,048	418,962
				Liquid Curing Compounds	28,498 sf	0.003 mh / sf	86	39.17 /mh	3,349	0.06	1,676	-	-	-	-	-	-	5,025	7,844
				6 Mil. Vapor Barrier	28,900 sf	0.002 mh / sf	58	43.53 /mh	2,516	0.05	1,518	-	-	-	-	-	-	4,034	6,286
				03.00 Foundation Mat	1,944 cy		5,324		223,079	196.29	381,584			4.59	8,920			613,583	946,403
			03.03	Columns															
				Form Rectangle Columns 20' h	1,920 sf	0.165 mh / sf	317	39.49 /mh	12,510	1.60	3,065	-	-	-	-	-	-	15,575	24,451
				Chamfer	1,280 lf	0.015 mh / lf	19	39.49 /mh	758	0.57	725	-	-	-	-	-	-	1,484	2,302
				Strip & Oil Column Form	1,920 sf	0.005 mh / sf	10	39.17 /mh	376	0.03	58	-	-	-	-	-	-	434	683
				Superplasticizers @ Columns	27 cy			/cy		8.40	227	-	-	-	-	-	-	227	344
				Column Rebar (120 #/cy)	2 tn	20.004 mh / tn	40	43.53 /mh	1,741	997.70	1,995	-	-	-	-	-	-	3,737	5,785
				Finish- Float	72 sf	0.017 mh / sf	1	39.17 /mh	48	-	-	-	-	-	-	-	-	48	76
				Pump Place Columns 18 ea	27 cy	1.600 mh / cy	43	41.39 /mh	1,788	-	-	-	-	7.50	202	-	-	1,991	3,153
				4000 psi Concrete	27 cy			/cy		142.00	3,834	-	-	-	-	-	-	3,834	5,819
				Grind/Patch Columns	1,920 sf	0.013 mh / sf	25	39.17 /mh	978	0.03	58	-	-	-	-	-	-	1,035	1,635
				Rub Columns	1,920 sf	0.065 mh / sf	125	39.17 /mh	4,888	0.06	115	-	-	-	-	-	-	5,003	7,911
				Liquid Curing Compounds	1,920 sf	0.003 mh / sf	6	39.17 /mh	226	0.06	113	-	-	-	-	-	-	339	528

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				03.03 Columns	27 cy		586		23,313	377.42	10,190			7.50	202			33,706	52,686
			03.04	Walls															
				Keyway 6"	3,254 lf	0.050 mh / lf	163	39.49 /mh	6,426	0.67	2,187	-	-	-	-	-	-	8,613	13,490
				Vertical Wall Keyway 6"	795 lf	0.110 mh / lf	87	39.49 /mh	3,454	0.67	534	-	-	-	-	-	-	3,988	6,277
				Panel Form System 8-12'	4,871 sf	0.150 mh / sf	731	39.49 /mh	28,852	1.84	8,950	-	-	-	-	-	-	37,802	59,249
				Panel Form System 12-16'	8,948 sf	0.170 mh / sf	1,521	39.49 /mh	60,068	1.84	16,442	-	-	-	-	-	-	76,510	120,024
				Panel Form System > 16' h	49,674 sf	0.190 mh / sf	9,440	39.49 /mh	372,765	1.84	91,294	-	-	-	-	-	-	464,059	728,539
				Waterstop 6" Flat	4,049 lf	0.110 mh / lf	445	39.18 /mh	17,452	2.10	8,505	-	-	-	-	-	-	25,956	40,529
				Strip & Oil Wall Forms	63,493 sf	0.005 mh / sf	318	39.17 /mh	12,436	0.03	1,905	-	-	-	-	-	-	14,342	22,575
				Superplasticizers @ Walls	1,609 cy			/cy		8.40	13,517	-	-	-	-	-	-	13,517	20,515
				Rebar- Walls (125 #/cy)	101 tn	15.003 mh / tn	1,515	43.53 /mh	65,957	997.70	100,768	-	-	-	-	-	-	166,724	257,327
				Finish- Top of Wall	4,571 sf	0.008 mh / sf	37	39.17 /mh	1,433	-	-	-	-	-	-	-	-	1,433	2,267
				Pump Place Walls 12", 18" & 20"	1,609 cy	1.150 mh / cy	1,851	41.39 /mh	76,599	-	-	-	-	6.65	10,699	-	-	87,298	138,263
				4000 psi Concrete	1,609 cy			/cy		142.00	228,478	-	-	-	-	-	-	228,478	346,765
				Grind/Patch Walls	63,493 sf	0.013 mh / sf	826	39.17 /mh	32,335	0.03	1,905	-	-	-	-	-	-	34,240	54,069
				Rub Walls	53,253 sf	0.058 mh / sf	3,089	39.17 /mh	120,974	0.06	3,195	-	-	-	-	-	-	124,169	196,317
				Liquid Curing Compounds	65,983 sf	0.002 mh / sf	132	39.17 /mh	5,170	0.06	3,881	-	-	-	-	-	-	9,050	14,072
				03.04 Walls	1,609 cy		20,154		803,920	299.29	481,562			6.65	10,699			1,296,181	2,020,278
			03.05	Slab On Grade															
				Slab Edge Form 8"	361 sf	0.240 mh / sf	87	39.49 /mh	3,421	1.22	440	-	-	-	-	-	-	3,861	6,092
				Slab Edge Form 18"	579 sf	0.340 mh / sf	197	39.49 /mh	7,774	1.52	882	-	-	-	-	-	-	8,655	13,641
				Strip & Oil Forms	940 sf	0.005 mh / sf	5	39.17 /mh	184	0.04	39	-	-	-	-	-	-	223	350
				Rebar- SOG (125 #/cy)	8 tn	14.003 mh / tn	107	43.53 /mh	4,650	997.70	7,612	-	-	-	-	-	-	12,263	18,914
				Mesh Support - bricks (.12/sf)	335 ea	0.002 mh / ea	1	43.53 /mh	29	0.26	88	-	-	-	-	-	-	117	180
				Finish- Hard Trowel	2,791 sf	0.025 mh / sf	70	39.17 /mh	2,733	-	-	-	-	-	-	-	-	2,733	4,325
				Pump Place Slab on Grade 8"	27 cy	0.500 mh / cy	14	41.39 /mh	559	-	-	-	-	3.67	99	-	-	658	1,042
				Pump Place Slab on Grade 18"	95 cy	0.500 mh / cy	48	41.39 /mh	1,966	-	-	-	-	3.67	349	-	-	2,315	3,667
				4000 psi Concrete	122 cy			/cy		142.00	17,324	-	-	-	-	-	-	17,324	26,293
				Saw Cut S-O-G (.08/sf)	223 lf	0.030 mh / lf	7	39.17 /mh	262	0.17	38	-	-	0.95	212	-	-	512	810
				Liquid Curing Compounds	3,731 sf	0.002 mh / sf	7	39.17 /mh	292	0.06	219	-	-	-	-	-	-	512	796
				Seal Floors	2,791 sf	0.002 mh / sf	6	39.17 /mh	219	0.09	258	-	-	-	-	-	-	477	738
				6 Mil. Vapor Barrier	7,000 sf	0.002 mh / sf	14	43.53 /mh	610	0.05	368	-	-	-	-	-	-	977	1,523
				Gravel Fill Under Slab 4"	34 cy	0.004 cd / cy	4	1,412.15 /cd	182	29.26	995	-	-	3.84	130	-	-	1,307	2,005
				03.05 Slab On Grade	122 cy		564		22,881	231.65	28,262			6.48	791			51,934	80,366
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	8,903 sf	0.220 mh / sf	1,959	39.49 /mh	77,344	2.18	19,448			-	-	-	-	96,792	151,929
				Slab Edge Form 8" & 12"	3,060 sf	0.250 mh / sf	765	39.49 /mh	30,214	5.17	15,823			-	-	-	-	46,038	71,836
				Strip & Oil Suspended Slab Forms	11,963 sf	0.005 mh / sf	60	39.17 /mh	2,343	0.04	491			-	-	-	-	2,834	4,453
				Superplasticizers	317 cy			-	-	8.40	2,663			-	-	-	-	2,663	4,042
				Rebar- Suspended Slab (225 #/cy)	36 tn	20.004 mh / tn	720	43.53 /mh	31,346	997.70	35,917	-	-	-	-	-	-	67,263	104,123
				Finish- Hard Trowel	8,903 sf	0.035 mh / sf	312	39.17 /mh	12,205	-	-			-	-	-	-	12,205	19,316
				Pump Place Suspended Slab	317 cy	2.160 mh / cy	685	41.39 /mh	28,340	-	-			6.65	2,109	-	-	30,449	48,211
				4000 psi Concrete	317 cy			-	-	142.00	45,014			-	-	-	-	45,014	68,318
				Liquid Curing Compounds	20,866 sf	0.003 mh / sf	63	39.17 /mh	2,452	0.68	14,244			-	-	-	-	16,696	25,499
				03.06 Suspended Flat Slab	317 cy		4,563		184,244	421.45	133,600			6.65	2,109			319,953	497,729
			05.01	Misc Metals															
				Aluminum 2 Line Rail @ Basin Walkways	3,000 lf	0.200 mh / lf	600	38.76 /mh	23,255	32.20	96,600	-	-	-	-	-	-	119,855	183,417
				Alum Hatch Cover & Frame 2.5'x2.5' @ Sludge Valve Vault	8 ea	2.000 mh / ea	16	39.18 /mh	627	900.00	7,200	-	-	-	-	-	-	7,827	11,920
				05.01 Misc Metals	1 ls		616		23,881	103,800.00	103,800							127,681	195,336
			31.01	Dewatering															
				Dewatering @ Building Excavation	1 ea	960.000 ch / ea	3,840	159.35 /ch	152,974	7,500.00	7,500	-	-	33,592.77	33,593	-	-	194,067	306,961
				31.01 Dewatering	1 ls		3,840		152,974	7,500.00	7,500			33,592.77	33,593			194,067	306,961
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 410 ea (1 per 64 sf)	10,250 vf	0.002 cd / vf	1,148	2,146.97 /cd	44,022	35.16	360,354	-	-	2.58	26,448	-	-	430,824	658,681
				31.02 Piles	410 ea		1,148		44,022	878.91	360,354			64.51	26,448			430,824	658,681
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (731' x 30' deep)	21,930 sf	0.001 cd / sf	1,081	2,465.38 /cd	41,647	16.00	350,950	-	-	0.75	16,489	-	-	409,086	624,800
				Tie Backs (1 per 80 sf of Sheeting, 731' x 22"= 16,082 sf)	201 ea			-	-	-	-	2,377.47	477,872	-	-	-	-	477,872	725,274
				31.03 Excavation Shoring	21,930 sf		1,081		41,647	16.00	350,950	22.48	492,875	0.75	16,489			901,962	1,372,845
			31.10	Structure Excavation															
				Exc Clay-Backhoe/Truck	27,471 cy	499.900 cy / cd	1,978	1,410.06 /cd	77,487	-	-	-	-	6.58	180,870	-	-	258,356	410,496
				31.10 Structure Excavation	27,471 cy		1,978		77,487					6.58	180,870			258,356	410,496
			31.12	Structure Backfill															
				BackFill Earth-Backhoe/Truck	3,620 cy	0.002 cd / cy	234	1,327.72 /cd	9,709			-	-	4.69	16,966	-	-	26,675	42,368
				31.12 Structure Backfill	3,620 cy		234		9,709					4.69	16,966			26,675	42,368
			31.13	Soil Disposal															
				Spoils to Waste	23,851 cy	0.003 day / cy	2,147	1,410.06 /day	84,095	-	-	-	-	8.23	196,304	-	-	280,399	445,519
				31.13 Soil Disposal	23,851 cy		2,147		84,095					8.23	196,304			280,399	445,519
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 26,244 sf x 4"	321 cy	0.003 cd / cy	39	1,609.56 /cd	1,566	28.28	9,078	-	-	10.02	3,215	-	-	13,859	21,373
				31.20 Structure Stone Base	321 cy		39		1,566	28.28	9,078			10.02	3,215			13,859	21,373
			32.00	Site Improvements															
				Misc Site Improvement ALLOWANCE	1 ls			/ls				10,000.00	10,000					10,000	15,177
				32.00 Site Improvements	1 ls							10,000.00	10,000					10,000	15,177
				00 Building & Structure Construction	26,244 gsf		42,274		1,692,817	71.14	1,866,881	19.16	502,875	18.92	496,605			4,559,179	7,066,219
		26		Electrical & Instrumentation															
			26.01	Above Ground Electrical															
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				315,783.00	315,783					315,783	479,269
				26.01 Above Ground Electrical	0 ls							31,578,300.00	315,783					315,783	479,269
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1.5% Equipment Cost)	1 ls			/ls				94,735.00	94,735					94,735	143,781
				26.02 Instrumentation & Controls	0 ls							9,473,500.00	94,735					94,735	143,781
				26 Electrical & Instrumentation	1 ls							410,518.00	410,518					410,518	623,050
		40		Process Piping															
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	762 lf	600.000 lf / cd	71	2,539.31 /cd	3,225			-	-	1.88	1,435	-	-	4,660	7,389
				Stone Pipe Bedding	37 cy	200.000 cy / cd	13	2,896.43 /cd	536	23.29	862	-	-			-	-	1,398	2,156

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			40.00	Under Ground Process Piping															
				DI Pipe Push - Class 52 6	762 lf	0.220 mh / lf	168	24.05 /mh	4,033	22.53	17,170	-	-	-	-	-	-	21,203	32,442
				Hydrostatic Testing	762 lf	0.021 ch / lf	64	182.49 /ch	2,920	0.16	122	-	-	-	-	-	-	3,042	4,807
				Chlorination	762 lf			/lf		0.10	76	-	-	-	-	-	-	76	116
				DI 90 ell 6"	12 ea	4.830 mh / ea	58	45.62 /mh	2,644	105.30	1,264	-	-	-	-	-	-	3,908	6,103
				DI Tee 6"	8 ea	4.830 mh / ea	39	30.57 /mh	1,181	0.02	0	-	-	-	-	-	-	1,181	1,870
				DI Blind Flange 6"	1 ea	4.680 mh / ea	5	30.57 /mh	143	103.25	103	-	-	-	-	-	-	246	383
				40.00 Under Ground Process Piping	762 lf		417		14,682	25.72	19,597			1.88	1,435			35,714	55,264
			40.01	Above Ground Process Piping															
				Pipe Supports	8 ea	4.001 mh / ea	32	45.62 /mh	1,460	250.05	2,000	-	-			-	-	3,461	5,347
				Hydrostatic Testing	100 lf	0.021 ch / lf	8	182.49 /ch	383	0.16	16	-	-	-	-	-	-	399	631
				Chlorination	100 lf			/lf		0.10	10	-	-	-	-	-	-	10	15
				Wall Thimble 36" x 24" long	4 ea	3.500 ch / ea	56	182.49 /ch	2,555	1,800.00	7,200	-	-	842.80	3,371	-	-	13,126	20,336
				Mud Valves 8" w/ 20' Stem	12 ea	11.200 mh / ea	134	30.71 /mh	4,127	4,000.00	48,000	-	-	-	-	-	-	52,127	79,382
				Gasket/Nuts/Bolt Kit 24"	8 ea	1.000 mh / ea	8	32.89 /mh	263	129.45	1,036	-	-	-	-	-	-	1,299	1,988
				Gasket/Nuts/Bolt Kit 36"	12 ea	2.600 mh / ea	31	45.62 /mh	1,423	175.04	2,100	-	-	-	-	-	-	3,524	5,441
				DI Flanged Joint Pipe 24"	100 lf	2.670 mh / lf	267	30.57 /mh	8,161	267.83	26,783	-	-	-	-	-	-	34,945	53,567
				DI Flanged Tee 36"	4 ea	20.520 mh / ea	82	30.57 /mh	2,509			-	-	-	-	-	-	2,509	3,971
				DI Flanged Con Red 36x24"	8 ea	20.520 mh / ea	164	30.57 /mh	5,018	4,519.20	36,154	-	-	-	-	-	-	41,171	62,813
				Piping & Accessories- ALLOWANCE	100 LF	0.240 mh / LF	24	45.62 /mh	1,095	55.01	5,501	-	-	-	-	-	-	6,596	10,082
				40.01 Above Ground Process Piping	100 lf		807		26,995	1,288.01	128,801			33.71	3,371			159,167	243,573
			40.02	Valves, Meters, Etc.															
				Backflow Preventer Flg 6"	0 ea	12.170 mh / ea	0	45.62 /mh	6	5,000.00	50	-	-	-	-	-	-	56	85
				Magnetic Flow Meter - Inline - 30" w/ transmitter	0 ea	30.000 mh / ea	0	46.85 /mh	15	15,000.00	150	-	-	-	-	-	-	165	251
				Swing Check Valve 6"	0 ea	4.669 mh / ea	0	45.62 /mh	2	1,100.00	11	-	-	-	-	-	-	13	20
				Swing Check Valve 18"	0 ea	13.713 mh / ea	0	30.71 /mh	4	10,800.00	108	-	-	-	-	-	-	112	171
				6" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	0 ea	6.200 mh / ea	0	30.57 /mh	2	2,850.00	29	-	-	-	-	-	-	30	46
				24" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	0 ea	19.204 mh / ea	0	45.62 /mh	9	12,502.00	125	-	-	-	-	-	-	134	204
				36" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	0 ea	28.800 mh / ea	0	30.57 /mh	9	19,781.00	198	-	-	-	-	-	-	207	314
				42" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	0 ea	33.600 mh / ea	0	30.57 /mh	10	23,078.00	231	-	-	-	-	-	-	241	366
				40.02 Valves, Meters, Etc.	0 ls		1		56	90,111.00	901							957	1,457
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				65,000.00	65,000					65,000	98,652
				40.04 Hydropneumatic Piping System	0 ls							6,500,000.00	65,000					65,000	98,652
				40 Process Piping	862 lf		1,226		41,733	173.20	149,299	75.41	65,000	6.58	4,807			260,839	398,946
		43		Process Equipment															
			43.01	Flocculators & Mixers															
				Freight On Mixers & Flocculators To Jobsite	36 ea			/ea								1,500.00	54,000	54,000	81,957
				Equipment Unloading	36 ea	4.000 ch / ea	792	182.62 /ch	26,298	500.00	18,000	-	-	381.61	13,739	-	-	58,036	90,805
				Equipment Rigging / Rough Set	36 ea	6.000 ch / ea	1,296	195.85 /ch	42,303	500.00	18,000	-	-	401.59	14,457	-	-	74,760	117,281
				Variable Frequency Drives (Included)	*36 ea*			*/ea*											
				Rapid Mixer w/7.33' Shaft & Dual 2.33' Blades, 2 HP	4 ea	45.000 mh / ea	180	42.40 /mh	7,631	100.02	400					13,700.00	54,800	62,831	95,856
				Flocculator w/19' Shaft & 9' Blades, 3 HP	24 ea	60.000 mh / ea	1,440	42.40 /mh	61,049	100.00	2,400	-	-	-	-	30,000.00	720,000	783,449	1,193,021
				PAC Mixer w/19' Shaft & Dual 3.5' Blades 5 hp	8 ea	60.000 mh / ea	480	42.40 /mh	20,350	100.00	800	-	-	-	-	10,000.00	80,000	101,150	154,839
				43.01 Flocculators & Mixers	1 ls		4,198		157,630	39,600.08	39,600			28,195.34	28,195	908,800.00	908,800	1,134,225	1,733,758
			43.02	Settlement Equipment															
				Freight On Sedimentation System To Jobsite	*6 ea*			*/ea*											
				Verified Performance Test (2 days per System x 6 ea)	12 day	8.000 ch / day	96	29.43 /ch	2,826			-	-	-	-	1,500.00	18,000	20,826	31,791
				Vendor Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Vendor Witnessed, Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Equipment Unloading	6 ea	16.000 ch / ea	528	182.62 /ch	17,532	500.00	3,000	-	-	381.61	2,290	-	-	22,822	35,945
				Equipment Rigging / Rough Set	6 ea	96.000 ch / ea	3,456	195.85 /ch	112,807	500.00	3,000	-	-	401.59	2,410	-	-	118,216	186,929
				Equipment - Final Setting	6 ea	360.000 ch / ea	6,480	103.33 /ch	223,202	50.00	300	-	-	346.16	2,077	-	-	225,579	357,027
				Inclined Plate Settlers w/ Flow Control Deck 55' x 86' x 8.2'	6 ea			/ea								474,375.00	2,846,250	2,846,250	4,319,798
				43.02 Settlement Equipment	1 ls		10,560		356,367	6,300.00	6,300			6,776.18	6,776	2,882,250.00	2,882,250	3,251,693	4,958,808
			43.03	Baffle Walls															
				Flow Control Diffuser Wall SS 304/304L SS 20' h, 12 ea, 10,560 sf	528 lf	6.000 mh / lf	3,168	30.57 /mh	96,836					28.00	14,784	719.70	380,000	491,620	753,524
				43.03 Baffle Walls	1 sf		3,168		96,836					14,784.00	14,784	380,000.00	380,000	491,620	753,524
			43.20	Slide Gate w/ Operator															
				Sluice Gates 60" x 60"	4 ea	44.800 mh / ea	179	30.71 /mh	5,503	27,500.00	110,000	-	-	-	-	-	-	115,503	175,658
				43.20 Slide Gate w/ Operator	1 ls		179		5,503	110,000.00	110,000							115,503	175,658
				43 Process Equipment	1 ls		18,095		616,335	155,900.08	155,900			49,756.62	49,756	4,171,050.00	4,171,050	4,993,041	7,621,750
				2C Pretreatment - Construct New Facility	1 ls		61,595		2,350,865	2,172,079.51	2,172,080	978,393.35	978,393	551,167.39	551,167	4,171,050.00	4,171,050	10,223,576	15,709,965
				02 Pretreatment	1 ls		136,318		5,123,300	4,526,502.63	4,526,503	2,102,725.48	2,102,725	773,916.45	773,916	15,132,807.79	15,132,808	27,659,252	42,369,007

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
03				**Filtration**															
	3A			Filtration - Rehab Existing															
		47.1		**Water Plant Process Rehab @ Filters 21 thru 28**															
			02.01	**Demolition Work**															
				Non-Hazardous Waste Transport and Disposal	520 ton			-	-	-	-	50.00	26,000	-	-	-	-	26,000	39,461
				Pressure Washing Basin Walls @ Basins 22, 25 & 26	5,573 sf	150.000 sf / ch	74	53.11 /ch	1,973	0.35	1,951	-	-	0.52	2,908	-	-	6,831	10,711
				Pressure Washing Basin Slab @ Basins 22, 25 & 26	3,108 sf	200.000 sf / ch	31	53.11 /ch	825	0.35	1,088	-	-	0.39	1,216	-	-	3,129	4,893
				Remove Air Header	3 ea	8.000 ch / ea	120	231.62 /ch	5,559	250.00	750	-	-	1,957.34	5,872	-	-	12,181	19,282
				Bag, Transport and Dispose Of Media	9,342 cf	65.867 cf / ch	567	163.29 /ch	23,159	0.22	2,076	-	-	4.08	38,137	-	-	63,372	100,500
				Remove Sand (3,108 sf x 24" deep), 230 cy	6,210 cf	0.033 mh / cf	202	46.32 /mh	9,349			-	-	6.12	37,985	-	-	47,334	75,250
				Remove Anthracite Media (3,108 sf x 6" deep), 58 cy	1,566 cf	0.033 mh / cf	51	46.32 /mh	2,358			-	-	6.12	9,579	-	-	11,936	18,976
				Remove Gravel Media (3,108 sf x 6" deep), 58 cy	1,566 cf	0.033 mh / cf	51	46.32 /mh	2,358			-	-	6.12	9,579	-	-	11,936	18,976
				Remove Underdrain System - Grouted Blocks @ Filters 22, 25 & 26	3,108 sf	0.180 mh / sf	559	46.32 /mh	25,915	1.09	3,396	-	-	6.12	19,011	-	-	48,321	76,426
				02.01 Demolition Work	1 ls		1,656		71,496	9,260.15	9,260	26,000.00	26,000	124,285.12	124,285			231,041	364,474
			03.30	**Patch Cracks and Resurface Concrete**															
				Patch Cracks & Resurface Walls @ Basins 22, 25 & 26	2,120 sf	10.000 sf / ch	424	53.11 /ch	11,259	0.11	231	-	-	-	-	-	-	11,490	18,171
				Patch Cracks & Resurface Walls @ Lower Gallary	6,831 sf	10.000 sf / ch	1,366	53.11 /ch	36,280	0.11	744	-	-	-	-	-	-	37,024	58,549
				Patch Cracks & Resurface Slab @ Basins 22, 25 % 26	848 sf	6.764 sf / ch	251	53.11 /ch	6,659	0.07	63	-	-	-	-	-	-	6,721	10,634
				03.30 Patch Cracks and Resurface Concrete	9,799 sf		2,041		54,198	0.11	1,037							55,235	87,354
			09.00	**Finishes**															
				Pressure Wash Basins 22, 25 & 26	6 filt	90.000 mh / filt	540	40.56 /mh	21,905	-	-	-	-	701.91	4,211	-	-	26,116	41,371
				Clean Basins 22, 25 & 26	6 filt	30.000 ch / filt	540	143.32 /ch	25,798	500.00	3,000	-	-	3,597.12	21,583	-	-	50,381	79,733
				Clean Lower Gallary Walls For Painting	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Clean & Prep Pipe For Painting	1,740 lf			-	-	-	-	6.00	10,440	-	-	-	-	10,440	15,845
				Paint Lower Gallery Concrete Surfaces	6,831 sf			-	-	-	-	1.10	7,514	-	-	-	-	7,514	11,404
				Paint 4" Pipe	0 lf	0.035 mh / lf	0	27.53 /mh	0	1.00	0	-	-	4.00	0	-	-	0	0
				Paint 6" Pipe	818 lf	0.070 mh / lf	57	27.53 /mh	1,577	0.69	566	-	-	4.24	3,467	-	-	5,610	8,873
				Paint 12" Pipe	0 lf	0.120 mh / lf	0	27.53 /mh	0	1.00	0	-	-	6.00	0	-	-	0	0
				Paint 16" Pipe	227 lf	0.140 mh / lf	32	27.53 /mh	875	1.85	419	-	-	6.06	1,375	-	-	2,669	4,209
				Paint 18" Pipe	96 lf	0.200 mh / lf	19	27.53 /mh	529	2.08	196	-	-	6.06	581	-	-	1,309	2,064
				Paint 20" Pipe	0 lf	0.300 mh / lf	0	27.53 /mh	0	2.00	0	-	-	7.00	0	-	-	0	0
				Paint 24" Pipe	0 lf	0.350 mh / lf	0	27.53 /mh	0	3.00	0	-	-	7.00	0	-	-	0	0
				Paint 30" Pipe	0 lf	0.438 mh / lf	0	27.53 /mh	0	4.00	0	-	-	4.00	0	-	-	0	0
				Paint 36" Pipe	541 lf	0.525 mh / lf	284	27.53 /mh	7,820	4.15	2,247	-	-	4.95	2,676	-	-	12,743	20,046
				Paint 42" Pipe	58 lf	0.525 mh / lf	30	27.53 /mh	838	4.85	281	-	-	4.95	287	-	-	1,406	2,210
				09.00 Finishes	1 ls		1,924		70,639	17,782.62	17,783	17,954.10	17,954	50,680.35	50,680			156,956	246,540
			43.05	**Filtration Equipment**															
				Filter Equipment Start-Up	3 ea	150.000 ch / ea	3,150	350.77 /ch	157,845	2,500.00	7,500					-	-	165,345	261,206
				Gravity Filters - Underdrain Blocks, Sand & Anthracite - Purchase	3,108 sf			/sf				-	-	-	-	172.84	537,185	537,185	815,294
				Install Anthracite Media 6"	1,566 cf	0.033 mh / cf	51	46.32 /mh	2,358			-	-	6.36	9,962	-	-	12,319	19,596
				Install Gravel Media 6"	1,566 cf	0.033 mh / cf	51	46.32 /mh	2,358			-	-	6.36	9,962	-	-	12,319	19,586
				New Air Header @ Each Basin	6 ea	16.000 ch / ea	480	231.62 /ch	22,235			-	-	3,914.67	23,488	-	-	45,723	72,573
				Install Sand Media .45 - .55 mm	6,210 cf	0.033 mh / cf	202	46.32 /mh	9,349			-	-	6.36	39,504	-	-	48,853	77,668
				Install Gravity Filter Bottoms/Blocks	3,108 sf	0.180 mh / sf	559	46.32 /mh	25,915	1.09	3,396	-	-	15.66	48,667	-	-	77,978	123,624
				43.05 Filtration Equipment	1 ls		4,493		220,059	10,895.80	10,896			131,582.88	131,583	537,185.18	537,185	899,723	1,389,538
				47.1 Water Plant Process Rehab @ Filters 21 thru 28	1 ls		10,114		416,292	38,975.94	38,976	43,954.10	43,954	306,548.35	306,548	537,185.18	537,185	1,342,955	2,087,906
		47.2		**Water Plant Process Rehab @ Filters 29 thru 32**															
			02.01	**Demolition Work**															
				Non-Hazardous Waste Transport and Disposal	524 ton			-	-	-	-	50.00	26,200	-	-	-	-	26,200	39,764
				Pressure Washing Basin Walls @ Basins 30, 31 & 32	5,595 sf	150.000 sf / ch	75	53.11 /ch	1,981	0.35	1,958	-	-	0.52	2,919	-	-	6,858	10,753
				Pressure Washing Basin Slab @ Basins 30, 31 & 32	3,174 sf	200.000 sf / ch	32	53.11 /ch	843	0.35	1,111	-	-	0.39	1,242	-	-	3,196	4,997
				Remove Air Header	3 ea	8.000 ch / ea	120	231.62 /ch	5,559	250.00	750	-	-	1,957.34	5,872	-	-	12,181	19,282
				Bag, Transport and Dispose Of Media	9,531 cf	65.867 cf / ch	579	163.29 /ch	23,627	0.22	2,118	-	-	4.08	38,908	-	-	64,654	102,533
				Remove Sand (3,174 sf x 24" deep), 235 cy	6,345 cf	0.033 mh / cf	206	46.32 /mh	9,552			-	-	6.12	38,810	-	-	48,363	76,886
				Remove Anthracite Media (3,174 sf x 6" deep), 59 cy	1,593 cf	0.033 mh / cf	52	46.32 /mh	2,398			-	-	6.12	9,744	-	-	12,142	19,303
				Remove Gravel Media (3,174 sf x 6" deep), 59 cy	1,593 cf	0.033 mh / cf	52	46.32 /mh	2,398			-	-	6.12	9,744	-	-	12,142	19,303
				Remove Underdrain System - Grouted Blocks @ Filters 30, 31 & 32	3,174 sf	0.180 mh / sf	571	46.32 /mh	26,465	1.09	3,468	-	-	6.12	19,414	-	-	49,348	78,048
				02.01 Demolition Work	1 ls		1,686		72,824	9,405.06	9,405	26,200.00	26,200	126,653.73	126,654			235,083	370,870
			03.30	**Patch Cracks and Resurface Concrete**															
				Patch Cracks & Resurface Walls @ Basins 30, 31 & 32	2,120 sf	10.000 sf / ch	424	53.11 /ch	11,259	0.11	231	-	-	-	-	-	-	11,490	18,171
				Patch Cracks & Resurface Walls @ Lower Gallery	6,831 sf	10.000 sf / ch	1,366	53.11 /ch	36,280	0.11	744	-	-	-	-	-	-	37,024	58,549
				Patch Cracks & Resurface Slab @ Basins 30, 31 & 32	848 sf	6.764 sf / ch	251	53.11 /ch	6,659	0.07	63	-	-	-	-	-	-	6,721	10,634
				03.30 Patch Cracks and Resurface Concrete	9,799 sf		2,041		54,198	0.11	1,037							55,235	87,354
			09.00	**Finishes**															
				Pressure Wash Basins 30, 31 & 32	6 filt	90.000 mh / filt	540	40.56 /mh	21,905	-	-	-	-	701.91	4,211	-	-	26,116	41,371
				Clean Tank	8 filt	30.000 ch / filt	720	143.32 /ch	34,397	500.00	4,000	-	-	3,597.12	28,777	-	-	67,174	106,311
				Clean Basins 22, 25 & 26	6 filt	30.000 ch / filt	540	143.32 /ch	25,798	500.00	3,000	-	-	3,597.12	21,583	-	-	50,381	79,733
				Clean Lower Gallary Walls For Painting	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Clean & Prep Pipe For Painting	1,740 lf			-	-	-	-	6.00	10,440	-	-	-	-	10,440	15,845
				Paint Lower Gallery Concrete Surfaces	6,831 sf			-	-	-	-	1.10	7,514	-	-	-	-	7,514	11,404
				Paint 4" Pipe	52 lf	0.035 mh / lf	2	27.53 /mh	50	0.46	24	-	-	4.24	220	-	-	295	467
				Paint 6" Pipe	94 lf	0.070 mh / lf	7	27.53 /mh	181	0.69	65	-	-	4.24	398	-	-	645	1,020
				Paint 12" Pipe	54 lf	0.120 mh / lf	6	27.53 /mh	178	1.39	75	-	-	5.65	305	-	-	558	882
				Paint 16" Pipe	38 lf	0.140 mh / lf	5	27.53 /mh	146	1.85	70	-	-	6.06	230	-	-	447	705
				Paint 18" Pipe	0 lf	0.200 mh / lf	0	27.53 /mh	0	2.00	0	-	-	6.00	0	-	-	0	0
				Paint 20" Pipe	276 lf	0.300 mh / lf	83	27.53 /mh	2,280	2.31	637	-	-	7.07	1,950	-	-	4,867	7,678
				Paint 24" Pipe	206 lf	0.350 mh / lf	72	27.53 /mh	1,985	2.77	571	-	-	7.07	1,455	-	-	4,011	6,324
				Paint 30" Pipe	29 lf	0.438 mh / lf	13	27.53 /mh	349	3.46	100	-	-	4.12	119	-	-	569	895
				Paint 36" Pipe	91 lf	0.525 mh / lf	48	27.53 /mh	1,315	4.15	378	-	-	4.95	450	-	-	2,143	3,372
				Paint 42" Pipe	0 lf	0.525 mh / lf	0	27.53 /mh	0	5.00	0	-	-	5.00	0	-	-	0	0
				09.00 Finishes	1 ls		2,457		99,783	19,989.10	19,989	17,954.10	17,954	76,200.63	76,201			213,927	336,790
			40.01	**Above Ground Process Piping**															
				12" Filter To Waste Piping To Basins 29 thru 36	600 lf	2.200 mh / lf	1,320	30.57 /mh	40,348	136.00	81,600	-	-	-	-	-	-	121,948	187,705
				40.01 Above Ground Process Piping	600 lf		1,320		40,348	136.00	81,600							121,948	187,705
			43.05	**Filtration Equipment**															
				Filter Equipment Start-Up	3 ea	150.000 ch / ea	3,150	350.77 /ch	157,845	2,500.00	7,500					-	-	165,345	261,206
				Gravity Filters - Underdrain Blocks, Sand & Anthracite - Purchase	3,174 sf			/sf				-	-	-	-	172.84	548,593	548,593	832,608
				Install Gravel Media	1,593 cf	0.033 mh / cf	52	46.32 /mh	2,398			-	-	6.36	10,134	-	-	12,532	19,924
				Install Anthracite Media	1,593 cf	0.033 mh / cf	52	46.32 /mh	2,398			-	-	6.36	10,134	-	-	12,532	19,924
				New Air Header @ Each Basin	6 ea	16.000 ch / ea	480	231.62 /ch	22,235			-	-	3,914.67	23,488	-	-	45,723	72,573

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			43.05	Filtration Equipment															
				Install Sand Media .45 - .55 mm	6,345 cf	0.033 mh / cf	206	46.32 /mh	9,552			-	-	6.36	40,363	-	-	49,915	79,357
				Install Gravity Filter Bottoms/Blocks	3,174 sf	0.180 mh / sf	571	46.32 /mh	26,465	1.09	3,468	-	-	15.66	49,701	-	-	79,634	126,250
				43.05 Filtration Equipment	1 ls		4,511		220,894	10,967.91	10,968			133,818.66	133,819	548,592.59	548,593	914,273	1,411,840
				47.2 Water Plant Process Rehab @ Filters 29 thru 32	1 ls		12,015		488,047	122,999.44	122,999	44,154.10	44,154	336,673.02	336,673	548,592.59	548,593	1,540,466	2,394,559
		47.3		Water Plant Building @ Filters 21 thru 36															
			02.01	Demolition Work															
				Demo HVAC System @ Upper & Lower Levels	44,000 sf			-	-	-	-	3.00	132,000	-	-	-	-	132,000	200,338
				Demo Lighting System @ Upper & Lower Levels	44,000 sf			/sf				3.00	132,000					132,000	200,338
				02.01 Demolition Work	1 ls							264,000.00	264,000					264,000	400,677
			08.00	Doors, Frames & Hardware															
				Aluminum Frame Storefronts 10' h @ Filters 21 thru 28	8,400 sf			-	-	-	-	60.00	504,000	-	-	-	-	504,000	754,929
				Aluminum Doors & Frames Single 3'x7' full 1/2" glass panel	6 ea	8.000 mh / ea	48	25.39 /mh	1,219	1,150.00	6,900			-	-	-	-	8,119	12,401
				Finish Hardware by Leaf- Allowance	6 ea	8.002 mh / ea	48	39.18 /mh	1,881	900.18	5,401	-	-	-	-	-	-	7,282	11,174
				08.00 Doors, Frames & Hardware	6 ea		96		3,099	2,050.18	12,301	84,000.00	504,000					519,400	788,504
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	32 ea			/ea		-	-	100.02	3,201	-	-	-	-	3,201	4,858
				Paint HM Doors - primer (2) coats	32 ea			/ea		-	-	140.03	4,481	-	-	-	-	4,481	6,801
				Paint CMU Block - block filler & (2) coat	16,800 sf			-	-	-	-	1.35	22,680	-	-	-	-	22,680	34,422
				Paint Ceilings	44,000 sf			-	-	-	-	1.00	44,000	-	-	-	-	44,000	66,779
				Minor Architectural Improvements	1 ls			-	-	-	-	10,000.00	10,000		-	-	-	10,000	15,177
				Paint 12" Pipe	400 lf	0.120 mh / lf	48	27.53 /mh	1,322	1.39	554	-	-	5.65	2,261	-	-	4,136	6,530
				Paint 16" Pipe	77 lf	0.140 mh / lf	11	27.53 /mh	297	1.85	142	-	-	6.06	466	-	-	905	1,428
				Paint 18" Pipe	12 lf	0.200 mh / lf	2	27.53 /mh	66	2.08	25	-	-	6.06	73	-	-	164	258
				Paint 20" Pipe	17 lf	0.300 mh / lf	5	27.53 /mh	140	2.31	39	-	-	7.07	120	-	-	300	473
				Paint 24" Pipe	960 lf	0.350 mh / lf	336	27.53 /mh	9,251	2.77	2,659	-	-	7.07	6,782	-	-	18,692	29,471
				Paint 36" Pipe	666 lf	0.525 mh / lf	350	27.53 /mh	9,627	4.15	2,767	-	-	4.95	3,294	-	-	15,687	24,678
				Paint 48" Pipe	303 lf	0.525 mh / lf	159	27.53 /mh	4,380	5.54	1,678	-	-	4.95	1,498	-	-	7,557	11,864
				09.00 Finishes	1 ls		911		25,083	7,863.94	7,864	84,361.50	84,362	14,494.42	14,494			131,803	202,739
			23.00	HVAC															
				New HVAC System	44,000 sf			/sf		-	-	20.00	880,000	-	-	-	-	880,000	1,335,590
				23.00 HVAC	44,000 sf							20.00	880,000					880,000	1,335,590
			26.01	Above Ground Electrical															
				New Lighting System	44,000 sf			/sf				12.00	528,000					528,000	801,354
				New Support For Conduit & Wiring System	44,000 sf			/sf				6.00	264,000					264,000	400,677
				26.01 Above Ground Electrical	1 ls							792,000.00	792,000					792,000	1,202,031
				47.3 Water Plant Building @ Filters 21 thru 36	1 ls		1,007		28,182	20,166.02	20,165	2,624,361.50	2,524,362	14,494.42	14,494			2,587,203	3,929,540
				3A Filtration - Rehab Existing	1 ls		23,137		932,521	182,140.40	182,140	2,612,469.70	2,612,470	657,715.79	657,716	1,085,777.77	1,085,778	5,470,625	8,412,006
3B				Filtration - Rehab Existing & Add Ozone Facility															
		47.4		Rehab North Basins #1, 2, 3, 4 & 5															
			02.01	Demolition Work															
				Non-Hazardous Waste Transport and Disposal	2,464 ton			-	-	-	-	50.00	123,200	-	-	-	-	123,200	186,983
				Demo Top 2' Of Conc Basin Walls @ Basins 2, 3, 4 & 5 (1512 LF)	149 cy	0.500 ch / cy	149	84.95 /ch	6,329	-	-	-	-	26.86	4,003	-	-	10,332	16,387
				Demo Top 2' Of Conc Basin Columns @ Basins 2, 3, 4 & 5 (32 EA)	16 cy	1.000 ch / cy	32	84.95 /ch	1,359	-	-	-	-	26.86	430	-	-	1,789	2,835
				Demo Baffle Walls @ Basins 1,2,3, 4 & 5	505 cy	0.100 ch / cy	101	84.95 /ch	4,290	-	-	-	-	26.86	13,567	-	-	17,857	28,381
				Demo 7" Reinforced Sups Slab Over Basins, 547 cy	25,454 sf	0.018 ch / sf	1,375	117.52 /ch	53,842	-	-	-	-	2.00	50,908	-	-	104,750	165,238
				Demo All Piping & Equipment From Basins 1-5	5 ea	32.000 ch / ea	640	167.66 /ch	26,825	-	-	-	-	103.03	515	-	-	27,340	43,277
				Demo Electrical System @ Basins	1 ls			/ls				2,000.00	2,000					2,000	3,035
				Pressure Washing Basin Walls @ Basin #1	12,647 sf	150.000 sf / ch	169	53.11 /ch	4,478	0.35	4,426	-	-	0.52	6,598	-	-	15,503	24,307
				Pressure Washing Basin Slab @ Basin #1	5,518 sf	200.000 sf / ch	55	53.11 /ch	1,465	0.35	1,931	-	-	0.39	2,159	-	-	5,556	8,687
				02.01 Demolition Work	1 ls		2,520		98,589	6,357.75	6,358	125,200.00	125,200	78,179.91	78,180			308,326	480,130
			03.03	Columns															
				Form Rectangle Column Surrounds 28.5' h, 8 ea	2,892 sf	0.165 mh / sf	477	39.49 /mh	18,843	1.60	4,617	-	-	-	-	-	-	23,459	36,830
				Chamfer	928 lf	0.015 mh / lf	14	39.49 /mh	550	0.57	525	-	-	-	-	-	-	1,076	1,669
				Strip & Oil Column Form	2,892 sf	0.005 mh / sf	14	39.17 /mh	566	0.03	87	-	-	-	-	-	-	653	1,028
				Superplasticizers @ Columns	107 cy			/cy		8.40	899	-	-	-	-	-	-	899	1,364
				Column Rebar (120 #/cy)	6 tn	20.004 mh / tn	128	43.53 /mh	5,590	997.70	6,406	-	-	-	-	-	-	11,996	18,569
				Finish- Float	101 sf	0.017 mh / sf	2	39.17 /mh	67	-	-	-	-	-	-	-	-	67	106
				Pump Place Columns 8 ea	107 cy	1.600 mh / cy	171	41.39 /mh	7,087	-	-	-	-	7.50	802	-	-	7,889	12,493
				4000 psi Concrete	107 cy			/cy		142.00	15,194	-	-	-	-	-	-	15,194	23,060
				Grind/Patch Columns	2,892 sf	0.013 mh / sf	38	39.17 /mh	1,473	0.03	87	-	-	-	-	-	-	1,560	2,463
				Rub Columns	2,892 sf	0.065 mh / sf	188	39.17 /mh	7,363	0.06	174	-	-	-	-	-	-	7,536	11,916
				Liquid Curing Compounds	2,892 sf	0.003 mh / sf	9	39.17 /mh	340	0.06	170	-	-	-	-	-	-	510	796
				03.03 Columns	19 cy		1,041		41,879	1,482.01	28,158			42.21	802			70,839	110,294
			03.04	Walls															
				Keyway 6"	1,170 lf	0.050 mh / lf	59	39.49 /mh	2,311	0.67	786	-	-	-	-	-	-	3,097	4,850
				Vertical Wall Keyway 6"	504 lf	0.110 mh / lf	55	39.49 /mh	2,190	0.67	339	-	-	-	-	-	-	2,528	3,980
				Panel Form System 12-16'	4,973 sf	0.170 mh / sf	845	39.49 /mh	33,384	1.84	9,138	-	-	-	-	-	-	42,521	66,705
				Panel Form System > 16' h	22,686 sf	0.190 mh / sf	4,311	39.49 /mh	170,241	1.84	41,694	-	-	-	-	-	-	211,935	332,722
				Waterstop 6" Flat	1,674 lf	0.110 mh / lf	184	39.18 /mh	7,215	2.10	3,516	-	-	-	-	-	-	10,731	16,756
				Strip & Oil Wall Forms	22,686 sf	0.005 mh / sf	113	39.17 /mh	4,444	0.03	681	-	-	-	-	-	-	5,124	8,066
				Superplasticizers @ Walls	934 cy			/cy		8.40	7,847	-	-	-	-	-	-	7,847	11,909
				Rebar- Walls (125 #/cy)	59 tn	15.003 mh / tn	885	43.53 /mh	38,529	997.70	58,864	-	-	-	-	-	-	97,393	150,320
				Finish- Top of Wall	1,495 sf	0.008 mh / sf	12	39.17 /mh	469	-	-	-	-	-	-	-	-	469	742
				Pump Place Walls	934 cy	1.150 mh / cy	1,074	41.39 /mh	44,465	-	-	-	-	6.65	6,211	-	-	50,675	80,259
				4000 psi Concrete	934 cy			/cy		142.00	132,628	-	-	-	-	-	-	132,628	201,292
				Grind/Patch Walls	22,686 sf	0.013 mh / sf	295	39.17 /mh	11,553	0.03	681	-	-	-	-	-	-	12,234	19,319
				Rub Walls	22,686 sf	0.058 mh / sf	1,316	39.17 /mh	51,535	0.06	1,361	-	-	-	-	-	-	52,897	83,632
				Liquid Curing Compounds	24,181 sf	0.002 mh / sf	48	39.17 /mh	1,895	0.06	1,422	-	-	-	-	-	-	3,317	5,157
				03.04 Walls	934 cy		9,199		368,229	277.26	258,957			6.65	6,211			633,396	985,708
			03.05	Slab On Grade															
				S.O.G. Edge Form < 1'	68 sf	0.240 mh / sf	16	39.49 /mh	644	1.22	83	-	-	-	-	-	-	727	1,146
				Rebar- SOG (125 #/cy)	0 tn	16.000 mh / tn	3	43.53 /mh	139	997.70	200	-	-	-	-	-	-	339	523
				Mesh Support - bricks (.12/sf)	15 ea	0.002 mh / ea	0	43.53 /mh	1	0.26	4	-	-	-	-	-	-	5	8
				Finish- Hard Trowel	126 sf	0.025 mh / sf	3	39.17 /mh	123	-	-	-	-	-	-	-	-	123	195
				Pump Place Slab on Grade 8" @ Sludge Control Vault	3 cy	0.500 mh / cy	2	41.39 /mh	62	-	-	-	-	3.67	11	-	-	73	116
				4000 psi Concrete	3 cy			/cy		142.00	426	-	-	-	-	-	-	426	647
				Liquid Curing Compounds	194 sf	0.002 mh / sf	0	39.17 /mh	15	0.06	11	-	-	-	-	-	-	27	41
				Seal Floors	126 sf	0.002 mh / sf	0	39.17 /mh	10	0.09	12	-	-	-	-	-	-	22	33
				6 Mil Vapor Barrier	126 sf	0.002 mh / sf	0	43.53 /mh	11	0.05	7	-	-	-	-	-	-	18	27

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.05	Slab On Grade															
				Gravel Fill Under Slab 4"	2 cy	0.004 cd / cy	0	1,412.15 /cd	11	29.26	59	-	-	3.84	8	-	-	77	118
				03.05 Slab On Grade	187 cy		25		1,017	4.28	800			0.10	19			1,836	2,855
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	5,697 sf	0.220 mh / sf	1,253	39.49 /mh	49,492	2.18	12,445			-	-	-	-	61,937	97,219
				Slab Edge Form 12"	307 sf	0.250 mh / sf	77	39.49 /mh	3,031	5.17	1,588			-	-	-	-	4,619	7,207
				Strip & Oil Suspended Slab Forms	6,004 sf	0.005 mh / sf	30	39.17 /mh	1,176	0.04	246			-	-	-	-	1,422	2,235
				Superplasticizers	211 cy			-	-	8.40	1,773			-	-	-	-	1,773	2,690
				Rebar- Suspended Slab (225 #/cy)	24 tn	20.004 mh / tn	480	43.53 /mh	20,897	997.70	23,945	-	-	-	-	-	-	44,842	69,416
				Finish- Hard Trowel	5,697 sf	0.035 mh / sf	199	39.17 /mh	7,810	-	-			-	-	-	-	7,810	12,361
				Pump Place Suspended Slab	211 cy	2.160 mh / cy	456	41.39 /mh	18,863	-	-			6.65	1,404	-	-	20,267	32,090
				4000 psi Concrete	211 cy			-	-	142.00	29,962			-	-	-	-	29,962	45,474
				Liquid Curing Compounds	11,701 sf	0.003 mh / sf	35	39.17 /mh	1,375	0.68	7,988			-	-	-	-	9,363	14,289
				03.06 Suspended Flat Slab	211 cy		2,530		102,645	369.41	77,945			6.65	1,404			181,994	282,991
			05.01	Misc Metals															
				Aluminum 2 Line Rail @ Basin Walkways	209 lf	0.200 mh / lf	42	38.76 /mh	1,620	32.20	6,730	-	-	-	-	-	-	8,350	12,778
				05.01 Misc Metals	1 ls		42		1,620	6,729.80	6,730							8,350	12,778
			31.12	Structure Backfill															
				Engineered Fill @ Basins # 2 thru 5 w/ Engineered Fill 29' deep	20,741 cy	300.000 cy / cd	2,212	1,327.72 /cd	91,794	14.00	290,374	-	-	7.73	160,391	-	-	542,559	841,254
				31.12 Structure Backfill	20,741 cy		2,212		91,794	14.00	290,374			7.73	160,391			542,559	841,254
			40.01	Above Ground Process Piping															
				Misc Pipe Work- ALLOWANCE	1 ls	40.000 mh / ls	40	45.62 /mh	1,825	2,000.00	2,000	-	-	-	-	-	-	3,825	5,924
				40.01 Above Ground Process Piping	1 lf		40		1,825	2,000.00	2,000							3,825	5,924
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				13,000.00	13,000					13,000	19,730
				40.04 Hydropneumatic Piping System	1 ls							13,000.00	13,000					13,000	19,730
				47.4 Rehab North Basins #1, 2, 3, 4 & 5	1 ls		17,610		707,597	671,322.08	671,322	138,200.00	138,200	247,006.48	247,006			1,764,126	2,741,664
		47.5		Ozone Facility															
			03.03	Columns															
				Form Rectangle Columns 12" h	1,536 sf	0.165 mh / sf	253	39.49 /mh	10,008	1.60	2,452	-	-	-	-	-	-	12,460	19,561
				Chamfer	1,152 lf	0.015 mh / lf	17	39.49 /mh	682	0.57	653	-	-	-	-	-	-	1,336	2,072
				Strip & Oil Column Form	1,536 sf	0.005 mh / sf	8	39.17 /mh	301	0.03	46	-	-	-	-	-	-	347	546
				Superplasticizers @ Columns	19 cy			/cy		8.40	160	-	-	-	-	-	-	160	242
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	23	43.53 /mh	993	997.70	1,137	-	-	-	-	-	-	2,130	3,287
				Finish- Float	42 sf	0.017 mh / sf	1	38.17 /mh	28	-	-	-	-	-	-	-	-	28	44
				Pump Place Columns 24 ea	19 cy	1.600 mh / cy	30	41.39 /mh	1,258	-	-	-	-	7.49	142	-	-	1,401	2,218
				4000 psi Concrete	19 cy			/cy		142.00	2,698	-	-	-	-	-	-	2,698	4,095
				Grind/Patch Columns	1,536 sf	0.013 mh / sf	20	39.17 /mh	782	0.03	46	-	-	-	-	-	-	828	1,308
				Rub Columns	1,536 sf	0.085 mh / sf	100	39.17 /mh	3,910	0.06	92	-	-	-	-	-	-	4,003	6,329
				Liquid Curing Compounds	1,536 sf	0.003 mh / sf	5	39.17 /mh	181	0.06	90	-	-	-	-	-	-	271	423
				03.03 Columns	19 cy		457		18,143	388.16	7,375			7.49	142			25,661	40,135
			03.05	Slab On Grade															
				Slab Edge Form 28"	715 sf	0.350 mh / sf	250	39.49 /mh	9,884	1.31	939	-	-	-	-	-	-	10,822	17,068
				Strip & Oil Form	715 sf	0.005 mh / sf	4	39.17 /mh	140	0.03	21	-	-	-	-	-	-	162	254
				Rebar- SOG (125 #/cy)	12 tn	14.003 mh / tn	168	43.53 /mh	7,314	997.70	11,972	-	-	-	-	-	-	19,286	29,747
				Mesh Support - bricks (.12/sf)	689 ea	0.002 mh / ea	1	43.53 /mh	60	0.26	181	-	-	-	-	-	-	241	370
				Finish- Hard Trowel	5,740 sf	0.015 mh / sf	86	39.17 /mh	3,373	-	-	-	-	-	-	-	-	3,373	5,338
				Pump Place Slab on Grade 8"	142 cy	0.500 mh / cy	71	41.39 /mh	2,939	-	-	-	-	3.67	521	-	-	3,460	5,481
				Pump Place Thickened Slab 28" x 20"	45 cy	0.500 mh / cy	23	41.39 /mh	931	-	-	-	-	3.67	165	-	-	1,097	1,737
				4000 psi Concrete	187 cy			/cy		142.00	26,554	-	-	-	-	-	-	26,554	40,301
				Saw Cut S-O-G (.08/sf)	459 lf	0.030 mh / lf	14	39.17 /mh	539	0.17	78	-	-	0.95	437	-	-	1,054	1,668
				Liquid Curing Compounds	6,455 sf	0.002 mh / sf	13	39.17 /mh	506	0.06	380	-	-	-	-	-	-	886	1,377
				Seal Floors	5,740 sf	0.002 mh / sf	11	39.17 /mh	450	0.09	530	-	-	-	-	-	-	980	1,517
				6 Mil Vapor Barrier	16,300 sf	0.002 mh / sf	33	43.53 /mh	1,419	0.05	856	-	-	-	-	-	-	2,275	3,545
				Gravel Fill Under Slab 4"	70 cy	0.004 cd / cy	8	1,412.15 /cd	375	29.26	2,048	-	-	3.84	269	-	-	2,691	4,129
				03.05 Slab On Grade	187 cy		682		27,930	232.94	43,559			7.44	1,392			72,882	112,532
			03.07	Suspended Beams															
				Beam Side Forms	2,932 sf	0.210 mh / sf	616	39.49 /mh	24,318	2.21	6,466	-	-	-	-	-	-	30,785	48,303
				Beam Bottom Forms	975 sf	0.210 mh / sf	205	39.49 /mh	8,087	2.21	2,150	-	-	-	-	-	-	10,237	16,063
				Chamfer	1,466 lf	0.015 mh / lf	22	39.49 /mh	869	0.57	831	-	-	-	-	-	-	1,700	2,636
				Strip & Oil Beam Forms	3,907 sf	0.005 mh / sf	20	39.17 /mh	766	0.03	117	-	-	-	-	-	-	883	1,389
				Superplasticizers @ Beams	72 cy			/cy		8.40	605	-	-	-	-	-	-	605	918
				Rebar- Beams (250 #/cy)	9 tn	15.003 mh / tn	135	43.53 /mh	5,877	997.70	8,979	-	-	-	-	-	-	14,857	22,930
				Finish- Top of Beam	975 sf	0.008 mh / sf	8	39.17 /mh	306	-	-	-	-	-	-	-	-	306	484
				Pump Place Beams @ Roof	72 cy	2.001 mh / cy	144	41.39 /mh	5,963	-	-	-	-	14.42	1,038	-	-	7,001	11,090
				4000 psi Concrete	72 cy			/cy		142.00	10,224	-	-	-	-	-	-	10,224	15,517
				Grind/Patch Beams	3,907 sf	0.013 mh / sf	51	39.17 /mh	1,990	0.03	117	-	-	-	-	-	-	2,107	3,327
				Rub Beams	3,907 sf	0.085 mh / sf	332	39.17 /mh	13,007	0.06	234	-	-	-	-	-	-	13,242	20,842
				Liquid Curing Compounds	3,907 sf	0.002 mh / sf	8	39.17 /mh	306	0.06	230	-	-	-	-	-	-	536	833
				03.07 Suspended Beams	72 cy		1,540		61,488	416.04	29,955			14.42	1,038			92,481	144,433
			03.08	Pads & Curbs															
				Pad Forms 8" h	264 sf	0.200 mh / sf	53	39.49 /mh	2,085	1.52	402	-	-	-	-	-	-	2,487	3,911
				Chamfer	394 lf	0.015 mh / lf	6	39.49 /mh	233	0.57	223	-	-	-	-	-	-	457	709
				Strip & Oil Equipment Curb Forms	264 sf	0.005 mh / sf	1	39.17 /mh	52	0.03	8	-	-	-	-	-	-	60	94
				Rebar- Pads (100 #/cy)	1 tn	18.004 mh / tn	18	43.53 /mh	784	997.70	998	-	-	-	-	-	-	1,781	2,755
				Finish- Float	669 sf	0.017 mh / sf	11	39.17 /mh	446	-	-	-	-	-	-	-	-	446	705
				Pump Place Pads 8"	17 cy	2.501 mh / cy	43	41.39 /mh	1,759	-	-	-	-	9.86	168	-	-	1,927	3,051
				4000 psi Concrete	17 cy			/cy		142.00	2,414	-	-	-	-	-	-	2,414	3,664
				Liquid Curing Compounds	933 sf	0.003 mh / sf	3	39.17 /mh	110	0.06	55	-	-	-	-	-	-	165	257
				03.08 Pads & Curbs	17 cy		135		5,469	241.17	4,100			9.86	168			9,736	15,145
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	5,712 sf	0.020 mh / sf	114	42.24 /mh	4,826	8.80	50,276	-	-	0.35	2,010	-	-	57,112	87,142
				03.20 Precast Planks	5,712 sf		114		4,826	8.80	50,276			0.35	2,010			57,112	87,142
			06.00	Wood															
				PT Roof Blocking @ Top Of Masonry Wall	307 lf	0.035 mh / lf	11	39.67 /mh	426	1.82	559	-	-	-	-	-	-	985	1,523
				06.00 Wood	1 ls		11		426	558.54	559							985	1,523
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	555 lf			/lf				4.00	2,220	-	-	-	-	2,220	3,370
				Caulking @ Masonry Wall Joints- Interior	555 lf			/lf				4.00	2,220	-	-	-	-	2,220	3,370

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				07.00 Moisture Protection	1 ls							4,440.88	4,441					4,441	6,740
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	6,168 sf			/sf				3.00	18,508					18,508	28,089
				Aluminum Downspouts, 2 ea x 32' each	64 vf			/vf				18.00	1,152					1,152	1,749
				Scuppers	2 ea			/ea				50.01	100					100	152
				Aluminum Coping @ Roof Parapet 12" wide	313 lf			/lf				15.00	4,696					4,696	7,127
				Translucent Panel Skylight Frame & Panels	1,398 sf			/sf				38.01	53,135					53,135	80,643
				07.01 Roofing	6,168 sf							12.58	77,590					77,590	117,760
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	4 ea	1.000 mh / ea	4	39.18 /mh	157	180.04	720	-	-	-	-	-	-	877	1,341
				HM Door Leafs- 3'x7' 20 ga. half glass	4 ea	1.500 ea / mh	3	39.18 /mh	104	450.09	1,800	-	-	-	-	-	-	1,905	2,898
				Overhead Doors- 10'x10' 24 ga steel manual 1" insuation 26 ga back-up panel	1 ea			-	-	-	-	2,255.00	2,255	-	-	-	-	2,255	3,422
				Finish Hardware by Leaf- Allowance	4 ea	8.002 mh / ea	32	39.18 /mh	1,254	900.18	3,601	-	-	-	-	-	-	4,855	7,449
				08.00 Doors, Frames & Hardware	4 ea		39		1,515	1,530.31	6,121	563.75	2,255					9,891	15,111
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	4 ea			/ea		-	-	100.02	400	-	-	-	-	400	607
				Paint HM Doors - primer (2) coats	4 ea			/ea		-	-	140.03	560	-	-	-	-	560	850
				Paint CMU Block - block filler & (2) coat	6,168 sf			-	-	-	-	1.35	8,327	-	-	-	-	8,327	12,638
				09.00 Finishes	1 ls							9,286.99	9,287					9,287	14,095
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	4 ea			/ea				30.01	120	-	-	-	-	120	182
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	1 ls							4,020.81	4,021					4,021	6,102
			22.00	Plumbing															
				Plumbing Subcontract	5,740 sf			/sf				6.00	34,447					34,447	52,281
				22.00 Plumbing	1 ls							34,446.88	34,447					34,447	52,281
			23.00	HVAC															
				Ventilation & Unit Heater System	5,740 sf			/sf		-	-	45.00	258,300	-	-	-	-	258,300	392,026
				23.00 HVAC	1 sf							258,300.00	258,300					258,300	392,026
			26.00	UG Electrical															
				Building Electrical System	5,956 sf			/sf				16.00	95,315					95,315	144,661
				26.00 UG Electrical	1 ls							95,315.03	95,315					95,315	144,661
			26.01	Above Ground Electrical															
				Building Electrical System	5,956 sf			/sf				8.00	47,658					47,658	72,331
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				66,000.00	66,000					66,000	100,169
				26.01 Above Ground Electrical	1 ls							113,657.51	113,658					113,658	172,500
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1.5% Equipment Cost)	1 ls			/ls				49,500.00	49,500					49,500	75,127
				26.02 Instrumentation & Controls	1 ls							49,500.00	49,500					49,500	75,127
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	350 lf	600.000 lf / cd	33	2,539.31 /cd	1,481			-	-	1.88	659	-	-	2,141	3,394
				Stone Pipe Bedding	52 cy	200.000 cy / cd	19	2,896.43 /cd	753	23.29	1,211	-	-			-	-	1,964	3,030
				DI Pipe Push - Class 52 8	200 lf	0.250 mh / lf	50	51.34 /mh	2,567	31.86	6,371	-	-	-	-	-	-	8,938	13,733
				DI Pipe Push - Class 52 14	150 lf	0.340 mh / lf	51	51.34 /mh	2,618	65.16	9,774	-	-	-	-	-	-	12,392	18,977
				Hydrostatic Testing	350 lf	0.021 ch / lf	29	182.49 /ch	1,341	0.16	56	-	-	-	-	-	-	1,397	2,208
				DI 90 ell 14"	2 ea	12.060 mh / ea	24	30.57 /mh	737	469.80	940	-	-	-	-	-	-	1,677	2,593
				40.00 Under Ground Process Piping	350 lf		206		9,498	52.43	18,352			1.88	659			28,509	43,935
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	1,192 lf			-	-	-	-	10.00	11,922	-	-	-	-	11,922	18,095
				Pipe Supports	40 ea	4.001 mh / ea	160	45.62 /mh	7,301	250.05	10,002	-	-			-	-	17,303	26,736
				Hydrostatic Testing	1,192 lf	0.021 ch / lf	100	182.49 /ch	4,569	0.16	191	-	-	-	-	-	-	4,760	7,521
				8" DI Wall Thimble 24" long	4 ea	5.001 ch / ea	80	182.49 /ch	3,650	1,286.25	5,145	-	-	1,200.15	4,801	-	-	13,596	21,227
				Gasket/Nuts/Bolt Kit 4"	16 ea	1.000 mh / ea	16	32.89 /mh	526	7.87	126	-	-	-	-	-	-	652	1,024
				Gasket/Nuts/Bolt Kit 6"	12 ea	1.000 mh / ea	12	32.89 /mh	395	15.87	190	-	-	-	-	-	-	585	914
				Gasket/Nuts/Bolt Kit 8"	24 ea	1.000 mh / ea	24	32.89 /mh	789	22.00	528	-	-	-	-	-	-	1,317	2,051
				Gasket/Nuts/Bolt Kit 12"	30 ea	1.000 mh / ea	30	32.89 /mh	987	45.00	1,350	-	-	-	-	-	-	2,337	3,611
				Gasket/Nuts/Bolt Kit 14"	20 ea	1.000 mh / ea	20	32.89 /mh	658	46.58	932	-	-	-	-	-	-	1,589	2,455
				DI Flanged Joint Pipe 4"	188 lf	0.820 mh / lf	154	30.57 /mh	4,712	30.99	5,825	-	-	-	-	-	-	10,537	16,299
				DI Flanged Joint Pipe 6"	144 lf	0.900 mh / lf	130	30.57 /mh	3,961	47.39	6,824	-	-	-	-	-	-	10,785	16,626
				DI Flanged Joint Pipe 8"	285 lf	0.980 mh / lf	279	30.57 /mh	8,537	67.30	19,180	-	-	-	-	-	-	27,718	42,622
				DI Flanged Joint Pipe 12"	350 lf	1.890 mh / lf	662	30.57 /mh	20,220	112.92	39,521	-	-	-	-	-	-	59,741	91,984
				DI Flanged Joint Pipe 14"	226 lf	2.050 mh / lf	463	30.57 /mh	14,162	138.18	31,228	-	-	-	-	-	-	45,389	69,808
				DI Flanged 90 ell 6"	2 ea	4.830 mh / ea	10	30.57 /mh	295	105.30	211	-	-	-	-	-	-	506	787
				DI Flanged 90 ell 14"	4 ea	12.060 mh / ea	48	30.57 /mh	1,475	469.80	1,879	-	-	-	-	-	-	3,354	5,186
				DI Flanged Tee 6"	2 ea	4.830 mh / ea	10	30.57 /mh	295	0.02	0	-	-	-	-	-	-	295	467
				DI Flanged Tee 8"	4 ea	5.050 mh / ea	20	30.57 /mh	617	313.10	1,252	-	-	-	-	-	-	1,870	2,878
				DI Flanged Con Red 12x8"	4 ea	11.010 mh / ea	44	30.57 /mh	1,346	487.20	1,949	-	-	-	-	-	-	3,295	5,088
				DI Flanged Con Red 14x8"	2 ea	12.060 mh / ea	24	30.57 /mh	737	588.00	1,176	-	-	-	-	-	-	1,913	2,952
				Misc Piping & Accessories- ALLOWANCE	200 LF	0.240 mh / LF	48	45.62 /mh	2,190	55.01	11,002	-	-	-	-	-	-	13,192	20,165
				40.01 Above Ground Process Piping	1,192 lf		2,334		77,424	116.20	138,511	10.00	11,922	4.03	4,801			232,658	358,496
			40.02	Valves, Meters, Etc.															
				6" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	6.200 mh / ea	25	30.57 /mh	758	2,850.00	11,400	-	-	-	-	-	-	12,158	18,502
				Pressure Regulator 8"	2 ea	5.229 mh / ea	10	30.57 /mh	320			-	-	-	-	-	-	320	506
				40.02 Valves, Meters, Etc.	1 ls		35		1,078	11,400.00	11,400							12,478	19,008
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				14,000.00	14,000					14,000	21,248
				40.04 Hydropneumatic Piping System	1 ls							14,000.00	14,000					14,000	21,248
			43.10	Ozone Equipment															
				Freight On Equipment To Jobsite	*1 ls*			*/ls*											
				Verified Performance Test	*1 ls*			*/ls*											
				Vendor Verified Performance Test	1 ls			/ls								1,500.00	1,500	1,500	2,277
				Vendor Witnessed, Verified Performance Test	*1 ls*			*/ls*											
				Equipment Unloading, Setting, Startup & Testing	1 ls	650.000 ch / ls	3,575	182.62 /ch	118,706	500.00	500	-	-	31,005.98	31,006	-	-	150,212	237,984
				Ozone System Equipment	1 ls			/ls								3,300,000.00	3,300,000	3,300,000	5,008,461
				Air Compressor & Receiver	*1 ea*			*/ea*											
				Destruct Units (Blower, Analyzer, Preheater, Destruct Vessel)	*2 ea*			*/ea*											

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			43.10	Ozone Equipment															
				Blower Silencer	*2 ea*			*/ea*											
				Catalytic Chamber	*2 ea*			*/ea*											
				Cooling Water Pump	*2 ea*			*/ea*											
				Cooling Water Skid / Heat X-Changer 10' x 5.67'	*2 ea*			*/ea*											
				Cooling Water Supply Pumps	*3 ea*			*/ea*											
				Demister	*2 ea*			*/ea*											
				Eductor	*2 ea*			*/ea*											
				Filter	*2 ea*			*/ea*											
				Heater	*3 ea*			*/ea*											
				Ozone Diffuser	*2 ea*			*/ea*											
				Ozone Generator Skid 17' x 6.5'	*2 ea*			*/ea*											
				Ozone Injection Manifold 8" x 10.75' long	*1 ea*			*/ea*											
				Ozone Injection Water Supply Pumps	*4 ea*			*/ea*											
				Ozone Quench Manifold 30" x 11' long	*2 ea*			*/ea*											
				Particulate Filter	*1 ea*			*/ea*											
				43.10 Ozone Equipment	1 ls		3,575		118,706	500.00	500			31,005.98	31,006	3,301,500.00	3,301,500	3,451,712	5,248,722
				47.5 Ozone Facility	6,168 gsf		9,127		326,505	50.37	310,707	109.39	674,736	6.68	41,216	535.26	3,301,500	4,654,664	7,088,721
		47.6		LOX Equipment															
			03.05	Slab On Grade															
				S.O.G. Edge Form 8"	118 sf	0.240 mh / sf	28	39.49 /mh	1,118	1.22	144	-	-	-	-	-	-	1,262	1,988
				Strip & Oil Form	118 sf	0.005 mh / sf	1	39.17 /mh	23	0.03	4	-	-	-	-	-	-	27	42
				Rebar- SOG (125 #/cy)	2 tn	14.003 mh / tn	32	43.53 /mh	1,371	997.70	2,245	-	-	-	-	-	-	3,616	5,578
				Mesh Support - bricks (.12/sf)	175 ea	0.002 mh / ea	0	43.53 /mh	15	0.26	46	-	-	-	-	-	-	61	94
				Finish- Broom	1,462 sf	0.022 mh / sf	32	39.17 /mh	1,260	-	-	-	-	-	-	-	-	1,260	1,994
				Pump Place Slab on Grade 8"	36 cy	0.500 mh / cy	18	41.39 /mh	745	-	-	-	-	3.67	132	-	-	877	1,390
				4000 psi Concrete	36 cy			/cy		142.00	5,112	-	-	-	-	-	-	5,112	7,759
				Saw Cut S-O-G (.08/sf)	117 lf	0.030 mh / lf	4	39.17 /mh	138	0.17	20	-	-	0.95	111	-	-	269	425
				Liquid Curing Compounds	1,580 sf	0.002 mh / sf	3	39.17 /mh	124	0.06	93	-	-	-	-	-	-	217	337
				Seal Floors	1,462 sf	0.002 mh / sf	3	39.17 /mh	115	0.09	135	-	-	-	-	-	-	250	386
				6 MIL Vapor Barrier	1,600 sf	0.002 mh / sf	3	43.53 /mh	139	0.05	84	-	-	-	-	-	-	223	348
				Gravel Fill Under Slab 4"	18 cy	0.004 cd / cy	2	1,412.15 /cd	96	29.26	527	-	-	3.84	69	-	-	692	1,062
				03.05 Slab On Grade	36 cy		126		5,144	233.57	8,409			8.68	313			13,866	21,402
			03.08	Pads & Curbs															
				LOX Tank Pad Form 24"	350 sf	0.180 mh / sf	63	39.49 /mh	2,488	1.37	478	-	-	-	-	-	-	2,966	4,663
				LOX Vaporizer Pad Form 12"	78 sf	0.160 mh / sf	12	39.49 /mh	493	1.37	106	-	-	-	-	-	-	599	942
				Chamfer	191 lf	0.015 mh / lf	3	39.49 /mh	113	0.57	108	-	-	-	-	-	-	221	343
				Strip & Oil Equipment Pad Forms	428 sf	0.005 mh / sf	2	39.17 /mh	84	0.03	13	-	-	-	-	-	-	97	152
				Rebar- Pads (100 #/cy)	1 tn	18.004 mh / tn	18	43.53 /mh	784	997.70	998	-	-	-	-	-	-	1,781	2,754
				Finish- Float	223 sf	0.017 mh / sf	4	39.17 /mh	149	-	-	-	-	-	-	-	-	149	235
				Pump Place Pads 12" & 24"	17 cy	1.600 mh / cy	27	41.39 /mh	1,126	-	-	-	-	7.49	127	-	-	1,253	1,985
				4000 psi Concrete	17 cy			/cy		142.00	2,414	-	-	-	-	-	-	2,414	3,664
				Liquid Curing Compounds	651 sf	0.003 mh / sf	2	39.17 /mh	77	0.06	38	-	-	-	-	-	-	115	179
				03.08 Pads & Curbs	17 cy		131		5,313	244.44	4,155			7.49	127			9,596	14,918
			26.01	Above Ground Electrical															
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				42,977.00	42,977					42,977	65,227
				26.01 Above Ground Electrical	1 ls							42,977.00	42,977					42,977	65,227
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1.5% Equipment Cost)	1 ls			/ls				12,893.00	12,893					12,893	19,568
				26.02 Instrumentation & Controls	1 ls							12,893.00	12,893					12,893	19,568
			32.01	Fencing & Gates															
				8' Chain Link Fence @ LOX Tanks	111 lf			-	-	-	-	31.01	3,442	-	-	-	-	3,442	5,224
				8' Fence Vehicle Gate 12' @ LOX Tanks	1 ea			-	-	-	-	1,700.34	1,700	-	-	-	-	1,700	2,581
				32.01 Fencing & Gates	1 ls							5,142.02	5,142					5,142	7,804
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	100 lf	600.000 lf / cd	9	2,539.31 /cd	423			-	-	1.88	188	-	-	612	970
				Stone Pipe Bedding	15 cy	200.000 cy / cd	5	2,896.43 /cd	217	23.29	349	-	-			-	-	567	874
				DI Pipe Push - Class 52 4	100 lf	0.190 mh / lf	19	/mh		14.54	1,454	-	-	-	-	-	-	1,454	2,207
				Hydrostatic Testing	100 lf	0.021 ch / lf	8	182.49 /ch	383	0.16	16	-	-	-	-	-	-	399	631
				DI 90 ell 4"	2 ea	4.530 mh / ea	9	30.57 /mh	277	72.90	146	-	-	-	-	-	-	423	660
				40.00 Under Ground Process Piping	100 lf		51		1,301	19.65	1,965			1.88	188			3,454	5,341
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	113 lf			-	-	-	-	10.00	1,130	-	-	-	-	1,130	1,715
				Pipe Supports	5 ea	4.001 mh / ea	20	45.62 /mh	913	250.05	1,250	-	-			-	-	2,163	3,342
				Hydrostatic Testing	113 lf	0.021 ch / lf	9	182.49 /ch	433	0.16	18	-	-	-	-	-	-	451	713
				Gasket/Nuts/Bolt Kit 3"	10 ea	1.000 mh / ea	10	32.89 /mh	329	4.90	49	-	-	-	-	-	-	378	595
				Gasket/Nuts/Bolt Kit 4"	15 ea	1.000 mh / ea	15	32.89 /mh	493	7.87	118	-	-	-	-	-	-	611	960
				DI Flanged Joint Pipe 3"	50 lf	0.820 mh / lf	41	30.57 /mh	1,253	30.99	1,549	-	-	-	-	-	-	2,803	4,335
				DI Flanged Joint Pipe 4"	63 lf	0.820 mh / lf	52	30.57 /mh	1,579	30.99	1,952	-	-	-	-	-	-	3,531	5,462
				DI Flanged 90 ell 3"	20 ea	1.940 mh / ea	39	30.57 /mh	1,186	55.08	1,102	-	-	-	-	-	-	2,288	3,549
				DI Flanged 90 ell 4"	30 ea	4.530 mh / ea	136	30.57 /mh	4,154	72.90	2,187	-	-	-	-	-	-	6,341	9,894
				DI Flanged Tee 3"	3 ea	1.940 mh / ea	6	30.57 /mh	178	0.04	0	-	-	-	-	-	-	178	282
				DI Flanged Con Red 4x3"	4 ea	4.530 mh / ea	18	30.57 /mh	554	107.52	430	-	-	-	-	-	-	984	1,529
				40.01 Above Ground Process Piping	1 lf		346		11,072	8,655.55	8,656	1,130.23	1,130					20,858	32,376
			40.02	Valves, Meters, Etc.															
				3" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	8 ea	3.000 mh / ea	24	30.57 /mh	734	1,425.00	11,400	-	-	-	-	-	-	12,134	18,463
				4" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	3.500 mh / ea	14	30.57 /mh	428	1,900.00	7,600	-	-	-	-	-	-	8,028	12,212
				40.02 Valves, Meters, Etc.	1 ls		38		1,162	19,000.00	19,000							20,162	30,675
			43.17	LOX Equipment															
				Vaporizer 5.67'x5.67'x20' h, 6,000 lbs (Charter/Thermox #SG500)	2 ea	1.000 cd / ea	80	1,783.17 /cd	3,566			-	-	763.23	1,526	209,000.00	418,000	423,093	642,479
				High Pressure Tank 10,960 gal, 9.5'dia.x34' h, 46,700 lbs (Charter #VS-11000SC)	2 ea	1.000 cd / ea	80	1,783.17 /cd	3,566	2,000.00	4,000	-	-	763.23	1,526	219,000.00	438,000	447,093	678,904
				LOX Fo;; Station	1 ea	1.000 mh / ea	1	45.65 /mh	46	13,450.00	13,450	-	-	-	-	7,200.00	7,200	20,696	31,413
				43.17 LOX Equipment			161		7,178		17,450				3,053		863,200	890,881	1,352,796
				47.6 LOX Equipment	1 ls		853		31,170	59,634.94	59,635	62,142.25	62,142	3,681.24	3,681	863,200.00	863,200	1,019,828	1,550,107

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				3B Filtration - Rehab Existing & Add Ozone Facility	1 ls		27,591		1,065,272	1,041,664.11	1,041,664	875,078.20	875,078	291,903.83	291,904	4,164,700.00	4,164,700	7,438,618	11,380,492
	3C			Filtration - Install Membranes In Existing Filters															
		47.1		Water Plant Process Rehab @ Filters 21 thru 28															
			02.01	Demolition Work															
				Non-Hazardous Waste Transport and Disposal	2,058 ton			-	-	-	-	50.00	102,900	-	-	-	-	102,900	156,173
				Pressure Washing Basin Walls @ Basins 21 thru 28	14,860 sf	150.000 sf / ch	198	53.11 /ch	5,261	0.35	5,201	-	-	0.52	7,753	-	-	18,215	28,560
				Pressure Washing Basin Slab @ Basins 21 thru 28	8,288 sf	200.000 sf / ch	83	53.11 /ch	2,201	0.35	2,901	-	-	0.39	3,243	-	-	8,345	13,047
				Remove Air Header	8 ea	8.000 ch / ea	320	231.62 /ch	14,823	250.00	2,000	-	-	1,957.34	15,659	-	-	32,482	51,418
				Bag, Transport and Dispose Of Media	24,948 cf	65.867 cf / ch	1,515	163.29 /ch	61,846	0.22	5,544	-	-	4.08	101,845	-	-	169,235	268,387
				Remove Sand (8,288 sf x 24" deep), 614 cy	16,578 cf	0.033 mh / cf	539	46.32 /mh	24,958			-	-	6.12	101,402	-	-	126,360	200,885
				Remove Anthracite Media (8,288 sf x 6" deep), 155 cy	4,185 cf	0.033 mh / cf	136	46.32 /mh	6,301			-	-	6.12	25,598	-	-	31,899	50,712
				Remove Gravel Media (8,288 sf x 6" deep), 155 cy	4,185 cf	0.033 mh / cf	136	46.32 /mh	6,301			-	-	6.12	25,598	-	-	31,899	50,712
				Remove Underdrain System - Grouted Blocks	8,288 sf	0.180 mh / sf	1,492	46.32 /mh	69,107	1.09	9,055	-	-	6.12	50,695	-	-	128,857	203,801
				02.01 Demolition Work	1 ls		4,419		190,798	24,701.27	24,701	102,900.00	102,900	331,793.44	331,793			650,192	1,023,696
			03.30	Patch Cracks and Resurface Concrete															
				Patch Cracks & Resurface Walls @ Basins 21-28	14,860 sf	10.000 sf / ch	2,972	53.11 /ch	78,922	0.11	1,618	-	-	-	-	-	-	80,540	127,367
				Patch Cracks & Resurface Walls @ Lower Gallery	6,831 sf	10.000 sf / ch	1,366	53.11 /ch	36,280	0.11	744	-	-	-	-	-	-	37,024	58,549
				Patch Cracks & Resurface Slab @ Basins 21-28	8,288 sf	6.764 sf / ch	2,451	53.11 /ch	65,078	0.07	613	-	-	-	-	-	-	65,691	103,930
				03.30 Patch Cracks and Resurface Concrete	29,979 sf		6,789		180,280	0.10	2,975							183,255	289,847
			09.00	Finishes															
				Pressure Wash Basins 21-28	16 ea	90.000 mh / ea	1,440	40.56 /mh	58,412	-	-	-	-	701.91	11,231	-	-	69,643	110,323
				Clean Basins 21-28	16 ea	30.000 ch / ea	1,440	143.32 /ch	68,794	500.00	8,000	-	-	3,597.12	57,554	-	-	134,348	212,621
				Clean Lower Gallery Walls For Painting	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Clean & Prep Pipe For Painting	1,740 lf			-	-	-	-	6.00	10,440	-	-	-	-	10,440	15,845
				Paint Lower Gallery Concrete Surfaces	6,831 sf			-	-	-	-	1.10	7,514	-	-	-	-	7,514	11,404
				Paint 4" Pipe	0 lf	0.035 mh / lf	0	27.53 /mh	0	1.00	0	-	-	4.00	0	-	-	0	0
				Paint 6" Pipe	818 lf	0.070 mh / lf	57	27.53 /mh	1,577	0.69	566	-	-	4.24	3,467	-	-	5,610	8,873
				Paint 12" Pipe	0 lf	0.120 mh / lf	0	27.53 /mh	0	1.00	0	-	-	6.00	0	-	-	0	0
				Paint 16" Pipe	227 lf	0.140 mh / lf	32	27.53 /mh	875	1.85	419	-	-	6.06	1,375	-	-	2,669	4,209
				Paint 18" Pipe	96 lf	0.200 mh / lf	19	27.53 /mh	529	2.08	199	-	-	6.06	581	-	-	1,309	2,064
				Paint 20" Pipe	0 lf	0.300 mh / lf	0	27.53 /mh	0	2.00	0	-	-	7.00	0	-	-	0	0
				Paint 24" Pipe	0 lf	0.350 mh / lf	0	27.53 /mh	0	3.00	0	-	-	7.00	0	-	-	0	0
				Paint 30" Pipe	0 lf	0.438 mh / lf	0	27.53 /mh	0	4.00	0	-	-	4.00	0	-	-	0	0
				Paint 36" Pipe	541 lf	0.525 mh / lf	284	27.53 /mh	7,820	4.15	2,247	-	-	4.95	2,676	-	-	12,743	20,046
				Paint 42" Pipe	58 lf	0.525 mh / lf	30	27.53 /mh	838	4.85	281	-	-	4.95	287	-	-	1,406	2,210
				09.00 Finishes	1 ls		3,724		150,043	22,782.62	22,783	17,954.10	17,954	93,670.65	93,671			284,451	448,381
				47.1 Water Plant Process Rehab @ Filters 21 thru 28	1 ls		14,932		521,121	50,468.56	50,459	120,854.10	120,854	425,464.09	425,464			1,117,898	1,761,923
		47.2		Water Plant Process Rehab @ Filters 29 thru 32															
			02.01	Demolition Work															
				Non-Hazardous Waste Transport and Disposal	2,154 ton			-	-	-	-	50.00	107,700	-	-	-	-	107,700	163,458
				Pressure Washing Basin Walls @ Basins 29 thru 36	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Pressure Washing Basin Slab @ Basins 29 thru 36	20,059 sf	200.000 sf / ch	201	53.11 /ch	5,327	0.35	7,021	-	-	0.39	7,849	-	-	20,196	31,578
				Remove Air Header	8 ea	8.000 ch / ea	320	231.62 /ch	14,823	250.00	2,000	-	-	1,957.34	15,659	-	-	32,482	51,418
				Bag, Transport and Dispose Of Media	7,938 cf	65.867 cf / ch	482	163.29 /ch	19,678	0.22	1,764	-	-	4.08	32,405	-	-	53,848	85,396
				Remove Sand (8704 sf x 24" deep), 645 cy	17,408 cf	0.033 mh / cf	566	46.32 /mh	26,208			-	-	6.12	106,479	-	-	132,687	210,942
				Remove Anthracite Media (8704 sf x 6" deep), 161 cy	4,352 cf	0.033 mh / cf	141	46.32 /mh	6,552			-	-	6.12	26,620	-	-	33,172	52,736
				Remove Gravel Media (8704 sf x 6" deep), 161 cy	4,352 cf	0.033 mh / cf	141	46.32 /mh	6,552			-	-	6.12	26,620	-	-	33,172	52,736
				Remove Underdrain System - Grouted Blocks	8,704 sf	0.180 mh / sf	1,567	46.32 /mh	72,575	1.09	9,510	-	-	6.12	53,240	-	-	135,325	214,031
				02.01 Demolition Work	1 ls		3,840		162,913	31,363.74	31,364	107,700.00	107,700	285,371.47	285,371			587,348	923,077
			03.30	Patch Cracks and Resurface Concrete															
				Patch Cracks & Resurface Walls @ Only Basins 33 thru 36	7,460 sf	10.000 sf / ch	1,492	53.11 /ch	39,620	0.11	812	-	-	-	-	-	-	40,433	63,941
				Patch Cracks & Resurface Walls @ Lower Gallery Basins 29 thru 36	6,831 sf	10.000 sf / ch	1,366	53.11 /ch	36,280	0.11	744	-	-	-	-	-	-	37,024	58,549
				Patch Cracks & Resurface Slab @ Only Basins 33 thru 36	4,352 sf	6.764 sf / ch	1,287	53.11 /ch	34,172	0.07	322	-	-	-	-	-	-	34,494	54,574
				03.30 Patch Cracks and Resurface Concrete	18,643 sf		4,145		110,073	0.10	1,878							111,950	177,064
			09.00	Finishes															
				Pressure Wash Basins 29 thru 36	16 filt	90.000 mh / filt	1,440	40.56 /mh	58,412	-	-	-	-	701.91	11,231	-	-	69,643	110,323
				Clean Tank	16 filt	30.000 ch / filt	1,440	143.32 /ch	68,794	500.00	8,000	-	-	3,597.12	57,554	-	-	134,348	212,621
				Clean Basins 29 thru 36	16 filt	30.000 ch / filt	1,440	143.32 /ch	68,794	500.00	8,000	-	-	3,597.12	57,554	-	-	134,348	212,621
				Clean Lower Gallery Walls For Painting	31,626 sf	150.000 sf / ch	422	53.11 /ch	11,198	0.35	11,069	-	-	0.52	16,500	-	-	38,767	60,783
				Clean & Prep Pipe For Painting	1,740 lf			-	-	-	-	6.00	10,440	-	-	-	-	10,440	15,845
				Paint Lower Gallery Concrete Surfaces	6,831 sf			-	-	-	-	1.10	7,514	-	-	-	-	7,514	11,404
				Paint 4" Pipe	52 lf	0.035 mh / lf	2	27.53 /mh	50	0.46	24	-	-	4.24	220	-	-	295	467
				Paint 6" Pipe	94 lf	0.070 mh / lf	7	27.53 /mh	181	0.69	65	-	-	4.24	398	-	-	645	1,020
				Paint 12" Pipe	54 lf	0.120 mh / lf	6	27.53 /mh	178	1.39	75	-	-	5.65	305	-	-	558	882
				Paint 16" Pipe	38 lf	0.140 mh / lf	5	27.53 /mh	146	1.85	70	-	-	6.06	230	-	-	447	705
				Paint 18" Pipe	0 lf	0.200 mh / lf	0	27.53 /mh	0	2.00	0	-	-	6.00	0	-	-	0	0
				Paint 20" Pipe	276 lf	0.300 mh / lf	83	27.53 /mh	2,280	2.31	637	-	-	7.07	1,950	-	-	4,867	7,678
				Paint 24" Pipe	206 lf	0.350 mh / lf	72	27.53 /mh	1,985	2.77	571	-	-	7.07	1,455	-	-	4,011	6,324
				Paint 30" Pipe	29 lf	0.438 mh / lf	13	27.53 /mh	349	3.46	100	-	-	4.12	119	-	-	569	895
				Paint 36" Pipe	91 lf	0.525 mh / lf	48	27.53 /mh	1,315	4.15	378	-	-	4.95	450	-	-	2,143	3,372
				Paint 42" Pipe	0 lf	0.525 mh / lf	0	27.53 /mh	0	5.00	0	-	-	5.00	0	-	-	0	0
				09.00 Finishes	1 ls		4,977		213,684	28,989.10	28,989	17,954.10	17,954	147,967.89	147,968			408,595	644,941
			40.01	Above Ground Process Piping															
				12" Filter To Waste Piping To Basins 29 thru 36	600 lf	2.200 mh / lf	1,320	30.57 /mh	40,348	136.00	81,600	-	-	-	-	-	-	121,948	187,705
				40.01 Above Ground Process Piping	600 lf		1,320		40,348	136.00	81,600							121,948	187,705
				47.2 Water Plant Process Rehab @ Filters 29 thru 32	1 ls		14,282		527,018	143,830.73	143,831	125,654.10	125,654	433,339.36	433,339			1,229,842	1,932,787
		47.3		Water Plant Building @ Filters 21 thru 36															
			02.01	Demolition Work															
				Non-Hazardous Waste Transport and Disposal	1 ls			-	-	-	-	10,000.00	10,000	-	-	-	-	10,000	15,177
				Demo HVAC System @ Upper & Lower Levels	44,000 sf			-	-	-	-	3.00	132,000	-	-	-	-	132,000	200,338
				Demo Lighting System @ Upper & Lower Levels	44,000 sf			/sf				3.00	132,000					132,000	200,338
				02.01 Demolition Work	1 ls							274,000.00	274,000					274,000	415,854
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	32 ea			/ea		-	-	100.02	3,201	-	-	-	-	3,201	4,858
				Paint HM Doors - primer (2) coats	32 ea			/ea		-	-	140.03	4,481	-	-	-	-	4,481	6,801
				Paint CMU Block - block filler & (2) coat	16,800 sf			-	-	-	-	1.35	22,680	-	-	-	-	22,680	34,422
				Paint Ceilings	44,000 sf			-	-	-	-	1.00	44,000	-	-	-	-	44,000	66,779
				Minor Architectural Improvements	1 ls			-	-	-	-	10,000.00	10,000	-	-	-	-	10,000	15,177
				09.00 Finishes	1 ls							84,361.50	84,362					84,362	128,037
			23.00	HVAC															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			23.00	HVAC															
				New HVAC System	44,000 sf			/sf		-	-	20.00	880,000	-	-	-	-	880,000	1,335,590
				23.00 HVAC	44,000 sf							20.00	880,000					880,000	1,335,590
			26.01	Above Ground Electrical															
				New Lighting System	44,000 sf			/sf				4.00	176,000					176,000	267,118
				New Support For Conduit & Wiring System	44,000 sf			/sf				2.00	88,000					88,000	133,559
				Electrical Work For Equipment (3% Equipment Cost)	1 ls			/ls				540,000.00	540,000					540,000	819,566
				26.01 Above Ground Electrical	1 ls							804,000.00	804,000					804,000	1,220,243
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1% Equipment Cost)	1 ls			/ls				180,000.00	180,000					180,000	273,189
				26.02 Instrumentation & Controls	1 ls							180,000.00	180,000					180,000	273,189
			40.01	Above Ground Process Piping															
				Filtrate 7 Backwash Piping & Valves	1,800 lf	2.200 mh / lf	3,960	30.57 /mh	121,045	136.00	244,800	-	-	-	-	-	-	365,845	563,116
				Cut Holes In Walls For Filtrate 7 Backwash Piping	24 ea			/ea				2,500.00	60,000					60,000	91,063
				40.01 Above Ground Process Piping	1,800 lf		3,960		121,045	136.00	244,800	33.33	60,000					425,845	654,179
			43.11	Membrane Filtration Equipment															
				Filter Equipment Start-Up @ Basins 21-28 & 33-36	12 ea	150.000 ch / ea	12,600	350.77 /ch	631,379	2,500.00	30,000					-	-	661,379	1,044,825
				Suez- ZeeWeed Ultrafiltration Membrane System	1 ls			/ls								18,594,595.00	18,594,595	18,594,595	28,221,307
				Install Double Stack Cassette 23' long w/o 112 Modules/Cassette (21-28)	64 ea	9.000 mh / ea	576	30.57 /mh	17,606			-	-	55.00	3,520	-	-	21,126	33,468
				Install Double Stack Casstte 18' long w/o 98 Modules/Cassette (33-36)	40 ea	7.000 mh / ea	280	30.57 /mh	8,559			-	-	55.00	2,200	-	-	10,759	17,047
				Install 2' x 2' Modules In 104 Cassettes	11,008 ea	1.000 mh / ea	11,008	30.57 /mh	336,479			-	-	6.00	66,048	-	-	402,527	637,667
				Install 2' x 2' Modules In 104 Cassettes	11,008 ea	1.000 mh / ea	11,008	30.57 /mh	336,479			-	-	6.00	66,048	-	-	402,527	637,667
				Install Membrane Header Piping System @ Each Basin	24 ea	64.000 mh / ea	1,536	30.57 /mh	46,951			-	-	400.00	9,600	-	-	56,551	89,588
				Install Air Scour Header Piping System @ Each Basin	24 ea	64.000 mh / ea	1,536	30.57 /mh	46,951			-	-	400.00	9,600	-	-	56,551	89,588
				Install Sodium Hypochlorite Dosing System @ Each Basin	24 ea	64.000 mh / ea	1,536	30.57 /mh	46,951			-	-	400.00	9,600	-	-	56,551	89,588
				43.11 Membrane Filtration Equipment	1 ls		40,080		1,471,354	30,000.00	30,000			166,616.00	166,616	18,594,595.00	18,594,595	20,262,565	30,860,746
			43.12	Air Scour Blowers															
				Air Scour Blower 200 hp	4 ea	40.000 mh / ea	160	34.45 /mh	5,511			-	-	-	-	220,000.00	880,000	885,511	1,344,312
				43.12 Air Scour Blowers	1 ls		160		5,511							880,000.00	880,000	885,511	1,344,312
				47.3 Water Plant Building @ Filters 21 thru 36	1 ls		44,200		1,597,910	274,799.99	274,800	2,282,361.50	2,282,362	166,616.00	166,616	19,474,595.00	19,474,595	23,796,283	36,232,149
				3C Filtration - Install Membranes In Existing Filters	1 ls		73,414		2,646,049	469,089.28	469,089	2,528,869.70	2,528,870	1,025,419.45	1,025,419	19,474,595.00	19,474,595	26,144,022	39,926,860
3D				Filtration - Construct New Gravity Filters															
		00		Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	2,842 lf	0.050 mh / lf	142	39.49 /mh	5,612	0.67	1,910	-	-	-	-	-	-	7,523	11,782
				Mat Foundation Edge Form 30"	1,628 sf	0.350 mh / sf	570	39.49 /mh	22,505	1.31	2,137	-	-	-	-	-	-	24,642	38,862
				Mat Foundation Bulkhead Form	1,095 sf	0.350 mh / sf	383	39.49 /mh	15,134	1.52	1,667	-	-	-	-	-	-	16,801	26,483
				Waterstop 6" Flat	2,842 lf	0.110 mh / lf	313	39.18 /mh	12,250	2.10	5,969	-	-	-	-	-	-	18,219	28,448
				Strip & Oil Mat Found. Form	2,723 sf	0.005 mh / sf	14	39.17 /mh	533	0.03	82	-	-	-	-	-	-	615	968
				Rebar- Foundation Mat (100 #/cy)	122 tn	28.006 mh / tn	3,417	43.53 /mh	148,718	997.70	121,719	-	-	-	-	-	-	270,437	420,114
				Rebar Support - bricks (.12/sf)	3,147 ea	0.002 mh / ea	6	43.53 /mh	274	0.26	826	-	-	-	-	-	-	1,100	1,688
				Finish- Hard Trowel	26,221 sf	0.023 mh / sf	603	39.17 /mh	23,626	-	-	-	-	-	-	-	-	23,626	37,393
				Pump Place Mat Foundation 24"	2,428 cy	0.500 mh / cy	1,214	41.39 /mh	50,246	-	-	-	-	4.59	11,140	-	-	61,387	97,256
				4000 psi Concrete	2,428 cy			/cy		142.00	344,776	-	-	-	-	-	-	344,776	523,272
				Liquid Curing Compounds	28,944 sf	0.003 mh / sf	87	39.17 /mh	3,402	0.06	1,702	-	-	-	-	-	-	5,104	7,967
				6 Mil Vapor Barrier	28,800 sf	0.002 mh / sf	58	43.53 /mh	2,508	0.05	1,512	-	-	-	-	-	-	4,020	6,264
				03.00 Foundation Mat	2,428 cy		6,806		284,807	198.64	482,302			4.59	11,140			778,249	1,200,496
			03.03	Columns															
				Form Rectangle Columns 15'	3,780 sf	0.165 mh / sf	624	39.49 /mh	24,629	1.60	6,034	-	-	-	-	-	-	30,663	48,138
				Chamfer	2,520 lf	0.015 mh / lf	38	39.49 /mh	1,493	0.57	1,429	-	-	-	-	-	-	2,922	4,532
				Strip & Oil Column Form	3,780 sf	0.005 mh / sf	19	39.17 /mh	740	0.03	113	-	-	-	-	-	-	854	1,344
				Superplasticizers @ Columns	53 cy			/cy		8.40	445	-	-	-	-	-	-	445	676
				Column Rebar (120 #/cy)	3 tn	20.004 mh / tn	64	43.53 /mh	2,769	997.70	3,173	-	-	-	-	-	-	5,942	9,198
				Finish- Float	95 sf	0.017 mh / sf	2	39.17 /mh	63	-	-	-	-	-	-	-	-	63	100
				Pump Place Columns 42 ea	53 cy	1.600 mh / cy	85	41.39 /mh	3,510	-	-	-	-	7.49	397	-	-	3,908	6,188
				4000 psi Concrete	53 cy			/cy		142.00	7,526	-	-	-	-	-	-	7,526	11,422
				Grind/Patch Columns	3,780 sf	0.013 mh / sf	49	39.17 /mh	1,925	0.03	113	-	-	-	-	-	-	2,038	3,219
				Rub Columns	3,780 sf	0.065 mh / sf	246	39.17 /mh	9,623	0.06	227	-	-	-	-	-	-	9,850	15,575
				Liquid Curing Compounds	3,780 sf	0.003 mh / sf	11	39.17 /mh	444	0.06	222	-	-	-	-	-	-	667	1,041
				03.03 Columns	53 cy		1,137		45,197	363.83	19,283			7.49	397			64,877	101,433
			03.04	Walls															
				Keyway 6"	7,105 lf	0.050 mh / lf	355	39.49 /mh	14,033	0.67	4,776	-	-	-	-	-	-	18,809	29,459
				Vertical Wall Keyway 6"	1,415 lf	0.110 mh / lf	156	39.49 /mh	6,148	0.67	951	-	-	-	-	-	-	7,099	11,173
				Panel Form System 10' h	1,109 sf	0.150 mh / sf	166	39.49 /mh	6,570	1.84	2,038	-	-	-	-	-	-	8,608	13,492
				Panel Form System 20' & 25' h	111,995 sf	0.190 mh / sf	21,283	39.49 /mh	840,435	1.84	205,832	-	-	-	-	-	-	1,046,267	1,642,563
				Waterstop 6" Flat	8,521 lf	0.110 mh / lf	937	39.18 /mh	36,727	2.10	17,898	-	-	-	-	-	-	54,625	85,293
				Strip & Oil Wall Forms	113,104 sf	0.005 mh / sf	566	39.17 /mh	22,154	0.03	3,394	-	-	-	-	-	-	25,548	40,215
				Superplasticizers @ Walls	3,094 cy			/cy		8.40	25,993	-	-	-	-	-	-	25,993	39,450
				Rebar- Walls (125 #/cy)	194 tn	15.003 mh / tn	2,911	43.53 /mh	126,689	997.70	193,554	-	-	-	-	-	-	320,243	494,272
				Finish- Top of Wall	3,483 sf	0.008 mh / sf	28	39.17 /mh	1,092	-	-	-	-	-	-	-	-	1,092	1,728
				Pump Place Walls 12"	430 cy	1.150 mh / cy	495	41.39 /mh	20,470	-	-	-	-	6.65	2,861	-	-	23,331	36,952
				Pump Place Walls 18"	2,002 cy	1.150 mh / cy	2,303	41.39 /mh	95,309	-	-	-	-	6.65	13,312	-	-	108,621	172,034
				Pump Place Walls 24"	662 cy	1.150 mh / cy	761	41.39 /mh	31,515	-	-	-	-	6.65	4,404	-	-	35,919	56,889
				4000 psi Concrete	3,094 cy			/cy		142.00	439,348	-	-	-	-	-	-	439,348	666,805
				Grind/Patch Walls	113,104 sf	0.013 mh / sf	1,471	39.17 /mh	57,601	0.03	3,394	-	-	-	-	-	-	60,995	96,317
				Rub Walls	96,854 sf	0.058 mh / sf	5,618	39.17 /mh	220,022	0.06	5,811	-	-	-	-	-	-	225,833	357,052
				Liquid Curing Compounds	112 sf	0.002 mh / sf	0	39.17 /mh	9	0.06	7	-	-	-	-	-	-	15	24
				03.04 Walls	3,094 cy		37,049		1,478,773	291.85	902,995			6.65	20,577			2,402,345	3,743,715
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	17,177 sf	0.180 mh / sf	3,092	39.49 /mh	122,116	2.18	37,522			-	-	-	-	159,638	250,222
				Slab Edge Form 12"	4,181 sf	0.250 mh / sf	1,045	39.49 /mh	41,283	5.17	21,620			-	-	-	-	62,903	98,153
				Strip & Oil Suspended Slab Forms	21,358 sf	0.005 mh / sf	107	39.17 /mh	4,183	0.04	876			-	-	-	-	5,059	7,950
				Superplasticizers	647 cy			-	-	8.40	5,435			-	-	-	-	5,435	8,249
				Rebar- Suspended Slab (225 #/cy)	73 tn	20.004 mh / tn	1,460	43.53 /mh	63,562	997.70	72,832	-	-	-	-	-	-	136,394	211,139
				Finish- Hard Trowel	17,177 sf	0.030 mh / sf	515	39.17 /mh	20,187	-	-			-	-	-	-	20,187	31,951
				Pump Place Suspended Slab 12"	647 cy	1.800 mh / cy	1,165	41.39 /mh	48,211	-	-			6.65	4,304	-	-	52,516	83,155
				4000 psi Concrete	647 cy			-	-	142.00	91,874			-	-	-	-	91,874	139,439
				Liquid Curing Compounds	0 sf	0.003 mh / sf	0	39.17 /mh		1.00	0			-	-	-	-	0	0
				03.06 Suspended Flat Slab	647 cy		7,385		299,543	355.73	230,159			6.65	4,304			534,007	830,258
			03.07	Suspended Beams															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.07	Suspended Beams															
				Beam Side Forms	10,878 sf	0.210 mh / sf	2,285	39.49 /mh	90,224	2.21	23,991	-	-	-	-	-	-	114,214	179,209
				Beam Bottom Forms	3,146 sf	0.210 mh / sf	661	39.49 /mh	26,093	2.21	6,938	-	-	-	-	-	-	33,032	51,829
				Chamfer	4,194 lf	0.015 mh / lf	63	39.49 /mh	2,485	0.57	2,378	-	-	-	-	-	-	4,863	7,542
				Strip & Oil Beam Forms	14,024 sf	0.005 mh / sf	70	39.17 /mh	2,747	0.03	421	-	-	-	-	-	-	3,168	4,988
				Superplasticizers @ Beams	302 cy			/cy		8.40	2,537	-	-	-	-	-	-	2,537	3,851
				Rebar- Beams (250 #/cy)	38 tn	15.003 mh / tn	570	43.53 /mh	24,815	997.70	37,913	-	-	-	-	-	-	62,728	96,816
				Finish- Top of Beam	3,145 sf	0.008 mh / sf	25	39.17 /mh	986	-	-	-	-	-	-	-	-	986	1,560
				Pump Place Beams @ Roof	302 cy	2.001 mh / cy	604	41.39 /mh	25,011	-	-	-	-	14.42	4,355	-	-	29,367	46,517
				4000 psi Concrete	302 cy			/cy		142.00	42,884	-	-	-	-	-	-	42,884	65,086
				Grind/Patch Beams	14,024 sf	0.013 mh / sf	182	39.17 /mh	7,142	0.03	421	-	-	-	-	-	-	7,563	11,942
				Rub Beams	14,024 sf	0.085 mh / sf	1,192	39.17 /mh	46,689	0.06	841	-	-	-	-	-	-	47,530	75,172
				Liquid Curing Compounds	14,024 sf	0.002 mh / sf	28	39.17 /mh	1,099	0.06	825	-	-	-	-	-	-	1,924	2,991
				03.07 Suspended Beams	302 cy		5,681		227,290	394.53	119,149			14.42	4,355			350,795	547,502
			03.09	Pan Stair Fill															
				Finish Stairs	415 sf	0.055 mh / sf	23	39.17 /mh	894	-	-	-	-	-	-	-	-	894	1,415
				Pump Place Pan Stair Concrete	6 cy	3.001 mh / cy	18	41.39 /mh	745	-	-	-	-	9.17	55	-	-	800	1,267
				3000 psi Concrete	6 cy			-	-	138.00	828	-	-	-	-	-	-	828	1,257
				03.09 Pan Stair Fill	6 cy		41		1,639	138.00	828			9.17	55			2,522	3,939
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	25,298 sf	0.020 mh / sf	506	42.24 /mh	21,376	8.80	222,667	-	-	0.35	8,902	-	-	252,945	385,945
				03.20 Precast Planks	25,298 sf		506		21,376	8.80	222,667			0.35	8,902			252,946	385,945
			04.00	Masonry															
				8" CMU + Rigid Insulation Backup To Brick, 20' h	12,093 sf			/sf		-	-	18.00	217,717	-	-	-	-	217,717	330,433
				8" CMU + Rigid Insulation Backup To Brick @ Parapet 3.67' h	2,576 sf			/sf		-	-	18.00	46,368	-	-	-	-	46,368	70,373
				Precast Cap 16" x 4"	644 lf			/lf		-	-	20.00	12,883	-	-	-	-	12,883	19,552
				Brick Veneer @ Block Wall Backup & Concrete Beam	16,601 sf			-	-	-	-	9.00	149,439	-	-	-	-	149,439	226,806
				04.00 Masonry	16,601 sf							25.69	426,407					426,407	647,164
			05.01	Misc Metals															
				Metal Stairs Concrete Pans	132 rs	0.067 mh / rs	9	42.08 /mh	370	80.02	10,562	-	-	-	-	-	-	10,933	16,617
				Metal Stair Landing Concrete Pans	8 ea	4.000 mh / ea	32	42.08 /mh	1,347	800.00	6,400	-	-	-	-	-	-	7,747	11,845
				Alum Stair Wall Handrail	112 lf	0.150 mh / lf	17	42.08 /mh	707	16.80	1,882	-	-	-	-	-	-	2,589	3,975
				Aluminum 3 Line Rail @ Basins	1,512 lf	0.234 mh / lf	354	42.08 /mh	14,892	44.11	66,693	-	-	-	-	-	-	81,585	124,790
				Aluminum Handrail @ Pan Stairs	112 lf	0.234 mh / lf	26	42.08 /mh	1,103	44.11	4,940	-	-	-	-	-	-	6,043	9,244
				Alum Grate Cover .75" @ 4'x4' Sump	12 ea	0.600 mh / ea	7	42.08 /mh	303	185.04	2,220	-	-	-	-	-	-	2,523	3,850
				Aluminum Hatch & Frame Over Pipe Gallery 6.33' x 6.33'	12 ea	8.002 mh / ea	96	39.18 /mh	3,762	5,001.00	60,012	-	-	-	-	-	-	63,774	97,035
				05.01 Misc Metals	1 ls		541		22,484	152,709.28	152,709							175,193	267,355
			06.00	Wood															
				Misc Nailers & Blocking	26,076 sf	0.010 mh / sf	261	39.67 /mh	10,347	0.40	10,465	-	-	-	-	-	-	20,812	32,259
				06.00 Wood	1 ls		261		10,347	10,465.09	10,465							20,812	32,259
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	1,494 lf			/lf				4.00	5,977	-	-	-	-	5,977	9,072
				Caulking @ Masonry Wall Joints- Interior	1,494 lf			/lf				4.00	5,977	-	-	-	-	5,977	9,072
				07.00 Moisture Protection	1 ls							11,954.41	11,954					11,954	18,143
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	26,076 sf			/sf				3.00	78,244					78,244	118,752
				Aluminum Downspouts, 14 ea	280 lf			/lf				18.00	5,041					5,041	7,651
				Scuppers	14 ea			/ea				50.01	700					700	1,063
				Aluminum Coping @ Roof Parapet 12" wide	650 lf			/lf				15.00	9,752					9,752	14,801
				Roof Hatch 4'0" x 4'0"	1 ea			/ea				2,200.44	2,200					2,200	3,340
				07.01 Roofing	26,076 sf							3.68	95,937					95,937	145,605
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	8 ea	1.000 mh / ea	8	39.18 /mh	313	180.04	1,440	-	-	-	-	-	-	1,754	2,682
				HM Door Leafs- 3'x7' 20 ga. half glass	8 ea	1.500 ea / mh	5	39.18 /mh	209	450.09	3,601	-	-	-	-	-	-	3,810	5,796
				Finish Hardware by Leaf- Allowance	8 ea	8.002 mh / ea	64	39.18 /mh	2,508	900.18	7,201	-	-	-	-	-	-	9,709	14,899
				08.00 Doors, Frames & Hardware	8 ea		77		3,030	1,530.31	12,242							15,273	23,376
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	8 ea			/ea		-	-	100.02	800	-	-	-	-	800	1,214
				Paint HM Doors - primer (2) coats	8 ea			/ea		-	-	140.03	1,120	-	-	-	-	1,120	1,700
				Paint CMU Block - block filler & (2) coat	12,093 sf				-	-	-	1.35	16,326	-	-	-	-	16,326	24,778
				Paint 12" Pipe	400 lf	0.120 mh / lf	48	27.53 /mh	1,322	1.39	554	-	-	5.65	2,261	-	-	4,136	6,530
				Paint 16" Pipe	77 lf	0.140 mh / lf	11	27.53 /mh	297	1.85	142	-	-	6.06	466	-	-	905	1,428
				Paint 18" Pipe	12 lf	0.200 mh / lf	2	27.53 /mh	66	2.08	25	-	-	6.06	73	-	-	164	258
				Paint 20" Pipe	17 lf	0.300 mh / lf	5	27.53 /mh	140	2.31	39	-	-	7.07	120	-	-	300	473
				Paint 24" Pipe	960 lf	0.350 mh / lf	336	27.53 /mh	9,251	2.77	2,659	-	-	7.07	6,782	-	-	18,692	29,471
				Paint 36" Pipe	666 lf	0.525 mh / lf	350	27.53 /mh	9,627	4.15	2,767	-	-	4.95	3,294	-	-	15,687	24,678
				Paint 48" Pipe	303 lf	0.525 mh / lf	159	27.53 /mh	4,380	5.54	1,678	-	-	4.95	1,498	-	-	7,557	11,864
				09.00 Finishes	1 ls		911		25,083	7,863.94	7,864	18,245.93	18,246	14,494.42	14,494			65,687	102,395
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	8 ea			/ea				30.01	240	-	-	-	-	240	364
				Fire Extinguisher CO2 10 lbs	8 ea			/ea				225.05	1,800					1,800	2,732
				10.00 Specialty Items	1 ls							5,041.02	5,041					5,041	7,651
			22.00	Plumbing															
				Plumbing Subcontract	25,300 sf			/sf				4.00	101,220					101,220	153,624
				22.00 Plumbing	1 ls							101,220.21	101,220					101,220	153,624
			23.00	HVAC															
				Ventilation & Unit Heater System	25,300 sf			/sf		-	-	45.00	1,138,500	-	-	-	-	1,138,500	1,727,919
				23.00 HVAC	25,300 sf							45.00	1,138,500					1,138,500	1,727,919
			31.01	Dewatering															
				Dewatering - Well Point System Installation	1 sys	240.048 ch / sys	960	159.35 /ch	38,251	7,501.50	7,502	-	-	33,599.22	33,599	-	-	79,352	125,400
				Dewatering - Well Point System Monthly Rental	4 mo	13.288 mh / mo	53	39.17 /mh	2,082	5,704.89	22,820	-	-	22,004.39	88,018	-	-	112,919	178,010
				Dewatering - Well Point System Removal	1 sys	60.012 ch / sys	240	159.35 /ch	9,563	2,500.50	2,501	-	-	8,399.94	8,400	-	-	20,463	32,299
				31.01 Dewatering	1 ls		1,253		49,896	32,821.55	32,822			130,016.73	130,017			212,734	335,708
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 329 ea (1 per 77 sf)	8,225 vf	0.002 cd / vf	921	2,146.97 /cd	35,325	35.16	289,162	-	-	2.58	21,223	-	-	345,710	528,551
				31.02 Piles	329 ea		921		35,325	878.91	289,162			64.51	21,223			345,710	528,551
			31.03	Excavation Shoring															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (700' x 36' deep)	25,200 sf	0.001 cd / sf	1,242	2,465.38 /cd	47,851	16.00	403,280	-	-	0.75	18,952	-	-	470,084	717,962
				Tie Backs (1 per 80 sf of Sheeting, 700' x 28'= 19,600 sf)	245 ea			-	-	-	-	2,377.48	582,481	-	-	-	-	582,481	884,041
				31.03 Excavation Shoring	25,200 sf		1,242		47,851	16.00	403,280	23.71	597,484	0.75	18,952			1,067,568	1,624,773
			31.10	Structure Excavation															
				Exc Clay-Backhoe/Truck (30,336 sf x 28')	31,460 cy	499.900 cy / cd	2,266	1,410.06 /cd	88,738	-	-	-	-	6.58	207,133	-	-	295,872	470,103
				31.10 Structure Excavation	31,460 cy		2,266		88,738					6.58	207,133			295,872	470,103
			31.12	Structure Backfill															
				BackFill Earth-Backhoe/Truck	4,358 cy	495.000 cy / cd	282	1,327.72 /cd	11,689			-	-	4.69	20,425	-	-	32,114	51,007
				31.12 Structure Backfill	4,358 cy		282		11,689					4.69	20,425			32,114	51,007
			31.13	Soil Disposal															
				Spoils to Waste	27,102 cy	0.003 day / cy	2,440	1,410.06 /day	95,557	-	-	-	-	8.23	223,050	-	-	318,607	506,228
				31.13 Soil Disposal	27,102 cy		2,440		95,557					8.23	223,050			318,607	506,228
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 26,400 sf x 6"	489 cy	0.003 cd / cy	59	1,609.56 /cd	2,385	28.28	13,829	-	-	10.02	4,898	-	-	21,112	32,559
				31.20 Structure Stone Base	489 cy		59		2,385	28.28	13,829			10.02	4,898			21,112	32,559
				00 Building & Structure Construction	26,076 gsf		68,859		2,751,011	111.20	2,899,758	91.84	2,394,790	26.46	689,924			8,735,482	13,487,710
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				UG Electrical System	25,300 sf			/sf				16.00	404,881					404,881	614,494
				26.00 UG Electrical	1 ls							404,880.81	404,881					404,881	614,494
			26.01	Above Ground Electrical															
				Building Electrical Systems	25,300 sf			/sf				4.00	101,200					101,200	153,593
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				109,719.00	109,719					109,719	166,522
				26.01 Above Ground Electrical	1 ls							210,919.00	210,919					210,919	320,115
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1.5 % Equipment Cost)	1 ls			/ls				34,830.00	34,830					34,830	52,862
				26.02 Instrumentation & Controls	1 ls							34,830.00	34,830					34,830	52,862
				26 Electrical & Instrumentation	1 ls							650,629.81	650,630					650,630	987,471
		40		Process Piping															
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	920 lf	600.000 lf / cd	86	2,539.31 /cd	3,894			-	-	1.88	1,733	-	-	5,627	8,921
				Stone Pipe Bedding	135 cy	199.900 cy / cd	49	2,896.43 /cd	1,971	23.29	3,168	-	-			-	-	5,138	7,927
				DI Pipe Push - Class 52 30	794 lf	0.440 mh / lf	349	51.34 /mh	17,936	167.28	132,818	-	-	-	-	-	-	150,754	229,967
				DI Pipe Push - Class 52 48	126 lf	0.640 mh / lf	81	/mh		365.30	46,028	-	-	-	-	-	-	46,028	69,857
				Hydrostatic Testing	920 lf	0.021 ch / lf	77	182.49 /ch	3,527	0.16	147	-	-	-	-	-	-	3,674	5,805
				40.00 Under Ground Process Piping	920 lf		542		27,326	198.00	182,161			1.88	1,733			211,220	322,476
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	489 lf			-	-	-	-	10.00	4,891	-	-	-	-	4,891	7,423
				Paint & Stencil Exposed Piping >20"	1,946 lf			-	-	-	-	25.01	48,660	-	-	-	-	48,660	73,852
				Pipe Supports	60 ea	4.001 mh / ea	240	45.62 /mh	10,951	250.05	15,003	-	-	-	-	-	-	25,954	40,103
				Hydrostatic Testing	2,435 lf	0.021 ch / lf	205	182.49 /ch	9,333	0.16	390	-	-	-	-	-	-	9,723	15,363
				Dresser Couplings 48"	12 ea	27.200 mh / ea	326	40.79 /mh	13,313	2,400.00	28,800	-	-	-	-	-	-	42,113	64,780
				12" DI Wall Thimble 24" long	12 ea	1.250 ch / ea	60	182.49 /ch	2,737	430.09	5,161	-	-	301.00	3,612	-	-	11,510	17,914
				24" DI Wall Thimble 24" long	24 ea	2.501 ch / ea	240	182.49 /ch	10,951	860.17	20,644	-	-	602.12	14,451	-	-	46,046	71,664
				30" DI Wall Thimble 24" long	7 ea	3.751 ch / ea	105	182.49 /ch	4,792	1,100.21	7,701	-	-	900.35	6,302	-	-	18,796	29,303
				36" DI Wall Thimble 24" long	4 ea	5.001 ch / ea	80	182.49 /ch	3,650	1,286.26	5,145	-	-	1,200.24	4,801	-	-	13,596	21,227
				48" DI Wall Thimble 24" long	2 ea	6.700 ch / ea	54	182.49 /ch	2,445	1,715.00	3,430	-	-	1,600.00	3,200	-	-	9,075	14,159
				Gasket/Nuts/Bolt Kit 12"	40 ea	1.000 mh / ea	40	45.62 /mh	1,825	45.01	1,800	-	-	-	-	-	-	3,625	5,621
				Gasket/Nuts/Bolt Kit 16"	8 ea	1.000 mh / ea	8	32.89 /mh	263	46.64	373	-	-	-	-	-	-	636	983
				Gasket/Nuts/Bolt Kit 18"	1 ea	1.000 mh / ea	1	32.89 /mh	33	63.09	63	-	-	-	-	-	-	96	148
				Gasket/Nuts/Bolt Kit 20"	2 ea	1.000 mh / ea	2	32.89 /mh	66	94.52	189	-	-	-	-	-	-	255	391
				Gasket/Nuts/Bolt Kit 24"	80 ea	2.000 mh / ea	160	45.62 /mh	7,301	129.48	10,358	-	-	-	-	-	-	17,659	27,276
				Gasket/Nuts/Bolt Kit 36"	56 ea	3.001 mh / ea	168	45.62 /mh	7,666	225.05	12,603	-	-	-	-	-	-	20,269	31,260
				Gasket/Nuts/Bolt Kit 48"	26 ea	1.000 mh / ea	26	32.89 /mh	855	425.00	11,050	-	-	-	-	-	-	11,905	18,124
				DI Flanged Joint Pipe 12"	400 lf	1.890 mh / lf	756	45.62 /mh	34,497	112.94	45,176	-	-	-	-	-	-	79,673	123,163
				DI Flanged Joint Pipe 16"	77 lf	2.170 mh / lf	167	30.57 /mh	5,107	162.43	12,507	-	-	-	-	-	-	17,614	27,066
				DI Flanged Joint Pipe 18"	12 lf	2.270 mh / lf	27	30.57 /mh	833	183.93	2,207	-	-	-	-	-	-	3,040	4,668
				DI Flanged Joint Pipe 20"	17 lf	2.490 mh / lf	42	30.57 /mh	1,294	211.50	3,595	-	-	-	-	-	-	4,889	7,505
				DI Flanged Joint Pipe 24"	960 lf	2.671 mh / lf	2,564	45.62 /mh	116,962	267.89	257,171	-	-	-	-	-	-	374,133	575,430
				DI Flanged Joint Pipe 36"	666 lf	3.471 mh / lf	2,311	45.62 /mh	105,454	426.62	284,130	-	-	-	-	-	-	389,585	598,133
				DI Flanged Joint Pipe 48"	303 lf	4.370 mh / lf	1,324	30.57 /mh	40,474	711.54	215,597	-	-	-	-	-	-	256,071	391,274
				DI Flanged 90 ell 12"	12 ea	11.012 mh / ea	132	45.62 /mh	6,029	380.78	4,569	-	-	-	-	-	-	10,598	16,477
				DI Flanged 90 ell 16"	24 ea	12.680 mh / ea	304	30.57 /mh	9,302	599.40	14,386	-	-	-	-	-	-	23,688	36,556
				DI Flanged 90 ell 24"	28 ea	15.733 mh / ea	441	45.62 /mh	20,098	1,458.29	40,832	-	-	-	-	-	-	60,930	93,781
				DI Flanged 90 ell 30"	27 ea	17.870 mh / ea	482	30.57 /mh	14,748	2,316.60	62,548	-	-	-	-	-	-	77,296	118,273
				DI Flanged 90 ell 48"	1 ea	25.710 mh / ea	26	30.57 /mh	786	6,633.90	6,634	-	-	-	-	-	-	7,420	11,312
				DI Flanged Tee 12"	6 ea	11.012 mh / ea	66	45.62 /mh	3,014	777.86	4,667	-	-	-	-	-	-	7,682	11,854
				DI Flanged Tee 16"	6 ea	12.680 mh / ea	76	30.57 /mh	2,326	0.00	0	-	-	-	-	-	-	2,326	3,681
				DI Flanged Tee 24"	26 ea	15.733 mh / ea	409	45.62 /mh	18,662	2,687.14	69,866	-	-	-	-	-	-	88,528	135,573
				DI Flanged Tee 30"	7 ea	17.874 mh / ea	125	45.62 /mh	5,708	0.00	0	-	-	-	-	-	-	5,708	9,034
				DI Flanged Tee 36"	9 ea	20.524 mh / ea	185	45.62 /mh	8,427	0.00	0	-	-	-	-	-	-	8,427	13,338
				DI Flanged Tee 48"	3 ea	25.710 mh / ea	77	30.57 /mh	2,358	24,816.96	74,451	-	-	-	-	-	-	76,809	115,727
				DI Flanged Cross 48"	6 ea	53.500 mh / ea	321	30.57 /mh	9,812	26,896.80	161,381	-	-	-	-	-	-	171,193	260,460
				DI Flanged Con Red 24x16"	12 ea	15.730 mh / ea	189	30.57 /mh	5,770	1,764.00	21,168	-	-	-	-	-	-	26,938	41,259
				DI Flanged Con Red 48x36"	4 ea	25.710 mh / ea	103	30.57 /mh	3,143	9,912.00	39,648	-	-	-	-	-	-	42,791	65,150
				DI Blind Flange 48"	2 ea	23.590 mh / ea	47	30.57 /mh	1,442	7,186.20	14,372	-	-	-	-	-	-	15,815	24,096
				Chemical Piping & Accessories- ALLOWANCE	1,500 LF	0.240 mh / LF	360	45.62 /mh	16,427	55.01	82,516	-	-	-	-	-	-	98,944	151,236
				40.01 Above Ground Process Piping	2,435 lf		12,250		508,856	632.50	1,540,133	21.99	53,551	13.29	32,366			2,134,906	3,275,645
			40.02	Valves, Meters, Etc.															
				Magnetic Flow Meter - Inline - 24" w/ transmitter	12 ea	26.000 mh / ea	312	43.67 /mh	13,626	12,000.00	144,000	-	-	-	-	-	-	157,626	240,117
				12" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	12 ea	9.600 mh / ea	115	30.57 /mh	3,521	13,040.00	156,480	-	-	-	-	-	-	160,001	243,065
				16" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	24 ea	12.800 mh / ea	307	30.57 /mh	9,390	17,386.00	417,264	-	-	-	-	-	-	426,654	648,150
				24" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	34 ea	19.204 mh / ea	653	45.62 /mh	29,788	26,005.19	884,177	-	-	-	-	-	-	913,965	1,389,075
				36" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	0 ea	26.806 mh / ea	0	45.62 /mh	13	39,008.00	390	-	-	-	-	-	-	403	613
				40.02 Valves, Meters, Etc.	1 ls		1,388		56,338	1,602,310.64	1,602,311							1,658,649	2,521,019
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				64,000.00	64,000					64,000	97,134

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				40.04 Hydropneumatic Piping System	1 ls							64,000.00	64,000					64,000	97,134
				40 Process Piping	3,365 lf		14,280		592,521	990.94	3,324,605	35.04	117,551	10.16	34,098			4,068,775	6,216,274
		41		Material Handling & Process Equipment															
			41.22	Hoists & Cranes															
				Monorail 3 ton 28 ft span, 87 ft runway beam	1 ea			-	-	-	-			-	-	120,000.00	120,000	120,000	182,126
				5 -ton Jib Crane	1 ea	32.000 mh / ea	32	47.77 /mh	1,529	-	-	-	-			25,000.00	25,000	26,529	40,362
				41.22 Hoists & Cranes			32		1,529								145,000	146,529	222,488
				41 Material Handling & Process Equipment	1 ls		32		1,529							145,000.00	145,000	146,529	222,488
		43		Process Equipment															
			43.05	Filtration Equipment															
				Filter Equipment Start-Up	24 ea	150.000 ch / ea	25,200	350.77 /ch	1,262,758	2,500.00	60,000					-	-	1,322,758	2,089,649
				Gravity Filters - Underdrain Blocks, Sand & Anthracite - Purchase	12,696 sf			/sf				-	-	-	-	172.84	2,194,370	2,194,370	3,330,430
				Install Gravel Media 6"	6,348 cf	0.033 mh / cf	206	46.32 /mh	9,557			-	-	6.36	40,382	-	-	49,939	79,394
				Install Anthracite Media 6"	6,348 cf	0.033 mh / cf	206	46.32 /mh	9,557			-	-	6.36	40,382	-	-	49,939	79,394
				New Air Header @ Each Basin	24 ea	16.000 ch / ea	1,920	231.62 /ch	88,940			-	-	3,914.67	93,952	-	-	182,892	290,283
				Install Sand Media .45 - .55 mm, 24"	25,392 cf	0.033 mh / cf	825	46.32 /mh	38,228			-	-	6.36	161,527	-	-	199,755	317,576
				Install Gravity Filter Bottoms/Blocks	12,696 sf	0.180 mh / sf	2,285	46.32 /mh	105,861	1.09	13,872	-	-	15.66	198,803	-	-	318,535	504,999
				43.05 Filtration Equipment	1 ls		30,643		1,514,900	73,871.65	73,872			535,045.63	535,046	2,194,370.37	2,194,370	4,318,188	6,591,736
				43 Process Equipment	1 ls		30,643		1,514,900	73,871.65	73,872			535,045.63	535,046	2,194,370.37	2,194,370	4,318,188	6,591,736
				3D Filtration - Construct New Gravity Filters	1 ls		113,814		4,859,961	6,298,234.04	6,298,234	3,162,970.32	3,162,970	1,259,068.51	1,259,069	2,339,370.37	2,339,370	17,919,604	27,605,679
3E				Filtration - Construct New Gravity Filters & Ozone Facility															
	00			Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	2,842 lf	0.050 mh / lf	142	39.49 /mh	5,612	0.67	1,910	-	-	-	-	-	-	7,523	11,782
				Mat Foundation Edge Form 30"	1,628 sf	0.350 mh / sf	570	39.49 /mh	22,505	1.31	2,137	-	-	-	-	-	-	24,642	38,862
				Mat Foundation Bulkhead Form	1,095 sf	0.350 mh / sf	383	39.49 /mh	15,134	1.52	1,667	-	-	-	-	-	-	16,801	26,483
				Waterstop 6" Flat	2,842 lf	0.110 mh / lf	313	39.18 /mh	12,250	2.10	5,969	-	-	-	-	-	-	18,219	28,448
				Strip & Oil Mat Found. Form	2,723 sf	0.005 mh / sf	14	39.17 /mh	533	0.03	82	-	-	-	-	-	-	615	958
				Rebar- Foundation Mat (100 #/cy)	122 tn	28.006 mh / tn	3,417	43.53 /mh	148,718	997.70	121,719	-	-	-	-	-	-	270,437	420,114
				Rebar Support - bricks (.12/sf)	3,147 ea	0.002 mh / ea	6	43.53 /mh	274	0.26	826	-	-	-	-	-	-	1,100	1,688
				Finish- Hard Trowel	26,221 sf	0.023 mh / sf	603	39.17 /mh	23,626	-	-	-	-	-	-	-	-	23,626	37,393
				Pump Place Mat Foundation 24"	2,428 cy	0.500 mh / cy	1,214	41.39 /mh	50,246	-	-	-	-	4.59	11,140	-	-	61,387	97,256
				4000 psi Concrete	2,428 cy			/cy		142.00	344,776	-	-	-	-	-	-	344,776	523,272
				Liquid Curing Compounds	28,944 sf	0.003 mh / sf	87	39.17 /mh	3,402	0.06	1,702	-	-	-	-	-	-	5,104	7,967
				6 Mil. Vapor Barrier	28,800 sf	0.002 mh / sf	58	43.53 /mh	2,508	0.05	1,512	-	-	-	-	-	-	4,020	6,264
				03.00 Foundation Mat	2,428 cy		6,806		284,807	198.64	482,302			4.59	11,140			778,249	1,200,496
			03.03	Columns															
				Form Rectangle Columns 15'	3,780 sf	0.165 mh / sf	624	39.49 /mh	24,629	1.60	6,034	-	-	-	-	-	-	30,663	48,138
				Chamfer	2,520 lf	0.015 mh / lf	38	39.49 /mh	1,493	0.57	1,429	-	-	-	-	-	-	2,922	4,532
				Strip & Oil Column Form	3,780 sf	0.005 mh / sf	19	39.17 /mh	740	0.03	113	-	-	-	-	-	-	854	1,344
				Superplasticizers @ Columns	53 cy			/cy		8.40	445	-	-	-	-	-	-	445	676
				Column Rebar (120 #/cy)	3 tn	20.004 mh / tn	64	43.53 /mh	2,769	997.70	3,173	-	-	-	-	-	-	5,942	9,198
				Finish- Float	95 sf	0.017 mh / sf	2	39.17 /mh	63	-	-	-	-	-	-	-	-	63	100
				Pump Place Columns 42 ea	53 cy	1.600 mh / cy	85	41.39 /mh	3,510	-	-	-	-	7.49	397	-	-	3,908	6,188
				4000 psi Concrete	53 cy			/cy		142.00	7,526	-	-	-	-	-	-	7,526	11,422
				Grind/Patch Columns	3,780 sf	0.013 mh / sf	49	39.17 /mh	1,925	0.03	113	-	-	-	-	-	-	2,038	3,219
				Rub Columns	3,780 sf	0.065 mh / sf	246	39.17 /mh	9,623	0.06	227	-	-	-	-	-	-	9,850	15,575
				Liquid Curing Compounds	3,780 sf	0.003 mh / sf	11	39.17 /mh	444	0.06	222	-	-	-	-	-	-	667	1,041
				03.03 Columns	53 cy		1,137		45,197	363.83	19,283			7.49	397			64,877	101,433
			03.04	Walls															
				Keyway 6"	7,106 lf	0.050 mh / lf	355	39.49 /mh	14,033	0.67	4,776	-	-	-	-	-	-	18,809	29,459
				Vertical Wall Keyway 6"	1,415 lf	0.110 mh / lf	156	39.49 /mh	6,148	0.67	951	-	-	-	-	-	-	7,099	11,173
				Panel Form System 10' h	1,109 sf	0.150 mh / sf	166	39.49 /mh	6,570	1.84	2,038	-	-	-	-	-	-	8,608	13,492
				Panel Form System 20' & 25' h	111,995 sf	0.190 mh / sf	21,283	39.49 /mh	840,435	1.84	205,832	-	-	-	-	-	-	1,046,267	1,642,563
				Waterstop 6" Flat	8,521 lf	0.110 mh / lf	937	39.18 /mh	36,727	2.10	17,898	-	-	-	-	-	-	54,625	85,293
				Strip & Oil Wall Forms	113,104 sf	0.005 mh / sf	566	39.17 /mh	22,154	0.03	3,394	-	-	-	-	-	-	25,548	40,215
				Superplasticizers @ Walls	3,094 cy			/cy		8.40	25,993	-	-	-	-	-	-	25,993	39,450
				Rebar- Walls (125 #/cy)	194 tn	15.003 mh / tn	2,911	43.53 /mh	126,689	997.70	193,554	-	-	-	-	-	-	320,243	494,272
				Finish- Top of Wall	3,483 sf	0.008 mh / sf	28	39.17 /mh	1,092	-	-	-	-	-	-	-	-	1,092	1,728
				Pump Place Walls 12"	430 cy	1.150 mh / cy	495	41.39 /mh	20,470	-	-	-	-	6.65	2,861	-	-	23,331	36,952
				Pump Place Walls 18"	2,002 cy	1.150 mh / cy	2,303	41.39 /mh	95,309	-	-	-	-	6.65	13,312	-	-	108,621	172,034
				Pump Place Walls 24"	662 cy	1.150 mh / cy	761	41.39 /mh	31,515	-	-	-	-	6.65	4,404	-	-	35,919	56,889
				4000 psi Concrete	3,094 cy			/cy		142.00	439,348	-	-	-	-	-	-	439,348	666,805
				Grind/Patch Walls	113,104 sf	0.013 mh / sf	1,471	39.17 /mh	57,601	0.03	3,394	-	-	-	-	-	-	60,995	96,317
				Rub Walls	96,854 sf	0.058 mh / sf	5,618	39.17 /mh	220,022	0.06	5,811	-	-	-	-	-	-	225,833	357,052
				Liquid Curing Compounds	112 sf	0.002 mh / sf	0	39.17 /mh	9	0.06	7	-	-	-	-	-	-	15	24
				03.04 Walls	3,094 cy		37,049		1,478,773	291.85	902,995			6.65	20,577			2,402,345	3,743,716
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	17,177 sf	0.180 mh / sf	3,092	39.49 /mh	122,116	2.18	37,522			-	-	-	-	159,638	250,222
				Slab Edge Form 12"	4,181 sf	0.250 mh / sf	1,045	39.49 /mh	41,283	5.17	21,620			-	-	-	-	62,903	98,153
				Strip & Oil Suspended Slab Forms	21,358 sf	0.005 mh / sf	107	39.17 /mh	4,183	0.04	876			-	-	-	-	5,059	7,950
				Superplasticizers	647 cy			-	-	8.40	5,435			-	-	-	-	5,435	8,249
				Rebar- Suspended Slab (225 #/cy)	73 tn	20.004 mh / tn	1,460	43.53 /mh	63,562	997.70	72,832	-	-	-	-	-	-	136,394	211,139
				Finish- Hard Trowel	17,177 sf	0.030 mh / sf	515	39.17 /mh	20,187	-	-			-	-	-	-	20,187	31,951
				Pump Place Suspended Slab 12"	647 cy	1.800 mh / cy	1,165	41.39 /mh	48,211	-	-			6.65	4,304	-	-	52,516	83,155
				4000 psi Concrete	647 cy			-	-	142.00	91,874			-	-	-	-	91,874	139,439
				Liquid Curing Compounds	0 sf	0.003 mh / sf	0	39.17 /mh		1.00	0			-	-	-	-	0	0
				03.06 Suspended Flat Slab	647 cy		7,385		299,543	355.73	230,159			6.65	4,304			534,007	830,258
			03.07	Suspended Beams															
				Beam Side Forms	10,878 sf	0.210 mh / sf	2,285	39.49 /mh	90,224	2.21	23,991	-	-	-	-	-	-	114,214	179,210
				Beam Bottom Forms	3,146 sf	0.210 mh / sf	661	39.49 /mh	26,093	2.21	6,938	-	-	-	-	-	-	33,032	51,829
				Chamfer	4,194 lf	0.015 mh / lf	63	39.49 /mh	2,485	0.57	2,378	-	-	-	-	-	-	4,863	7,542
				Strip & Oil Beam Forms	14,024 sf	0.005 mh / sf	70	39.17 /mh	2,747	0.03	421	-	-	-	-	-	-	3,168	4,986
				Superplasticizers @ Beams	302 cy			/cy		8.40	2,537	-	-	-	-	-	-	2,537	3,851
				Rebar- Beams (250 #/cy)	38 tn	15.003 mh / tn	570	43.53 /mh	24,815	997.70	37,913	-	-	-	-	-	-	62,728	96,815
				Finish- Top of Beam	3,145 sf	0.008 mh / sf	25	39.17 /mh	986	-	-	-	-	-	-	-	-	986	1,560
				Pump Place Beams @ Roof	302 cy	2.001 mh / cy	604	41.39 /mh	25,011	-	-	-	-	14.42	4,355	-	-	29,367	46,517
				4000 psi Concrete	302 cy			/cy		142.00	42,884	-	-	-	-	-	-	42,884	65,086
				Grind/Patch Beams	14,024 sf	0.013 mh / sf	182	39.17 /mh	7,142	0.03	421	-	-	-	-	-	-	7,563	11,942
				Rub Beams	14,024 sf	0.085 mh / sf	1,192	39.17 /mh	46,689	0.06	841	-	-	-	-	-	-	47,530	75,172
				Liquid Curing Compounds	14,024 sf	0.002 mh / sf	28	39.17 /mh	1,099	0.06	825	-	-	-	-	-	-	1,924	2,991

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				03.07 Suspended Beams	302 cy		5,681		227,290	394.53	119,149			14.42	4,355			350,795	547,502
			03.09	Pan Stair Fill															
				Finish Stairs	415 sf	0.055 mh / sf	23	39.17 /mh	894	-	-	-	-	-	-	-	-	894	1,415
				Pump Place Pan Stair Concrete	6 cy	3.001 mh / cy	18	41.39 /mh	745	-	-	-	-	9.17	55	-	-	800	1,257
				3000 psi Concrete	6 cy			-	-	136.00	828	-	-	-	-	-	-	828	1,257
				03.09 Pan Stair Fill	6 cy		41		1,639	138.00	828			9.17	55			2,522	3,939
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	25,298 sf	0.020 mh / sf	506	42.24 /mh	21,376	8.80	222,667	-	-	0.35	8,902	-	-	252,945	385,945
				03.20 Precast Planks	25,298 sf		506		21,376	8.80	222,667			0.35	8,902			252,945	385,945
			04.00	Masonry															
				8" CMU + Rigid Insulation Backup To Brick, 20' h	12,093 sf			/sf		-	-	18.00	217,717	-	-	-	-	217,717	330,433
				8" CMU + Rigid Insulation Backup To Brick @ Parapet 3.67' h	2,576 sf			/sf		-	-	18.00	46,368	-	-	-	-	46,368	70,373
				Precast Cap 16" x 4"	644 lf			/lf		-	-	20.00	12,883	-	-	-	-	12,883	19,552
				Brick Veneer @ Block Wall Backup & Concrete Beam	16,601 sf			-	-	-	-	9.00	149,439	-	-	-	-	149,439	226,806
				04.00 Masonry	16,601 sf							25.69	426,407					426,407	647,164
			05.01	Misc Metals															
				Metal Stairs Concrete Pans	132 rs	0.067 mh / rs	9	42.08 /mh	370	80.02	10,562	-	-	-	-	-	-	10,933	16,617
				Metal Stair Landing Concrete Pans	8 ea	4.000 mh / ea	32	42.08 /mh	1,347	800.00	6,400	-	-	-	-	-	-	7,747	11,845
				Alum Stair Wall Handrail	112 lf	0.150 mh / lf	17	42.08 /mh	707	16.80	1,882	-	-	-	-	-	-	2,589	3,975
				Aluminum 3 Line Rail @ Basins	1,512 lf	0.234 mh / lf	354	42.08 /mh	14,892	44.11	66,693	-	-	-	-	-	-	81,585	124,790
				Aluminum Handrail @ Pan Stairs	112 lf	0.234 mh / lf	26	42.08 /mh	1,103	44.11	4,940	-	-	-	-	-	-	6,043	9,244
				Alum Grate Cover .75" @ 4'x4' Sump	12 ea	0.600 mh / ea	7	42.08 /mh	303	185.04	2,220	-	-	-	-	-	-	2,523	3,850
				Aluminum Hatch & Frame Over Pipe Gallery 6.33' x 6.33'	12 ea	8.002 mh / ea	96	39.18 /mh	3,762	5,001.00	60,012	-	-	-	-	-	-	63,774	97,035
				05.01 Misc Metals	1 ls		541		22,484	152,709.28	152,709							175,193	267,355
			06.00	Wood															
				Misc Nailers & Blocking	26,076 sf	0.010 mh / sf	261	39.67 /mh	10,347	0.40	10,465	-	-	-	-	-	-	20,812	32,259
				06.00 Wood	1 ls		261		10,347	10,465.09	10,465							20,812	32,259
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	1,494 lf			/lf				4.00	5,977	-	-	-	-	5,977	9,072
				Caulking @ Masonry Wall Joints- Interior	1,494 lf			/lf				4.00	5,977	-	-	-	-	5,977	9,072
				07.00 Moisture Protection	1 ls							11,954.41	11,954					11,954	18,143
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	26,076 sf			/sf				3.00	78,244					78,244	118,752
				Aluminum Downspouts, 14 ea	280 lf			/lf				18.00	5,041					5,041	7,651
				Scuppers	14 ea			/ea				50.01	700					700	1,063
				Aluminum Coping @ Roof Parapet 12" wide	650 lf			/lf				15.00	9,752					9,752	14,801
				Roof Hatch 4'0" x 4'0"	1 ea			/ea				2,200.44	2,200					2,200	3,340
				07.01 Roofing	26,076 sf							3.68	95,937					95,937	145,605
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	8 ea	1.000 mh / ea	8	39.18 /mh	313	180.04	1,440	-	-	-	-	-	-	1,754	2,682
				HM Door Leafs- 3'x7' 20 ga. half glass	8 ea	1.500 ea / mh	5	39.18 /mh	209	450.09	3,601	-	-	-	-	-	-	3,810	5,796
				Finish Hardware by Leaf- Allowance	8 ea	8.002 mh / ea	64	39.18 /mh	2,508	900.18	7,201	-	-	-	-	-	-	9,709	14,899
				08.00 Doors, Frames & Hardware	8 ea		77		3,030	1,530.31	12,242							15,273	23,376
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	8 ea			/ea		-	-	100.02	800	-	-	-	-	800	1,214
				Paint HM Doors - primer (2) coats	8 ea			/ea		-	-	140.03	1,120	-	-	-	-	1,120	1,700
				Paint CMU Block - block filler & (2) coat	12,093 sf			-	-	-	-	1.35	16,326	-	-	-	-	16,326	24,778
				09.00 Finishes	1 ls							18,245.93	18,246					18,246	27,692
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	8 ea			/ea				30.01	240	-	-	-	-	240	364
				Fire Extinguisher CO2 10 lbs	8 ea			/ea				225.05	1,800					1,800	2,732
				10.00 Specialty Items	1 ls							5,041.02	5,041					5,041	7,651
			22.00	Plumbing															
				Plumbing Subcontract	25,300 sf			/sf				4.00	101,220					101,220	153,623
				22.00 Plumbing	1 ls							101,220.21	101,220					101,220	153,623
			23.00	HVAC															
				Ventilation & Unit Heater System	25,300 sf			/sf		-	-	45.00	1,138,500	-	-	-	-	1,138,500	1,727,919
				23.00 HVAC	25,300 sf							45.00	1,138,500					1,138,500	1,727,919
			31.01	Dewatering															
				Dewatering - Well Point System Installation	1 sys	240.048 ch / sys	960	159.35 /ch	38,251	7,501.50	7,502	-	-	33,599.22	33,599	-	-	79,352	125,400
				Dewatering - Well Point System Monthly Rental	4 mo	13.288 mh / mo	53	39.17 /mh	2,082	5,704.89	22,820	-	-	22,004.39	88,018	-	-	112,919	170,010
				Dewatering - Well Point System Removal	1 sys	60.012 ch / sys	240	159.35 /ch	9,563	2,500.50	2,501	-	-	8,399.94	8,400	-	-	20,463	32,299
				31.01 Dewatering	1 ls		1,253		49,896	32,821.55	32,822			130,016.73	130,017			212,734	335,708
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 329 ea (1 per 77 sf)	8,225 vf	0.002 cd / vf	921	2,146.97 /cd	35,325	35.16	289,162	-	-	2.58	21,223	-	-	345,710	528,551
				31.02 Piles	329 ea		921		35,325	878.91	289,162			64.51	21,223			345,710	528,551
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (700' x 36' deep)	25,200 sf	0.001 cd / sf	1,242	2,465.38 /cd	47,851	16.00	403,280	-	-	0.75	18,952	-	-	470,084	717,962
				Tie Backs (1 per 80 sf of Sheeting, 700' x 28'= 19,600 sf)	245 ea			-	-	-	-	2,377.48	582,481	-	-	-	-	582,481	884,041
				31.03 Excavation Shoring	25,200 sf		1,242		47,851	16.00	403,280	23.71	597,484	0.75	18,952			1,067,568	1,624,773
			31.10	Structure Excavation															
				Exc Clay-Backhoe/Truck (30,336 sf x 28')	31,460 cy	499.900 cy / cd	2,266	1,410.06 /cd	88,738	-	-	-	-	6.58	207,133	-	-	295,872	470,103
				31.10 Structure Excavation	31,460 cy		2,266		88,738					6.58	207,133			295,872	470,103
			31.12	Structure Backfill															
				BackFill Earth-Backhoe/Truck	4,358 cy	495.000 cy / cd	282	1,327.72 /cd	11,689			-	-	4.69	20,425	-	-	32,114	51,007
				31.12 Structure Backfill	4,358 cy		282		11,689					4.69	20,425			32,114	51,007
			31.13	Soil Disposal															
				Spoils to Waste	27,102 cy	0.003 day / cy	2,440	1,410.06 /day	95,557	-	-	-	-	8.23	223,050	-	-	318,607	506,228
				31.13 Soil Disposal	27,102 cy		2,440		95,557					8.23	223,050			318,607	506,228
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 26,400 sf x 6"	489 cy	0.003 cd / cy	59	1,609.56 /cd	2,385	28.28	13,829	-	-	10.02	4,898	-	-	21,112	32,558
				31.20 Structure Stone Base	489 cy		59		2,385	28.28	13,829			10.02	4,898			21,112	32,558
				00 Building & Structure Construction	26,076 gsf		67,948		2,725,928	110.90	2,891,894	91.84	2,394,790	25.90	675,429			8,688,041	13,413,007
		26		Electrical & Instrumentation															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			26.00	UG Electrical															
				UG Electrical System	25,300 sf			/sf				16.00	404,881					404,881	614,494
				26.00 UG Electrical									404,881					404,881	614,494
			26.01	Above Ground Electrical															
				Building Electrical Systems	25,300 sf			/sf				4.00	101,200					101,200	153,593
				Electrical Work For Equipment (3% Equipment Cost)	1 ls			/ls				65,820.00	65,820					65,820	99,896
				26.01 Above Ground Electrical									167,020					167,020	253,489
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1 % Equipment Cost)	1 ls			/ls				21,944.00	21,944					21,944	33,305
				26.02 Instrumentation & Controls									21,944					21,944	33,305
				26 Electrical & Instrumentation	1 ls							593,844.81	593,845					593,845	901,288
		40		Process Piping															
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	920 lf	600.000 lf / cd	86	2,539.31 /cd	3,894			-	-	1.88	1,733	-	-	5,627	8,921
				Stone Pipe Bedding	136 cy	199.900 cy / cd	49	2,896.43 /cd	1,971	23.29	3,168	-	-			-	-	5,138	7,927
				DI Pipe Push - Class 52 30	794 lf	0.440 mh / lf	349	51.34 /mh	17,936	167.28	132,818	-	-			-	-	150,754	229,967
				DI Pipe Push - Class 52 48	126 lf	0.640 mh / lf	81	/mh		365.30	46,028	-	-	-	-	-	-	46,028	69,857
				Hydrostatic Testing	920 lf	0.021 ch / lf	77	182.49 /ch	3,527	0.16	147	-	-	-	-	-	-	3,674	5,805
				40.00 Under Ground Process Piping	920 lf		642		27,326	198.00	182,161			1.88	1,733			211,220	322,476
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	489 lf			-	-	-	-	10.00	4,891	-	-	-	-	4,891	7,423
				Paint & Stencil Exposed Piping >20"	1,946 lf			-	-	-	-	25.01	48,660	-	-	-	-	48,660	73,852
				Pipe Supports	60 ea	4.001 mh / ea	240	45.62 /mh	10,951	250.05	15,003	-	-			-	-	25,954	40,103
				Hydrostatic Testing	2,435 lf	0.021 ch / lf	205	182.49 /ch	9,333	0.16	390	-	-	-	-	-	-	9,723	15,363
				Dresser Couplings 48"	12 ea	27.200 mh / ea	326	40.79 /mh	13,313	2,400.00	28,800	-	-	-	-	-	-	42,113	64,780
				12" DI Wall Thimble 24" long	12 ea	1.250 ch / ea	60	182.49 /ch	2,737	430.09	5,161	-	-	301.00	3,612	-	-	11,510	17,914
				24" DI Wall Thimble 24" long	24 ea	2.501 ch / ea	240	182.49 /ch	10,951	860.17	20,644	-	-	602.12	14,451	-	-	46,046	71,664
				30" DI Wall Thimble 24" long	7 ea	3.751 ch / ea	105	182.49 /ch	4,792	1,100.21	7,701	-	-	900.35	6,302	-	-	18,795	29,303
				36" DI Wall Thimble 24" long	4 ea	5.001 ch / ea	80	182.49 /ch	3,650	1,286.26	5,145	-	-	1,200.24	4,801	-	-	13,596	21,227
				48" DI Wall Thimble 24" long	2 ea	6.700 ch / ea	54	182.49 /ch	2,445	1,715.00	3,430	-	-	1,600.00	3,200	-	-	9,075	14,169
				Gasket/Nuts/Bolt Kit 12"	40 ea	1.000 mh / ea	40	45.62 /mh	1,825	45.01	1,800	-	-	-	-	-	-	3,626	5,621
				Gasket/Nuts/Bolt Kit 16"	8 ea	1.000 mh / ea	8	32.89 /mh	263	46.64	373	-	-	-	-	-	-	636	983
				Gasket/Nuts/Bolt Kit 18"	1 ea	1.000 mh / ea	1	32.89 /mh	33	63.09	63	-	-	-	-	-	-	96	148
				Gasket/Nuts/Bolt Kit 20"	2 ea	1.000 mh / ea	2	32.89 /mh	66	94.52	189	-	-	-	-	-	-	255	391
				Gasket/Nuts/Bolt Kit 24"	80 ea	2.000 mh / ea	160	45.62 /mh	7,301	129.48	10,358	-	-	-	-	-	-	17,659	27,276
				Gasket/Nuts/Bolt Kit 36"	56 ea	3.001 mh / ea	168	45.62 /mh	7,666	225.05	12,603	-	-	-	-	-	-	20,269	31,260
				Gasket/Nuts/Bolt Kit 48"	26 ea	1.000 mh / ea	26	32.89 /mh	855	425.00	11,050	-	-	-	-	-	-	11,905	18,124
				DI Flanged Joint Pipe 12"	400 lf	1.890 mh / lf	756	45.62 /mh	34,497	112.94	45,176	-	-	-	-	-	-	79,673	123,163
				DI Flanged Joint Pipe 16"	77 lf	2.170 mh / lf	167	30.57 /mh	5,107	162.43	12,507	-	-	-	-	-	-	17,614	27,066
				DI Flanged Joint Pipe 18"	12 lf	2.270 mh / lf	27	30.57 /mh	833	183.93	2,207	-	-	-	-	-	-	3,040	4,668
				DI Flanged Joint Pipe 20"	17 lf	2.490 mh / lf	42	30.57 /mh	1,294	211.50	3,595	-	-	-	-	-	-	4,889	7,505
				DI Flanged Joint Pipe 24"	960 lf	2.671 mh / lf	2,564	45.62 /mh	116,962	267.89	257,171	-	-	-	-	-	-	374,133	575,430
				DI Flanged Joint Pipe 36"	666 lf	3.471 mh / lf	2,311	45.62 /mh	105,454	426.62	284,130	-	-	-	-	-	-	389,585	598,133
				DI Flanged Joint Pipe 48"	303 lf	4.370 mh / lf	1,324	30.57 /mh	40,474	711.54	215,597	-	-	-	-	-	-	256,071	391,274
				DI Flanged 90 ell 12"	12 ea	11.012 mh / ea	132	45.62 /mh	6,029	380.78	4,569	-	-	-	-	-	-	10,598	16,477
				DI Flanged 90 ell 16"	24 ea	12.680 mh / ea	304	30.57 /mh	9,302	599.40	14,386	-	-	-	-	-	-	23,688	36,556
				DI Flanged 90 ell 24"	28 ea	15.733 mh / ea	441	45.62 /mh	20,098	1,458.29	40,832	-	-	-	-	-	-	60,930	93,781
				DI Flanged 90 ell 30"	27 ea	17.870 mh / ea	482	30.57 /mh	14,748	2,316.60	62,548	-	-	-	-	-	-	77,296	118,273
				DI Flanged 90 ell 48"	1 ea	25.710 mh / ea	26	30.57 /mh	786	6,633.90	6,634	-	-	-	-	-	-	7,420	11,312
				DI Flanged Tee 12"	6 ea	11.012 mh / ea	66	45.62 /mh	3,014	777.86	4,667	-	-	-	-	-	-	7,682	11,854
				DI Flanged Tee 16"	6 ea	12.680 mh / ea	76	30.57 /mh	2,326	0.00	0	-	-	-	-	-	-	2,326	3,681
				DI Flanged Tee 24"	26 ea	15.733 mh / ea	409	45.62 /mh	18,662	2,687.14	69,866	-	-	-	-	-	-	88,528	135,573
				DI Flanged Tee 30"	7 ea	17.874 mh / ea	125	45.62 /mh	5,708	0.00	0	-	-	-	-	-	-	5,708	9,034
				DI Flanged Tee 36"	9 ea	20.524 mh / ea	185	45.62 /mh	8,427	0.00	0	-	-	-	-	-	-	8,427	13,338
				DI Flanged Tee 48"	3 ea	25.710 mh / ea	77	30.57 /mh	2,358	24,816.96	74,451	-	-	-	-	-	-	76,809	116,727
				DI Flanged Cross 48"	6 ea	53.500 mh / ea	321	30.57 /mh	9,812	26,896.80	161,381	-	-	-	-	-	-	171,193	260,460
				DI Flanged Con Red 24x16"	12 ea	15.730 mh / ea	189	30.57 /mh	5,770	1,764.00	21,168	-	-	-	-	-	-	26,938	41,259
				DI Flanged Con Red 48x36"	4 ea	25.710 mh / ea	103	30.57 /mh	3,143	9,912.00	39,648	-	-	-	-	-	-	42,791	65,150
				DI Blind Flange 48"	2 ea	23.590 mh / ea	47	30.57 /mh	1,442	7,186.20	14,372	-	-	-	-	-	-	15,815	24,096
				Chemical Piping & Accessories- ALLOWANCE	1,500 LF	0.240 mh / LF	360	45.62 /mh	16,427	55.01	82,516	-	-	-	-	-	-	98,944	151,236
				40.01 Above Ground Process Piping	2,435 lf		12,250		508,856	632.50	1,540,133	21.99	53,551	13.29	32,366			2,134,906	3,275,645
			40.02	Valves, Meters, Etc.															
				Magnetic Flow Meter - Inline - 24" w/ transmitter	12 ea	26.000 mh / ea	312	43.67 /mh	13,626	12,000.00	144,000	-	-	-	-	-	-	157,626	240,117
				12" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	12 ea	9.600 mh / ea	115	30.57 /mh	3,521	13,040.00	156,480	-	-	-	-	-	-	160,001	243,065
				16" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	24 ea	12.800 mh / ea	307	30.57 /mh	9,390	17,386.00	417,264	-	-	-	-	-	-	426,654	648,150
				24" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	34 ea	19.204 mh / ea	653	45.62 /mh	29,788	26,005.19	884,177	-	-	-	-	-	-	913,965	1,389,075
				36" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	0 ea	28.806 mh / ea	0	45.62 /mh	13	39,008.00	390	-	-	-	-	-	-	403	613
				40.02 Valves, Meters, Etc.	1 ls		1,388		56,338	1,602,310.64	1,602,311							1,658,649	2,521,019
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				64,000.00	64,000					64,000	97,134
				40.04 Hydropneumatic Piping System	1 ls							64,000.00	64,000					64,000	97,134
				40 Process Piping	3,355 lf		14,280		592,521	990.94	3,324,605	35.04	117,551	10.16	34,099			4,068,775	6,216,274
		41		Material Handling & Process Equipment															
			41.22	Hoists & Cranes															
				Monorail 3 ton 28 ft span, 87 ft runway beam	1 ea			-	-	-	-			-	-	120,000.00	120,000	120,000	182,126
				5 -ton Jib Crane	1 ea	32.000 mh / ea	32	47.77 /mh	1,529	-	-	-	-			25,000.00	25,000	26,529	40,362
				41.22 Hoists & Cranes			32		1,529								145,000	146,529	222,488
				41 Material Handling & Process Equipment	1 ls		32		1,529							145,000.00	145,000	146,529	222,488
		43		Process Equipment															
			43.05	Filtration Equipment															
				Filter Equipment Start-Up	24 ea	150.000 ch / ea	25,200	350.77 /ch	1,262,758	2,500.00	60,000							1,322,758	2,089,649
				Gravity Filters - Underdrain Blocks, Sand & Anthracite - Purchase	12,696 sf			/sf				-	-	-	-	172.84	2,194,370	2,194,370	3,330,430
				Install Gravel Media 6"	6,348 cf	0.033 mh / cf	206	46.32 /mh	9,557			-	-	6.36	40,382	-	-	49,939	79,394
				Install Anthracite Media 6"	6,348 cf	0.033 mh / cf	206	46.32 /mh	9,557			-	-	6.36	40,382	-	-	49,939	79,394
				New Air Header @ Each Basin	24 ea	16.000 ch / ea	1,920	231.62 /ch	88,940			-	-	3,914.67	93,952	-	-	182,892	290,293
				Install Sand Media .45 - .55 mm, 24"	25,392 cf	0.033 mh / cf	825	46.32 /mh	38,228			-	-	6.36	161,527	-	-	199,755	317,576
				Install Gravity Filter Bottoms/Blocks	12,696 sf	0.180 mh / sf	2,285	46.32 /mh	105,861	1.09	13,872	-	-	15.66	198,803	-	-	318,535	504,998
				43.05 Filtration Equipment			30,643		1,514,900		73,872				535,046		2,194,370	4,318,188	6,691,736
				43 Process Equipment	1 ls		30,643		1,514,900	73,871.65	73,872			535,045.63	535,046	2,194,370.37	2,194,370	4,318,188	6,691,736
		47.6		Ozone Facility															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.03	Columns															
				Form Rectangle Columns 12" h	1,536 sf	0.165 mh / sf	253	39.49 /mh	10,008	1.60	2,452	-	-	-	-	-	-	12,460	19,561
				Chamfer	1,152 lf	0.015 mh / lf	17	39.49 /mh	682	0.57	653	-	-	-	-	-	-	1,336	2,072
				Strip & Oil Column Form	1,536 sf	0.005 mh / sf	8	39.17 /mh	301	0.03	46	-	-	-	-	-	-	347	546
				Superplasticizers @ Columns	19 cy			/cy		8.40	160	-	-	-	-	-	-	160	242
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	23	43.53 /mh	993	997.70	1,137	-	-	-	-	-	-	2,130	3,297
				Finish- Float	42 sf	0.017 mh / sf	1	39.17 /mh	28	-	-	-	-	-	-	-	-	28	44
				Pump Place Columns 24 ea	19 cy	1.600 mh / cy	30	41.39 /mh	1,258	-	-	-	-	7.49	142	-	-	1,401	2,218
				4000 psi Concrete	19 cy			/cy		142.00	2,698	-	-	-	-	-	-	2,698	4,095
				Grind/Patch Columns	1,536 sf	0.013 mh / sf	20	39.17 /mh	782	0.03	46	-	-	-	-	-	-	828	1,308
				Rub Columns	1,536 sf	0.065 mh / sf	100	39.17 /mh	3,910	0.06	92	-	-	-	-	-	-	4,003	6,329
				Liquid Curing Compounds	1,536 sf	0.003 mh / sf	5	39.17 /mh	181	0.06	90	-	-	-	-	-	-	271	423
				03.03 Columns	19 cy		457		18,143	388.16	7,375			7.49	142			25,661	40,135
			03.05	Slab On Grade															
				Slab Edge Form 28"	715 sf	0.350 mh / sf	250	39.49 /mh	9,884	1.31	939	-	-	-	-	-	-	10,822	17,068
				Strip & Oil Form	715 sf	0.005 mh / sf	4	39.17 /mh	140	0.03	21	-	-	-	-	-	-	162	254
				Rebar- SOG (125 #/cy)	12 tn	14.003 mh / tn	168	43.53 /mh	7,314	997.70	11,972	-	-	-	-	-	-	19,286	29,747
				Mesh Support - bricks (.12/sf)	689 ea	0.002 mh / ea	1	43.53 /mh	60	0.26	181	-	-	-	-	-	-	241	369
				Finish- Hard Trowel	5,740 sf	0.015 mh / sf	86	39.17 /mh	3,373	-	-	-	-	-	-	-	-	3,373	5,338
				Pump Place Slab on Grade 8"	142 cy	0.500 mh / cy	71	41.39 /mh	2,939	-	-	-	-	3.67	521	-	-	3,460	5,481
				Pump Place Thickened Slab 28" x 20"	45 cy	0.500 mh / cy	23	41.39 /mh	931	-	-	-	-	3.67	165	-	-	1,097	1,737
				4000 psi Concrete	187 cy			/cy		142.00	26,554	-	-	-	-	-	-	26,554	40,301
				Saw Cut S-O-G (.08/sf)	459 lf	0.030 mh / lf	14	39.17 /mh	539	0.17	78	-	-	0.95	437	-	-	1,054	1,668
				Liquid Curing Compounds	6,455 sf	0.002 mh / sf	13	39.17 /mh	506	0.06	380	-	-	-	-	-	-	885	1,377
				Seal Floors	5,740 sf	0.002 mh / sf	11	39.17 /mh	450	0.09	530	-	-	-	-	-	-	980	1,517
				6 MIL Vapor Barrier	16,300 sf	0.002 mh / sf	33	43.53 /mh	1,419	0.05	856	-	-	-	-	-	-	2,275	3,545
				Gravel Fill Under Slab 4"	70 cy	0.004 cd / cy	8	1,412.15 /cd	375	29.26	2,048	-	-	3.84	269	-	-	2,691	4,129
				03.05 Slab On Grade	187 cy		682		27,930	232.94	43,559			7.44	1,392			72,882	112,532
			03.07	Suspended Beams															
				Beam Side Forms	2,932 sf	0.210 mh / sf	616	39.49 /mh	24,318	2.21	6,466	-	-	-	-	-	-	30,785	48,303
				Beam Bottom Forms	975 sf	0.210 mh / sf	205	39.49 /mh	8,087	2.21	2,150	-	-	-	-	-	-	10,237	16,063
				Chamfer	1,466 lf	0.015 mh / lf	22	39.49 /mh	869	0.57	831	-	-	-	-	-	-	1,700	2,636
				Strip & Oil Beam Forms	3,907 sf	0.005 mh / sf	20	39.17 /mh	765	0.03	117	-	-	-	-	-	-	883	1,389
				Superplasticizers @ Beams	72 cy			/cy		8.40	605	-	-	-	-	-	-	606	918
				Rebar- Beams (250 #/cy)	9 tn	15.003 mh / tn	135	43.53 /mh	5,877	997.70	8,979	-	-	-	-	-	-	14,857	22,930
				Finish- Top of Beam	975 sf	0.008 mh / sf	8	39.17 /mh	306	-	-	-	-	-	-	-	-	306	484
				Pump Place Beams @ Roof	72 cy	2.001 mh / cy	144	41.39 /mh	5,963	-	-	-	-	14.42	1,038	-	-	7,001	11,090
				4000 psi Concrete	72 cy			/cy		142.00	10,224	-	-	-	-	-	-	10,224	15,517
				Grind/Patch Beams	3,907 sf	0.013 mh / sf	51	39.17 /mh	1,990	0.03	117	-	-	-	-	-	-	2,107	3,327
				Rub Beams	3,907 sf	0.085 mh / sf	332	39.17 /mh	13,007	0.06	234	-	-	-	-	-	-	13,242	20,942
				Liquid Curing Compounds	3,907 sf	0.002 mh / sf	8	39.17 /mh	306	0.06	230	-	-	-	-	-	-	536	833
				03.07 Suspended Beams	72 cy		1,540		61,488	416.04	29,955			14.42	1,038			92,481	144,433
			03.08	Pads & Curbs															
				Pad Forms 8" h	264 sf	0.200 mh / sf	53	39.49 /mh	2,085	1.52	402	-	-	-	-	-	-	2,487	3,911
				Chamfer	394 lf	0.015 mh / lf	6	39.49 /mh	233	0.57	223	-	-	-	-	-	-	457	709
				Strip & Oil Equipment Curb Forms	264 sf	0.005 mh / sf	1	39.17 /mh	52	0.03	8	-	-	-	-	-	-	60	94
				Rebar- Pads (100 #/cy)	1 tn	18.004 mh / tn	18	43.53 /mh	784	997.70	998	-	-	-	-	-	-	1,781	2,755
				Finish- Float	669 sf	0.017 mh / sf	11	39.17 /mh	446	-	-	-	-	-	-	-	-	446	705
				Pump Place Pads 8"	17 cy	2.501 mh / cy	43	41.39 /mh	1,759	-	-	-	-	9.86	168	-	-	1,927	3,051
				4000 psi Concrete	17 cy			/cy		142.00	2,414	-	-	-	-	-	-	2,414	3,664
				Liquid Curing Compounds	933 sf	0.003 mh / sf	3	39.17 /mh	110	0.06	55	-	-	-	-	-	-	165	257
				03.08 Pads & Curbs	17 cy		135		5,469	241.17	4,100			9.86	168			9,736	15,145
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	5,712 sf	0.020 mh / sf	114	42.24 /mh	4,826	8.80	50,276	-	-	0.35	2,010	-	-	57,112	87,142
				03.20 Precast Planks	5,712 sf		114		4,826	8.80	50,276			0.35	2,010			57,112	87,142
			06.00	Wood															
				PT Roof Blocking @ Top Of Masonry Wall	307 lf	0.035 mh / lf	11	39.67 /mh	426	1.82	559	-	-	-	-	-	-	985	1,522
				06.00 Wood	1 ls		11		426	558.54	559							985	1,522
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	555 lf			/lf				4.00	2,220	-	-	-	-	2,220	3,370
				Caulking @ Masonry Wall Joints- Interior	555 lf			/lf				4.00	2,220	-	-	-	-	2,220	3,370
				07.00 Moisture Protection	1 ls							4,440.88	4,441					4,441	6,740
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	6,168 sf			/sf				3.00	18,508					18,508	28,089
				Aluminum Downspouts, 2 ea x 32' each	64 vf			/vf				18.00	1,152					1,152	1,749
				Scuppers	2 ea			/ea				50.01	100					100	152
				Aluminum Coping @ Roof Parapet 12" wide	313 lf			/lf				15.00	4,696					4,696	7,127
				Translucent Panel Skylight Frame & Panels	1,398 sf			/sf				38.01	53,135					53,135	80,643
				07.01 Roofing	6,168 sf							12.58	77,590					77,590	117,760
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	4 ea	1.000 mh / ea	4	39.18 /mh	157	180.04	720	-	-	-	-	-	-	877	1,341
				HM Door Leafs- 3'x7' 20 ga. half glass	4 ea	1.500 ea / mh	3	39.18 /mh	104	450.09	1,800	-	-	-	-	-	-	1,905	2,898
				Overhead Doors- 10'x10' 24 ga steel manual 1" insuation 26 ga back-up panel	1 ea			-	-	-	-	2,255.00	2,255	-	-	-	-	2,255	3,422
				Finish Hardware by Leaf- Allowance	4 ea	8.002 mh / ea	32	39.18 /mh	1,254	900.18	3,601	-	-	-	-	-	-	4,855	7,449
				08.00 Doors, Frames & Hardware	5 ea		39		1,515	1,224.24	6,121	451.00	2,255					9,891	15,111
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	4 ea			/ea		-	-	100.02	400	-	-	-	-	400	607
				Paint HM Doors - primer (2) coats	4 ea			/ea		-	-	140.03	560	-	-	-	-	560	850
				Paint CMU Block - block filler & (2) coat	6,168 sf			-	-	-	-	1.35	8,327	-	-	-	-	8,327	12,638
				09.00 Finishes	1 ls							9,286.99	9,287					9,287	14,095
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	4 ea			/ea				30.01	120	-	-	-	-	120	182
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	1 ls							4,020.81	4,021					4,021	6,102
			22.00	Plumbing															
				Plumbing Subcontract	5,740 sf			/sf				6.00	34,447					34,447	52,281
				22.00 Plumbing	1 ls							34,446.88	34,447					34,447	52,281
			23.00	HVAC															
				Ventilation & Unit Heater System	5,740 sf			/sf		-	-	45.00	258,300	-	-	-	-	258,300	392,026

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				23.00 HVAC	5,740 sf							45.00	258,300					258,300	392,026
			26.00	UG Electrical															
				Building Electrical System	5,956 sf			/sf				16.00	95,315					95,315	144,661
				26.00 UG Electrical	1 ls							95,315.03	95,315					95,315	144,661
			26.01	Above Ground Electrical															
				Building Electrical System	5,956 sf			/sf				8.00	47,658					47,658	72,331
				Electrical Work For Equipment (3% Equipment Cost)	1 ls			/ls				99,000.00	99,000					99,000	150,254
				26.01 Above Ground Electrical	1 ls							146,657.51	146,658					146,658	222,584
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1% Equipment Cost)	1 ls			/ls				33,000.00	33,000					33,000	50,085
				26.02 Instrumentation & Controls	1 ls							33,000.00	33,000					33,000	50,085
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	350 lf	600.000 lf / cd	33	2,539.31 /cd	1,481			-	-	1.88	659	-	-	2,141	3,394
				Stone Pipe Bedding	52 cy	200.000 cy / cd	19	2,896.43 /cd	753	23.29	1,211	-	-			-	-	1,964	3,030
				DI Pipe Push - Class 52 8	200 lf	0.250 mh / lf	50	51.34 /mh	2,567	31.86	6,371	-	-	-	-	-	-	8,938	13,733
				DI Pipe Push - Class 52 14	150 lf	0.340 mh / lf	51	51.34 /mh	2,618	65.16	9,774	-	-	-	-	-	-	12,392	18,978
				Hydrostatic Testing	350 lf	0.021 ch / lf	29	182.49 /ch	1,341	0.16	56	-	-	-	-	-	-	1,397	2,208
				DI 90 ell 14"	2 ea	12.060 mh / ea	24	30.57 /mh	737	469.80	940	-	-	-	-	-	-	1,677	2,593
				40.00 Under Ground Process Piping	350 lf		206		9,498	52.43	18,352			1.88	659			28,509	43,935
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	1,192 lf			-	-	-	-	10.00	11,922	-	-	-	-	11,922	18,095
				Pipe Supports	40 ea	4.001 mh / ea	160	45.62 /mh	7,301	250.05	10,002	-	-	-	-	-	-	17,303	26,736
				Hydrostatic Testing	1,192 lf	0.021 ch / lf	100	182.49 /ch	4,569	0.16	191	-	-	-	-	-	-	4,760	7,521
				8" DI Wall Thimble 24" long	4 ea	5.001 ch / ea	80	182.49 /ch	3,650	1,286.25	5,145	-	-	1,200.15	4,801	-	-	13,596	21,227
				Gasket/Nuts/Bolt Kit 4"	16 ea	1.000 mh / ea	16	32.89 /mh	526	7.87	126	-	-	-	-	-	-	652	1,024
				Gasket/Nuts/Bolt Kit 6"	12 ea	1.000 mh / ea	12	32.89 /mh	395	15.87	190	-	-	-	-	-	-	585	914
				Gasket/Nuts/Bolt Kit 8"	24 ea	1.000 mh / ea	24	32.89 /mh	789	22.00	528	-	-	-	-	-	-	1,317	2,051
				Gasket/Nuts/Bolt Kit 12"	30 ea	1.000 mh / ea	30	32.89 /mh	987	45.00	1,350	-	-	-	-	-	-	2,337	3,611
				Gasket/Nuts/Bolt Kit 14"	20 ea	1.000 mh / ea	20	32.89 /mh	658	46.58	932	-	-	-	-	-	-	1,589	2,455
				DI Flanged Joint Pipe 4"	188 lf	0.820 mh / lf	154	30.57 /mh	4,712	30.99	5,825	-	-	-	-	-	-	10,537	16,299
				DI Flanged Joint Pipe 6"	144 lf	0.900 mh / lf	130	30.57 /mh	3,961	47.39	6,824	-	-	-	-	-	-	10,785	16,626
				DI Flanged Joint Pipe 8"	285 lf	0.980 mh / lf	279	30.57 /mh	8,537	67.30	19,180	-	-	-	-	-	-	27,718	42,622
				DI Flanged Joint Pipe 12"	350 lf	1.890 mh / lf	662	30.57 /mh	20,220	112.92	39,521	-	-	-	-	-	-	59,741	91,884
				DI Flanged Joint Pipe 14"	226 lf	2.050 mh / lf	463	30.57 /mh	14,162	138.18	31,228	-	-	-	-	-	-	45,389	69,808
				DI Flanged 90 ell 6"	2 ea	4.830 mh / ea	10	30.57 /mh	295	105.30	211	-	-	-	-	-	-	506	787
				DI Flanged 90 ell 14"	4 ea	12.060 mh / ea	48	30.57 /mh	1,475	469.80	1,879	-	-	-	-	-	-	3,354	5,186
				DI Flanged Tee 6"	2 ea	4.830 mh / ea	10	30.57 /mh	295	0.02	0	-	-	-	-	-	-	295	467
				DI Flanged Tee 8"	4 ea	5.050 mh / ea	20	30.57 /mh	617	313.10	1,252	-	-	-	-	-	-	1,870	2,878
				DI Flanged Con Red 12x8"	4 ea	11.010 mh / ea	44	30.57 /mh	1,346	487.20	1,949	-	-	-	-	-	-	3,295	5,088
				DI Flanged Con Red 14x8"	2 ea	12.060 mh / ea	24	30.57 /mh	737	588.00	1,176	-	-	-	-	-	-	1,913	2,952
				Misc Piping & Accessories- ALLOWANCE	200 LF	0.240 mh / LF	48	45.62 /mh	2,190	55.01	11,002	-	-	-	-	-	-	13,192	20,165
				40.01 Above Ground Process Piping	1,192 lf		2,334		77,424	115.20	138,511	10.00	11,922	4.03	4,801			232,658	358,496
			40.02	Valves, Meters, Etc.															
				6" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	6.200 mh / ea	25	30.57 /mh	758	2,850.00	11,400	-	-	-	-	-	-	12,158	18,502
				Pressure Regulator 8"	2 ea	5.229 mh / ea	10	30.57 /mh	320			-	-	-	-	-	-	320	506
				40.02 Valves, Meters, Etc.	1 ls		35		1,078	11,400.00	11,400							12,478	19,008
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				17,000.00	17,000					17,000	25,801
				40.04 Hydropneumatic Piping System	1 ls							17,000.00	17,000					17,000	25,801
			43.10	Ozone Equipment															
				Freight On Equipment To Jobsite	*1 ls*			/ls											
				Verified Performance Test	*1 ls*			/ls											
				Vendor Verified Performance Test	1 ls			/ls								1,500.00	1,500	1,500	2,277
				Vendor Witnessed, Verified Performance Test	*1 ls*			/ls											
				Equipment Unloading, Setting, Startup & Testing	1 ls	650.000 ch / ls	3,575	182.62 /ch	118,706	500.00	500	-	-	31,005.98	31,006	-	-	150,212	237,984
				Ozone System Equipment	1 ls			/ls								3,300,000.00	3,300,000	3,300,000	5,008,461
				Air Compressor & Receiver	*1 ea*			/ea											
				Destruct Units (Blower, Analyzer, Preheater, Destruct Vessel)	*2 ea*			/ea											
				Blower Silencer	*2 ea*			/ea											
				Catalytic Chamber	*2 ea*			/ea											
				Cooling Water Pump	*2 ea*			/ea											
				Cooling Water Skid / Heat X-Changer 10' x 5.67'	*2 ea*			/ea											
				Cooling Water Supply Pumps	*3 ea*			/ea											
				Demister	*2 ea*			/ea											
				Eductor	*2 ea*			/ea											
				Filter	*2 ea*			/ea											
				Heater	*3 ea*			/ea											
				Ozone Diffuser	*2 ea*			/ea											
				Ozone Generator Skid 17' x 6.5'	*2 ea*			/ea											
				Ozone Injection Manifold 8" x 10.75' long	*1 ea*			/ea											
				Ozone Injection Water Supply Pumps	*4 ea*			/ea											
				Ozone Quench Manifold 30" x 11' long	*2 ea*			/ea											
				Particulate Filter	*1 ea*			/ea											
				43.10 Ozone Equipment	1 ls		3,575		118,706	500.00	500			31,005.98	31,006	3,301,500.00	3,301,500	3,451,712	5,248,722
				47.5 Ozone Facility	1 gsf		9,127		326,505	310,707.09	310,707	694,235.95	694,236	41,216.11	41,216	3,301,500.00	3,301,500	4,674,164	7,118,316
		47.6		LOX Equipment															
			03.05	Slab On Grade															
				S.O.G. Edge Form 8"	118 sf	0.240 mh / sf	28	39.49 /mh	1,118	1.22	144	-	-	-	-	-	-	1,262	1,988
				Strip & Oil Form	118 sf	0.005 mh / sf	1	39.17 /mh	23	0.03	4	-	-	-	-	-	-	27	42
				Rebar- SOG (125 #/cy)	2 tn	14.003 mh / tn	32	43.53 /mh	1,371	997.70	2,245	-	-	-	-	-	-	3,616	5,577
				Mesh Support - bricks (.12/sf)	175 ea	0.002 mh / ea	0	43.53 /mh	15	0.26	46	-	-	-	-	-	-	61	94
				Finish- Broom	1,462 sf	0.022 mh / sf	32	39.17 /mh	1,260	-	-	-	-	-	-	-	-	1,260	1,994
				Pump Place Slab on Grade 8"	36 cy	0.500 mh / cy	18	41.39 /mh	745	-	-	-	-	3.67	132	-	-	877	1,390
				4000 psi Concrete	36 cy			/cy		142.00	5,112	-	-	-	-	-	-	5,112	7,759

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.05	Slab On Grade															
				Saw Cut S-O-G (.08/sf)	117 lf	0.030 mh / lf	4	39.17 /mh	138	0.17	20	-	-	0.95	111	-	-	269	425
				Liquid Curing Compounds	1,580 sf	0.002 mh / sf	3	39.17 /mh	124	0.06	93	-	-	-	-	-	-	217	337
				Seal Floors	1,462 sf	0.002 mh / sf	3	39.17 /mh	115	0.09	135	-	-	-	-	-	-	250	386
				6 Mil. Vapor Barrier	1,600 sf	0.002 mh / sf	3	43.53 /mh	139	0.05	84	-	-	-	-	-	-	223	348
				Gravel Fill Under Slab 4"	18 cy	0.004 cd / cy	2	1,412.15 /cd	96	29.26	527	-	-	3.84	69	-	-	692	1,062
				03.05 Slab On Grade	36 cy		126		5,144	233.57	8,409			8.68	313			13,866	21,401
			03.08	Pads & Curbs															
				LOX Tank Pad Form 24"	350 sf	0.180 mh / sf	63	39.49 /mh	2,486	1.37	478	-	-	-	-	-	-	2,966	4,663
				LOX Vaporizer Pad Form 12"	78 sf	0.160 mh / sf	12	39.49 /mh	493	1.37	106	-	-	-	-	-	-	599	942
				Chamfer	191 lf	0.015 mh / lf	3	39.49 /mh	113	0.57	108	-	-	-	-	-	-	221	343
				Strip & Oil Equipment Pad Forms	428 sf	0.005 mh / sf	2	39.17 /mh	84	0.03	13	-	-	-	-	-	-	97	152
				Rebar- Pads (100 #/cy)	1 tn	18.004 mh / tn	18	43.53 /mh	784	997.70	998	-	-	-	-	-	-	1,781	2,755
				Finish- Float	223 sf	0.017 mh / sf	4	39.17 /mh	149	-	-	-	-	-	-	-	-	149	235
				Pump Place Pads 12" & 24"	17 cy	1.600 mh / cy	27	41.39 /mh	1,126	-	-	-	-	7.49	127	-	-	1,253	1,985
				4000 psi Concrete	17 cy			/cy		142.00	2,414	-	-	-	-	-	-	2,414	3,664
				Liquid Curing Compounds	651 sf	0.003 mh / sf	2	39.17 /mh	77	0.06	38	-	-	-	-	-	-	115	179
				03.08 Pads & Curbs	17 cy		131		5,313	244.44	4,155			7.49	127			9,596	14,918
			26.01	Above Ground Electrical															
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				43,160.00	43,160					43,160	65,505
				26.01 Above Ground Electrical	1 ls							43,160.00	43,160					43,160	65,505
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1.5% Equipment Cost)	1 ls			/ls				12,948.00	12,948					12,948	19,651
				26.02 Instrumentation & Controls	1 ls							12,948.00	12,948					12,948	19,651
			32.01	Fencing & Gates															
				8' Chain Link Fence @ LOX Tanks	111 lf			-	-	-	-	31.01	3,442	-	-	-	-	3,442	5,224
				8' Fence Vehicle Gate 12' @ LOX Tanks	1 ea			-	-	-	-	1,700.34	1,700	-	-	-	-	1,700	2,581
				32.01 Fencing & Gates	1 ls							5,142.02	5,142					5,142	7,804
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0-4'	100 lf	600.000 lf / cd	9	2,539.31 /cd	423			-	-	1.88	188	-	-	612	970
				Stone Pipe Bedding	15 cy	200.000 cy / cd	5	2,896.43 /cd	217	23.29	349	-	-			-	-	567	874
				DI Pipe Push - Class 52 4	200 lf	0.190 mh / lf	38	51.34 /mh	1,951	14.54	2,908	-	-	-	-	-	-	4,859	7,502
				Hydrostatic Testing	100 lf	0.021 ch / lf	8	182.49 /ch	383	0.16	16	-	-	-	-	-	-	399	631
				DI 90 ell 4"	2 ea	4.530 mh / ea	9	30.57 /mh	277	72.90	146	-	-	-	-	-	-	423	660
				40.00 Under Ground Process Piping	100 lf		70		3,252	34.19	3,419			1.88	188			6,859	10,636
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	113 lf			-	-	-	-	10.00	1,130	-	-	-	-	1,130	1,715
				Pipe Supports	5 ea	4.001 mh / ea	20	45.62 /mh	913	250.05	1,250	-	-			-	-	2,163	3,342
				Hydrostatic Testing	113 lf	0.021 ch / lf	9	182.49 /ch	433	0.16	18	-	-	-	-	-	-	451	713
				Gasket/Nuts/Bolt Kit 3"	10 ea	1.000 mh / ea	10	32.89 /mh	329	4.90	49	-	-	-	-	-	-	378	595
				Gasket/Nuts/Bolt Kit 4"	15 ea	1.000 mh / ea	15	32.89 /mh	493	7.87	118	-	-	-	-	-	-	611	960
				DI Flanged Joint Pipe 3"	50 lf	0.820 mh / lf	41	30.57 /mh	1,253	30.99	1,549	-	-	-	-	-	-	2,803	4,335
				DI Flanged Joint Pipe 4"	63 lf	0.820 mh / lf	52	30.57 /mh	1,579	30.99	1,952	-	-	-	-	-	-	3,531	5,462
				DI Flanged 90 ell 3"	20 ea	1.940 mh / ea	39	30.57 /mh	1,186	55.08	1,102	-	-	-	-	-	-	2,288	3,549
				DI Flanged 90 ell 4"	30 ea	4.530 mh / ea	136	30.57 /mh	4,154	72.90	2,187	-	-	-	-	-	-	6,341	9,894
				DI Flanged Tee 3"	3 ea	1.940 mh / ea	6	30.57 /mh	178	0.04	0	-	-	-	-	-	-	178	282
				DI Flanged Con Red 4x3"	4 ea	4.530 mh / ea	18	30.57 /mh	554	107.52	430	-	-	-	-	-	-	984	1,529
				40.01 Above Ground Process Piping	113 lf		346		11,072	76.60	8,656	10.00	1,130					20,858	32,376
			40.02	Valves, Meters, Etc.															
				3" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	8 ea	3.000 mh / ea	24	30.57 /mh	734	1,425.00	11,400	-	-	-	-	-	-	12,134	18,463
				4" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	3.500 mh / ea	14	30.57 /mh	428	1,900.00	7,600	-	-	-	-	-	-	8,028	12,212
				40.02 Valves, Meters, Etc.	1 ls		38		1,162	19,000.00	19,000							20,162	30,675
			43.17	LOX Equipment															
				Vaporizer 5.67'x5.67'x20' h, 6,000 lbs (Charter/Thermax #SG500)	2 ea	1.000 cd / ea	80	1,783.17 /cd	3,566			-	-	763.23	1,526	209,000.00	418,000	423,093	642,479
				High Pressure Tank 10,960 gal, 9.5'dia.x34' h, 46,700 lbs (Charter #VS-11000SC)	2 ea	1.000 cd / ea	80	1,783.17 /cd	3,566	2,000.00	4,000	-	-	763.23	1,526	219,000.00	438,000	447,093	678,904
				LOX Fo;; Station	1 ea	1.000 mh / ea	1	45.65 /mh	46	13,450.00	13,450	-	-	-	-	7,200.00	7,200	20,696	31,413
				43.17 LOX Equipment	1 ls		161		7,178	17,450.00	17,450			3,052.90	3,053	863,200.00	863,200	890,881	1,352,796
				47.6 LOX Equipment	1 ls		872		33,121	61,089.04	61,089	62,380.26	62,380	3,681.24	3,681	863,200.00	863,200	1,023,471	1,555,763
				3E Filtration - Construct New Gravity Filters & Ozone Facility	1 ls		122,902		5,194,504	6,662,166.23	6,662,166	3,862,801.52	3,862,802	1,289,471.44	1,289,471	6,504,070.37	6,504,070	23,513,013	36,118,873
3F				Filtration - Construct New Membrane Gravity System															
		00		Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	1,115 lf	0.050 mh / lf	56	39.49 /mh	2,202	0.67	749	-	-	-	-	-	-	2,951	4,622
				Mat Foundation Edge Form 30"	1,295 sf	0.350 mh / sf	453	39.49 /mh	17,902	1.31	1,700	-	-	-	-	-	-	19,602	30,913
				Mat Foundation Bulkhead Form	375 sf	0.350 mh / sf	131	39.49 /mh	5,183	1.52	571	-	-	-	-	-	-	5,754	9,069
				Waterstop 6" Flat	1,265 lf	0.110 mh / lf	139	39.18 /mh	5,452	2.10	2,657	-	-	-	-	-	-	8,109	12,662
				Strip & Oil Mat Found. Form	1,670 sf	0.005 mh / sf	8	39.17 /mh	327	0.03	50	-	-			-	-	377	594
				Rebar- Foundation Mat (100 #/cy)	66 tn	28.006 mh / tn	1,848	43.53 /mh	80,454	997.70	65,848	-	-	-	-	-	-	146,302	227,275
				Rebar Support - bricks (.12/sf)	1,695 ea	0.002 mh / ea	3	43.53 /mh	148	0.26	445	-	-	-	-	-	-	593	909
				Finish- Hard Trowel	14,128 sf	0.023 mh / sf	325	39.17 /mh	12,730	-	-	-	-	-	-	-	-	12,730	20,147
				Pump Place Mat Foundation 30"	1,308 cy	0.500 mh / cy	654	41.39 /mh	27,068	-	-	-	-	4.59	6,001	-	-	33,070	52,393
				4000 psi Concrete	1,308 cy			/cy		142.00	185,736	-	-	-	-	-	-	185,736	281,894
				Liquid Curing Compounds	15,798 sf	0.003 mh / sf	47	39.17 /mh	1,857	0.06	929	-	-	-	-	-	-	2,786	4,349
				6 Mil. Vapor Barrier	17,400 sf	0.002 mh / sf	35	43.53 /mh	1,515	0.05	914	-	-	-	-	-	-	2,429	3,785
				03.00 Foundation Mat	1,308 cy		3,701		154,837	198.47	259,600			4.59	6,001			420,438	648,612
			03.03	Columns															
				Form Rectangle Columns 15'	2,520 sf	0.165 mh / sf	416	39.49 /mh	16,419	1.60	4,023	-	-	-	-	-	-	20,442	32,092
				Chamfer	1,680 lf	0.015 mh / lf	25	39.49 /mh	995	0.57	953	-	-	-	-	-	-	1,948	3,021
				Strip & Oil Column Form	2,520 sf	0.005 mh / sf	13	39.17 /mh	494	0.03	76	-	-	-	-	-	-	569	896
				Superplasticizers @ Columns	35 cy			/cy		8.40	294	-	-	-	-	-	-	294	446
				Column Rebar (120 #/cy)	2 tn	20.004 mh / tn	42	43.53 /mh	1,829	997.70	2,095	-	-	-	-	-	-	3,924	6,074
				Finish- Float	126 sf	0.017 mh / sf	2	39.17 /mh	84	-	-	-	-	-	-	-	-	84	133
				Pump Place Columns 28 ea	35 cy	1.600 mh / cy	56	41.39 /mh	2,318	-	-	-	-	7.49	262	-	-	2,580	4,086
				4000 psi Concrete	35 cy			/cy		142.00	4,970	-	-	-	-	-	-	4,970	7,543
				Grind/Patch Columns	2,520 sf	0.013 mh / sf	33	39.17 /mh	1,283	0.03	76	-	-	-	-	-	-	1,359	2,146
				Rub Columns	2,520 sf	0.065 mh / sf	164	39.17 /mh	6,416	0.06	151	-	-	-	-	-	-	6,567	10,384
				Liquid Curing Compounds	2,520 sf	0.003 mh / sf	8	39.17 /mh	296	0.06	148	-	-	-	-	-	-	444	694
				03.03 Columns	35 cy		758		30,134	365.30	12,785			7.49	262			43,181	67,515
			03.04	Walls															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.04	Walls															
				Keyway 6"	2,230 lf	0.050 mh / lf	112	39.49 /mh	4,404	0.67	1,499	-	-	-	-	-	-	5,903	9,245
				Vertical Wall Keyway 6"	502 lf	0.110 mh / lf	55	39.49 /mh	2,181	0.67	337	-	-	-	-	-	-	2,518	3,984
				Panel Form System 18' h	40,125 sf	0.190 mh / sf	7,625	39.49 /mh	301,107	1.84	73,744	-	-	-	-	-	-	374,851	588,489
				Waterstop 6" Flat	2,732 lf	0.110 mh / lf	301	39.18 /mh	11,776	2.10	5,738	-	-	-	-	-	-	17,514	27,347
				Strip & Oil Wall Forms	40,125 sf	0.005 mh / sf	201	39.17 /mh	7,859	0.03	1,204	-	-	-	-	-	-	9,063	14,287
				Superplasticizers @ Walls	1,115 cy			/cy		8.40	9,367	-	-	-	-	-	-	9,367	14,217
				Rebar- Walls (125 #/cy)	70 tn	15.003 mh / tn	1,050	43.53 /mh	45,712	997.70	69,839	-	-	-	-	-	-	115,551	178,346
				Finish- Top of Wall	3,345 sf	0.008 mh / sf	27	39.17 /mh	1,048	-	-	-	-	-	-	-	-	1,048	1,659
				Pump Place Walls 18"	1,115 cy	1.150 mh / cy	1,283	41.39 /mh	53,082	-	-	-	-	6.65	7,414	-	-	60,496	95,813
				4000 psi Concrete	1,115 cy			/cy		142.00	158,330	-	-	-	-	-	-	158,330	240,300
				Grind/Patch Walls	40,125 sf	0.013 mh / sf	522	39.17 /mh	20,435	0.03	1,204	-	-	-	-	-	-	21,639	34,169
				Rub Walls	31,161 sf	0.058 mh / sf	1,807	39.17 /mh	70,788	0.06	1,870	-	-	-	-	-	-	72,658	114,875
				Liquid Curing Compounds	43,470 sf	0.002 mh / sf	87	39.17 /mh	3,406	0.06	2,557	-	-	-	-	-	-	5,962	9,271
				03.04 Walls	1,115 cy		13,069		521,797	292.10	325,689			6.65	7,414			854,901	1,331,960
			03.05	Slab On Grade															
				Slab Edge Form 28"	172 sf	0.350 mh / sf	60	39.49 /mh	2,378	1.31	226	-	-	-	-	-	-	2,603	4,108
				Rebar- SOG (125 #/cy)	1 tn	14.003 mh / tn	8	43.53 /mh	366	997.70	599	-	-	-	-	-	-	964	1,487
				Mesh Support - bricks (.12/sf)	37 ea	0.002 mh / ea	0	43.53 /mh	3	0.26	10	-	-	-	-	-	-	13	20
				Finish- Hard Trowel	304 sf	0.015 mh / sf	5	39.17 /mh	179	-	-	-	-	-	-	-	-	179	283
				Pump Place Slab on Grade 8" @ Electrical & Blower Room	7 cy	0.500 mh / cy	4	41.39 /mh	145	-	-	-	-	3.67	26	-	-	171	270
				Pump Place Thickened Slab 28" x 20"	2 cy	0.500 mh / cy	1	41.39 /mh	41	-	-	-	-	3.67	7	-	-	49	77
				4000 psi Concrete	9 cy			/cy		142.00	1,278	-	-	-	-	-	-	1,278	1,940
				Saw Cut S-O-G (.06/sf)	24 lf	0.030 mh / lf	1	39.17 /mh	28	0.17	4	-	-	0.95	23	-	-	55	87
				Liquid Curing Compounds	476 sf	0.002 mh / sf	1	39.17 /mh	37	0.06	28	-	-	-	-	-	-	65	101
				Seal Floors	304 sf	0.002 mh / sf	1	39.17 /mh	24	0.09	28	-	-	-	-	-	-	52	80
				6 Mil. Vapor Barrier	350 sf	0.002 mh / sf	1	43.53 /mh	30	0.05	18	-	-	-	-	-	-	49	76
				Gravel Fill Under Slab 4"	8 cy	0.004 cd / cy	1	1,412.15 /cd	43	29.26	234	-	-	3.84	31	-	-	308	472
				03.05 Slab On Grade	9 cy		82		3,274	269.41	2,425			9.62	87			5,785	9,000
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	7,342 sf	0.180 mh / sf	1,322	39.49 /mh	52,196	2.18	16,038			-	-	-	-	68,234	106,953
				Slab Edge Form 12"	1,501 sf	0.250 mh / sf	375	39.49 /mh	14,821	5.17	7,762			-	-	-	-	22,583	35,237
				Strip & Oil Suspended Slab Forms	8,843 sf	0.005 mh / sf	44	39.17 /mh	1,732	0.04	363			-	-	-	-	2,095	3,292
				Superplasticizers	272 cy			-	-	8.40	2,285			-	-	-	-	2,285	3,488
				Rebar- Suspended Slab (225 #/cy)	31 tn	20.004 mh / tn	612	43.53 /mh	26,644	997.70	30,530	-	-	-	-	-	-	57,173	88,505
				Finish- Hard Trowel	7,372 sf	0.030 mh / sf	221	39.17 /mh	8,664	-	-			-	-	-	-	8,664	13,712
				Pump Place Suspended Slab 12"	272 cy	1.800 mh / cy	490	41.39 /mh	20,268	-	-			6.65	1,810	-	-	22,078	34,959
				4000 psi Concrete	272 cy			-	-	142.00	38,624			-	-	-	-	38,624	58,620
				Liquid Curing Compounds	16,215 sf	0.003 mh / sf	49	39.17 /mh	1,906	0.68	11,069			-	-	-	-	12,975	19,816
				03.06 Suspended Flat Slab	272 cy		3,113		126,231	392.17	106,670			6.65	1,810			234,710	364,562
			03.07	Suspended Beams															
				Beam Side Forms	6,264 sf	0.210 mh / sf	1,316	39.49 /mh	51,954	2.21	13,815	-	-	-	-	-	-	65,769	103,198
				Beam Bottom Forms	1,814 sf	0.210 mh / sf	381	39.49 /mh	15,046	2.21	4,001	-	-	-	-	-	-	19,046	29,885
				Chamfer	2,418 lf	0.015 mh / lf	36	39.49 /mh	1,433	0.57	1,371	-	-	-	-	-	-	2,804	4,349
				Strip & Oil Beam Forms	8,078 sf	0.005 mh / sf	40	39.17 /mh	1,582	0.03	242	-	-	-	-	-	-	1,825	2,872
				Superplasticizers @ Beams	174 cy			/cy		8.40	1,462	-	-	-	-	-	-	1,462	2,219
				Rebar- Beams (250 #/cy)	22 tn	15.003 mh / tn	330	43.53 /mh	14,367	997.70	21,949	-	-	-	-	-	-	36,316	56,051
				Finish- Top of Beam	1,814 sf	0.008 mh / sf	15	39.17 /mh	569	-	-	-	-	-	-	-	-	569	900
				Pump Place Beams @ Roof	174 cy	2.001 mh / cy	348	41.39 /mh	14,411	-	-	-	-	14.42	2,509	-	-	16,920	26,801
				4000 psi Concrete	174 cy			/cy		142.00	24,708	-	-	-	-	-	-	24,708	37,500
				Grind/Patch Beams	8,078 sf	0.013 mh / sf	105	39.17 /mh	4,114	0.03	242	-	-	-	-	-	-	4,356	8,879
				Rub Beams	8,078 sf	0.085 mh / sf	687	39.17 /mh	26,893	0.06	485	-	-	-	-	-	-	27,378	43,300
				Liquid Curing Compounds	9,892 sf	0.002 mh / sf	20	39.17 /mh	775	0.06	582	-	-	-	-	-	-	1,357	2,110
				03.07 Suspended Beams	174 cy		3,278		131,143	395.73	68,857			14.42	2,509			202,509	316,051
			03.08	Pads & Curbs															
				Pad Form	1,267 sf	0.120 mh / sf	152	39.49 /mh	6,005	1.37	1,730	-	-	-	-	-	-	7,734	12,129
				Chamfer	447 lf	0.015 mh / lf	7	39.49 /mh	265	0.57	254	-	-	-	-	-	-	518	804
				Strip & Oil Equipment Pad Forms	1,267 sf	0.005 mh / sf	6	39.17 /mh	248	0.03	38	-	-	-	-	-	-	286	450
				Rebar- Pads (100 #/cy)	2 tn	18.003 mh / tn	33	43.53 /mh	1,450	997.70	1,846	-	-	-	-	-	-	3,295	5,096
				Finish- Float	1,444 sf	0.017 mh / sf	25	39.17 /mh	961	-	-	-	-	-	-	-	-	961	1,522
				Pump Place Pads	37 cy	1.601 mh / cy	59	41.39 /mh	2,451	-	-	-	-	7.49	277	-	-	2,728	4,320
				4000 psi Concrete	37 cy			/cy		142.00	5,254	-	-	-	-	-	-	5,254	7,974
				Liquid Curing Compounds	2,711 sf	0.003 mh / sf	8	39.17 /mh	319	0.06	159	-	-	-	-	-	-	478	748
				03.08 Pads & Curbs	37 cy		290		11,699	250.82	9,280			7.49	277			21,256	33,042
			03.09	Pan Stair Fill															
				Finish Stairs	415 sf	0.055 mh / sf	23	39.17 /mh	894	-	-	-	-	-	-	-	-	894	1,415
				Pump Place Pan Stair Concrete	6 cy	3.001 mh / cy	18	41.39 /mh	745	-	-	-	-	9.17	55	-	-	800	1,267
				3000 psi Concrete	6 cy			-	-	138.00	828	-	-	-	-	-	-	828	1,257
				03.09 Pan Stair Fill	6 cy		41		1,639	138.00	828			9.17	55			2,522	3,939
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	14,596 sf	0.020 mh / sf	292	42.24 /mh	12,333	8.80	128,470	-	-	0.35	5,136	-	-	145,940	222,676
				03.20 Precast Planks	14,596 sf		292		12,333	8.80	128,470			0.35	5,136			145,940	222,678
			04.00	Masonry															
				8" CMU + Rigid Insulation Backup To Brick, 20' h	10,070 sf			/sf		-	-	18.00	181,296	-	-	-	-	181,296	275,156
				8" CMU + Rigid Insulation Backup To Brick @ Parapet 3.67' h	2,500 sf			/sf		-	-	18.00	46,000	-	-	-	-	45,000	68,297
				8" CMU Interior Wall 15' h	7,018 sf			/sf		-	-	14.00	98,252	-	-	-	-	98,252	149,119
				8" CMU + Rigid Insulation Backup To Brick, 14' h @ Electrical & Blower Bldgs	2,352 sf			/sf		-	-	18.00	42,344	-	-	-	-	42,344	64,267
				Precast Cap 16" x 4"	671 lf			/lf		-	-	20.00	13,423	-	-	-	-	13,423	20,372
				Brick Veneer @ Block Wall Backup & Concrete Beam	16,446 sf			-	-	-	-	9.00	148,044	-	-	-	-	148,044	224,688
				04.00 Masonry	23,464 sf							22.52	528,359					528,359	801,898
			05.01	Misc Metals															
				Metal Stairs Concrete Pans	132 rs	0.067 mh / rs	9	42.08 /mh	370	80.02	10,562	-	-	-	-	-	-	10,933	16,617
				Metal Stair Landing Concrete Pans	8 ea	4.000 mh / ea	32	42.08 /mh	1,347	800.00	6,400	-	-	-	-	-	-	7,747	11,845
				Alum Stair Wall Handrail	112 lf	0.150 mh / lf	17	42.08 /mh	707	16.80	1,882	-	-	-	-	-	-	2,589	3,975
				Aluminum 3 Line Rail @ Basins	559 lf	0.234 mh / lf	131	42.08 /mh	5,506	44.11	24,657	-	-	-	-	-	-	30,163	46,136
				Aluminum Handrail @ Pan Stairs	112 lf	0.234 mh / lf	26	42.08 /mh	1,103	44.11	4,940	-	-	-	-	-	-	6,043	9,244
				Alum Grate Cover .75" @ 4'x4' Sump	12 ea	0.600 mh / ea	7	42.08 /mh	303	185.04	2,220	-	-	-	-	-	-	2,523	3,850
				Aluminum Hatch & Frame Over Pipe Gallery 6.33' x 6.33'	12 ea	8.002 mh / ea	96	39.18 /mh	3,762	5,001.00	60,012	-	-	-	-	-	-	63,774	97,035
				05.01 Misc Metals	1 ls		318		13,098	110,673.59	110,674							123,771	188,701
			06.00	Wood															
				Misc Nailers & Blocking	15,596 sf	0.010 mh / sf	155	39.67 /mh	6,186	0.40	6,259	-	-	-	-	-	-	12,446	19,294

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				06.00 Wood	1 ls		156		6,188	6,259.15	6,259							12,448	19,294
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	1,349 lf			/lf				4.00	5,397	-	-	-	-	5,397	8,191
				Caulking @ Masonry Wall Joints- Interior	1,349 lf			/lf				4.00	5,397	-	-	-	-	5,397	8,191
				07.00 Moisture Protection	1 ls							10,794.17	10,794					10,794	16,382
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	15,395 sf			/sf				3.00	46,194					46,194	70,110
				Aluminum Downspouts, 14 ea	280 lf			/lf				18.00	5,041					5,041	7,651
				Scuppers	14 ea			/ea				50.01	700					700	1,063
				Aluminum Coping @ Roof Parapet 12" wide	645 lf			/lf				15.00	9,677					9,677	14,687
				Roof Hatch 4'0" x 4'0"	1 ea			/ea				2,200.44	2,200					2,200	3,340
				07.01 Roofing	15,395 sf							4.15	63,813					63,813	96,850
			08.00	Doors, Frames & Hardware															
				HM Single Frames- 16 ga 3'x7'	8 ea	1.000 mh / ea	8	39.18 /mh	313	180.04	1,440	-	-	-	-	-	-	1,754	2,682
				HM Double Frames- 16 ga. 6'x7'	3 ea	1.500 mh / ea	5	25.39 /mh	114	210.00	630	-	-	-	-	-	-	744	1,137
				HM Door Leafs- 3'x7' 20 ga. half glass	14 ea	1.500 ea / mh	9	39.18 /mh	366	460.09	6,301	-	-	-	-	-	-	6,667	10,142
				Overhead Doors- 10'x10' 24 ga steel manual 1" insulation 26 ga back-up panel	2 ea			-	-	-	-	2,255.00	4,510	-	-	-	-	4,510	6,845
				Finish Hardware by Leaf- Allowance	14 ea	8.002 mh / ea	112	39.18 /mh	4,389	900.18	12,603	-	-	-	-	-	-	16,991	26,073
				08.00 Doors, Frames & Hardware	16 ea		134		5,182	1,310.88	20,974	281.88	4,510					30,666	46,879
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	11 ea			/ea		-	-	100.02	1,100	-	-	-	-	1,100	1,670
				Paint HM Doors - primer (2) coats	14 ea			/ea		-	-	140.03	1,960	-	-	-	-	1,960	2,975
				Paint CMU Block - block filler & (2) coat	28,958 sf			-	-	-	-	1.35	39,093	-	-	-	-	39,093	59,333
				Paint 2" Pipe	194 lf	0.035 mh / lf	7	27.53 /mh	187	0.23	45	-	-	2.12	411	-	-	643	1,018
				Paint 6" Pipe	373 lf	0.070 mh / lf	26	27.53 /mh	719	0.69	258	-	-	4.24	1,581	-	-	2,558	4,046
				Paint 12" Pipe	53 lf	0.120 mh / lf	6	27.53 /mh	175	1.39	73	-	-	5.65	300	-	-	548	865
				Paint 16" Pipe	340 lf	0.140 mh / lf	48	27.53 /mh	1,311	1.85	628	-	-	6.06	2,059	-	-	3,997	6,304
				Paint 20" Pipe	0 lf	0.300 mh / lf	0	27.53 /mh	0	2.00	0	-	-	7.00	0	-	-	0	0
				Paint 24" Pipe	203 lf	0.350 mh / lf	71	27.53 /mh	1,956	2.77	562	-	-	7.07	1,434	-	-	3,953	6,232
				Paint 30" Pipe	154 lf	0.438 mh / lf	67	27.53 /mh	1,855	3.46	533	-	-	4.12	635	-	-	3,023	4,755
				Paint 72" Pipe	183 lf	0.525 mh / lf	96	27.53 /mh	2,645	8.31	1,520	-	-	4.95	905	-	-	5,071	7,935
				09.00 Finishes	1 ls		321		8,848	3,619.94	3,620	42,153.90	42,154	7,324.45	7,324			61,846	95,133
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	11 ea			/ea				30.01	330	-	-	-	-	330	501
				Fire Extinguisher CO2 10 lbs	12 ea			/ea				225.05	2,701					2,701	4,099
				10.00 Specialty Items	1 ls							6,031.22	6,031					6,031	9,154
			22.00	Plumbing															
				Plumbing Subcontract	15,395 sf			/sf				4.00	61,592					61,592	93,480
				22.00 Plumbing	1 ls							61,592.30	61,592					61,592	93,480
			23.00	HVAC															
				Ventilation & Unit Heater System	15,395 sf			/sf		-	-	45.00	692,775	-	-	-	-	692,775	1,051,435
				23.00 HVAC	15,395 sf							45.00	692,775					692,775	1,051,435
			31.01	Dewatering															
				Dewatering - Well Point System Installation	1 sys	240.048 ch / sys	960	159.35 /ch	38,251	7,501.50	7,502	-	-	33,599.22	33,599	-	-	79,352	125,400
				Dewatering - Well Point System Monthly Rental	4 mo	13.288 mh / mo	53	39.17 /mh	2,082	5,704.89	22,820	-	-	22,004.39	88,018	-	-	112,919	178,010
				Dewatering - Well Point System Removal	1 sys	60.012 ch / sys	240	159.35 /ch	9,563	2,500.50	2,501	-	-	8,399.94	8,400	-	-	20,463	32,299
				31.01 Dewatering	1 ls		1,253		49,896	32,821.55	32,822			130,016.73	130,017			212,734	335,708
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 184 ea (1 per 77 sf)	4,600 vf	0.002 cd / vf	515	2,146.97 /cd	19,756	35.16	161,720	-	-	2.58	11,869	-	-	193,345	295,603
				31.02 Piles	184 ea		515		19,756	878.91	161,720			64.51	11,869			193,345	295,603
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (557' x 28' deep)	15,596 sf	0.001 cd / sf	769	2,465.38 /cd	29,614	16.00	249,586	-	-	0.75	11,729	-	-	290,930	444,339
				Tie Backs (1 per 80 sf of Sheeting, 557' x 21'= 11,697 sf)	146 ea			-	-	-	-	2,377.48	347,111	-	-	-	-	347,111	526,816
				31.03 Excavation Shoring	15,596 sf		769		29,614	16.00	249,586	23.22	362,114	0.75	11,729			653,044	993,925
			31.10	Structure Excavation															
				Exc Clay-Backhoe/Truck (16,774 sf x 21')	13,047 cy	499.900 cy / cd	940	1,410.06 /cd	36,801	-	-	-	-	6.58	85,902	-	-	122,703	194,960
				31.10 Structure Excavation	13,047 cy		940		36,801					6.58	85,902			122,703	194,960
			31.12	Structure Backfill															
				BackFill Earth-Backhoe/Truck	2,479 cy	495.000 cy / cd	160	1,327.72 /cd	6,649			-	-	4.69	11,618	-	-	18,268	29,015
				31.12 Structure Backfill	2,479 cy		160		6,649					4.69	11,618			18,268	29,015
			31.13	Soil Disposal															
				Spoils to Waste	10,568 cy	0.003 day / cy	951	1,410.06 /day	37,261	-	-	-	-	8.23	86,975	-	-	124,236	197,396
				31.13 Soil Disposal	10,568 cy		951		37,261					8.23	86,975			124,236	197,396
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 14,128 sf x 6"	262 cy	0.003 cd / cy	32	1,609.56 /cd	1,278	28.28	7,410	-	-	10.02	2,624	-	-	11,312	17,444
				31.20 Structure Stone Base	262 cy		32		1,278	28.28	7,410			10.02	2,624			11,312	17,444
				00 Building & Structure Construction	15,395 gsf		30,172		1,207,659	97.03	1,507,669	115.11	1,772,142	24.14	371,610			4,859,081	7,460,626
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				UG Electrical System	15,395 sf			/sf				16.00	246,369					246,369	373,918
				26.00 UG Electrical	1 ls							246,369.17	246,369					246,369	373,918
			26.01	Above Ground Electrical															
				Building Electrical Systems	15,395 sf			/sf				4.00	61,580					61,580	93,461
				Electrical Work For Equipment (3% Equipment Cost)	1 ls			/ls				570,000.00	570,000					570,000	865,098
				26.01 Above Ground Electrical	1 ls							631,580.00	631,580					631,580	958,559
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1 % Equipment Cost)	1 ls			/ls				190,000.00	190,000					190,000	288,366
				26.02 Instrumentation & Controls	1 ls							190,000.00	190,000					190,000	288,366
				26 Electrical & Instrumentation	1 ls							1,067,949.17	1,067,949					1,067,949	1,620,843
		40		Process Piping															
			40.00	Under Ground Process Piping															
				Trench Excav & Lay Pipe 0- 4'	491 lf	600.000 lf / cd	46	2,539.31 /cd	2,078			-	-	1.88	925	-	-	3,003	4,761
				Stone Pipe Bedding	37 cy	199.900 cy / cd	13	2,896.43 /cd	536	23.29	862	-	-			-	-	1,398	2,156
				DI Pipe Push - Class 52 20	491 lf	0.380 mh / lf	187	51.34 /mh	9,579	99.35	48,778	-	-	-	-	-	-	58,357	89,193

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			40.00	Under Ground Process Piping															
				Hydrostatic Testing	491 lf	0.021 ch / lf	41	182.49 /ch	1,882	0.16	79	-	-	-	-	-	-	1,961	3,098
				40.00 Under Ground Process Piping	491 lf		287		14,075	101.26	49,719			1.88	925			64,719	99,208
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	960 lf			-	-	-	-	10.00	9,602	-	-	-	-	9,602	14,573
				Paint & Stencil Exposed Piping >20"	540 lf			-	-	-	-	25.01	13,503	-	-	-	-	13,503	20,493
				Pipe Supports	24 ea	4.001 mh / ea	96	45.62 /mh	4,381	250.05	6,001	-	-	-	-	-	-	10,382	16,041
				Hydrostatic Testing	1,500 lf	0.021 ch / lf	126	182.49 /ch	5,749	0.16	240	-	-	-	-	-	-	5,990	9,464
				Dresser Couplings 42"	6 ea	24.000 mh / ea	144	40.79 /mh	5,873	3,500.00	21,000	-	-	-	-	-	-	26,873	41,159
				Dresser Couplings 72"	18 ea	36.000 mh / ea	648	40.79 /mh	26,429	6,000.00	108,000	-	-	-	-	-	-	134,429	205,743
				12" DI Wall Thimble 24" long	12 ea	1.250 ch / ea	60	182.49 /ch	2,737	430.09	5,161	-	-	301.00	3,612	-	-	11,510	17,914
				16" DI Wall Thimble 24" long	12 ea	1.670 ch / ea	80	182.49 /ch	3,657	575.00	6,900	-	-	402.14	4,826	-	-	15,383	23,940
				20" DI Wall Thimble 24" long	12 ea	2.500 ch / ea	120	182.49 /ch	5,475	733.00	8,796	-	-	900.35	10,804	-	-	25,075	39,210
				24" DI Wall Thimble 24" long	12 ea	2.500 ch / ea	120	182.49 /ch	5,475	860.00	10,320	-	-	1,200.24	14,403	-	-	30,198	47,250
				72" DI Wall Thimble 24" long	2 ea	10.000 ch / ea	80	182.49 /ch	3,650	2,600.00	5,200	-	-	1,600.00	3,200	-	-	12,050	18,762
				Gasket/Nuts/Bolt Kit 6"	38 ea	1.000 mh / ea	38	32.89 /mh	1,250	15.87	603	-	-	-	-	-	-	1,853	2,894
				Gasket/Nuts/Bolt Kit 12"	5 ea	1.000 mh / ea	5	45.62 /mh	228	45.01	225	-	-	-	-	-	-	453	703
				Gasket/Nuts/Bolt Kit 16"	34 ea	1.000 mh / ea	34	32.89 /mh	1,118	46.64	1,586	-	-	-	-	-	-	2,704	4,177
				Gasket/Nuts/Bolt Kit 24"	20 ea	2.000 mh / ea	40	45.62 /mh	1,825	129.48	2,590	-	-	-	-	-	-	4,415	6,819
				Gasket/Nuts/Bolt Kit 30"	16 ea	1.000 mh / ea	16	32.89 /mh	526	175.00	2,800	-	-	-	-	-	-	3,326	5,083
				DI Flanged Joint Pipe 2"	194 lf	0.820 mh / lf	159	30.57 /mh	4,863	30.99	6,011	-	-	-	-	-	-	10,874	16,819
				DI Flanged Joint Pipe 6"	373 lf	0.900 mh / lf	336	30.57 /mh	10,261	47.39	17,675	-	-	-	-	-	-	27,936	43,056
				DI Flanged Joint Pipe 12"	53 lf	1.890 mh / lf	100	45.62 /mh	4,571	112.94	5,986	-	-	-	-	-	-	10,557	16,319
				DI Flanged Joint Pipe 16"	340 lf	2.170 mh / lf	738	30.57 /mh	22,552	162.43	55,226	-	-	-	-	-	-	77,778	119,510
				DI Flanged Joint Pipe 24"	203 lf	2.671 mh / lf	542	45.62 /mh	24,732	267.89	54,381	-	-	-	-	-	-	79,114	121,679
				DI Flanged Joint Pipe 30"	154 lf	3.050 mh / lf	470	30.57 /mh	14,357	310.14	47,762	-	-	-	-	-	-	62,119	95,213
				DI Flanged Joint Pipe 72"	183 lf	6.600 mh / lf	1,208	30.57 /mh	36,919	1,431.91	262,040	-	-	-	-	-	-	298,958	456,133
				DI Flanged 90 ell 16"	35 ea	12.688 mh / ea	444	30.57 /mh	13,566	599.40	20,979	-	-	-	-	-	-	34,545	53,311
				DI Flanged 90 ell 20"	23 ea	14.650 mh / ea	337	30.57 /mh	10,299	939.60	21,611	-	-	-	-	-	-	31,910	49,100
				DI Flanged 90 ell 24"	24 ea	15.730 mh / ea	378	30.57 /mh	11,540	1,458.00	34,992	-	-	-	-	-	-	46,532	71,372
				DI Flanged 90 ell 30"	47 ea	17.870 mh / ea	840	30.57 /mh	25,673	2,316.60	108,880	-	-	-	-	-	-	134,553	205,892
				DI Flanged Tee 12"	12 ea	11.012 mh / ea	132	45.62 /mh	6,029	777.86	9,334	-	-	-	-	-	-	15,363	23,709
				DI Flanged Tee 16"	12 ea	12.680 mh / ea	152	30.57 /mh	4,651	0.00	0	-	-	-	-	-	-	4,651	7,361
				DI Flanged Tee 30"	22 ea	17.874 mh / ea	393	45.62 /mh	17,940	0.00	0	-	-	-	-	-	-	17,940	28,394
				DI Flanged Cross 72"	6 ea	72.000 mh / ea	432	30.57 /mh	13,205	39,000.00	234,000	-	-	-	-	-	-	247,205	376,045
				DI Flanged Con Red 16x12"	12 ea	12.680 mh / ea	152	30.57 /mh	4,651	890.40	10,685	-	-	-	-	-	-	15,336	23,578
				DI Flanged Con Red 30x16"	12 ea	17.870 mh / ea	214	30.57 /mh	6,555	2,721.60	32,659	-	-	-	-	-	-	39,214	59,942
				DI Flanged Con Red 36x30"	2 ea	20.520 mh / ea	41	30.57 /mh	1,254	5,224.80	10,450	-	-	-	-	-	-	11,704	17,845
				DI Blind Flange 48"	0 ea	23.590 mh / ea	0	30.57 /mh	7	7,186.00	72	-	-	-	-	-	-	79	120
				Misc Piping & Accessories- ALLOWANCE	500 LF	0.240 mh / LF	120	45.62 /mh	5,476	55.01	27,595	-	-	-	-	-	-	32,881	50,412
				40.01 Above Ground Process Piping	1,500 lf		8,795		307,474	759.78	1,139,670	15.40	23,105	24.56	36,845			1,507,093	2,310,044
			40.02	Valves, Meters, Etc.															
				Water Solenoid Valve	12 ea	0.400 mh / ea	5	28.04 /mh	135	4,000.00	48,000	-	-	-	-	-	-	48,135	73,063
				Magnetic Flow Meter - Inline - 24" w/ transmitter	12 ea	26.000 mh / ea	312	43.67 /mh	13,626	12,000.00	144,000	-	-	-	-	-	-	157,626	240,117
				12" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	24 ea	9.600 mh / ea	230	30.57 /mh	7,043	13,040.00	312,960	-	-	-	-	-	-	320,003	486,131
				18" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	12 ea	14.400 mh / ea	173	30.57 /mh	5,282	8,550.00	102,600	-	-	-	-	-	-	107,882	164,077
				30" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	8 ea	24.000 mh / ea	192	30.57 /mh	5,869	16,484.00	131,872	-	-	-	-	-	-	137,741	209,433
				42" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	1 ea	33.600 mh / ea	34	30.57 /mh	1,027	23,078.00	23,078	-	-	-	-	-	-	24,105	36,651
				40.02 Valves, Meters, Etc.	1 ls		946		32,981	762,510.00	762,510							795,491	1,209,472
			40.04	Hydropneumatic Piping System															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				38,000.00	38,000					38,009	57,673
				40.04 Hydropneumatic Piping System	1 ls							38,000.00	38,000					38,000	57,673
				40 Process Piping	1,991 lf		10,028		354,530	980.36	1,951,898	30.69	61,105	18.97	37,770			2,405,303	3,676,398
		41		Material Handling & Process Equipment															
			41.22	Hoists & Cranes															
				Steel Bracket @ Column To Support Crane Rail Beam	28 ea	0.200 mh / ea	6	42.40 /mh	237	726.47	20,341	-	-	-	-	-	-	20,578	31,248
				W 18 x 156 Crane Rail Beam	700 lf			-	-	83.46	58,422	-	-	-	-	-	-	58,422	88,688
				Erect Steel W 18 x 156 Beams (29' long)	24 ea	5.000 ch / ea	600	197.59 /ch	23,711			-	-	518.13	12,435	-	-	36,146	57,318
				Bridge Crane 5 ton 26 ft span, 175 ft runway beam	2 ea			-	-	-	-	-	-			160,000.00	320,000	320,000	485,669
				41.22 Hoists & Cranes			606		23,948		78,763				12,435		320,000	435,147	662,903
				41 Material Handling & Process Equipment	1 ls		606		23,948	78,763.05	78,763			12,435.00	12,435	320,000.00	320,000	435,147	662,903
		43		Process Equipment															
			43.11	Membrane Filtration Equipment															
				Filter Equipment Start-Up @ Basins	24 ea	75.000 ch / ea	12,600	350.77 /ch	631,379	2,500.00	60,000					-	-	691,379	1,090,356
				Suez- ZeeWeed Ultrafiltration Membrane System	1 ls			/ls								18,594,595.00	18,594,595	18,594,595	28,221,307
				Install TripleStack Cassette 18' long w/144 Modules/Cassette @ (12) Basins	72 ea	9.000 mh / ea	648	30.57 /mh	19,807			-	-	55.00	3,960	-	-	23,767	37,652
				2' x 2' Modules I(included In Cassettes From Factory)	10,368 ea	1.000 mh / ea	10,368	30.57 /mh	316,917			-	-	6.00	62,208	-	-	379,125	600,594
				Install Membrane Header Piping System @ Each Basin	12 ea	64.000 mh / ea	768	30.57 /mh	23,475			-	-	400.00	4,800	-	-	28,275	44,794
				Install Air Scour Header Piping System @ Each Basin	12 ea	64.000 mh / ea	768	30.57 /mh	23,475			-	-	400.00	4,800	-	-	28,275	44,794
				Install Sodium Hypochlorite Dosing System @ Each Basin	12 ea	64.000 mh / ea	768	30.57 /mh	23,475			-	-	400.00	4,800	-	-	28,275	44,794
				43.11 Membrane Filtration Equipment	1 ls		25,920		1,038,529	60,000.00	60,000			80,568.00	80,568	18,594,595.00	18,594,595	19,773,692	30,084,290
			43.12	Air Scour Blowers															
				Air Scour Blower 200 hp	2 ea	40.000 mh / ea	80	34.45 /mh	2,756			-	-	-	-	220,000.00	440,000	442,756	672,156
				43.12 Air Scour Blowers	1 ls		80		2,756							440,000.00	440,000	442,756	672,156
				43 Process Equipment	1 ls		26,000		1,041,284	60,000.00	60,000			80,568.00	80,568	19,034,595.00	19,034,595	20,216,447	30,756,446
				3F Filtration - Construct New Membrane Gravity System	1 ls		66,806		2,627,422	3,598,330.20	3,598,330	2,901,198.24	2,901,196	502,383.03	502,383	19,354,595.00	19,354,595	28,983,926	44,197,215
				03 Filtration	1 ls		427,663		17,325,729	18,251,624.26	18,251,624	15,943,385.68	15,943,386	5,025,962.05	5,025,962	52,923,108.51	52,923,109	109,469,809	167,641,124

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
04				**Chlorine**															
	4A			Chlorine - Replace Chlorine Gas Equipment															
		00		**Building & Structure Construction**															
			03.03	**Columns**															
				Form Rectangle Columns 15' h	720 sf	0.165 mh / sf	119	39.49 /mh	4,691	1.60	1,149	-	-	-	-	-	-	5,841	9,169
				Chamfer	480 lf	0.015 mh / lf	7	39.49 /mh	284	0.57	272	-	-	-	-	-	-	557	863
				Strip & Oil Column Form	720 sf	0.005 mh / sf	4	39.17 /mh	141	0.03	22	-	-	-	-	-	-	163	256
				Superplasticizers @ Columns	10 cy			/cy		8.40	84	-	-	-	-	-	-	84	128
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	12	43.53 /mh	522	997.70	599	-	-	-	-	-	-	1,121	1,735
				Finish- Float	66 sf	0.017 mh / sf	1	39.17 /mh	44	-	-	-	-	-	-	-	-	44	70
				Pump Place Columns 8 ea	10 cy	1.600 mh / cy	16	41.39 /mh	662	-	-	-	-	7.50	75	-	-	737	1,168
				4000 psi Concrete	10 cy			/cy		142.00	1,420	-	-	-	-	-	-	1,420	2,155
				Grind/Patch Columns	720 sf	0.013 mh / sf	9	39.17 /mh	367	0.03	22	-	-	-	-	-	-	388	613
				Rub Columns	720 sf	0.065 mh / sf	47	39.17 /mh	1,833	0.06	43	-	-	-	-	-	-	1,876	2,987
				Liquid Curing Compounds	720 sf	0.003 mh / sf	2	39.17 /mh	85	0.06	42	-	-	-	-	-	-	127	198
				03.03 Columns	10 cy		217		8,630	365.30	3,653			7.50	75			12,357	19,322
			03.05	**Slab On Grade**															
				Slab Edge Form 30"	378 sf	0.350 mh / sf	132	39.49 /mh	5,225	1.31	496	-	-	-	-	-	-	5,722	9,023
				Rebar- SOG (125 #/cy)	8 tn	14.003 mh / tn	112	43.53 /mh	4,876	997.70	7,982	-	-	-	-	-	-	12,858	19,831
				Mesh Support - bricks (.12/sf)	165 ea	0.002 mh / ea	0	43.53 /mh	14	0.26	43	-	-	-	-	-	-	58	89
				Finish- Hard Trowel	1,372 sf	0.015 mh / sf	21	39.17 /mh	806	-	-	-	-	-	-	-	-	806	1,276
				Pump Place Slab on Grade 30"	128 cy	0.500 mh / cy	64	41.39 /mh	2,649	-	-	-	-	3.67	470	-	-	3,119	4,841
				4000 psi Concrete	128 cy			/cy		142.00	18,176	-	-	-	-	-	-	18,176	27,586
				Liquid Curing Compounds	1,750 sf	0.002 mh / sf	4	39.17 /mh	137	0.06	103	-	-	-	-	-	-	240	373
				Seal Floors	1,372 sf	0.002 mh / sf	3	39.17 /mh	108	0.09	127	-	-	-	-	-	-	234	363
				6 Mil Vapor Barrier	1,500 sf	0.002 mh / sf	3	43.53 /mh	131	0.05	79	-	-	-	-	-	-	209	326
				Gravel Fill Under Slab 4"	17 cy	0.004 cd / cy	2	1,412.15 /cd	91	29.26	497	-	-	3.84	65	-	-	654	1,003
				03.05 Slab On Grade	128 cy		341		14,038	214.87	27,503			4.18	535			42,076	64,811
			03.07	**Suspended Beams**															
				Beam Side Forms	776 sf	0.210 mh / sf	163	39.49 /mh	6,436	2.21	1,711	-	-	-	-	-	-	8,148	12,784
				Beam Bottom Forms	291 sf	0.210 mh / sf	61	39.49 /mh	2,414	2.21	642	-	-	-	-	-	-	3,055	4,794
				Chamfer	388 lf	0.015 mh / lf	6	39.49 /mh	230	0.57	220	-	-	-	-	-	-	450	698
				Strip & Oil Beam Forms	1,067 sf	0.005 mh / sf	5	39.17 /mh	209	0.03	32	-	-	-	-	-	-	241	379
				Superplasticizers @ Beams	22 cy			/cy		8.40	185	-	-	-	-	-	-	185	281
				Rebar- Beams (250 #/cy)	3 tn	15.003 mh / tn	41	43.53 /mh	1,796	997.70	2,744	-	-	-	-	-	-	4,540	7,008
				Finish- Top of Beam	281 sf	0.008 mh / sf	2	39.17 /mh	88	-	-	-	-	-	-	-	-	88	139
				Pump Place Beams @ Roof	22 cy	2.001 mh / cy	44	41.39 /mh	1,822	-	-	-	-	14.42	317	-	-	2,139	3,389
				4000 psi Concrete	22 cy			/cy		142.00	3,124	-	-	-	-	-	-	3,124	4,741
				Grind/Patch Beams	1,067 sf	0.013 mh / sf	14	39.17 /mh	543	0.03	32	-	-	-	-	-	-	575	909
				Rub Beams	1,067 sf	0.085 mh / sf	91	39.17 /mh	3,552	0.06	64	-	-	-	-	-	-	3,616	5,719
				Liquid Curing Compounds	1,067 sf	0.002 mh / sf	2	39.17 /mh	84	0.06	63	-	-	-	-	-	-	146	228
				03.07 Suspended Beams	22 cy		430		17,174	400.75	8,817			14.42	317			26,308	41,067
			03.20	**Precast Planks**															
				Precast Hollow Core Roof Planks 4' wide x 10"	1,283 sf	0.020 mh / sf	26	42.24 /mh	1,084	8.80	11,293	-	-	0.35	452	-	-	12,828	19,573
				03.20 Precast Planks	1,283 sf		26		1,084	8.80	11,293			0.35	452			12,828	19,573
			04.00	**Masonry**															
				8' CMU + Rigid Insulation Backup To Brick, 22' h	2,820 sf			/sf		-	-	18.00	50,760	-	-	-	-	50,760	77,039
				Precast Cap 16" x 4"	145 lf			/lf		-	-	20.00	2,901	-	-	-	-	2,901	4,402
				Brick Veneer	3,480 sf			-	-	-	-	9.00	31,326	-	-	-	-	31,326	47,544
				04.00 Masonry	3,480 sf							24.42	84,987					84,987	128,986
			05.02	**FRP Items**															
				FRP Stairs Grating Type Treads, 7 ea	0 rs	1.000 mh / rs	0	42.08 /mh	0	368.00	4	-	-	-	-	-	-	4	6
				FRP Stairs Grating Landing 4' x 4' w/ Support Frame, 7 ea	0 ea	4.001 mh / ea	0	42.08 /mh	2	1,000.00	10	-	-	-	-	-	-	12	18
				FRP Feed Pump Tables 6' x 2.5' x 3' h	0 ea	1.500 mh / ea	0	42.08 /mh	1	940.00	9	-	-	-	-	-	-	10	15
				FRP 2 Line Safety Rail @ Pit Stairs, 7 ea	0 lf	0.200 mh / lf	0	42.08 /mh	0	32.00	0	-	-	-	-	-	-	0	1
				05.02 FRP Items	1 ls		0		3	23.40	23							26	40
			06.00	**Wood**															
				Misc Nailers & Blocking	1,372 sf	0.010 mh / sf	14	39.67 /mh	544	0.40	551	-	-	-	-	-	-	1,095	1,697
				06.00 Wood	1 ls		14		544	550.63	551							1,095	1,897
			07.00	**Moisture Protection**															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	313 lf			/lf				4.00	1,252	-	-	-	-	1,252	1,901
				Caulking @ Masonry Wall Joints- Interior	313 lf			/lf				4.00	1,252	-	-	-	-	1,252	1,901
				07.00 Moisture Protection	1 ls							2,504.50	2,505					2,505	3,801
			07.01	**Roofing**															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	1,372 sf			/sf				3.00	4,117					4,117	8,248
				Aluminum Downspouts, 2 ea x 20' each	40 vf			/vf				18.00	720					720	1,093
				07.01 Roofing	1,372 sf							3.53	4,837					4,837	7,341
			08.00	**Doors, Frames & Hardware**															
				FRP Single Door Frames- 16 ga 3'x8'	2 ea	1.000 mh / ea	2	39.18 /mh	78	350.07	700	-	-	-	-	-	-	779	1,187
				FRP Door Leafs- 3'x7' 20 ga flush w/ Half Glass	2 ea	1.500 mh / ea	3	39.18 /mh	118	850.17	1,700	-	-	-	-	-	-	1,818	2,767
				Overhead Doors- 12'x12' 24 ga steel manual 1" insuation 26 ga back-up panel	2 ea			-	-	-	-	3,800.00	7,600	-	-	-	-	7,600	11,535
				FRP Framed Windows 14' x 15' h, 2 ea	420 sf			-	-	-	-	105.02	44,109	-	-	-	-	44,109	66,945
				Install Hardware by Leaf- Allowance	2 ea	8.002 mh / ea	16	39.18 /mh	627			-	-	-	-	-	-	627	992
				Finish Hardware @ FRP Doors	2 ea			/ea		1,250.25	2,501	-	-	-	-	-	-	2,501	3,795
				08.00 Doors, Frames & Hardware	4 ea		21		823	1,225.25	4,901	12,927.21	51,709					57,433	87,220
			09.00	**Finishes**															
				Paint Door Frames - primer (2) coats	2 ea			/ea		-	-	100.02	200	-	-	-	-	200	304
				Paint Doors - primer (2) coats	2 ea			/ea		-	-	140.03	280	-	-	-	-	280	425
				Paint Block Walls w/ Epoxy Coating	2,820 sf			/sf		-	-	2.50	7,051	-	-	-	-	7,051	10,702
				Epoxy Coating On Floor & Curbs	1,379 sf			-	-	-	-	4.50	6,207	-	-	-	-	6,207	9,420
				09.00 Finishes	1 ls							13,738.24	13,738					13,738	20,851
			10.00	**Specialty Items**															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	2 ea			/ea				30.01	60	-	-	-	-	60	91
				Fire Extinguisher CO2 10 lbs	2 ea			/ea				225.05	450					450	683
				10.00 Specialty Items	1 ls							3,510.70	3,511					3,511	5,328
			21.00	**Fire Protection (Wet System)**															
				Tap Onto Water Main to Provide Separate Water Feed for Suppression System	1 ea			/ea		-	-	2,000.40	2,000	-	-	-	-	2,000	3,036
				Flow Test	1 ea			/ea		-	-	1,000.20	1,000	-	-	-	-	1,000	1,518

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			21.00	Fire Protection (Wet System)															
				Post Indicator Valve & Backflow Preventer	1 ea			/ea		-	-	5,001.00	5,001	-	-	-	-	5,001	7,590
				Wet Pipe Fire Protection System	1,372 sf			/sf		-	-	8.00	10,978	-	-	-	-	10,978	16,662
				Testing of Fire Protection System	1,372 sf			/sf		-	-	2.00	2,745	-	-	-	-	2,745	4,165
				21.00 Fire Protection (Wet System)	1,372 sf							15.83	21,724					21,724	32,971
			22.00	Plumbing															
				Plumbing Subcontract	1,372 sf			/sf				11.00	15,092					15,092	22,905
				22.00 Plumbing	1 ls							15,092.00	15,092					15,092	22,905
			23.00	HVAC															
				Ventilation & Unit Heater System	1,372 sf			/sf		-	-	45.00	61,740	-	-	-	-	61,740	93,704
				23.00 HVAC	1,372 sf							45.00	61,740					61,740	93,704
			31_02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 20 ea (1 per 70 sf)	500 vf	0.002 cd / vf	56	2,146.97 /cd	2,147	35.16	17,578	-	-	2.58	1,290	-	-	21,016	32,131
				31_02 Piles	20 ea		56		2,147	878.91	17,578			64.51	1,290			21,016	32,131
				00 Building & Structure Construction	1,372 gsf		1,104		44,443	54.17	74,318	180.39	259,842	1.05	2,669			381,272	581,749
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				Ext Fixtures - Elec - ductbank Conduit/Cable/Wire	100 lf	0.250 mh / lf	25	45.53 /mh	1,138	2.72	272			5.00	500	-	-	1,910	3,010
				Building Electrical System	1,372 sf			/sf				16.00	21,956					21,956	33,324
				26.00 UG Electrical	1 ls		25		1,138	272.00	272	21,956.38	21,956	500.00	500			23,867	36,334
			26.01	Above Ground Electrical															
				Building Electrical System	1,372 sf			/sf				16.00	21,956					21,956	33,324
				Process Electrical System	1,372 sf			/sf				60.01	82,336					82,336	124,963
				26.01 Above Ground Electrical	1 ls							104,292.81	104,293					104,293	158,287
			26.02	Instrumentation & Controls															
				Controls & Instrumentation	1 ls			/ls				71,070.00	71,070					71,070	107,864
				26.02 Instrumentation & Controls	1 ls							71,070.00	71,070					71,070	107,864
				26 Electrical & Instrumentation	1 ls		25		1,138	272.00	272	197,319.19	197,319	500.00	500			199,229	302,484
		40		Process Piping															
			40.01	Above Ground Process Piping															
				Chlorine Piping & Accessories	200 LF	0.240 mh / LF	48	45.62 /mh	2,190	55.01	11,002	-	-	-	-	-	-	13,192	20,165
				Motive Water Supply Piping & Accessories	200 LF	0.240 mh / LF	48	45.62 /mh	2,190	55.01	11,002	-	-	-	-	-	-	13,192	20,165
				40.01 Above Ground Process Piping	400 lf		96		4,381	55.01	22,004							26,385	40,330
				40 Process Piping	400 lf		96		4,381	55.01	22,004							26,385	40,330
		41		Material Handling & Process Equipment															
			41.22	Hoists & Cranes															
				W 18 x 156 Bridge Crane Columns 14'h x 4 ea	56 lf			-	-	83.46	4,674	-	-	-	-	-	-	4,674	7,093
				W 18 x 156 Crane Rail Beam	72 lf			-	-	83.46	6,009	-	-	-	-	-	-	6,009	9,120
				Erect Steel W 18 x 156 Beams & Columns	4 ea	5.000 ch / ea	100	197.59 /ch	3,952			-	-	518.13	2,073			6,024	9,553
				Bridge Crane 3 ton 24.5 ft span, 36 ft runway beam	1 ea			-	-	-	-	-	-			96,000.00	96,000	96,000	145,701
				41.22 Hoists & Cranes			100		3,952		10,683				2,073		96,000	112,707	171,467
				41 Material Handling & Process Equipment	1 ls		100		3,952	10,682.89	10,683			2,072.50	2,073	96,000.00	96,000	112,707	171,467
		43		Process Equipment															
			43.13	Chemical System Equipment															
				Chlorinators	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	9,500.00	38,000	38,122	57,867
				Spare Chlorine Cylinder Rack 21' x 4.67'	1 ea	1.000 mh / ea	1	30.57 /mh	31			-	-	-	-	6,000.00	6,000	6,031	9,155
				Solution Panels 1"	2 ea	2.000 mh / ea	4	30.57 /mh	122			-	-	-	-	8,000.00	16,000	16,122	24,477
				Chlorine System Testing	1 ea	2.000 mh / ea	2	30.57 /mh	61			-	-	-	-	-	-	61	97
				Chlorine Leak Detector	6 ea	1.000 mh / ea	6	30.57 /mh	183			-	-	-	-	4,000.00	24,000	24,183	36,716
				Chlorine Gas Educators	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	5,000.00	20,000	20,122	30,548
				Chlorine Scales	6 ea	1.000 mh / ea	6	30.57 /mh	183			-	-	-	-	6,000.00	36,000	36,183	54,928
				43.13 Chemical System Equipment	1 ls		27		825							140,000.00	140,000	140,825	213,786
				43 Process Equipment	1 ls		27		825							140,000.00	140,000	140,825	213,786
				4A Chlorine - Replace Chlorine Gas Equipment	1 ls		1,352		54,739	107,277.69	107,278	457,161.58	457,162	5,241.42	5,241	236,000.00	236,000	860,419	1,309,816
	4B			Chlorine - Add New Liquid Hypochlorite Feed															
		00		Building & Structure Construction															
			03.03	Columns															
				Form Rectangle Columns 15' h	1,080 sf	0.165 mh / sf	178	39.49 /mh	7,037	1.60	1,724	-	-	-	-	-	-	8,761	13,754
				Chamfer	720 lf	0.015 mh / lf	11	39.49 /mh	427	0.57	408	-	-	-	-	-	-	835	1,295
				Strip & Oil Column Form	1,080 sf	0.005 mh / sf	5	39.17 /mh	212	0.03	32	-	-	-	-	-	-	244	384
				Superplasticizers @ Columns	15 cy			/cy		8.40	126	-	-	-	-	-	-	126	191
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	20	43.53 /mh	871	997.70	998	-	-	-	-	-	-	1,868	2,892
				Finish- Float	99 sf	0.017 mh / sf	2	39.17 /mh	66	-	-	-	-	-	-	-	-	66	104
				Pump Place Columns 12 ea	15 cy	1.600 mh / cy	24	41.39 /mh	994	-	-	-	-	7.50	112	-	-	1,106	1,751
				4000 psi Concrete	15 cy			/cy		142.00	2,130	-	-	-	-	-	-	2,130	3,233
				Grind/Patch Columns	1,080 sf	0.013 mh / sf	14	39.17 /mh	550	0.03	32	-	-	-	-	-	-	582	920
				Rub Columns	1,080 sf	0.065 mh / sf	70	39.17 /mh	2,750	0.06	65	-	-	-	-	-	-	2,814	4,450
				Liquid Curing Compounds	1,080 sf	0.003 mh / sf	3	39.17 /mh	127	0.06	64	-	-	-	-	-	-	190	297
				03.03 Columns	15 cy		328		13,031	371.95	5,579			7.50	112			18,723	29,272
			03.05	Slab On Grade															
				Slab Edge Form 30"	428 sf	0.350 mh / sf	150	39.49 /mh	5,916	1.31	562	-	-	-	-	-	-	6,478	10,217
				Rebar- SOG (125 #/cy)	11 tn	14.003 mh / tn	148	43.53 /mh	6,461	997.70	10,576	-	-	-	-	-	-	17,036	26,276
				Mesh Support - bricks (.12/sf)	218 ea	0.002 mh / ea	0	43.53 /mh	19	0.26	57	-	-	-	-	-	-	76	117
				Finish- Hard Trowel	1,819 sf	0.015 mh / sf	27	39.17 /mh	1,069	-	-	-	-	-	-	-	-	1,069	1,692
				Pump Place Slab on Grade 30"	169 cy	0.500 mh / cy	85	41.39 /mh	3,498	-	-	-	-	3.67	620	-	-	4,118	6,524
				4000 psi Concrete	169 cy			/cy		142.00	23,998	-	-	-	-	-	-	23,998	36,422
				Liquid Curing Compounds	2,247 sf	0.002 mh / sf	4	39.17 /mh	176	0.06	132	-	-	-	-	-	-	308	479
				Seal Floors	1,819 sf	0.002 mh / sf	4	39.17 /mh	143	0.09	168	-	-	-	-	-	-	311	481
				6 Mil Vapor Barrier	2,000 sf	0.002 mh / sf	4	43.53 /mh	174	0.05	105	-	-	-	-	-	-	279	435
				Gravel Fill Under Slab 4"	50 cy	0.004 cd / cy	6	1,412.15 /cd	268	29.26	1,463	-	-	3.84	192	-	-	1,922	2,949
				03.05 Slab On Grade	169 cy		429		17,723	219.30	37,061			4.81	812			55,596	85,591
			03.07	Suspended Beams															
				Beam Side Forms	1,103 sf	0.210 mh / sf	232	39.49 /mh	9,148	2.21	2,433	-	-	-	-	-	-	11,581	18,171
				Beam Bottom Forms	414 sf	0.210 mh / sf	87	39.49 /mh	3,434	2.21	913	-	-	-	-	-	-	4,347	6,820
				Chamfer	552 lf	0.015 mh / lf	8	39.49 /mh	327	0.57	313	-	-	-	-	-	-	640	993
				Strip & Oil Beam Forms	1,517 sf	0.005 mh / sf	8	39.17 /mh	297	0.03	46	-	-	-	-	-	-	343	539
				Superplasticizers @ Beams	31 cy			/cy		8.40	260	-	-	-	-	-	-	260	395

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.07	Suspended Beams															
				Rebar- Beams (250 #/cy)	4 tn	15.003 mh / tn	60	43.53 /mh	2,612	997.70	3,991	-	-	-	-	-	-	6,603	10,191
				Finish- Top of Beam	414 sf	0.008 mh / sf	3	39.17 /mh	130	-	-	-	-	-	-	-	-	130	205
				Pump Place Beams @ Roof	31 cy	2.001 mh / cy	62	41.39 /mh	2,567	-	-	-	-	14.42	447	-	-	3,014	4,775
				4000 psi Concrete	31 cy			/cy		142.00	4,402	-	-	-	-	-	-	4,402	6,681
				Grind/Patch Beams	1,517 sf	0.013 mh / sf	20	39.17 /mh	773	0.03	46	-	-	-	-	-	-	818	1,292
				Rub Beams	1,517 sf	0.085 mh / sf	129	39.17 /mh	5,050	0.06	91	-	-	-	-	-	-	5,141	8,131
				Liquid Curing Compounds	1,931 sf	0.002 mh / sf	4	39.17 /mh	151	0.06	114	-	-	-	-	-	-	265	412
				03.07 Suspended Beams	31 cy		512		24,490	406.70	12,608			14.42	447			37,545	58,607
			03.08	Pads & Curbs															
				Pad Form	150 sf	0.120 mh / sf	18	39.49 /mh	711	1.37	205	-	-	-	-	-	-	916	1,436
				Chamfer	150 lf	0.015 mh / lf	2	39.49 /mh	89	0.57	85	-	-	-	-	-	-	174	270
				Strip & Oil Equipment Pad Forms	150 sf	0.005 mh / sf	1	39.17 /mh	29	0.03	5	-	-	-	-	-	-	34	53
				Rebar- Pads (100 #/cy)	1 tn	18.003 mh / tn	18	43.53 /mh	784	997.70	998	-	-	-	-	-	-	1,781	2,754
				Finish- Float	444 sf	0.017 mh / sf	8	39.17 /mh	296	-	-	-	-	-	-	-	-	296	468
				Pump Place Pads	16 cy	1.601 mh / cy	26	41.39 /mh	1,060	-	-	-	-	7.49	120	-	-	1,180	1,868
				4000 psi Concrete	16 cy			/cy		142.00	2,272	-	-	-	-	-	-	2,272	3,448
				Liquid Curing Compounds	594 sf	0.003 mh / sf	2	39.17 /mh	70	0.06	35	-	-	-	-	-	-	105	164
				03.08 Pads & Curbs	16 cy		74		3,038	224.94	3,599			7.49	120			6,757	10,451
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	1,726 sf	0.020 mh / sf	35	42.24 /mh	1,456	8.80	15,192	-	-	0.35	607	-	-	17,258	26,332
				03.20 Precast Planks	1,726 sf		35		1,456	8.80	15,192			0.35	607			17,258	26,332
			04.00	Masonry															
				8' CMU + Rigid Insulation Backup To Brick, 22' h	3,190 sf			/sf		-	-	18.00	57,420	-	-	-	-	57,420	87,147
				Precast Cap 16" x 4"	164 lf			/lf		-	-	20.00	3,281	-	-	-	-	3,281	4,979
				Brick Veneer	3,938 sf			-	-	-	-	9.00	35,449	-	-	-	-	35,449	53,802
				04.00 Masonry	3,938 sf							24.42	96,150					96,150	145,928
			05.02	FRP Items															
				FRP Stairs Grating Type Treads, 7 ea	10 rs	1.000 mh / rs	10	42.08 /mh	421	367.57	3,676	-	-	-	-	-	-	4,097	6,245
				FRP Grating w/ Support Frame	522 SF	0.250 mh / SF	131	42.08 /mh	5,492	63.00	32,886	-	-	-	-	-	-	38,378	58,603
				FRP 2 Line Safety Rail	127 lf	0.200 mh / lf	25	42.08 /mh	1,069	32.21	4,090	-	-	-	-	-	-	5,159	7,900
				05.02 FRP Items	1 ls		166		6,982	40,651.95	40,652							47,634	72,748
			06.00	Wood															
				Misc Nailers & Blocking	1,819 sf	0.010 mh / sf	18	39.67 /mh	722	0.40	730	-	-	-	-	-	-	1,452	2,250
				06.00 Wood	1 ls		18		722	730.02	730							1,452	2,250
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	354 lf			/lf				4.00	1,416	-	-	-	-	1,416	2,150
				Caulking @ Masonry Wall Joints- Interior	354 lf			/lf				4.00	1,416	-	-	-	-	1,416	2,149
				07.00 Moisture Protection	1 ls							2,832.56	2,833					2,833	4,299
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	1,819 sf			/sf				3.00	5,458					5,458	8,284
				Aluminum Downspouts, 2 ea x 20' each	40 vf			/vf				18.00	720					720	1,093
				07.01 Roofing	1,819 sf							3.40	6,178					6,178	9,377
			08.00	Doors, Frames & Hardware															
				FRP Single Door Frames- 16 ga 3'x8'	1 ea	1.000 mh / ea	1	39.18 /mh	39	350.07	350	-	-	-	-	-	-	389	593
				FRP Double Door Frames- 16 ga 3'x8'	2 ea	1.250 mh / ea	3	39.18 /mh	98	650.13	1,300	-	-	-	-	-	-	1,398	2,128
				FRP Door Leafs- 3'x7' 20 ga. flush w/ Half Glass	5 ea	1.500 mh / ea	8	39.18 /mh	294	850.17	4,251	-	-	-	-	-	-	4,545	6,917
				Overhead Doors- 14'x14' 24 ga steel chain hoist 1" insulation 26 ga back-up panel	2 ea			-	-	-	-	5,975.00	11,950	-	-	-	-	11,950	18,137
				FRP Framed Windows 14' x 15' h, 2 ea	420 sf			-	-	-	-	105.02	44,109	-	-	-	-	44,109	66,945
				Install Hardware by Leaf- Allowance	5 ea	8.002 mh / ea	40	39.18 /mh	1,567			-	-	-	-	-	-	1,567	2,481
				Finish Hardware @ FRP Doors	5 ea			/ea		1,250.25	6,251	-	-	-	-	-	-	6,251	9,488
				08.00 Doors, Frames & Hardware	7 ea		51		1,998	1,736.06	12,152	8,008.40	56,059					70,210	106,688
			09.00	Finishes															
				Paint Door Frames - primer (2) coats	3 ea			/ea		-	-	100.02	300	-	-	-	-	300	455
				Paint Doors - primer (2) coats	5 ea			/ea		-	-	140.03	700	-	-	-	-	700	1,063
				Paint Block Walls w/ Epoxy Coating	3,190 sf			/sf		-	-	2.50	7,977	-	-	-	-	7,977	12,106
				Epoxy Coating On Floor & Curbs	1,819 sf			-	-	-	-	4.50	8,187	-	-	-	-	8,187	12,426
				09.00 Finishes	1 ls							17,163.92	17,164					17,164	26,050
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	3 ea			/ea				30.01	90	-	-	-	-	90	137
				Fire Extinguisher CO2 10 lbs	2 ea			/ea				225.05	450					450	683
				10.00 Specialty Items	1 ls							3,540.71	3,541					3,541	5,374
			21.00	Fire Protection (Wet System)															
				Tap Onto Water Main to Provide Separate Water Feed for Suppression System	1 ea			/ea		-	-	2,000.40	2,000	-	-	-	-	2,000	3,036
				Flow Test	1 ea			/ea		-	-	1,000.20	1,000	-	-	-	-	1,000	1,518
				Post Indicator Valve & Backflow Preventer	1 ea			/ea		-	-	5,001.00	5,001	-	-	-	-	5,001	7,590
				Wet Pipe Fire Protection System	1,372 sf			/sf		-	-	8.00	10,978	-	-	-	-	10,978	16,662
				Testing of Fire Protection System	1,372 sf			/sf		-	-	2.00	2,745	-	-	-	-	2,745	4,165
				21.00 Fire Protection (Wet System)	1,372 sf							15.83	21,724					21,724	32,971
			22.00	Plumbing															
				Plumbing Subcontract	1,819 sf			/sf				11.00	20,009					20,009	30,368
				22.00 Plumbing	1 ls							20,009.00	20,009					20,009	30,368
			23.00	HVAC															
				Ventilation & Unit Heater System	1,819 sf			/sf		-	-	45.00	81,855	-	-	-	-	81,855	124,233
				23.00 HVAC	1,819 sf							45.00	81,855					81,855	124,233
			31_02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 26 ea (1 per 70 sf)	650 vf	0.002 cd / vf	73	2,146.97 /cd	2,792	35.16	22,852	-	-	2.58	1,677	-	-	27,321	41,770
				31_02 Piles	26 ea		73		2,792	878.91	22,852			64.51	1,677			27,321	41,770
				00 Building & Structure Construction	1,819 gsf		1,785		72,235	82.70	150,425	107.96	305,512	2.08	3,776			531,948	812,319
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				Ext Fixtures - Elec - ductbank Conduit/Cable/Wire	100 lf	0.250 mh / lf	25	45.53 /mh	1,138	2.72	272			5.00	500	-	-	1,910	3,010
				Building Electrical System	1,819 sf			/sf				16.00	29,110					29,110	44,180
				26.00 UG Electrical	1 ls		25		1,138	272.00	272	29,109.81	29,110	500.00	500			31,020	47,190
			26.01	Above Ground Electrical															
				Building Electrical System	1,819 sf			/sf				16.00	29,110					29,110	44,180

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			26.01	Above Ground Electrical															
				Process Electrical System	1,819 sf			/sf				60.01	109,162					109,162	165,677
				26.01 Above Ground Electrical	1 ls							138,271.60	138,272					138,272	209,857
			26.02	Instrumentation & Controls															
				Controls & Instrumentation	1 ls			/ls				94,224.00	94,224					94,224	143,005
				26.02 Instrumentation & Controls	1 ls							94,224.00	94,224					94,224	143,005
				26 Electrical & Instrumentation	1 ls		25		1,138	272.00	272	261,605.41	261,605	500.00	500			263,516	400,053
		40		Process Piping															
			40.01	Above Ground Process Piping															
				Chlorine Piping & Accessories	200 LF	0.240 mh / LF	48	45.62 /mh	2,190	55.01	11,002	-	-	-	-	-	-	13,192	20,165
				Motive Water Supply Piping & Accessories	200 LF	0.240 mh / LF	48	45.62 /mh	2,190	55.01	11,002	-	-	-	-	-	-	13,192	20,165
				40.01 Above Ground Process Piping	400 lf		96		4,381	55.01	22,004							26,385	40,330
				40 Process Piping	400 lf		96		4,381	55.01	22,004							26,385	40,330
		43		Process Equipment															
			43.00	Pumps															
				Transfer Pumps 3 hp, 100 gpm	4 ea	35.000 mh / ea	140	47.77 /mh	6,688	1,500.30	6,001	-	-	-	-	20,000.00	80,000	92,690	141,111
				Softened Water Pumps < 1 hp 65 gpm	4 ea	12.000 mh / ea	48	47.77 /mh	2,293	200.00	800	-	-	-	-	5,000.00	20,000	23,093	35,198
				Metering Pump	8 ea	10.000 mh / ea	80	34.45 /mh	2,756			-	-	-	-	2,448.00	19,584	22,340	34,084
				Hose Pumps	8 ea	10.000 mh / ea	80	34.45 /mh	2,756			-	-	-	-	19,500.00	156,000	158,756	241,125
				43.00 Pumps	1 ls		348		14,493	6,801.20	6,801					275,584.00	275,584	296,878	451,518
			43.13	Chemical System Equipment															
				Water Softner 100 GPM	4 ea	54.000 mh / ea	216	24.89 /mh	5,375			-	-	-	-	1,800.00	7,200	12,575	19,435
				Fiberglass Tanks 10,000 gal, ' 2' Diameter x 11.41' h Hydrochlorite)	1 ea	1,420 cd / ea	57	1,757.90 /cd	2,496			-	-	1,056.45	1,056	13,500.00	13,500	17,053	26,121
				Day Tank 5.67' diameter, 1000 gallon	3 ea	1.000 mh / ea	3	41.79 /mh	125			-	-	-	-	3,500.00	10,500	10,625	16,134
				Wall Mt Residual analyzer	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	7,000.00	28,000	28,122	42,690
				Chlorine evaporator	4 ea	2.000 mh / ea	8	30.57 /mh	245			-	-	-	-	4,000.00	16,000	16,245	24,870
				Solution Panels 1"	2 ea	2.000 mh / ea	4	30.57 /mh	122			-	-	-	-	8,000.00	16,000	16,122	24,477
				Chlorine System Testing	1 ea	2.000 mh / ea	2	30.57 /mh	61			-	-	-	-	-	-	61	97
				Chlorine Leak Detector	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	4,000.00	16,000	16,122	24,477
				Chlorine Gas Educators	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	5,000.00	20,000	20,122	30,548
				Chlorine Scales	1 ea	1.000 mh / ea	1	30.57 /mh	31			-	-	-	-	6,000.00	6,000	6,031	9,156
				43.13 Chemical System Equipment	1 ls		303		8,822					1,056.45	1,056	133,200.00	133,200	143,079	217,804
				43 Process Equipment	1 ls		651		23,315	6,801.20	6,801			1,056.45	1,056	408,784.00	408,784	439,957	669,322
				4B Chlorine - Add New Liquid Hypochlorite Feed	1 ls		2,557		101,069	179,502.10	179,502	567,117.72	567,118	5,332.52	5,333	408,784.00	408,784	1,261,805	1,922,024
4C				Chlorine - Add New Onsite Generation of Hypochlorite Facility															
		00		Building & Structure Construction															
			03.03	Columns															
				Form Rectangle Columns 15' h	1,350 sf	0.165 mh / sf	223	39.49 /mh	8,796	1.60	2,155	-	-	-	-	-	-	10,951	17,192
				Chamfer	900 lf	0.015 mh / lf	14	39.49 /mh	533	0.57	510	-	-	-	-	-	-	1,044	1,618
				Strip & Oil Column Form	1,350 sf	0.005 mh / sf	7	39.17 /mh	264	0.03	41	-	-	-	-	-	-	305	480
				Superplasticizers @ Columns	19 cy			/cy		8.40	160	-	-	-	-	-	-	160	242
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	23	43.53 /mh	1,001	997.70	1,147	-	-	-	-	-	-	2,149	3,326
				Finish- Float	68 sf	0.017 mh / sf	1	39.17 /mh	45	-	-	-	-	-	-	-	-	45	72
				Pump Place Columns 15 ea	19 cy	1.600 mh / cy	30	41.39 /mh	1,258	-	-	-	-	7.50	142	-	-	1,401	2,218
				4000 psi Concrete	19 cy			/cy		142.00	2,698	-	-	-	-	-	-	2,698	4,095
				Grind/Patch Columns	1,350 sf	0.013 mh / sf	18	39.17 /mh	687	0.03	41	-	-	-	-	-	-	728	1,150
				Rub Columns	1,350 sf	0.065 mh / sf	88	39.17 /mh	3,437	0.06	81	-	-	-	-	-	-	3,518	5,563
				Liquid Curing Compounds	1,350 sf	0.003 mh / sf	4	39.17 /mh	159	0.06	79	-	-	-	-	-	-	238	372
				03.03 Columns	19 cy		407		16,162	363.78	6,912			7.50	142			23,236	36,328
			03.04	Walls															
				Keyway 6"	48 lf	0.050 mh / lf	2	39.49 /mh	95	0.67	32	-	-	-	-	-	-	127	199
				Job Built with Plyform 0-4'	383 sf	0.120 mh / sf	46	39.49 /mh	1,815	1.34	515	-	-	-	-	-	-	2,330	3,654
				Waterstop 6" Flat	48 lf	0.110 mh / lf	5	39.18 /mh	207	2.10	101	-	-	-	-	-	-	308	480
				Strip & Oil Wall Forms	383 sf	0.005 mh / sf	2	39.17 /mh	75	0.03	11	-	-	-	-	-	-	87	136
				Superplasticizers @ Walls	5 cy			/cy		8.40	42	-	-	-	-	-	-	42	64
				Rebar- Walls (125 #/cy)	0 tn	15.003 mh / tn	5	43.53 /mh	202	997.70	309	-	-	-	-	-	-	512	790
				Finish- Top of Wall	48 sf	0.008 mh / sf	0	39.17 /mh	15	-	-	-	-	-	-	-	-	15	24
				Pump Place Walls 12"	5 cy	1.150 mh / cy	6	41.39 /mh	238	-	-	-	-	6.65	33	-	-	271	430
				4000 psi Concrete	5 cy			/cy		142.00	710	-	-	-	-	-	-	710	1,078
				Grind/Patch Walls	383 sf	0.013 mh / sf	5	39.17 /mh	195	0.03	11	-	-	-	-	-	-	207	326
				Rub Walls	383 sf	0.058 mh / sf	22	39.17 /mh	870	0.06	23	-	-	-	-	-	-	893	1,412
				Liquid Curing Compounds	431 sf	0.002 mh / sf	1	39.17 /mh	34	0.06	25	-	-	-	-	-	-	59	92
				03.04 Walls	5 cy		94		3,746	356.09	1,780			6.65	33			5,560	8,684
			03.05	Slab On Grade															
				Slab Edge Form 30"	1,555 sf	0.350 mh / sf	544	39.49 /mh	21,496	1.31	2,041	-	-	-	-	-	-	23,537	37,120
				Rebar- SOG (125 #/cy)	13 tn	14.003 mh / tn	182	43.53 /mh	7,924	997.70	12,970	-	-	-	-	-	-	20,894	32,226
				Mesh Support - bricks (.12/sf)	264 ea	0.002 mh / ea	1	43.53 /mh	23	0.26	69	-	-	-	-	-	-	92	142
				Finish- Hard Trowel	2,200 sf	0.015 mh / sf	33	39.17 /mh	1,293	-	-	-	-	-	-	-	-	1,293	2,046
				Pump Place Slab on Grade 30"	203 cy	0.500 mh / cy	102	41.39 /mh	4,202	-	-	-	-	3.67	745	-	-	4,947	7,836
				4000 psi Concrete	203 cy			/cy		142.00	28,826	-	-	-	-	-	-	28,826	43,750
				Liquid Curing Compounds	3,755 sf	0.002 mh / sf	8	39.17 /mh	294	0.06	221	-	-	-	-	-	-	515	801
				Seal Floors	2,200 sf	0.002 mh / sf	4	39.17 /mh	172	0.09	203	-	-	-	-	-	-	376	581
				6 Mil. Vapor Barrier	2,400 sf	0.002 mh / sf	5	43.53 /mh	209	0.05	126	-	-	-	-	-	-	335	522
				Gravel Fill Under Slab 4"	27 cy	0.004 cd / cy	3	1,412.15 /cd	145	29.26	790	-	-	3.84	104	-	-	1,038	1,592
				03.05 Slab On Grade	203 cy		881		35,757	222.89	45,247			4.18	849			81,852	126,615
			03.07	Suspended Beams															
				Beam Side Forms	1,329 sf	0.210 mh / sf	279	39.49 /mh	11,023	2.21	2,931	-	-	-	-	-	-	13,954	21,895
				Beam Bottom Forms	498 sf	0.210 mh / sf	105	39.49 /mh	4,130	2.21	1,098	-	-	-	-	-	-	5,229	8,204
				Chamfer	664 lf	0.015 mh / lf	10	39.49 /mh	393	0.57	377	-	-	-	-	-	-	770	1,194
				Strip & Oil Beam Forms	1,827 sf	0.005 mh / sf	9	39.17 /mh	358	0.03	55	-	-	-	-	-	-	413	650
				Superplasticizers @ Beams	37 cy			/cy		8.40	311	-	-	-	-	-	-	311	472
				Rebar- Beams (250 #/cy)	5 tn	15.003 mh / tn	69	43.53 /mh	3,024	997.70	4,619	-	-	-	-	-	-	7,643	11,796
				Finish- Top of Beam	498 sf	0.008 mh / sf	4	39.17 /mh	156	-	-	-	-	-	-	-	-	156	247
				Pump Place Beams @ Roof	37 cy	2.001 mh / cy	74	41.39 /mh	3,064	-	-	-	-	14.42	534	-	-	3,598	5,699
				4000 psi Concrete	37 cy			/cy		142.00	5,254	-	-	-	-	-	-	5,254	7,974
				Grind/Patch Beams	1,827 sf	0.013 mh / sf	24	39.17 /mh	930	0.03	55	-	-	-	-	-	-	985	1,556
				Rub Beams	1,827 sf	0.085 mh / sf	155	39.17 /mh	6,082	0.06	110	-	-	-	-	-	-	6,192	9,793
				Liquid Curing Compounds	2,325 sf	0.002 mh / sf	5	39.17 /mh	182	0.06	137	-	-	-	-	-	-	319	496

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				03.07 Suspended Beams	37 cy		734		29,344	403.95	14,948			14.42	534			44,823	69,976
			03.08	Pads & Curbs															
				Pad Form	398 sf	0.120 mh / sf	48	39.49 /mh	1,885	1.37	543	-	-	-	-	-	-	2,430	3,810
				Chamfer	408 lf	0.015 mh / lf	6	39.49 /mh	242	0.57	231	-	-	-	-	-	-	473	734
				Strip & Oil Equipment Pad Forms	398 sf	0.005 mh / sf	2	39.17 /mh	78	0.03	12	-	-	-	-	-	-	90	142
				Rebar- Pads (100 #/cy)	2 tn	18.003 mh / tn	38	43.53 /mh	1,646	997.70	2,095	-	-	-	-	-	-	3,741	5,784
				Finish- Float	1,011 sf	0.017 mh / sf	17	39.17 /mh	673	-	-	-	-	-	-	-	-	673	1,065
				Pump Place Pads	42 cy	1.601 mh / cy	67	41.39 /mh	2,782	-	-	-	-	7.49	315	-	-	3,097	4,904
				4000 psi Concrete	42 cy			/cy		142.00	5,964	-	-	-	-	-	-	5,954	9,052
				Liquid Curing Compounds	1,409 sf	0.003 mh / sf	4	39.17 /mh	166	0.06	83	-	-	-	-	-	-	248	388
				03.08 Pads & Curbs	42 cy		182		7,473	212.59	8,929			7.49	315			16,716	25,879
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	2,078 sf	0.020 mh / sf	42	42.24 /mh	1,756	8.80	18,290	-	-	0.35	731	-	-	20,777	31,702
				03.20 Precast Planks	2,078 sf		42		1,756	8.80	18,290			0.35	731			20,777	31,702
			04.00	Masonry															
				8' CMU + Rigid Insulation Backup To Brick, 22' h	3,614 sf			/sf		-	-	18.00	65,052	-	-	-	-	65,052	98,730
				Precast Cap 16" x 4"	186 lf			/lf		-	-	20.00	3,721	-	-	-	-	3,721	5,647
				Brick Veneer	4,460 sf			-	-	-	-	9.00	40,148	-	-	-	-	40,148	60,933
				04.00 Masonry	4,460 sf							24.42	108,921					108,921	165,311
			05.02	FRP Items															
				FRP Stairs Grating Type Treads, 7 ea	12 rs	1.000 mh / rs	12	42.08 /mh	505	367.57	4,411	-	-	-	-	-	-	4,916	7,494
				FRP Grating w/ Support Frame	164 SF	0.250 mh / SF	41	42.08 /mh	1,725	63.00	10,332	-	-	-	-	-	-	12,057	18,412
				FRP 2 Line Safety Rail	112 lf	0.200 mh / lf	22	42.08 /mh	943	32.21	3,607	-	-	-	-	-	-	4,550	6,967
				05.02 FRP Items	1 ls		75		3,173	18,350.00	18,350							21,523	32,872
			06.00	Wood															
				Misc Nailers & Blocking	2,200 sf	0.010 mh / sf	22	39.67 /mh	873	0.40	883	-	-	-	-	-	-	1,756	2,722
				06.00 Wood	1 ls		22		873	882.93	883							1,756	2,722
			07.00	Moisture Protection															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	401 lf			/lf				4.00	1,604	-	-	-	-	1,604	2,435
				Caulking @ Masonry Wall Joints- Interior	401 lf			/lf				4.00	1,604	-	-	-	-	1,604	2,435
				07.00 Moisture Protection	1 ls							3,208.64	3,209					3,209	4,870
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	2,200 sf			/sf				3.00	6,601					6,601	10,019
				Aluminum Downspouts, 3 ea x 20' each	60 vf			/vf				18.00	1,080					1,080	1,639
				07.01 Roofing	2,200 sf							3.49	7,682					7,682	11,658
			08.00	Doors, Frames & Hardware															
				FRP Double Door Frames- 16 ga 3'x8'	2 ea	1.250 mh / ea	3	39.18 /mh	98	650.13	1,300	-	-	-	-	-	-	1,398	2,128
				FRP Door Leafs- 3'x7' 20 ga. flush w/ Half Glass	4 ea	1.500 mh / ea	6	39.18 /mh	235	850.17	3,401	-	-	-	-	-	-	3,636	5,533
				Overhead Doors- 12'x12' 24 ga steel manual 1" insuation 26 ga back-up panel	1 ea			-	-	-	-	3,800.00	3,800	-	-	-	-	3,800	5,757
				FRP Framed Windows 14' x 15' h, 4 ea	840 sf			-	-	-	-	105.02	88,218	-	-	-	-	88,218	133,689
				Install Hardware by Leaf- Allowance	4 ea	8.002 mh / ea	32	39.18 /mh	1,254			-	-	-	-	-	-	1,254	1,985
				Finish Hardware @ FRP Doors	4 ea			/ea		1,250.25	5,001	-	-	-	-	-	-	5,001	7,590
				08.00 Doors, Frames & Hardware	5 ea		41		1,587	1,940.39	9,702	18,403.53	92,018					103,307	156,883
			09.00	Finishes															
				Paint Door Frames - primer (2) coats	2 ea			/ea		-	-	100.02	200	-	-	-	-	200	304
				Paint Doors - primer (2) coats	4 ea			/ea		-	-	140.03	560	-	-	-	-	560	850
				Paint Block Walls w/ Epoxy Coating	3,614 sf			/sf		-	-	2.50	9,037	-	-	-	-	9,037	13,715
				Epoxy Coating On Floor & Curbs	2,200 sf			-	-	-	-	4.50	9,902	-	-	-	-	9,902	15,028
				09.00 Finishes	1 ls							19,698.93	19,699					19,699	29,897
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	2 ea			/ea				30.01	60	-	-	-	-	60	91
				Fire Extinguisher CO2 10 lbs	2 ea			/ea				225.05	450					450	683
				10.00 Specialty Items	1 ls							3,510.70	3,511					3,511	5,328
			21.00	Fire Protection (Wet System)															
				Tap Onto Water Main to Provice Separate Water Feed for Suppression System	1 ea			/ea		-	-	2,000.40	2,000	-	-	-	-	2,000	3,036
				Flow Test	1 ea			/ea		-	-	1,000.20	1,000	-	-	-	-	1,000	1,518
				Post Indicator Valve & Backflow Preventer	1 ea			/ea		-	-	5,001.00	5,001	-	-	-	-	5,001	7,590
				Wet Pipe Fire Protection System	2,200 sf			/sf		-	-	8.00	17,604	-	-	-	-	17,604	26,717
				Testing of Fire Protection System	2,200 sf			/sf		-	-	2.00	4,401	-	-	-	-	4,401	6,679
				21.00 Fire Protection (Wet System)	2,200 sf							13.64	30,006					30,006	45,541
			22.00	Plumbing															
				Plumbing Subcontract	2,200 sf			/sf				11.00	24,200					24,200	36,729
				22.00 Plumbing	1 ls							24,200.00	24,200					24,200	36,729
			23.00	HVAC															
				Ventilation & Unit Heater System	2,200 sf			/sf		-	-	45.00	99,000	-	-	-	-	99,000	150,254
				23.00 HVAC	2,200 sf							45.00	99,000					99,000	150,254
			31_02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 32 ea (1 per 70 sf)	800 vf	0.002 cd / vf	90	2,146.97 /cd	3,436	35.16	28,125	-	-	2.58	2,064	-	-	33,625	51,409
				31_02 Piles	32 ea		90		3,436	878.91	28,125			64.51	2,064			33,625	51,409
				00 Building & Structure Construction	2,200 gsf		2,568		103,325	89.62	153,164	176.48	388,244	2.12	4,668			649,402	892,667
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				Ext Fixtures - Elec - ductbank Conduit/Cable/Wire	100 lf	0.250 mh / lf	25	45.53 /mh	1,138	2.72	272			5.00	500	-	-	1,910	3,010
				Building Electrical System	2,200 sf			/sf				16.00	35,207					35,207	53,434
				26.00 UG Electrical	1 ls		25		1,138	272.00	272	35,207.03	35,207	500.00	500			37,117	56,444
			26.01	Above Ground Electrical															
				Building Electrical System	2,200 sf			/sf				16.00	35,207					35,207	53,434
				Process Electrical System	2,200 sf			/sf				60.01	132,026					132,026	200,378
				26.01 Above Ground Electrical	1 ls							167,233.38	167,233					167,233	253,813
			26.02	Instrumentation & Controls															
				Controls & Instrumentation	1 ls			/ls				113,960.00	113,960					113,960	172,969
				26.02 Instrumentation & Controls	1 ls							113,960.00	113,960					113,960	172,959
				26 Electrical & Instrumentation	1 ls		25		1,138	272.00	272	316,400.41	316,400	500.00	500			318,311	483,216
		40		Process Piping															
			40.01	Above Ground Process Piping															

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			40.01	**Above Ground Process Piping**															
				Chlorine Piping & Accessories	300 LF	0.240 mh / LF	72	45.62 /mh	3,285	55.01	16,503	-	-	-	-	-	-	19,789	30,247
				Motive Water Supply Piping & Accessories	300 LF	0.240 mh / LF	72	45.62 /mh	3,285	55.01	16,503	-	-	-	-	-	-	19,789	30,247
				Brine Maker Piping & Accessories	300 LF	0.240 mh / LF	72	45.62 /mh	3,285	55.01	16,503	-	-	-	-	-	-	19,789	30,247
				40.01 Above Ground Process Piping	900 lf		216		9,856	55.01	49,510							59,366	90,742
				40 Process Piping	900 lf		216		9,856	55.01	49,510							59,366	90,742
		43		**Process Equipment**															
			43.00	**Pumps**															
				Transfer Pumps 3 hp, 100 gpm	4 ea	35.000 mh / ea	140	47.77 /mh	6,688	1,500.30	6,001	-	-	-	-	20,000.00	80,000	92,690	141,111
				Softened Water Pumps < 1 hp, 65 gpm	4 ea	12.000 mh / ea	48	47.77 /mh	2,293	200.00	800	-	-	-	-	5,000.00	20,000	23,093	35,198
				Metering Pump	8 ea	10.000 mh / ea	80	34.45 /mh	2,756			-	-	-	-	2,448.00	19,584	22,340	34,084
				Hose Pumps	8 ea	10.000 mh / ea	80	34.45 /mh	2,756			-	-	-	-	19,500.00	156,000	158,756	241,125
				43.00 Pumps	1 ls		348		14,493	6,801.20	6,801					275,584.00	275,584	296,878	451,518
			43.13	**Chemical System Equipment**															
				Water Softner 100 GPM	4 ea	54.000 mh / ea	216	24.89 /mh	5,375			-	-	-	-	1,800.00	7,200	12,575	19,435
				Fiberglass Tanks 10,000 gal, 12' Diameter x 11.41' h Hydrochlorite)	3 ea	1.420 cd / ea	170	1,757.90 /cd	7,489			-	-	1,056.45	3,169	13,500.00	40,500	51,158	78,364
				Fiberglass Tanks 10,000 gal, 14' Diameter x 11.41' h Brine Maker)	2 ea	1.420 cd / ea	114	1,757.90 /cd	4,992			-	-	1,056.45	2,113	15,750.00	31,500	38,605	59,072
				Day Tank 5.67' diameter, 1000 gallon	3 ea	1.000 mh / ea	3	41.79 /mh	125			-	-	-	-	3,500.00	10,500	10,625	16,134
				Wall Mt Residual analyzer	4 ea	2.000 mh / ea	8	30.57 /mh	245			-	-	-	-	7,000.00	28,000	28,245	42,883
				Chlorine evaporator	4 ea	2.000 mh / ea	8	30.57 /mh	245			-	-	-	-	4,000.00	16,000	16,245	24,670
				Solution Panels 1"	2 ea	2.000 mh / ea	4	30.57 /mh	122			-	-	-	-	8,000.00	16,000	16,122	24,477
				Chlorine System Testing	1 ea	2.000 mh / ea	2	30.57 /mh	61			-	-	-	-	-	-	61	97
				Chlorine Leak Detector	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	4,000.00	16,000	16,122	24,477
				Chlorine Gas Educators	4 ea	1.000 mh / ea	4	30.57 /mh	122			-	-	-	-	5,000.00	20,000	20,122	30,548
				Hypochlorite Generators	2 ea	2,000.000 mh / ea	4,000	30.57 /mh	122,267	-	-	-	-			906,384.00	1,812,768	1,935,035	2,944,780
				43.13 Chemical System Equipment			4,533		141,166						5,282		1,998,468	2,144,916	3,264,938
				43 Process Equipment	1 ls		4,881		155,659	6,801.20	6,801			8,282.25	5,282	2,274,052.00	2,274,052	2,441,794	3,716,457
				4C Chlorine - Add New Onsite Generation of Hypochlorite Facility	1 ls		7,690		269,979	209,747.09	209,747	704,644.60	704,645	10,450.26	10,450	2,274,052.00	2,274,052	3,468,873	5,283,082
				04 Chlorine	1 ls		11,599		425,786	496,526.88	496,527	1,728,923.90	1,728,924	21,024.20	21,024	2,918,836.00	2,918,836	5,591,097	8,514,922

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05				**Clearwell**															
	5A			New Large Clearwell 275' x 137' x 24'h ID Dimensions															
		49		**Concrete Clearwell Construction**															
			03.00	**Foundation Mat**															
				Keyway 6"	872 lf	0.050 mh / lf	44	39.49 /mh	1,722	0.67	586	-	-	-	-	-	-	2,308	3,615
				Mat Foundation Edge Form 30"	2,180 sf	0.350 mh / sf	763	39.49 /mh	30,135	1.31	2,862	-	-	-	-	-	-	32,997	52,039
				Waterstop 6" Flat	872 lf	0.110 mh / lf	96	39.18 /mh	3,759	2.10	1,832	-	-	-	-	-	-	5,590	8,729
				Strip & Oil Mat Found. Form	2,180 sf	0.005 mh / sf	11	39.17 /mh	427	0.03	65	-	-			-	-	492	775
				Rebar- Foundation Mat (100 #/cy)	200 tn	28.006 mh / tn	5,612	43.53 /mh	244,267	997.70	199,939	-	-	-	-	-	-	444,226	690,088
				Rebar Support - bricks (.12/sf)	5,132 ea	0.002 mh / ea	10	43.53 /mh	447	0.26	1,347	-	-		-	-	-	1,794	2,752
				Finish- Hard Trowel	42,763 sf	0.023 mh / sf	984	39.17 /mh	38,530	-	-	-	-	-	-	-	-	38,530	60,983
				Pump Place Mat Foundation 30"	3,960 cy	0.500 mh / cy	1,980	41.39 /mh	81,950	-	-	-	-	4.59	18,169	-	-	100,119	158,620
				Pump Place Thickened Mat @ Columns 6'x25'x2.5' deep, 36 ea	120 cy	0.500 mh / cy	60	41.39 /mh	2,484	-	-	-	-	3.67	440	-	-	2,924	4,632
				4000 psi Concrete	4,080 cy			/cy		142.00	579,360	-	-	-	-	-	-	579,360	879,304
				Liquid Curing Compounds	44,943 sf	0.003 mh / sf	135	39.17 /mh	5,282	0.06	2,643	-	-	-	-	-	-	7,925	12,371
				6 MIL Vapor Barrier	47,000 sf	0.002 mh / sf	94	43.53 /mh	4,092	0.05	2,468	-	-	-	-	-	-	6,560	10,223
				03.00 Foundation Mat	**4,080 cy**		9,789		413,116	193.90	791,103			4.56	18,609			1,222,828	1,884,130
			03.03	**Columns**															
				Form Square Columns 24' h	6,912 sf	0.165 mh / sf	1,140	39.49 /mh	45,035	1.60	11,034	-	-	-	-	-	-	56,069	88,024
				Chamfer	3,456 lf	0.015 mh / lf	52	39.49 /mh	2,047	0.57	1,960	-	-	-	-	-	-	4,007	6,216
				Strip & Oil Column Form	6,912 sf	0.005 mh / sf	35	39.17 /mh	1,354	0.03	207	-	-	-	-	-	-	1,561	2,458
				Superplasticizers @ Columns	128 cy			/cy		8.40	1,075	-	-	-	-	-	-	1,075	1,632
				Column Rebar (120 #/cy)	8 tn	20.004 mh / tn	154	43.53 /mh	6,687	997.70	7,662	-	-	-	-	-	-	14,349	22,213
				Finish- Float	288 sf	0.017 mh / sf	5	39.17 /mh	192	-	-	-	-	-	-	-	-	192	304
				Pump Place Columns 36 ea	128 cy	1.600 mh / cy	205	41.39 /mh	8,478	-	-	-	-	7.49	959	-	-	9,437	14,944
				4000 psi Concrete	128 cy			/cy		142.00	18,176	-	-	-	-	-	-	18,176	27,596
				Grind/Patch Columns	6,912 sf	0.013 mh / sf	90	39.17 /mh	3,520	0.03	207	-	-	-	-	-	-	3,728	5,886
				Rub Columns	6,912 sf	0.065 mh / sf	449	39.17 /mh	17,597	0.06	415	-	-	-	-	-	-	18,012	28,480
				Liquid Curing Compounds	6,912 sf	0.003 mh / sf	21	39.17 /mh	812	0.06	407	-	-	-	-	-	-	1,219	1,903
				03.03 Columns	**128 cy**		2,150		85,723	321.43	41,143			7.49	959			127,825	199,645
			03.04	**Walls**															
				Keyway 6"	832 lf	0.050 mh / lf	42	39.49 /mh	1,643	0.67	559	-	-	-	-	-	-	2,202	3,449
				Vertical Wall Keyway 6"	500 lf	0.110 mh / lf	55	39.49 /mh	2,172	0.67	336	-	-	-	-	-	-	2,508	3,948
				Panel Form System 24' h	39,936 sf	0.190 mh / sf	7,589	39.49 /mh	299,689	1.84	73,397	-	-	-	-	-	-	373,086	585,718
				Waterstop 6" Flat	1,332 lf	0.110 mh / lf	147	39.18 /mh	5,741	2.10	2,798	-	-	-	-	-	-	8,539	13,333
				Strip & Oil Wall Forms	39,936 sf	0.005 mh / sf	200	39.17 /mh	7,822	0.03	1,198	-	-	-	-	-	-	9,021	14,109
				Superplasticizers @ Walls	1,479 cy			/cy		8.40	12,425	-	-	-	-	-	-	12,425	18,858
				Rebar- Walls (125 #/cy)	92 tn	15.003 mh / tn	1,387	43.53 /mh	60,367	997.70	92,227	-	-	-	-	-	-	152,594	235,518
				Finish- Top of Wall	3,328 sf	0.008 mh / sf	27	39.17 /mh	1,043	-	-	-	-	-	-	-	-	1,043	1,651
				Pump Place Foundation Walls 24"	1,479 cy	1.150 mh / cy	1,701	41.39 /mh	70,410	-	-	-	-	6.65	9,835	-	-	80,245	127,092
				4000 psi Concrete	1,479 cy			/cy		142.00	210,018	-	-	-	-	-	-	210,018	318,748
				Grind/Patch Walls	39,936 sf	0.013 mh / sf	519	39.17 /mh	20,338	0.03	1,198	-	-	-	-	-	-	21,537	34,009
				Rub Walls	40,808 sf	0.058 mh / sf	2,367	39.17 /mh	92,703	0.06	2,448	-	-	-	-	-	-	95,151	150,439
				Liquid Curing Compounds	39,936 sf	0.002 mh / sf	80	39.17 /mh	3,129	0.06	2,349	-	-	-	-	-	-	5,478	8,517
				03.04 Walls	**1,479 cy**		14,113		565,058	269.75	398,954			6.65	9,835			973,847	1,515,478
			03.06	**Suspended Flat Slab**															
				Form Suspended Slab Bottom	39,336 sf	0.180 mh / sf	7,082	39.49 /mh	279,650	2.18	85,927			-	-	-	-	365,577	573,019
				Slab Edge Form 12"	840 sf	0.250 mh / sf	210	39.49 /mh	8,294	5.17	4,344			-	-	-	-	12,638	19,720
				Strip & Oil Suspended Slab Forms	40,176 sf	0.005 mh / sf	201	39.17 /mh	7,869	0.04	1,648			-	-	-	-	9,517	14,956
				Superplasticizers	1,462 cy			-	-	8.40	12,282			-	-	-	-	12,282	18,641
				Rebar- Suspended Slab (225 #/cy)	164 tn	20.004 mh / tn	3,290	43.53 /mh	143,215	997.70	164,102	-	-	-	-	-	-	307,317	475,728
				Finish- Hard Trowel	39,336 sf	0.030 mh / sf	1,180	39.17 /mh	46,229	-	-			-	-	-	-	46,229	73,168
				Pump Place Suspended Slab 12"	1,462 cy	1.800 mh / cy	2,632	41.39 /mh	108,941	-	-			6.65	9,728	-	-	118,669	187,905
				4000 psi Concrete	1,462 cy			-	-	142.00	207,604			-	-	-	-	207,604	315,084
				Liquid Curing Compounds	79,512 sf	0.003 mh / sf	239	39.17 /mh	9,345	0.68	54,278			-	-	-	-	63,622	97,168
				03.06 Suspended Flat Slab	**1,462 cy**		14,834		603,544	362.64	530,184			6.65	9,728			1,143,456	1,775,389
			05.01	**Misc Metals**															
				Ladder Bolted to Concrete, w/o cage- aluminum, 4 ea x 20'	80 lf	0.750 mh / lf	60	/mh		68.25	5,460	-	-	-	-	-	-	5,460	8,287
				Goose Neck Air Vents 24" Diameter	10 ea	3.200 mh / ea	32	36.09 /mh	1,155	2,500.00	25,000	-	-			-	-	26,155	39,770
				Aluminum Access Hatch 4' x 6'	4 ea	5.000 mh / ea	20	36.09 /mh	722	1,750.00	7,000	-	-			-	-	7,722	11,766
				05.01 Misc Metals	**1 ls**		112		1,876	37,460.00	37,460							39,336	59,824
			31.01	**Dewatering**															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	70 lf			/lf				150.00	10,500			-	-	10,500	15,936
				Set & Wire Pumps	2 ea	2.000 ea / cd	48	2,249.33 /cd	2,249	25,000.00	50,000	-	-	323.92	648	-	-	52,897	80,477
				Maintenance/Operation	2 ea	1.000 ea / cd	96	2,249.33 /cd	4,499	1,000.00	2,000	-	-	647.84	1,296	-	-	7,794	12,218
				Suction Piping	00 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.09	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	2 ea	1.000 ea / cd	64	1,439.45 /cd	2,879	2,000.00	4,000	-	-	226.08	452	-	-	7,331	11,347
				Electric Consumption	4 mo	1.000 mo / ls		/ls		1,000.00	4,000	-	-			-	-	4,000	6,071
				31.01 Dewatering	**1 ls**		435		20,260	73,200.00	73,200	10,727.27	10,727	5,458.20	5,458			109,646	168,130
			31.02	**Piles**															
				Augered Piles CIP 18" x @ 25 ft depth, 1079 ea (1 per 36.46 sf)	26,975 vf	0.002 cd / vf	3,022	2,146.97 /cd	115,846	35.16	948,347	-	-	2.58	69,602	-	-	1,133,796	1,733,446
				31.02 Piles	**1,079 ea**		3,022		115,846	878.91	948,347			64.51	69,602			1,133,796	1,733,446
			31.03	**Excavation Shoring**															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,002.99	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (890' x 36' deep)	32,040 sf	0.001 cd / sf	1,579	2,465.38 /cd	60,823	16.00	512,742	-	-	0.75	24,110	-	-	597,675	912,833
				Tie Backs (1 per 80 sf of Sheeting, 890' x 26'= 23140 sf)	289 ea			-	-	-	-	2,377.47	687,090	-		-	-	687,090	1,042,807
				31.03 Excavation Shoring	**32,040 sf**		1,579		60,823	16.00	512,742	21.91	702,093	0.75	24,110			1,299,768	1,978,411
			31.10	**Structure Excavation**															
				Backhoe/Truck (44,523 sf x 28')	46,172 cy	499.900 cy / cd	3,325	1,410.06 /cd	130,236	-	-	-	-	6.58	303,997	-	-	434,233	689,943
				31.10 Structure Excavation	**46,172 cy**		3,325		130,236					6.58	303,997			434,233	689,943
			31.12	**Structure Backfill**															
				BackFill Earth-Backhoe/Truck	5,376 cy	0.002 cd / cy	348	1,327.72 /cd	14,418			-	-	4.69	25,196	-	-	39,614	62,920
				31.12 Structure Backfill	**5,376 cy**		348		14,418					4.69	25,196			39,614	62,920
			31.13	**Soil Disposal**															
				Spoils to Waste	40,796 cy	0.003 day / cy	3,672	1,410.06 /day	143,840	-	-	-	-	8.23	335,769	-	-	479,609	762,040

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				31.13 Soil Disposal	40,796 cy		3,672		143,840					8.23	335,769			479,609	762,040
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 41895 sf x 4"	90 cy	0.003 cd / cy	11	1,609.56 /cd	439	28.28	2,545	-	-	10.02	901	-	-	3,886	5,892
				31.20 Structure Stone Base	90 cy		11		439	28.28	2,545			10.02	901			3,886	5,892
				49 Concrete Clearwell Construction	39,339 gal		53,389		2,155,181	84.70	3,335,679	18.12	712,820	20.44	804,164			7,007,844	10,835,348
				5A New Large Clearwell 275' x 137' x 24'h ID Dimensions	1 ls		53,389		2,155,181	3,335,678.76	3,335,679	712,820.39	712,820	804,164.18	804,164			7,007,844	10,835,348
	5B			New Small Clearwell & UV															
		49		Concrete Clearwell Construction															
			03.00	Foundation Mat															
				Keyway 6"	262 lf	0.050 mh / lf	13	39.49 /mh	517	0.67	176	-	-	-	-	-	-	694	1,088
				Mat Foundation Edge Form 30"	655 sf	0.350 mh / sf	229	39.49 /mh	9,054	1.31	860	-	-	-	-	-	-	9,914	15,638
				Waterstop 6" Flat	262 lf	0.110 mh / lf	29	39.18 /mh	1,129	2.10	550	-	-	-	-	-	-	1,680	2,623
				Strip & Oil Mat Found. Form	655 sf	0.005 mh / sf	3	39.17 /mh	128	0.03	20	-	-	-	-	-	-	148	233
				Rebar- Foundation Mat (100 #/cy)	20 tn	28.006 mh / tn	560	43.53 /mh	24,380	997.70	19,954	-	-	-	-	-	-	44,334	68,871
				Rebar Support - bricks (.12/sf)	516 ea	0.002 mh / ea	1	43.53 /mh	45	0.26	135	-	-	-	-	-	-	180	277
				Finish- Hard Trowel	4,298 sf	0.023 mh / sf	99	39.17 /mh	3,873	-	-	-	-	-	-	-	-	3,873	6,129
				Pump Place Mat Foundation 30"	398 cy	0.500 mh / cy	199	41.39 /mh	8,236	-	-	-	-	4.59	1,826	-	-	10,062	15,942
				Pump Place Thickened Mat @ Columns 6"x26'x2.5' deep, 36 ea	3 cy	0.500 mh / cy	2	41.39 /mh	62	-	-	-	-	3.67	11	-	-	73	116
				4000 psi Concrete	401 cy			/cy		142.00	56,942	-	-	-	-	-	-	56,942	86,422
				Liquid Curing Compounds	4,953 sf	0.003 mh / sf	15	39.17 /mh	582	0.06	291	-	-	-	-	-	-	873	1,363
				6 MiL Vapor Barrier	10,200 sf	0.002 mh / sf	20	43.53 /mh	888	0.05	536	-	-	-	-	-	-	1,424	2,219
				03.00 Foundation Mat	401 cy		1,170		48,896	198.17	79,464			4.58	1,837			130,197	200,916
			03.03	Columns															
				Form Square Columns 24' h	192 sf	0.165 mh / sf	32	39.49 /mh	1,251	1.60	306	-	-	-	-	-	-	1,557	2,445
				Chamfer	96 lf	0.015 mh / lf	1	39.49 /mh	57	0.57	54	-	-	-	-	-	-	111	173
				Strip & Oil Column Form	88 sf	0.005 mh / sf	0	39.17 /mh	17	0.03	3	-	-	-	-	-	-	20	31
				Superplasticizers @ Columns	4 cy			/cy		8.40	34	-	-	-	-	-	-	34	51
				Column Rebar (120 #/cy)	0 tn	20.004 mh / tn	5	43.53 /mh	209	997.70	239	-	-	-	-	-	-	448	694
				Finish- Float	4 sf	0.017 mh / sf	0	39.17 /mh	3	-	-	-	-	-	-	-	-	3	4
				Pump Place Columns 1 ea	4 cy	1.600 mh / cy	6	41.39 /mh	265	-	-	-	-	7.49	30	-	-	295	467
				4000 psi Concrete	4 cy			/cy		142.00	568	-	-	-	-	-	-	568	862
				Grind/Patch Columns	192 sf	0.013 mh / sf	2	39.17 /mh	98	0.03	6	-	-	-	-	-	-	104	164
				Rub Columns	192 sf	0.065 mh / sf	12	39.17 /mh	489	0.06	12	-	-	-	-	-	-	500	781
				Liquid Curing Compounds	192 sf	0.003 mh / sf	1	39.17 /mh	23	0.06	11	-	-	-	-	-	-	34	53
				03.03 Columns	4 cy		60		2,411	308.30	1,233			7.49	30			3,674	5,735
			03.04	Walls															
				Keyway 6"	232 lf	0.050 mh / lf	12	39.49 /mh	458	0.67	156	-	-	-	-	-	-	614	962
				Vertical Wall Keyway 6"	48 lf	0.110 mh / lf	5	39.49 /mh	209	0.67	32	-	-	-	-	-	-	241	379
				Panel Form System 24' h	11,144 sf	0.190 mh / sf	2,118	39.49 /mh	83,627	1.84	20,481	-	-	-	-	-	-	104,108	163,442
				Waterstop 6" Flat	280 lf	0.110 mh / lf	31	39.18 /mh	1,207	2.10	588	-	-	-	-	-	-	1,795	2,803
				Strip & Oil Wall Forms	11,144 sf	0.005 mh / sf	56	39.17 /mh	2,183	0.03	334	-	-	-	-	-	-	2,517	3,962
				Superplasticizers @ Walls	413 cy			/cy		8.40	3,470	-	-	-	-	-	-	3,470	5,266
				Rebar- Walls (125 #/cy)	26 tn	15.003 mh / tn	390	43.53 /mh	16,979	997.70	25,940	-	-	-	-	-	-	42,919	66,243
				Finish- Top of Wall	464 sf	0.008 mh / sf	4	39.17 /mh	145	-	-	-	-	-	-	-	-	145	230
				Pump Place Foundation Walls 24"	413 cy	1.150 mh / cy	475	41.39 /mh	19,662	-	-	-	-	6.65	2,746	-	-	22,408	35,489
				4000 psi Concrete	413 cy			/cy		142.00	58,646	-	-	-	-	-	-	58,646	89,008
				Grind/Patch Walls	11,144 sf	0.013 mh / sf	145	39.17 /mh	5,675	0.03	334	-	-	-	-	-	-	6,010	9,490
				Rub Walls	5,804 sf	0.058 mh / sf	337	39.17 /mh	13,186	0.06	348	-	-	-	-	-	-	13,533	21,396
				Liquid Curing Compounds	11,144 sf	0.002 mh / sf	22	39.17 /mh	873	0.06	655	-	-	-	-	-	-	1,529	2,377
				03.04 Walls	413 cy		3,594		144,203	268.73	110,986			6.65	2,746			257,935	401,047
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	3,605 sf	0.180 mh / sf	649	39.49 /mh	25,629	2.18	7,875			-	-	-	-	33,504	52,516
				Slab Edge Form 12"	240 sf	0.250 mh / sf	60	39.49 /mh	2,370	5.17	1,241			-	-	-	-	3,611	5,634
				Strip & Oil Suspended Slab Forms	3,845 sf	0.005 mh / sf	19	39.17 /mh	753	0.04	156			-	-	-	-	911	1,431
				Superplasticizers	134 cy			-	-	8.40	1,126			-	-	-	-	1,126	1,709
				Rebar- Suspended Slab (225 #/cy)	15 tn	20.004 mh / tn	300	43.53 /mh	13,061	997.70	14,966	-	-	-	-	-	-	28,026	43,385
				Finish- Hard Trowel	3,605 sf	0.030 mh / sf	108	39.17 /mh	4,237	-	-			-	-	-	-	4,237	6,706
				Pump Place Suspended Slab 12"	134 cy	1.800 mh / cy	241	41.39 /mh	9,985	-	-			6.65	892	-	-	10,877	17,223
				4000 psi Concrete	134 cy			-	-	142.00	19,028			-	-	-	-	19,028	28,879
				Liquid Curing Compounds	7,450 sf	0.003 mh / sf	22	39.17 /mh	876	0.68	5,086			-	-	-	-	5,961	9,104
				03.06 Suspended Flat Slab	134 cy		1,400		56,910	369.24	49,478			6.65	892			107,280	166,585
			05.01	Misc Metals															
				Ladder Bolted to Concrete, w/o cage- aluminum, 2 ea x 20'	40 VF	0.750 mh / VF	30	/mh		68.25	2,730	-	-	-	-	-	-	2,730	4,143
				Goose Neck Air Vents 24" Diameter	2 ea	3.200 mh / ea	6	36.09 /mh	231	2,500.00	5,000	-	-			-	-	5,231	7,954
				Aluminum Access Hatch 4' x 6'	2 ea	5.000 mh / ea	10	36.09 /mh	361	1,750.00	3,500	-	-			-	-	3,861	5,883
				05.01 Misc Metals	1 ls		46		592	11,230.00	11,230							11,822	17,981
			31.01	Dewatering															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	35 lf			/lf				150.00	5,250			-	-	5,250	7,968
				Set & Wire Pumps	1 ea	2.000 ea / cd	24	2,249.33 /cd	1,125	25,000.00	25,000	-	-	323.92	324	-	-	26,449	40,238
				Maintenance/Operation	1 ea	1.000 ea / cd	48	2,249.33 /cd	2,249	1,000.00	1,000	-	-	647.84	648	-	-	3,897	6,109
				Suction Piping	80 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.89	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	1 ea	1.000 ea / cd	32	1,439.45 /cd	1,439	2,000.00	2,000	-	-	226.08	226	-	-	3,666	5,673
				Electric Consumption	2 mo	1.000 mo / ls		/ls		1,000.00	2,000	-	-			-	-	2,000	3,035
				31.01 Dewatering	1 ls		331		15,447	43,200.00	43,200	5,477.27	5,477	4,260.36	4,260			68,384	105,108
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 119 ea (1 per 36.46 sf)	2,975 vf	0.002 cd / vf	333	2,146.97 /cd	12,776	35.16	104,591	-	-	2.58	7,676	-	-	125,043	191,177
				31.02 Piles	119 ea		333		12,776	878.91	104,591			64.51	7,676			125,043	191,177
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,002.99	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (286' x 36' deep)	10,296 sf	0.001 cd / sf	507	2,465.38 /cd	19,545	16.00	164,769	-	-	0.75	7,748	-	-	192,062	293,337
				Tie Backs (1 per 80 sf of Sheeting, 286' x 26'= 7436 sf)	93 ea			-	-	-	-	2,377.48	221,105	-	-	-	-	221,105	336,575
				31.03 Excavation Shoring	10,296 sf		507		19,545	16.00	164,769	22.93	236,108	0.75	7,748			428,170	651,682
			31.10	Structure Excavation															
				Backhoe/Truck (5129 sf x 28')	5,319 cy	499.900 cy / cd	383	1,410.06 /cd	15,003	-	-	-	-	6.58	35,020	-	-	50,024	79,481
				31.10 Structure Excavation	5,319 cy		383		15,003					6.58	35,020			50,024	79,481
			31.12	Structure Backfill															
				BackFill Earth-Backhoe/Truck	1,648 cy	0.002 cd / cy	107	1,327.72 /cd	4,420			-	-	4.69	7,724	-	-	12,144	19,288

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				31.12 Structure Backfill	1,648 cy		107		4,420					4.59	7,724			12,144	19,288
			31.13	**Soil Disposal**															
				Spoils to Waste	3,671 cy	0.003 day / cy	330	1,410.06 /day	12,943	-	-	-	-	8.23	30,214	-	-	43,157	68,572
				31.13 Soil Disposal	3,671 cy		330		12,943					8.23	30,214			43,157	68,672
			31.20	**Structure Stone Base**															
				Structure Subbase Stone-Loaders/Truck - 41895 sf x 4"	80 cy	0.003 cd / cy	10	1,609.56 /cd	390	28.28	2,262	-	-	10.02	801	-	-	3,454	5,327
				31.20 Structure Stone Base	80 cy		10		390	28.28	2,262			10.02	801			3,454	5,327
				40 Concrete Clearwell Construction	3,540 gsf		8,272		333,536	160.23	567,214	68.24	241,685	27.05	95,948			1,241,283	1,912,897
		60		**UV Facility**															
			03.00	**Foundation Mat**															
				Keyway 6"	340 lf	0.050 mh / lf	17	39.49 /mh	671	0.67	229	-	-	-	-	-	-	900	1,410
				Mat Foundation Edge Form 30"	850 sf	0.350 mh / sf	298	39.49 /mh	11,750	1.31	1,116	-	-	-	-	-	-	12,866	20,290
				Waterstop 6" Flat	340 lf	0.110 mh / lf	37	39.18 /mh	1,466	2.10	714	-	-	-	-	-	-	2,180	3,403
				Strip & Oil Mat Found. Form	850 sf	0.005 mh / sf	4	39.17 /mh	166	0.03	26	-	-	-	-	-	-	192	302
				Rebar- Foundation Mat (100 #/cy)	33 tn	28.006 mh / tn	928	43.53 /mh	40,410	997.70	33,074	-	-	-	-	-	-	73,484	114,154
				Rebar Support - bricks (.12/sf)	859 ea	0.002 mh / ea	2	43.53 /mh	75	0.26	226	-	-	-	-	-	-	300	461
				Finish- Hard Trowel	7,156 sf	0.023 mh / sf	165	39.17 /mh	6,448	-	-	-	-	-	-	-	-	6,448	10,205
				Pump Place Mat Foundation 30"	663 cy	0.500 mh / cy	332	41.39 /mh	13,720	-	-	-	-	4.59	3,042	-	-	16,762	26,557
				4000 psi Concrete	663 cy			/cy		142.00	94,146	-	-	-	-	-	-	94,146	142,887
				Liquid Curing Compounds	8,006 sf	0.003 mh / sf	24	39.17 /mh	941	0.06	471	-	-	-	-	-	-	1,412	2,204
				6 Mil. Vapor Barrier	16,700 sf	0.002 mh / sf	33	43.53 /mh	1,454	0.05	877	-	-	-	-	-	-	2,331	3,632
				03.00 Foundation Mat	663 cy		1,840		77,101	197.40	130,877			4.59	3,042			211,020	325,505
			03.03	**Columns**															
				Form Rectangle Columns 9.33'	672 sf	0.165 mh / sf	111	39.49 /mh	4,378	1.60	1,073	-	-	-	-	-	-	5,451	8,558
				Form Rectangle Columns 26'	2,288 sf	0.165 mh / sf	378	39.49 /mh	14,908	1.60	3,652	-	-	-	-	-	-	18,560	29,138
				Chamfer	1,480 lf	0.015 mh / lf	22	39.49 /mh	877	0.57	839	-	-	-	-	-	-	1,716	2,862
				Strip & Oil Column Form	2,960 sf	0.005 mh / sf	15	39.17 /mh	580	0.03	89	-	-	-	-	-	-	669	1,052
				Superplasticizers @ Columns	54 cy			/cy		8.40	454	-	-	-	-	-	-	454	689
				Column Rebar (120 #/cy)	3 tn	20.004 mh / tn	65	43.53 /mh	2,821	997.70	3,233	-	-	-	-	-	-	6,054	9,371
				Finish- Float	80 sf	0.017 mh / sf	1	39.17 /mh	53	-	-	-	-	-	-	-	-	53	84
				Pump Place Columns 20 ea	54 cy	1.600 mh / cy	86	41.39 /mh	3,577	-	-	-	-	7.49	404	-	-	3,981	6,305
				4000 psi Concrete	54 cy			/cy		142.00	7,668	-	-	-	-	-	-	7,668	11,636
				Grind/Patch Columns	2,960 sf	0.013 mh / sf	38	39.17 /mh	1,507	0.03	89	-	-	-	-	-	-	1,596	2,521
				Rub Columns	2,960 sf	0.065 mh / sf	192	39.17 /mh	7,536	0.06	178	-	-	-	-	-	-	7,713	12,196
				Liquid Curing Compounds	2,960 sf	0.003 mh / sf	9	39.17 /mh	348	0.06	174	-	-	-	-	-	-	522	815
				03.03 Columns	54 cy		918		36,585	323.11	17,448			7.49	404			54,437	85,026
			03.04	**Walls**															
				Brick Ledge Forms	161 sf	0.300 mh / sf	48	39.49 /mh	1,908	2.21	355	-	-	-	-	-	-	2,263	3,558
				Keyway 6"	188 lf	0.050 mh / lf	9	39.49 /mh	371	0.67	126	-	-	-	-	-	-	498	779
				Vertical Wall Keyway 6"	80 lf	0.110 mh / lf	9	39.49 /mh	348	0.67	54	-	-	-	-	-	-	401	632
				Panel Form System 17' h	6,392 sf	0.190 mh / sf	1,215	39.49 /mh	47,967	1.84	11,748	-	-	-	-	-	-	59,715	93,748
				Waterstop 6" Flat	268 lf	0.110 mh / lf	29	39.18 /mh	1,155	2.10	563	-	-	-	-	-	-	1,718	2,683
				Strip & Oil Wall Forms	6,392 sf	0.005 mh / sf	32	39.17 /mh	1,252	0.03	192	-	-	-	-	-	-	1,444	2,273
				Superplasticizers @ Walls	237 cy			/cy		8.40	1,991	-	-	-	-	-	-	1,991	3,022
				Rebar- Walls (125 #/cy)	18 tn	15.003 mh / tn	270	43.53 /mh	11,755	997.70	17,959	-	-	-	-	-	-	29,713	45,860
				Finish- Top of Wall	376 sf	0.008 mh / sf	3	39.17 /mh	118	-	-	-	-	-	-	-	-	118	187
				Pump Place Foundation Walls 24"	237 cy	1.150 mh / cy	273	41.39 /mh	11,283	-	-	-	-	6.65	1,576	-	-	12,859	20,366
				Pump Place Brick Ledge	1 cy	2.001 mh / cy	2	41.39 /mh	83	-	-	-	-	14.42	14	-	-	97	154
				4000 psi Concrete	238 cy			/cy		142.00	33,796	-	-	-	-	-	-	33,796	51,293
				Grind/Patch Walls	6,392 sf	0.013 mh / sf	83	39.17 /mh	3,255	0.03	192	-	-	-	-	-	-	3,447	5,443
				Rub Walls	3,196 sf	0.058 mh / sf	185	39.17 /mh	7,260	0.06	192	-	-	-	-	-	-	7,452	11,782
				Liquid Curing Compounds	6,392 sf	0.002 mh / sf	13	39.17 /mh	501	0.06	376	-	-	-	-	-	-	877	1,363
				03.04 Walls	238 cy		2,172		87,255	283.79	67,543			6.68	1,590			156,388	243,142
			03.07	**Suspended Beams**															
				Beam Side Forms	3,181 sf	0.210 mh / sf	668	39.49 /mh	26,384	2.21	7,016	-	-	-	-	-	-	33,399	52,405
				Beam Bottom Forms	1,060 sf	0.210 mh / sf	223	39.49 /mh	8,792	2.21	2,338	-	-	-	-	-	-	11,130	17,453
				Chamfer	2,120 lf	0.015 mh / lf	32	39.49 /mh	1,256	0.57	1,202	-	-	-	-	-	-	2,458	3,813
				Strip & Oil Beam Forms	4,241 sf	0.005 mh / sf	21	39.17 /mh	831	0.03	127	-	-	-	-	-	-	958	1,508
				Superplasticizers @ Beams	118 cy			/cy		8.40	991	-	-	-	-	-	-	991	1,505
				Rebar- Beams (250 #/cy)	15 tn	15.003 mh / tn	221	43.53 /mh	9,632	997.70	14,716	-	-	-	-	-	-	24,348	37,580
				Finish- Top of Beam	1,060 sf	0.008 mh / sf	8	39.17 /mh	332	-	-	-	-	-	-	-	-	332	526
				Pump Place Beams @ Roof	118 cy	2.001 mh / cy	236	41.39 /mh	9,773	-	-	-	-	14.42	1,702	-	-	11,474	18,176
				4000 psi Concrete	118 cy			/cy		142.00	16,756	-	-	-	-	-	-	16,756	25,431
				Grind/Patch Beams	4,241 sf	0.013 mh / sf	55	39.17 /mh	2,160	0.03	127	-	-	-	-	-	-	2,287	3,612
				Rub Beams	4,241 sf	0.085 mh / sf	360	39.17 /mh	14,119	0.06	254	-	-	-	-	-	-	14,374	22,733
				Liquid Curing Compounds	5,301 sf	0.002 mh / sf	11	39.17 /mh	415	0.06	312	-	-	-	-	-	-	727	1,131
				03.07 Suspended Beams	118 cy		1,836		73,694	371.52	43,840			14.42	1,702			119,235	185,880
			03.08	**Pads & Curbs**															
				Roof Parapet Curb Forms 48" h	3,876 sf	0.200 mh / sf	775	39.49 /mh	30,617	1.52	5,902	-	-	-	-	-	-	36,520	57,417
				Chamfer	968 lf	0.015 mh / lf	15	39.49 /mh	573	0.57	549	-	-	-	-	-	-	1,122	1,741
				Strip & Oil Equipment Curb Forms	3,876 sf	0.005 mh / sf	19	39.17 /mh	759	0.03	116	-	-	-	-	-	-	876	1,378
				Rebar- Pads (100 #/cy)	4 tn	18.004 mh / tn	65	43.53 /mh	2,821	997.70	3,592	-	-	-	-	-	-	6,413	9,918
				Finish- Float	484 sf	0.017 mh / sf	8	39.17 /mh	322	-	-	-	-	-	-	-	-	322	510
				Pump Place Curbs 12"	72 cy	2.501 mh / cy	180	41.39 /mh	7,452	-	-	-	-	9.86	710	-	-	8,161	12,923
				4000 psi Concrete	72 cy			/cy		142.00	10,224	-	-	-	-	-	-	10,224	15,517
				Liquid Curing Compounds	4,360 sf	0.003 mh / sf	13	39.17 /mh	512	0.06	256	-	-	-	-	-	-	769	1,200
				03.08 Pads & Curbs	72 cy		1,075		43,057	286.66	20,640			9.86	710			64,407	100,602
			03.09	**Pan Stair Fill**															
				Finish Stairs	562 sf	0.055 mh / sf	31	39.17 /mh	1,211	-	-	-	-	-	-	-	-	1,211	1,916
				Pump Place Pan Stair Concrete	4 cy	3.001 mh / cy	12	41.39 /mh	497	-	-	-	-	9.18	37	-	-	533	845
				3000 psi Concrete	4 cy			-	-	138.00	552	-	-	-	-	-	-	552	838
				03.09 Pan Stair Fill	4 cy		43		1,708	138.00	552			9.18	37			2,296	3,599
			05.01	**Misc Metals**															
				Work Platform Frame & Floor Grating Structural Support (13 #/sf)	1 tn	8.002 ch / tn	40	214.54 /ch	1,734	1,200.25	1,212	-	-	829.21	838	-	-	3,784	5,917
				Metal Stairs Concrete Pans	63 rs	0.067 mh / rs	4	42.08 /mh	177	80.02	5,041	-	-	-	-	-	-	5,218	7,931
				Metal Stairs Grating Type	18 rs	1.000 mh / rs	18	42.08 /mh	758	367.57	6,616	-	-	-	-	-	-	7,374	11,241
				Alum Stair Wall Handrail	32 lf	0.150 mh / lf	5	42.08 /mh	202	16.80	538	-	-	-	-	-	-	740	1,136
				Aluminum 3 Line Rail	84 lf	0.234 mh / lf	20	42.08 /mh	827	44.11	3,705	-	-	-	-	-	-	4,532	6,933
				Aluminum Handrail @ Work Platform	60 lf	0.234 mh / lf	14	42.08 /mh	591	44.11	2,647	-	-	-	-	-	-	3,237	4,952
				Aluminum Handrail @ Pan Stairs	92 lf	0.234 mh / lf	22	42.08 /mh	906	44.11	4,058	-	-	-	-	-	-	4,964	7,593
				Alum Grate Cover .75" @ 4'x4' Sump	2 ea	0.600 mh / ea	1	42.08 /mh	51	185.04	370	-	-	-	-	-	-	421	642

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			05.01	**Misc Metals**															
				Alumi Grating Work Platform @ UV Reactor 12' x 6.5' x 5' h, 2 ea	156 sf	0.035 mh / sf	5	42.08 /mh	230	12.39	1,933	-	-	-	-	-	-	2,163	3,298
				Alum Grating Banding	74 lf			/lf		23.70	1,754	-	-	-	-	-	-	1,754	2,662
				Aluminum Hatch & Frame Over Pipe Gallery 6.33' x 6.33'	0 ea	8.000 mh / ea	0	39.18 /mh	3	5,001.00	50	-	-	-	-	-	-	53	81
				05.01 Misc Metals	1 ls		129		5,478	27,924.05	27,924			837.50	838			34,240	62,384
			06.00	**Wood**															
				Misc Nailers & Blocking	7,071 sf	0.010 mh / sf	71	39.67 /mh	2,806	0.40	2,838	-	-	-	-	-	-	5,644	8,748
				PT Roof Blocking @ Top Of Masonry Wall	332 lf	0.035 mh / lf	12	39.67 /mh	461	1.82	604	-	-	-	-	-	-	1,065	1,647
				PT Roof Blocking @ Skylight Curb	156 lf	0.035 mh / lf	5	39.67 /mh	217	1.82	284	-	-	-	-	-	-	500	774
				06.00 Wood	1 ls		88		3,483	3,725.66	3,726							7,209	11,168
			07.00	**Moisture Protection**															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	1,223 lf			/lf				4.00	4,893	-	-	-	-	4,893	7,426
				Caulking @ Masonry Wall Joints- Interior	1,021 lf			/lf				4.00	4,085	-	-	-	-	4,085	6,200
				07.00 Moisture Protection	1 ls							8,977.80	8,978					6,978	13,626
			07.01	**Roofing**															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" insulation	5,800 sf			/sf				3.00	17,403					17,403	26,414
				Aluminum Downspouts, 2 ea x 32' each	64 vf			/vf				18.00	1,152					1,152	1,749
				Scuppers	2 ea			/ea				50.01	100					100	152
				Aluminum Coping @ Roof Parapet 12" wide	332 lf			/lf				15.00	4,981					4,981	7,560
				Translucent Panel Skylight Frame & Panels	1,398 sf			/sf				38.01	53,135					53,135	80,643
				07.01 Roofing	1 sf							76,771.31	76,771					76,771	116,517
			08.00	**Doors, Frames & Hardware**															
				HM Single Frames- 16 ga 3'x7'	5 ea	1.000 mh / ea	5	39.18 /mh	196	180.04	900	-	-	-	-	-	-	1,096	1,676
				HM Double Frames- 16 ga. 6'x7'	1 ea	1.500 mh / ea	2	39.18 /mh	59	210.00	210	-	-	-	-	-	-	269	412
				HM Door Leafs- 3'x7' 20 ga. half glass	7 ea	1.500 ea / mh	5	39.18 /mh	183	450.09	3,151	-	-	-	-	-	-	3,333	5,071
				Overhead Doors- 10'x10' 24 ga steel manual 1" insuation 26 ga back-up penel	1 ea			-	-	-	-	2,255.00	2,255	-	-	-	-	2,255	3,422
				Finish Hardware by Leaf- Allowance	7 ea	8.002 mh / ea	56	39.18 /mh	2,194	900.18	6,301	-	-	-	-	-	-	8,495	13,036
				08.00 Doors, Frames & Hardware	1 ea		67		2,632	10,562.07	10,562	2,255.00	2,255					15,449	23,618
			09.00	**Finishes**															
				Paint HM Door Frames - primer (2) coats	7 ea			/ea		-	-	100.02	700	-	-	-	-	700	1,063
				Paint HM Doors - primer (2) coats	7 ea			/ea		-	-	140.03	980	-	-	-	-	980	1,488
				Paint CMU Block - block filler & (2) coat	10,186 sf			-	-	-	-	1.35	13,751	-	-	-	-	13,751	20,870
				09.00 Finishes	1 ls							15,431.44	15,431					15,431	23,421
			10.00	**Specialty Items**															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	4 ea			/ea				30.01	120	-	-	-	-	120	182
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	1 ls							4,020.81	4,021					4,021	6,102
			22.00	**Plumbing**															
				Plumbing Subcontract	7,071 sf			/sf				6.00	42,434					42,434	64,403
				22.00 Plumbing	1 ls							42,434.47	42,434					42,434	64,403
			23.00	**HVAC**															
				Ventilation & Unit Heater System	7,071 sf			/sf		-	-	45.00	318,195	-	-	-	-	318,195	482,930
				23.00 HVAC	1 sf							318,195.00	318,195					318,195	482,930
			26.00	**UG Electrical**															
				Building Electrical System	7,071 sf			/sf				16.00	113,159					113,159	171,743
				26.00 UG Electrical	1 ls							113,158.59	113,159					113,159	171,743
			26.01	**Above Ground Electrical**															
				Building Electrical System	7,071 sf			/sf				8.00	56,579					56,579	85,871
				Process Electrical System	7,071 sf			/sf				30.01	212,172					212,172	322,017
				26.01 Above Ground Electrical	1 ls							268,751.64	268,752					268,752	407,889
			26.02	**Instrumentation & Controls**															
				Controls & Instrumentation	1 ls			/ls				366,278.00	366,278					366,278	555,906
				26.02 Instrumentation & Controls	1 ls							366,278.00	366,278					366,278	555,906
			31.01	**Dewatering**															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	35 lf			/lf				150.00	5,250			-	-	5,250	7,988
				Set & Wire Pumps	1 ea	2.000 ea / cd	24	2,249.33 /cd	1,125	25,000.00	25,000	-	-	323.92	324	-	-	26,449	40,238
				Maintenance/Operation	1 ea	1.000 ea / cd	48	2,249.33 /cd	2,249	1,000.00	1,000	-	-	647.84	648	-	-	3,897	6,109
				Suction Piping	80 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.89	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	1 ea	1.000 ea / cd	32	1,439.45 /cd	1,439	2,000.00	2,000	-	-	226.08	226	-	-	3,666	5,674
				Electric Consumption	4 mo	1.000 mo / ls		/ls		1,000.00	4,000	-	-			-	-	4,000	6,071
				31.01 Dewatering	1 ls		331		15,447	45,200.00	45,200	5,477.27	5,477	4,260.36	4,260			70,384	108,142
			31.02	**Piles**															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 104 ea (1 per 68 sf)	2,600 vf	0.002 cd / vf	291	2,146.97 /cd	11,166	35.16	91,407	-	-	2.58	6,709	-	-	109,282	167,079
				31.02 Piles	104 ea		291		11,166	878.91	91,407			64.51	6,709			109,282	167,079
			31.03	**Excavation Shoring**															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,002.99	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (87' x 22' deep)	1,914 sf	0.001 cd / sf	94	2,465.38 /cd	3,633	16.00	30,630	-	-	0.75	1,440	-	-	35,704	54,531
				Tie Backs (1 per 80 sf of Sheeting, 87' x 18'= 1566 sf)	20 ea			-	-	-	-	2,377.48	47,549	-	-	-	-	47,549	72,167
				31.03 Excavation Shoring	1,914 sf		94		3,633	16.00	30,630	32.68	62,552	0.75	1,440			98,256	149,468
			31.10	**Structure Excavation**															
				Exc Clay-Backhoe/Truck (7,310 sf x 18.33')	4,963 cy	499.900 cy / cd	357	1,410.06 /cd	13,999	-	-	-	-	6.58	32,676	-	-	46,676	74,162
				31.10 Structure Excavation	4,963 cy		357		13,999					6.58	32,676			46,676	74,162
			31.12	**Structure Backfill**															
				BackFill Earth-Backhoe/Truck (87' x 4' x 18.33')	236 cy	0.002 cd / cy	15	1,327.72 /cd	633			-	-	4.69	1,106	-	-	1,739	2,782
				31.12 Structure Backfill	236 cy		15		633					4.69	1,106			1,739	2,762
			31.13	**Soil Disposal**															
				Spoils to Waste	4,727 cy	0.003 day / cy	426	1,410.06 /day	16,667	-	-	-	-	8.23	38,905	-	-	55,572	86,297
				31.13 Soil Disposal	4,727 cy		426		16,667					8.23	38,905			55,572	86,297
			31.20	**Structure Stone Base**															
				Structure Subbase Stone-Loaders/Truck - 7,310 sf x 4"	90 cy	0.003 cd / cy	11	1,609.56 /cd	439	28.28	2,545	-	-	10.02	901	-	-	3,886	5,992
				31.20 Structure Stone Base	90 cy		11		439	28.28	2,545			10.02	901			3,886	5,992
			40.00	**Under Ground Process Piping**															
				Trench Excav & Lay Pipe 0- 4'	28 lf	600.000 lf / cd	3	2,539.31 /cd	119			-	-	1.88	53	-	-	171	272

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			40.00	**Under Ground Process Piping**															
				Stone Pipe Bedding	5 cy	200.000 cy / cd	2	2,896.43 /cd	72	23.29	116	-	-			-	-	189	291
				DI Pipe Push - Class 52 36	28 lf	0.500 mh / lf	14	51.34 /mh	719	225.44	6,312	-	-	-	-	-	-	7,031	10,718
				Hydrostatic Testing	28 lf	0.021 ch / lf	2	182.49 /ch	107	0.16	4	-	-	-	-	-	-	112	177
				DI Tee 36"	4 ea	20.524 mh / ea	82	45.62 /mh	3,745	19,000.00	76,000	-	-	-	-	-	-	79,745	121,274
				DI Blind Flange 36"	1 ea	19.230 mh / ea	19	45.62 /mh	877	3,840.90	3,841	-	-	-	-	-	-	4,718	7,218
				40.00 Under Ground Process Piping	**28 lf**		122		5,640	3,081.22	86,274			1.88	53			91,967	139,950
			40.01	**Above Ground Process Piping**															
				Paint & Stencil Exposed Piping >20"	204 lf			-	-	-	-	25.01	5,101	-	-	-	-	5,101	7,742
				Paint & Stencil Exposed Piping <20"	800 lf			-	-	-	-	10.00	8,002	-	-	-	-	8,002	12,144
				Pipe Supports	17 ea	4.001 mh / ea	68	45.62 /mh	3,103	250.05	4,251	-	-		-	-	-	7,354	11,363
				DI RJ Std Wgt Cap 36	1 ea	5.088 mh / ea	5	45.62 /mh	231	4,020.80	4,021	-	-	-	-	-	-	4,252	6,486
				Hydrostatic Testing	204 lf	0.021 ch / lf	17	182.49 /ch	782	0.16	33	-	-	-	-	-	-	815	1,287
				Dresser Couplings 36"	4 ea	20.804 mh / ea	83	45.62 /mh	3,797	1,270.26	5,081	-	-	-	-	-	-	8,878	13,720
				36" DI Wall Thimble 24" long	1 ea	5.001 ch / ea	20	182.49 /ch	913	1,286.25	1,286	-	-	1,200.15	1,200	-	-	3,399	5,307
				Gasket/Nuts/Bolt Kit 30"	4 ea	2.501 mh / ea	10	45.62 /mh	456	175.04	700	-	-	-	-	-	-	1,156	1,785
				Gasket/Nuts/Bolt Kit 36"	14 ea	3.001 mh / ea	42	45.62 /mh	1,917	225.05	3,151	-	-	-	-	-	-	5,067	7,815
				Gasket/Nuts/Bolt Kit 48"	18 ea	1.000 mh / ea	18	45.62 /mh	821	425.09	7,652	-	-	-	-	-	-	8,473	12,913
				DI Flanged Joint Pipe 30"	6 lf	3.051 mh / lf	18	45.62 /mh	835	310.21	1,861	-	-	-	-	-	-	2,696	4,147
				DI Flanged Joint Pipe 36"	70 lf	3.471 mh / lf	243	45.62 /mh	11,084	426.62	29,864	-	-	-	-	-	-	40,947	62,867
				DI Flanged Joint Pipe 48"	128 lf	4.371 mh / lf	559	45.62 /mh	25,524	711.68	91,096	-	-	-	-	-	-	116,620	178,855
				DI Flanged 90 ell 30"	5 ea	17.874 mh / ea	89	45.62 /mh	4,077	2,317.06	11,585	-	-	-	-	-	-	15,662	24,036
				DI Flanged 90 ell 48"	4 ea	25.715 mh / ea	103	45.62 /mh	4,693	6,635.22	26,541	-	-	-	-	-	-	31,234	47,709
				DI Flanged Tee 36"	4 ea	20.524 mh / ea	82	45.62 /mh	3,745	19,000.00	76,000	-	-	-	-	-	-	79,745	121,274
				DI Flanged Tee 48"	4 ea	25.715 mh / ea	103	45.62 /mh	4,693	24,821.92	99,288	-	-	-	-	-	-	103,980	158,118
				DI Flanged Con Red 48x32"	4 ea	25.715 mh / ea	103	45.62 /mh	4,693	9,913.98	39,656	-	-	-	-	-	-	44,349	67,514
				DI Flanged Con Red 48x36"	2 ea	25.715 mh / ea	51	45.62 /mh	2,346	11,157.43	22,315	-	-	-	-	-	-	24,661	37,581
				DI Blind Flange 48"	1 ea	23.595 mh / ea	24	45.62 /mh	1,076	7,187.63	7,188	-	-	-	-	-	-	8,264	12,612
				Chemical Piping & Accessories- ALLOWANCE	800 LF	0.240 mh / LF	192	45.62 /mh	8,761	55.01	44,009	-	-	-	-	-	-	52,770	80,659
				40.01 Above Ground Process Piping	**1 lf**		1,831		83,547	475,575.26	475,575	13,102.62	13,103	1,200.15	1,200			573,425	875,815
			40.02	**Valves, Meters, Etc.**															
				Magnetic Flow Meter, Inline - 48" w/ transmitter	2 ea	52.000 mh / ea	104	48.85 /mh	5,080	28,000.00	56,000	-	-	-	-	-	-	61,080	93,033
				30" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	24.005 mh / ea	96	45.62 /mh	4,381	16,487.29	65,949	-	-	-	-	-	-	70,330	107,025
				48" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	38.408 mh / ea	154	45.62 /mh	7,009	26,380.26	105,521	-	-	-	-	-	-	112,530	171,244
				40.02 Valves, Meters, Etc.	**1 ls**		354		16,470	227,470.23	227,470							243,940	371,302
			40.04	**Hydropneumatic Piping System**															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				17,000.00	17,000					17,000	25,801
				40.04 Hydropneumatic Piping System	**1 ls**							17,000.00	17,000					17,000	25,801
			41.22	**Hoists & Cranes**															
				Steel Bracket @ Column To Support Crane Rail Beam	10 ea	0.200 mh / ea	2	42.40 /mh	85	726.47	7,265	-	-	-	-	-	-	7,349	11,160
				W 18 x 116 Crane Rail Beam	162 lf			-	-	86.88	14,075	-	-	-	-	-	-	14,075	21,362
				Erect Steel W 18 x 116 Beams (20' long)	8 ea	5.000 ch / ea	200	197.59 /ch	7,904					518.13	4,145			12,049	19,106
				Bridge Crane 3 ton 21 ft span, 81 ft runway beam. Equipment and installation. @ Maint Bldg	1 ea			-	-	-	-	-	-			110,000.00	110,000	110,000	166,940
				41.22 Hoists & Cranes	**1 ea**		202		7,988	21,339.87	21,340			4,145.00	4,145	110,000.00	110,000	143,473	218,577
			43.07	**UV Disinfection Equipment**															
				Centrifugal Blowers, 51-100 hp (Air Scour Blowers 1-4)	4 ea	40.008 mh / ea	160	47.77 /mh	7,645	1,500.30	6,001			150,029.95	600,120			613,766	976,309
				UV Reactor #1, 2, 3 & 4	4 ea	60.012 mh / ea	240	45.62 /mh	10,951	5,001.00	20,004					250,950.00	1,003,800	1,034,755	1,671,176
				43.07 UV Disinfection Equipment	**1 ls**		400		18,597	26,005.19	26,005			600,119.78	600,120	1,003,800.00	1,003,800	1,648,522	2,547,485
				50 UV Facility	**7,071 gsf**		12,603		525,218	188.03	1,329,558	185.90	1,314,406	98.97	699,838	157.52	1,113,800	4,982,821	7,648,293
				5B New Small Clearwell & UV	**1 ls**		20,875		858,754	1,896,771.69	1,896,772	1,555,991.82	1,555,992	798,786.78	798,787	1,113,800.00	1,113,800	6,224,105	9,581,190
5C				**New Small Clearwell & UV w/ Oxidation**															
		49		**Concrete Clearwell Construction**															
			03.00	**Foundation Mat**															
				Keyway 6"	262 lf	0.050 mh / lf	13	39.49 /mh	517	0.67	176	-	-	-	-	-	-	694	1,086
				Mat Foundation Edge Form 30"	655 sf	0.350 mh / sf	229	39.49 /mh	9,054	1.31	860	-	-	-	-	-	-	9,914	15,636
				Waterstop 6" Flat	262 lf	0.110 mh / lf	29	39.18 /mh	1,129	2.10	550	-	-	-	-	-	-	1,680	2,623
				Strip & Oil Mat Found. Form	655 sf	0.005 mh / sf	3	39.17 /mh	128	0.03	20	-	-	-	-	-	-	148	233
				Rebar- Foundation Mat (100 #/cy)	20 tn	28.006 mh / tn	560	43.53 /mh	24,380	997.70	19,954	-	-	-	-	-	-	44,334	68,871
				Rebar Support - bricks (.12/sf)	516 ea	0.002 mh / ea	1	43.53 /mh	45	0.26	135	-	-	-	-	-	-	180	277
				Finish- Hard Trowel	4,298 sf	0.023 mh / sf	99	39.17 /mh	3,873	-	-	-	-	-	-	-	-	3,873	6,129
				Pump Place Mat Foundation 30"	398 cy	0.500 mh / cy	199	41.39 /mh	8,236	-	-	-	-	4.59	1,826	-	-	10,062	15,942
				Pump Place Thickened Mat @ Columns 6"x26'x2.5' deep, 36 ea	3 cy	0.500 mh / cy	2	41.39 /mh	62	-	-	-	-	3.67	11	-	-	73	116
				4000 psi Concrete	401 cy			/cy		142.00	56,942	-	-	-	-	-	-	56,942	86,422
				Liquid Curing Compounds	4,953 sf	0.003 mh / sf	15	39.17 /mh	582	0.06	291	-	-	-	-	-	-	873	1,353
				6 Mil Vapor Barrier	18,200 sf	0.002 mh / sf	20	43.53 /mh	888	0.05	536	-	-	-	-	-	-	1,424	2,219
				03.00 Foundation Mat	**401 cy**		1,170		48,896	198.17	79,464			4.58	1,837			130,197	200,918
			03.03	**Columns**															
				Form Square Columns 24' h	192 sf	0.165 mh / sf	32	39.49 /mh	1,251	1.60	306	-	-	-	-	-	-	1,557	2,445
				Chamfer	96 lf	0.015 mh / lf	1	39.49 /mh	57	0.57	54	-	-	-	-	-	-	111	173
				Strip & Oil Column Form	88 sf	0.005 mh / sf	0	39.17 /mh	17	0.03	3	-	-	-	-	-	-	20	31
				Superplasticizers @ Columns	4 cy			/cy		8.40	34	-	-	-	-	-	-	34	51
				Column Rebar (120 #/cy)	0 tn	20.004 mh / tn	5	43.53 /mh	209	997.70	239	-	-	-	-	-	-	448	694
				Finish- Float	4 sf	0.017 mh / sf	0	39.17 /mh	3	-	-	-	-	-	-	-	-	3	4
				Pump Place Columns 1 ea	4 cy	1.600 mh / cy	6	41.39 /mh	265	-	-	-	-	7.49	30	-	-	295	467
				4000 psi Concrete	4 cy			/cy		142.00	568	-	-	-	-	-	-	568	862
				Grind/Patch Columns	192 sf	0.013 mh / sf	2	39.17 /mh	98	0.03	6	-	-	-	-	-	-	104	164
				Rub Columns	192 sf	0.065 mh / sf	12	39.17 /mh	489	0.06	12	-	-	-	-	-	-	500	791
				Liquid Curing Compounds	192 sf	0.003 mh / sf	1	39.17 /mh	23	0.06	11	-	-	-	-	-	-	34	53
				03.03 Columns	**4 cy**		60		2,411	308.30	1,233			7.49	30			3,674	5,735
			03.04	**Walls**															
				Keyway 6"	232 lf	0.050 mh / lf	12	39.49 /mh	468	0.67	156	-	-	-	-	-	-	614	962
				Vertical Wall Keyway 6"	48 lf	0.110 mh / lf	5	39.49 /mh	209	0.67	32	-	-	-	-	-	-	241	379
				Panel Form System 24' h	11,144 sf	0.190 mh / sf	2,118	39.49 /mh	83,627	1.84	20,481	-	-	-	-	-	-	104,108	163,442
				Waterstop 6" Flat	280 lf	0.110 mh / lf	31	39.18 /mh	1,207	2.10	588	-	-	-	-	-	-	1,795	2,803
				Strip & Oil Wall Forms	11,144 sf	0.005 mh / sf	56	39.17 /mh	2,183	0.03	334	-	-	-	-	-	-	2,517	3,952
				Superplasticizers @ Walls	413 cy			/cy		8.40	3,470	-	-	-	-	-	-	3,470	5,266
				Rebar- Walls (125 #/cy)	26 tn	15.003 mh / tn	390	43.53 /mh	16,979	997.70	25,940	-	-	-	-	-	-	42,919	66,243
				Finish- Top of Wall	464 sf	0.008 mh / sf	4	39.17 /mh	145	-	-	-	-	-	-	-	-	145	230
				Pump Place Foundation Walls 24"	413 cy	1.150 mh / cy	475	41.39 /mh	19,662	-	-	-	-	6.65	2,746	-	-	22,408	35,489
				4000 psi Concrete	413 cy			/cy		142.00	58,646	-	-	-	-	-	-	58,646	89,008
				Grind/Patch Walls	11,144 sf	0.013 mh / sf	145	39.17 /mh	5,675	0.03	334	-	-	-	-	-	-	6,010	9,490

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.04	**Walls**															
				Rub Walls	5,804 sf	0.058 mh / sf	337	39.17 /mh	13,185	0.06	348	-	-	-	-	-	-	13,533	21,396
				Liquid Curing Compounds	11,144 sf	0.002 mh / sf	22	39.17 /mh	873	0.06	655	-	-	-	-	-	-	1,529	2,377
				03.04 Walls	413 cy		3,594		144,203	268.73	110,986			6.65	2,746			257,935	401,047
			03.06	**Suspended Flat Slab**															
				Form Suspended Slab Bottom	3,605 sf	0.180 mh / sf	649	39.49 /mh	25,629	2.18	7,875			-	-	-	-	33,504	52,515
				Slab Edge Form 12"	240 sf	0.250 mh / sf	60	39.49 /mh	2,370	5.17	1,241			-	-	-	-	3,611	5,634
				Strip & Oil Suspended Slab Forms	3,845 sf	0.005 mh / sf	19	39.17 /mh	753	0.04	158			-	-	-	-	911	1,431
				Superplasticizers	134 cy			-	-	8.40	1,126			-	-	-	-	1,126	1,709
				Rebar- Suspended Slab (225 #/cy)	15 tn	20.004 mh / tn	300	43.53 /mh	13,061	997.70	14,966	-	-	-	-	-	-	28,026	43,385
				Finish- Hard Trowel	3,605 sf	0.030 mh / sf	108	39.17 /mh	4,237	-	-			-	-	-	-	4,237	6,706
				Pump Place Suspended Slab 12"	134 cy	1.800 mh / cy	241	41.39 /mh	9,985	-	-			6.65	892	-	-	10,877	17,223
				4000 psi Concrete	134 cy			-	-	142.00	19,028			-	-	-	-	19,028	28,879
				Liquid Curing Compounds	7,450 sf	0.003 mh / sf	22	39.17 /mh	876	0.68	5,086			-	-	-	-	5,961	9,104
				03.06 Suspended Flat Slab	134 cy		1,400		56,910	369.24	49,478			6.65	892			107,280	166,585
			05.01	**Misc Metals**															
				Ladder Bolted to Concrete, w/c cage- aluminum, 2 ea x 20'	40 VF	0.750 mh / VF	30	/mh		68.25	2,730	-	-	-	-	-	-	2,730	4,143
				Goose Neck Air Vents 24" Diameter	2 ea	3.200 mh / ea	6	36.09 /mh	231	2,500.00	5,000	-	-			-	-	5,231	7,954
				Aluminum Access Hatch 4' x 6'	2 ea	5.000 mh / ea	10	36.09 /mh	361	1,750.00	3,500	-	-			-	-	3,861	5,883
				05.01 Misc Metals	1 ls		46		592	11,230.00	11,230							11,822	17,981
			31.01	**Dewatering**															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	35 lf			/lf				150.00	5,250			-	-	5,250	7,968
				Set & Wire Pumps	1 ea	2.000 ea / cd	24	2,249.33 /cd	1,125	25,000.00	25,000	-	-	323.92	324	-	-	26,449	40,238
				Maintenance/Operation	1 ea	1.000 ea / cd	48	2,249.33 /cd	2,249	1,000.00	1,000	-	-	647.84	648	-	-	3,897	6,109
				Suction Piping	80 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.89	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	1 ea	1.000 ea / cd	32	1,439.45 /cd	1,439	2,000.00	2,000	-	-	226.08	226	-	-	3,666	5,673
				Electric Consumption	2 mo	1.000 mo / ls		/ls		1,000.00	2,000	-	-			-	-	2,000	3,035
				31.01 Dewatering	1 ls		331		15,447	43,200.00	43,200	5,477.27	5,477	4,260.36	4,260			68,384	105,106
			31.02	**Piles**															
				Augered Piles CIP 18" x @ 25 ft depth, 119 ea (1 per 36.46 sf)	2,975 vf	0.002 cd / vf	333	2,146.97 /cd	12,776	35.16	104,591	-	-	2.58	7,676	-	-	125,043	191,177
				31.02 Piles	119 ea		333		12,776	878.91	104,591			64.51	7,676			125,043	191,177
			31.03	**Excavation Shoring**															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,002.99	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (286' x 36' deep)	10,296 sf	0.001 cd / sf	507	2,465.38 /cd	19,545	16.00	164,769	-	-	0.75	7,748	-	-	192,062	293,337
				Tie Backs (1 per 80 sf of Sheeting, 286' x 26'= 7436 sf)	93 ea			-	-	-	-	2,377.48	221,105	-	-	-	-	221,105	335,575
				31.03 Excavation Shoring	10,296 sf		507		19,545	16.00	164,769	22.93	236,108	0.75	7,748			428,170	651,682
			31.10	**Structure Excavation**															
				Backhoe/Truck (5129 sf x 28')	5,319 cy	499.900 cy / cd	383	1,410.06 /cd	15,003	-	-	-	-	6.58	35,020	-	-	50,024	79,481
				31.10 Structure Excavation	5,319 cy		383		15,003					6.58	35,020			50,024	79,481
			31.12	**Structure Backfill**															
				BackFill Earth-Backhoe/Truck	1,648 cy	0.002 cd / cy	107	1,327.72 /cd	4,420			-	-	4.69	7,724	-	-	12,144	19,288
				31.12 Structure Backfill	1,648 cy		107		4,420					4.69	7,724			12,144	19,288
			31.13	**Soil Disposal**															
				Spoils to Waste	3,671 cy	0.003 day / cy	330	1,410.06 /day	12,943	-	-	-	-	8.23	30,214	-	-	43,157	68,572
				31.13 Soil Disposal	3,671 cy		330		12,943					8.23	30,214			43,157	68,572
			31.20	**Structure Stone Base**															
				Structure Subbase Stone-Loaders/Truck - 41895 sf x 4"	80 cy	0.003 cd / cy	10	1,609.56 /cd	390	28.28	2,262	-	-	10.02	801	-	-	3,454	5,327
				31.20 Structure Stone Base	80 cy		10		390	28.28	2,262			10.02	801			3,454	5,327
				40 Concrete Clearwell Construction	3,540 gsf		8,272		333,536	160.23	567,214	68.24	241,585	27.95	98,948			1,241,283	1,912,897
		50		**UV Facility**															
			03.00	**Foundation Mat**															
				Keyway 6"	340 lf	0.050 mh / lf	17	39.49 /mh	671	0.67	229	-	-	-	-	-	-	900	1,410
				Mat Foundation Edge Form 30"	850 sf	0.350 mh / sf	298	39.49 /mh	11,750	1.31	1,116	-	-	-	-	-	-	12,866	20,290
				Waterstop 6" Flat	340 lf	0.110 mh / lf	37	39.18 /mh	1,466	2.10	714	-	-	-	-	-	-	2,180	3,403
				Strip & Oil Mat Found. Form	850 sf	0.005 mh / sf	4	39.17 /mh	166	0.03	26	-	-			-	-	192	302
				Rebar- Foundation Mat (100 #/cy)	33 tn	28.006 mh / tn	928	43.53 /mh	40,410	997.70	33,074	-	-	-	-	-	-	73,484	114,154
				Rebar Support - bricks (.12/sf)	859 ea	0.002 mh / ea	2	43.53 /mh	75	0.26	226	-	-	-	-	-	-	300	461
				Finish- Hard Trowel	7,156 sf	0.023 mh / sf	165	39.17 /mh	6,448	-	-	-	-	-	-	-	-	6,448	10,205
				Pump Place Mat Foundation 30"	663 cy	0.500 mh / cy	332	41.39 /mh	13,720	-	-	-	-	4.59	3,042	-	-	16,762	26,557
				4000 psi Concrete	663 cy			/cy		142.00	94,146	-	-	-	-	-	-	94,146	142,887
				Liquid Curing Compounds	8,006 sf	0.003 mh / sf	24	39.17 /mh	941	0.06	471	-	-	-	-	-	-	1,412	2,204
				6 Mil. Vapor Barrier	16,700 sf	0.002 mh / sf	33	43.53 /mh	1,454	0.05	877	-	-	-	-	-	-	2,331	3,632
				03.00 Foundation Mat	663 cy		1,840		77,101	197.40	130,877			4.59	3,042			211,020	325,505
			03.03	**Columns**															
				Form Rectangle Columns 9.33'	672 sf	0.165 mh / sf	111	39.49 /mh	4,378	1.60	1,073	-	-	-	-	-	-	5,451	8,558
				Form Rectangle Columns 26'	2,288 sf	0.165 mh / sf	378	39.49 /mh	14,908	1.60	3,652	-	-	-	-	-	-	18,560	29,138
				Chamfer	1,480 lf	0.015 mh / lf	22	39.49 /mh	877	0.57	839	-	-	-	-	-	-	1,716	2,662
				Strip & Oil Column Form	2,960 sf	0.005 mh / sf	15	39.17 /mh	580	0.03	89	-	-	-	-	-	-	669	1,052
				Superplasticizers @ Columns	54 cy			/cy		8.40	454	-	-	-	-	-	-	454	689
				Column Rebar (120 #/cy)	3 tn	20.004 mh / tn	65	43.53 /mh	2,821	997.70	3,233	-	-	-	-	-	-	6,054	9,371
				Finish- Float	80 sf	0.017 mh / sf	1	39.17 /mh	53	-	-	-	-	-	-	-	-	53	84
				Pump Place Columns 20 ea	54 cy	1.600 mh / cy	86	41.39 /mh	3,577	-	-	-	-	7.49	404	-	-	3,981	6,305
				4000 psi Concrete	54 cy			/cy		142.00	7,668	-	-	-	-	-	-	7,668	11,638
				Grind/Patch Columns	2,960 sf	0.013 mh / sf	38	39.17 /mh	1,507	0.03	89	-	-	-	-	-	-	1,596	2,521
				Rub Columns	2,960 sf	0.065 mh / sf	192	39.17 /mh	7,536	0.06	178	-	-	-	-	-	-	7,713	12,196
				Liquid Curing Compounds	2,960 sf	0.003 mh / sf	9	39.17 /mh	348	0.06	174	-	-	-	-	-	-	522	815
				03.03 Columns	54 cy		918		36,585	323.11	17,448			7.49	404			54,437	85,028
			03.04	**Walls**															
				Brick Ledge Forms	161 sf	0.300 mh / sf	48	39.49 /mh	1,908	2.21	355	-	-	-	-	-	-	2,263	3,558
				Keyway 6"	188 lf	0.050 mh / lf	9	39.49 /mh	371	0.67	126	-	-	-	-	-	-	498	779
				Vertical Wall Keyway 6"	80 lf	0.110 mh / lf	9	39.49 /mh	348	0.67	54	-	-	-	-	-	-	401	632
				Panel Form System 17' h	6,392 sf	0.190 mh / sf	1,215	39.49 /mh	47,987	1.84	11,748	-	-	-	-	-	-	59,715	93,748
				Waterstop 6" Flat	268 lf	0.110 mh / lf	29	39.18 /mh	1,155	2.10	563	-	-	-	-	-	-	1,718	2,683
				Strip & Oil Wall Forms	6,392 sf	0.005 mh / sf	32	39.17 /mh	1,252	0.03	192	-	-	-	-	-	-	1,444	2,273
				Superplasticizers @ Walls	237 cy			/cy		8.40	1,991	-	-	-	-	-	-	1,991	3,022
				Rebar- Walls (125 #/cy)	18 tn	15.003 mh / tn	270	43.53 /mh	11,755	997.70	17,959	-	-	-	-	-	-	29,713	45,860

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.04	**Walls**															
				Finish- Top of Wall	376 sf	0.008 mh / sf	3	39.17 /mh	118	-	-	-	-	-	-	-	-	118	187
				Pump Place Foundation Walls 24"	237 cy	1.150 mh / cy	273	41.39 /mh	11,283	-	-	-	-	6.65	1,576	-	-	12,859	20,366
				Pump Place Brick Ledge	1 cy	2.001 mh / cy	2	41.39 /mh	83	-	-	-	-	14.42	14	-	-	97	154
				4000 psi Concrete	238 cy			/cy		142.00	33,796	-	-	-	-	-	-	33,796	51,203
				Grind/Patch Walls	6,392 sf	0.013 mh / sf	83	39.17 /mh	3,255	0.03	192	-	-	-	-	-	-	3,447	5,443
				Rub Walls	3,196 sf	0.058 mh / sf	185	39.17 /mh	7,260	0.06	192	-	-	-	-	-	-	7,452	11,782
				Liquid Curing Compounds	6,392 sf	0.002 mh / sf	13	39.17 /mh	501	0.06	376	-	-	-	-	-	-	877	1,363
				03.04 Walls	238 cy		2,172		87,255	283.79	67,543			5.68	1,590			156,388	243,142
			03.07	**Suspended Beams**															
				Beam Side Forms	3,181 sf	0.210 mh / sf	668	39.49 /mh	26,384	2.21	7,016	-	-	-	-	-	-	33,399	52,405
				Beam Bottom Forms	1,060 sf	0.210 mh / sf	223	39.49 /mh	8,792	2.21	2,338	-	-	-	-	-	-	11,130	17,463
				Chamfer	2,120 lf	0.015 mh / lf	32	39.49 /mh	1,256	0.57	1,202	-	-	-	-	-	-	2,458	3,813
				Strip & Oil Beam Forms	4,241 sf	0.005 mh / sf	21	39.17 /mh	831	0.03	127	-	-	-	-	-	-	958	1,508
				Superplasticizers @ Beams	118 cy			/cy		8.40	991	-	-	-	-	-	-	991	1,505
				Rebar- Beams (250 #/cy)	15 tn	15.003 mh / tn	221	43.53 /mh	9,632	997.70	14,716	-	-	-	-	-	-	24,348	37,580
				Finish- Top of Beam	1,060 sf	0.008 mh / sf	8	39.17 /mh	332	-	-	-	-	-	-	-	-	332	526
				Pump Place Beams @ Roof	118 cy	2.001 mh / cy	236	41.39 /mh	9,773	-	-	-	-	14.42	1,702	-	-	11,474	18,176
				4000 psi Concrete	118 cy			/cy		142.00	16,756	-	-	-	-	-	-	16,756	25,431
				Grind/Patch Beams	4,241 sf	0.013 mh / sf	55	39.17 /mh	2,160	0.03	127	-	-	-	-	-	-	2,287	3,612
				Rub Beams	4,241 sf	0.085 mh / sf	360	39.17 /mh	14,119	0.06	254	-	-	-	-	-	-	14,374	22,733
				Liquid Curing Compounds	5,301 sf	0.002 mh / sf	11	39.17 /mh	415	0.06	312	-	-	-	-	-	-	727	1,130
				03.07 Suspended Beams	118 cy		1,836		73,694	371.52	43,840			14.42	1,702			119,235	185,880
			03.08	**Pads & Curbs**															
				Roof Parapet Curb Forms 48" h	3,876 sf	0.200 mh / sf	775	39.49 /mh	30,617	1.52	5,902	-	-	-	-	-	-	36,520	57,417
				Chamfer	968 lf	0.015 mh / lf	15	39.49 /mh	573	0.57	549	-	-	-	-	-	-	1,122	1,741
				Strip & Oil Equipment Curb Forms	3,876 sf	0.005 mh / sf	19	39.17 /mh	759	0.03	116	-	-	-	-	-	-	876	1,378
				Rebar- Pads (100 #/cy)	4 tn	18.004 mh / tn	65	43.53 /mh	2,821	997.70	3,592	-	-	-	-	-	-	6,413	9,916
				Finish- Float	484 sf	0.017 mh / sf	8	39.17 /mh	322	-	-	-	-	-	-	-	-	322	510
				Pump Place Curbs 12"	72 cy	2.501 mh / cy	180	41.39 /mh	7,452	-	-	-	-	9.86	710	-	-	8,161	12,923
				4000 psi Concrete	72 cy			/cy		142.00	10,224	-	-	-	-	-	-	10,224	15,617
				Liquid Curing Compounds	4,360 sf	0.003 mh / sf	13	39.17 /mh	512	0.06	256	-	-	-	-	-	-	769	1,200
				03.08 Pads & Curbs	72 cy		1,075		43,057	286.66	20,640			9.86	710			64,407	100,602
			03.09	**Pan Stair Fill**															
				Finish Stairs	562 sf	0.055 mh / sf	31	39.17 /mh	1,211	-	-	-	-	-	-	-	-	1,211	1,916
				Pump Place Pan Stair Concrete	4 cy	3.001 mh / cy	12	41.39 /mh	497	-	-	-	-	9.18	37	-	-	533	845
				3000 psi Concrete	4 cy			-	-	138.00	552	-	-	-	-	-	-	552	838
				03.09 Pan Stair Fill	4 cy		43		1,708	138.00	552			9.18	37			2,296	3,599
			05.01	**Misc Metals**															
				Work Platform Frame & Floor Grating Structural Support (13 #/sf)	1 tn	8.002 ch / tn	40	214.54 /ch	1,734	1,200.25	1,212	-	-	829.21	838	-	-	3,784	5,917
				Metal Stairs Concrete Pans	63 rs	0.067 mh / rs	4	42.08 /mh	177	80.02	5,041	-	-	-	-	-	-	5,218	7,931
				Metal Stairs Grating Type	18 rs	1.000 mh / rs	18	42.08 /mh	758	367.57	6,616	-	-	-	-	-	-	7,374	11,241
				Alum Stair Wall Handrail	32 lf	0.150 mh / lf	5	42.08 /mh	202	16.80	538	-	-	-	-	-	-	740	1,136
				Aluminum 3 Line Rail	84 lf	0.234 mh / lf	20	42.08 /mh	827	44.11	3,705	-	-	-	-	-	-	4,532	6,933
				Aluminum Handrail @ Work Platform	60 lf	0.234 mh / lf	14	42.08 /mh	591	44.11	2,647	-	-	-	-	-	-	3,237	4,952
				Aluminum Handrail @ Pan Stairs	92 lf	0.234 mh / lf	22	42.08 /mh	905	44.11	4,058	-	-	-	-	-	-	4,864	7,593
				Alum Grate Cover .75" @ 4'x4' Sump	2 ea	0.600 mh / ea	1	42.08 /mh	51	185.04	370	-	-	-	-	-	-	421	642
				Alumi Grating Work Platform @ UV Reactor 12' x 6.5' x 5' h, 2 ea	156 sf	0.035 mh / sf	5	42.08 /mh	230	12.39	1,933	-	-	-	-	-	-	2,163	3,298
				Alum Grating Banding	74 lf			/lf		23.70	1,754	-	-	-	-	-	-	1,754	2,662
				Aluminum Hatch & Frame Over Pipe Gallery 6.33' x 6.33'	0 ea	8.000 mh / ea	0	39.18 /mh	3	5,001.00	50	-	-	-	-	-	-	53	81
				05.01 Misc Metals	1 ls		129		5,478	27,924.05	27,924			837.50	838			34,240	52,384
			06.00	**Wood**															
				Misc Nailers & Blocking	7,071 sf	0.010 mh / sf	71	39.67 /mh	2,806	0.40	2,838	-	-	-	-	-	-	5,644	8,748
				PT Roof Blocking @ Top Of Masonry Wall	332 lf	0.035 mh / lf	12	39.67 /mh	481	1.82	604	-	-	-	-	-	-	1,085	1,647
				PT Roof Blocking @ Skylight Curb	156 lf	0.035 mh / lf	5	39.67 /mh	217	1.82	284	-	-	-	-	-	-	500	774
				06.00 Wood	1 ls		88		3,483	3,725.66	3,726							7,209	11,168
			07.00	**Moisture Protection**															
				Caulking @ Masonry Wall Joints- Exterior (.09 lf/sf)	1,223 lf			/lf				4.00	4,893	-	-	-	-	4,893	7,426
				Caulking @ Masonry Wall Joints- Interior	1,021 lf			/lf				4.00	4,085	-	-	-	-	4,085	6,200
				07.00 Moisture Protection	1 ls							8,977.80	8,978					8,978	13,626
			07.01	**Roofing**															
				Membrane Roofing- 60 mil EFDM Mechanically Attached w/ 3" Insulation	5,800 sf			/sf				3.00	17,403					17,403	26,414
				Aluminum Downspouts, 2 ea x 32' each	64 vf			/vf				18.00	1,152					1,152	1,749
				Scuppers	2 ea			/ea				50.01	100					100	152
				Aluminum Coping @ Roof Parapet 12" wide	332 lf			/lf				15.00	4,981					4,981	7,560
				Translucent Panel Skylight Frame & Panels	1,398 sf			/sf				38.01	53,135					53,135	80,643
				07.01 Roofing	1 sf							76,771.31	76,771					76,771	116,517
			08.00	**Doors, Frames & Hardware**															
				HM Single Frames- 16 ga 3'x7'	5 ea	1.000 mh / ea	5	39.18 /mh	196	180.04	900	-	-	-	-	-	-	1,096	1,676
				HM Double Frames- 16 ga. 6'x7'	1 ea	1.500 mh / ea	2	39.18 /mh	59	210.00	210	-	-	-	-	-	-	269	412
				HM Door Leafs- 3'x7' 20 ga. half glass	7 ea	1.500 ea / mh	5	39.18 /mh	183	450.09	3,151	-	-	-	-	-	-	3,333	5,071
				Overhead Doors- 10'x10' 24 ga steel manual 1" insulation 26 ga back-up panel	1 ea			-	-	-	-	2,255.00	2,255	-	-	-	-	2,255	3,422
				Finish Hardware by Leaf- Allowance	7 ea	8.002 mh / ea	56	39.18 /mh	2,194	900.18	6,301	-	-	-	-	-	-	8,496	13,036
				08.00 Doors, Frames & Hardware	1 ea		67		2,632	10,562.07	10,562	2,255.00	2,255					15,449	23,618
			09.00	**Finishes**															
				Paint HM Door Frames - primer (2) coats	7 ea			/ea		-	-	100.02	700	-	-	-	-	700	1,063
				Paint HM Doors - primer (2) coats	7 ea			/ea		-	-	140.03	980	-	-	-	-	980	1,488
				Paint CMU Block - block filler & (2) coat	10,186 sf			-	-	-	-	1.35	13,751	-	-	-	-	13,751	20,870
				09.00 Finishes	1 ls							15,431.44	15,431					15,431	23,421
			10.00	**Specialty Items**															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	4 ea			/ea				30.01	120	-	-	-	-	120	182
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	1 ls							4,020.81	4,021					4,021	6,102
			22.00	**Plumbing**															
				Plumbing Subcontract	7,071 sf			/sf				6.00	42,434					42,434	64,403
				22.00 Plumbing	1 ls							42,434.47	42,434					42,434	64,403
			23.00	**HVAC**															
				Ventilation & Unit Heater System	7,071 sf			/sf		-	-	45.00	318,195	-	-	-	-	318,195	482,930

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
				23.00 HVAC	1 sf							318,195.00	318,195					318,195	482,930
			26.00	**UG Electrical**															
				Building Electrical System	7,071 sf			/sf				16.00	113,159					113,159	171,743
				26.00 UG Electrical	1 ls							113,158.59	113,159					113,159	171,743
			26.01	**Above Ground Electrical**															
				Building Electrical System	7,071 sf			/sf				8.00	56,579					56,579	85,871
				Process Electrical System	7,071 sf			/sf				30.01	212,172					212,172	322,017
				26.01 Above Ground Electrical	1 ls							268,751.64	268,752					268,752	407,888
			26.02	**Instrumentation & Controls**															
				Controls & Instrumentation	1 ls			/ls				366,278.00	366,278					366,278	555,906
				26.02 Instrumentation & Controls	1 ls							366,278.00	366,278					366,278	555,906
			31.01	**Dewatering**															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	35 lf			/lf				150.00	5,250			-	-	5,250	7,968
				Set & Wire Pumps	1 ea	2.000 ea / cd	24	2,249.33 /cd	1,125	25,000.00	25,000	-	-	323.92	324	-	-	26,449	40,238
				Maintenance/Operation	1 ea	1.000 ea / cd	48	2,249.33 /cd	2,249	1,000.00	1,000	-	-	647.84	648	-	-	3,897	6,109
				Suction Piping	80 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.89	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	1 ea	1.000 ea / cd	32	1,439.45 /cd	1,439	2,000.00	2,000	-	-	226.08	226	-	-	3,666	5,673
				Electric Consumption	4 mo	1.000 mo / ls		/ls		1,000.00	4,000	-	-			-	-	4,000	6,071
				31.01 Dewatering	1 ls		331		15,447	45,200.00	45,200	5,477.27	5,477	4,260.36	4,260			70,384	106,142
			31.02	**Piles**															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 104 ea (1 per 68 sf)	2,600 vf	0.002 cd / vf	291	2,146.97 /cd	11,166	35.16	91,407	-	-	2.58	6,709	-	-	109,282	167,079
				31.02 Piles	104 ea		291		11,166	878.91	91,407			64.51	6,709			109,282	167,079
			31.03	**Excavation Shoring**															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,002.99	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (87' x 22' ceep)	1,914 sf	0.001 cd / sf	94	2,465.38 /cd	3,633	16.00	30,630	-	-	0.75	1,440	-	-	35,704	54,531
				Tie Backs (1 per 80 sf of Sheeting, 87' x 18'= 1566 sf)	20 ea			-	-	-	-	2,377.48	47,549	-	-	-	-	47,549	72,167
				31.03 Excavation Shoring	1,914 sf		94		3,633	16.00	30,630	32.68	62,552	0.75	1,440			98,256	149,468
			31.10	**Structure Excavation**															
				Exc Clay-Backhoe/Truck (7,310 sf x 18.33')	4,963 cy	499.900 cy / cd	357	1,410.06 /cd	13,999	-	-	-	-	6.58	32,676	-	-	46,676	74,182
				31.10 Structure Excavation	4,963 cy		357		13,999					6.58	32,676			46,676	74,182
			31.12	**Structure Backfill**															
				BackFill Earth-Backhoe/Truck (87' x 4' x 18.33')	236 cy	0.002 cd / cy	15	1,327.72 /cd	633			-	-	4.69	1,106	-	-	1,739	2,762
				31.12 Structure Backfill	236 cy		15		633					4.69	1,106			1,739	2,762
			31.13	**Soil Disposal**															
				Spoils to Waste	4,727 cy	0.003 day / cy	426	1,410.06 /day	16,667	-	-	-	-	8.23	38,905	-	-	55,572	88,297
				31.13 Soil Disposal	4,727 cy		426		16,667					8.23	38,905			55,572	88,297
			31.20	**Structure Stone Base**															
				Structure Subbase Stone-Loaders/Truck - 7,310 sf x 4"	90 cy	0.003 cd / cy	11	1,609.56 /cd	439	28.28	2,545	-	-	10.02	901	-	-	3,886	5,992
				31.20 Structure Stone Base	90 cy		11		439	28.28	2,545			10.02	901			3,886	5,992
			40.00	**Under Ground Process Piping**															
				Trench Excav & Lay Pipe 0- 4'	28 lf	600.000 lf / cd	3	2,539.31 /cd	119			-	-	1.86	53	-	-	171	272
				Stone Pipe Bedding	5 cy	200.000 cy / cd	2	2,896.43 /cd	72	23.29	116	-	-			-	-	189	291
				Hydrostatic Testing	28 lf	0.021 ch / lf	2	182.49 /ch	107	0.16	4	-	-	-	-	-	-	112	177
				Gasket/Nuts/Bolt Kit 36"	6 ea	3.001 mh / ea	18	45.62 /mh	821	225.05	1,350	-	-	-	-	-	-	2,172	3,349
				DI Flanged Joint Pipe 36"	28 lf	3.471 mh / lf	97	45.62 /mh	4,434	426.62	11,945	-	-	-	-	-	-	16,379	25,147
				DI Flanged Tee 36"	4 ea	20.524 mh / ea	82	45.62 /mh	3,745	19,000.00	76,000	-	-	-	-	-	-	79,745	121,274
				DI Blind Flange 36"	1 ea	19.230 mh / ea	19	45.62 /mh	877	3,840.90	3,841	-	-	-	-	-	-	4,718	7,218
				40.00 Under Ground Process Piping	1 lf		223		10,176	93,257.54	93,258			52.74	53			103,486	157,728
			40.01	**Above Ground Process Piping**															
				Paint & Stencil Exposed Piping >20"	204 lf			-	-	-	-	25.01	5,101	-	-	-	-	5,101	7,742
				Paint & Stencil Exposed Piping <20"	800 lf			-	-	-	-	10.00	8,002	-	-	-	-	8,002	12,144
				Pipe Supports	17 ea	4.001 mh / ea	68	45.62 /mh	3,103	250.05	4,251	-	-			-	-	7,354	11,363
				DI RJ Std Wgt Cap 36	1 ea	5.068 mh / ea	5	45.62 /mh	231	4,020.80	4,021	-	-	-	-	-	-	4,252	6,468
				Hydrostatic Testing	204 lf	0.021 ch / lf	17	182.49 /ch	782	0.16	33	-	-	-	-	-	-	815	1,287
				Dresser Couplings 36"	4 ea	20.804 mh / ea	83	45.62 /mh	3,797	1,270.26	5,081	-	-			-	-	8,878	13,720
				36" DI Wall Thimble 24" long	1 ea	5.001 ch / ea	20	182.49 /ch	913	1,286.25	1,286	-	-	1,200.15	1,200	-	-	3,399	5,307
				Gasket/Nuts/Bolt Kit 30"	4 ea	2.501 mh / ea	10	45.62 /mh	456	175.04	700	-	-	-	-	-	-	1,156	1,785
				Gasket/Nuts/Bolt Kit 36"	14 ea	3.001 mh / ea	42	45.62 /mh	1,917	225.05	3,151	-	-	-	-	-	-	5,067	7,815
				Gasket/Nuts/Bolt Kit 48"	18 ea	1.000 mh / ea	18	45.62 /mh	821	425.09	7,652	-	-	-	-	-	-	8,473	12,913
				DI Flanged Joint Pipe 30"	6 lf	3.051 mh / lf	18	45.62 /mh	835	310.21	1,861	-	-	-	-	-	-	2,696	4,147
				DI Flanged Joint Pipe 36"	70 lf	3.471 mh / lf	243	45.62 /mh	11,084	426.62	29,864	-	-	-	-	-	-	40,947	62,887
				DI Flanged Joint Pipe 48"	128 lf	4.371 mh / lf	559	45.62 /mh	25,524	711.68	91,096	-	-	-	-	-	-	116,620	178,665
				DI Flanged 90 ell 30"	5 ea	17.874 mh / ea	89	45.62 /mh	4,077	2,317.06	11,585	-	-	-	-	-	-	15,662	24,036
				DI Flanged 90 ell 48"	4 ea	25.715 mh / ea	103	45.62 /mh	4,693	6,635.22	26,541	-	-	-	-	-	-	31,234	47,709
				DI Flanged Tee 36"	4 ea	20.524 mh / ea	82	45.62 /mh	3,745	19,000.00	76,000	-	-	-	-	-	-	79,745	121,274
				DI Flanged Tee 48"	4 ea	25.715 mh / ea	103	45.62 /mh	4,693	24,821.92	99,288	-	-	-	-	-	-	103,980	158,118
				DI Flanged Con Red 48x32"	4 ea	25.715 mh / ea	103	45.62 /mh	4,693	9,913.98	39,656	-	-	-	-	-	-	44,349	67,614
				DI Flanged Con Red 48x36"	2 ea	25.715 mh / ea	51	45.62 /mh	2,346	11,157.43	22,315	-	-	-	-	-	-	24,661	37,581
				DI Blind Flange 48"	1 ea	23.595 mh / ea	24	45.62 /mh	1,076	7,187.63	7,188	-	-	-	-	-	-	8,264	12,813
				Chemical Piping & Accessories- ALLOWANCE	800 LF	0.240 mh / LF	192	45.62 /mh	8,761	55.01	44,009	-	-	-	-	-	-	52,770	80,859
				40.01 Above Ground Process Piping	1 lf		1,831		83,547	475,575.26	475,575	13,102.62	13,103	1,200.15	1,200			573,425	875,815
			40.02	**Valves, Meters, Etc.**															
				Magnetic Flow Meter, Inline - 48" w/ transmitter	2 ea	52.000 mh / ea	104	48.85 /mh	5,080	28,000.00	56,000	-	-	-	-	-	-	61,080	93,033
				30" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	24.005 mh / ea	96	45.62 /mh	4,381	16,487.29	65,949	-	-	-	-	-	-	70,330	107,025
				48" Butterfly Valve, 75 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	38.408 mh / ea	154	45.62 /mh	7,009	26,380.26	105,521	-	-	-	-	-	-	112,530	171,244
				40.02 Valves, Meters, Etc.	1 ls		354		16,470	227,470.23	227,470							243,940	371,302
			40.04	**Hydropneumatic Piping System**															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				17,000.00	17,000					17,000	25,801
				40.04 Hydropneumatic Piping System	1 ls							17,000.00	17,000					17,000	25,801
			41.22	**Hoists & Cranes**															
				Steel Bracket @ Column To Support Crane Rail Beam	10 ea	0.200 mh / ea	2	42.40 /mh	85	726.47	7,265	-	-	-	-	-	-	7,349	11,160
				W 18 x 116 Crane Rail Beam	162 lf			-	-	86.88	14,075	-	-	-	-	-	-	14,075	21,352
				Erect Steel W 18 x 116 Beams (20' long)	8 ea	5.000 ch / ea	200	197.59 /ch	7,904					518.13	4,145			12,049	19,106
				Bridge Crane 3 ton 21 ft span, 81 ft runway beam. Equipment and installation. @ Maint Bldg	1 ea			-	-	-	-	-	-			110,000.00	110,000	110,000	166,949

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				41.22 Hoists & Cranes	1 ea		202		7,988	21,339.87	21,340			4,145.00	4,145	110,000.00	110,000	143,473	218,577
			43.07	UV Disinfection Equipment															
				Centrifugal Blowers, 51-100 hp (Air Scour Blowers 1-4)	4 ea	40.008 mh / ea	160	47.77 /mh	7,645	1,500.30	6,001			150,029.95	600,120			613,766	978,309
				UV Reactor #1, 2, 3 & 4	4 ea	60.012 mh / ea	240	45.62 /mh	10,951	5,001.00	20,004					250,950.00	1,003,800	1,034,755	1,571,176
				43.07 UV Disinfection Equipment	1 ls		400		18,597	26,005.19	26,005			600,119.78	600,120	1,003,800.00	1,003,800	1,648,522	2,547,485
				50 UV Facility	7,071 gsf		12,704		529,755	189.02	1,336,541	185.89	1,314,406	98.97	699,838	157.52	1,113,800	4,994,341	7,668,071
		51		Oxidation System															
			03.08	Pads & Curbs															
				Pad Form 14"	447 sf	0.160 mh / sf	72	39.49 /mh	2,825	1.37	610	-	-	-	-	-	-	3,435	5,397
				LOX Tank Pad Form 24"	288 sf	0.180 mh / sf	52	39.49 /mh	2,047	1.37	393	-	-	-	-	-	-	2,441	3,837
				LOX Vaporizer Pad Form 12"	78 sf	0.160 mh / sf	12	39.49 /mh	493	1.37	106	-	-	-	-	-	-	599	942
				Chamfer	821 lf	0.015 mh / lf	12	39.49 /mh	486	0.57	466	-	-	-	-	-	-	952	1,476
				Strip & Oil Equipment Pad Forms	222 sf	0.005 mh / sf	1	39.17 /mh	43	0.03	7	-	-	-	-	-	-	50	79
				Rebar- Pads (100 #/cy)	3 tn	18.004 mh / tn	59	43.53 /mh	2,586	997.70	3,292	-	-	-	-	-	-	5,878	9,090
				Finish- Float	1,321 sf	0.017 mh / sf	22	39.17 /mh	880	-	-	-	-	-	-	-	-	880	1,392
				Pump Place Pads 12" & 14"	27 cy	1.600 mh / cy	43	41.39 /mh	1,788	-	-	-	-	7.49	202	-	-	1,991	3,152
				Pump Place Pads 24"	32 cy	1.600 mh / cy	51	41.39 /mh	2,120	-	-	-	-	7.49	240	-	-	2,359	3,736
				4000 psi Concrete	59 cy			/cy		142.00	8,378	-	-	-	-	-	-	8,378	12,715
				Liquid Curing Compounds	1,543 sf	0.003 mh / sf	5	39.17 /mh	181	0.06	91	-	-	-	-	-	-	272	425
				03.08 Pads & Curbs	59 cy		330		13,450	226.16	13,343			7.49	442			27,235	42,242
			26.01	Above Ground Electrical															
				Electrical Work For Equipment (5% Equipment Cost)	1 ls			/ls				42,977.00	42,977					42,977	65,227
				26.01 Above Ground Electrical	1 ls							42,977.00	42,977					42,977	65,227
			26.02	Instrumentation & Controls															
				Controls & Instrumentation Work For New Equipment (1.5% Equipment Cost)	1 ls			/ls				12,893.00	12,893					12,893	19,568
				26.02 Instrumentation & Controls	1 ls							12,893.00	12,893					12,893	19,568
			32.01	Fencing & Gates															
				8' Chain Link Fence @ LOX Tanks	125 lf			-	-	-	-	31.01	3,876	-	-	-	-	3,876	5,892
				8' Fence Vehicle Gate 12' @ LOX Tanks	1 ea			-	-	-	-	1,700.34	1,700	-	-	-	-	1,700	2,581
				32.01 Fencing & Gates	1 ls							5,576.11	5,576					5,576	8,463
			40.01	Above Ground Process Piping															
				Process Piping Work For Equipment (10% Equipment Cost)	1 ls			/ls				86,000.00	86,000					86,000	130,524
				40.01 Above Ground Process Piping	1 lf							86,000.00	86,000					86,000	130,524
			43.17	LOX Equipment															
				Vaporizer 9'x9'x20' h, 6,000 lbs (Charter/Thermax #SG500)	1 ea	1.000 cd / ea	40	1,783.17 /cd	1,783			-	-	763.22	763	209,000.00	209,000	211,546	321,239
				High Pressure Tank 10,960 gal, 9.5'dia.x34' h, 46,700 lbs (Charter #VS-11000SC)	1 ea	1.000 cd / ea	40	1,783.17 /cd	1,783	2,000.00	2,000	-	-	763.22	763	219,000.00	219,000	223,546	339,452
				Tanks - Unload	1 mh		1	47.77 /mh	48	-	-	-	-	-	-	-	-	48	76
				Tanks - Move-Uncrate	1 mh		1	47.77 /mh	48	-	-	-	-	-	-	-	-	48	76
				Tanks - Set-Grout	1 mh		1	47.77 /mh	48	-	-	-	-	-	-	-	-	48	76
				Tank Water 10000 Gal	1 ea	1.000 mh / ea	1	47.77 /mh	48	13,450.00	13,450	-	-	-	-	7,200.00	7,200	20,698	31,416
				Carbon Dioxide Storage & Feed System (10MGD), 50ton liquid CO2 storage, feed panel, vaporizers, heater, regulator, diffusers, controls	1 ea	1.000 mh / ea	1	42.40 /mh	42	-	-	-	-			403,565.00	403,565	403,607	612,564
				43.17 LOX Equipment	1 ls		85		3,800	15,450.00	15,450			1,526.44	1,526	838,765.00	838,765	859,541	1,304,809
				51 Oxidation System	1 ls		415		17,250	28,793.39	28,793	147,446.11	147,446	1,988.40	1,988	838,765.00	838,765	1,034,223	1,570,922
				5C New Small Clearwell & UV w/ Oxidation	1 ls		21,391		880,540	1,932,548.42	1,932,548	1,703,437.93	1,703,438	800,755.24	800,755	1,952,565.00	1,952,565	7,269,847	11,149,891
				05 Clearwell	1 ls		95,656		3,894,475	7,164,998.87	7,164,999	3,972,250.14	3,972,250	2,403,706.20	2,403,706	3,066,365.00	3,066,365	20,501,796	31,546,429

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06				**High Service Pump Station**															
	6A			High Service Pump Station (Retrofit)															
		43		Process Equipment															
			43.00	Pumps															
				Pump Inspection	5 ea	24.000 mh / ea	120	42.40 /mh	5,087	-	-	2,200.00	11,000	-	-	-	-	16,087	24,747
				HSPS Vert Turbine Can Pump - 1250 hp	5 ea	240.000 mh / ea	1,200	47.77 /mh	57,329	2,500.00	12,500	-	-	-	-	562,500.00	2,812,500	2,882,329	4,378,282
				43.00 Pumps	1 ls		1,320		62,416	12,500.00	12,500	11,000.00	11,000			2,812,500.00	2,812,500	2,898,416	4,403,029
				43 Process Equipment	1 ls		1,320		62,416	12,500.00	12,500	11,000.00	11,000			2,812,500.00	2,812,500	2,898,416	4,403,029
				6A High Service Pump Station (Retrofit)	1 ls		1,320		62,416	12,500.00	12,500	11,000.00	11,000			2,812,500.00	2,812,500	2,898,416	4,403,029
	6B			High Service Pump Station (New)															
		00		Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	504 lf	0.050 mh / lf	25	39.49 /mh	995	0.67	339	-	-	-	-	-	-	1,334	2,089
				Mat Foundation Edge Form 12"	260 sf	0.350 mh / sf	91	39.49 /mh	3,594	1.31	341	-	-	-	-	-	-	3,935	6,207
				Mat Foundation Edge Form 30"	1,870 sf	0.350 mh / sf	655	39.49 /mh	25,850	1.31	2,455	-	-	-	-	-	-	28,305	44,639
				Waterstop 6" Flat	504 lf	0.110 mh / lf	55	39.18 /mh	2,172	2.10	1,059	-	-	-	-	-	-	3,231	5,045
				Strip & Oil Mat Found. Form	2,130 sf	0.005 mh / sf	11	39.17 /mh	417	0.03	64	-	-	-	-	-	-	481	757
				Rebar- Foundation Mat (100 #/cy)	17 tn	26.006 mh / tn	489	43.53 /mh	21,272	997.70	17,410	-	-	-	-	-	-	38,681	60,090
				Rebar Support - bricks (.12/sf)	608 ea	0.002 mh / ea	1	43.53 /mh	53	0.26	160	-	-	-	-	-	-	213	326
				Finish- Hard Trowel	5,067 sf	0.023 mh / sf	117	39.17 /mh	4,565	-	-	-	-	-	-	-	-	4,565	7,226
				Pump Place Mat Foundation 12"	81 cy	0.500 mh / cy	41	41.39 /mh	1,676	-	-	-	-	4.59	372	-	-	2,048	3,245
				Pump Place Mat Foundation 30"	268 cy	0.500 mh / cy	134	41.39 /mh	5,546	-	-	-	-	4.59	1,230	-	-	6,776	10,735
				Pump Place Thickened Mat 36" x 12"	14 cy	0.500 mh / cy	7	41.39 /mh	290	-	-	-	-	4.59	64	-	-	354	561
				4000 psi Concrete	363 cy			/cy		142.00	51,546	-	-	-	-	-	-	51,546	78,232
				Liquid Curing Compounds	7,197 sf	0.003 mh / sf	22	39.17 /mh	846	0.06	423	-	-	-	-	-	-	1,269	1,981
				6 Mil. Vapor Barrier	5,600 sf	0.002 mh / sf	11	43.53 /mh	488	0.05	294	-	-	-	-	-	-	782	1,218
				03.00 Foundation Mat	363 cy		1,658		67,765	204.11	74,090			4.59	1,666			143,520	222,351
			03.03	Columns															
				Form Rectangle Columns 9.33' & 9.58'	1,128 sf	0.165 mh / sf	186	39.49 /mh	7,350	1.60	1,801	-	-	-	-	-	-	9,150	14,365
				Chamfer	565 lf	0.015 mh / lf	8	39.49 /mh	335	0.57	320	-	-	-	-	-	-	655	1,018
				Strip & Oil Column Form	1,128 sf	0.005 mh / sf	6	39.17 /mh	221	0.03	34	-	-	-	-	-	-	255	401
				Superplasticizers @ Columns	21 cy			/cy		8.40	176	-	-	-	-	-	-	176	268
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	25	43.53 /mh	1,097	997.70	1,257	-	-	-	-	-	-	2,354	3,644
				Finish- Float	44 sf	0.017 mh / sf	1	39.17 /mh	29	-	-	-	-	-	-	-	-	29	46
				Pump Place Columns 15 ea	21 cy	1.600 mh / cy	34	41.39 /mh	1,391	-	-	-	-	7.50	157	-	-	1,548	2,452
				4000 psi Concrete	21 cy			/cy		142.00	2,982	-	-	-	-	-	-	2,982	4,526
				Grind/Patch Columns	1,128 sf	0.013 mh / sf	15	39.17 /mh	574	0.03	34	-	-	-	-	-	-	608	961
				Rub Columns	1,128 sf	0.065 mh / sf	73	39.17 /mh	2,872	0.06	68	-	-	-	-	-	-	2,939	4,648
				Liquid Curing Compounds	1,128 sf	0.003 mh / sf	3	39.17 /mh	133	0.06	66	-	-	-	-	-	-	199	310
				03.03 Columns	21 cy		351		14,001	320.87	6,738			7.50	157			20,897	32,637
			03.04	Walls															
				Brick Ledge Forms	161 sf	0.300 mh / sf	48	39.49 /mh	1,908	2.21	355	-	-	-	-	-	-	2,263	3,558
				Keyway 6"	327 lf	0.050 mh / lf	16	39.49 /mh	646	0.67	220	-	-	-	-	-	-	866	1,355
				Vertical Wall Keyway 6"	95 lf	0.110 mh / lf	10	39.49 /mh	413	0.67	64	-	-	-	-	-	-	477	750
				Panel Form System 16' h	10,450 sf	0.190 mh / sf	1,986	39.49 /mh	78,419	1.84	19,206	-	-	-	-	-	-	97,625	153,264
				Wall Box Out For Weir, 34 lf	140 sf	0.550 mh / sf	77	39.49 /mh	3,041	1.34	188	-	-	-	-	-	-	3,229	5,099
				Waterstop 6" Flat	422 lf	0.110 mh / lf	46	39.18 /mh	1,819	2.10	886	-	-	-	-	-	-	2,705	4,224
				Strip & Oil Wall Forms	10,450 sf	0.005 mh / sf	52	39.17 /mh	2,047	0.03	314	-	-	-	-	-	-	2,360	3,715
				Superplasticizers @ Walls	398 cy			/cy		8.40	3,344	-	-	-	-	-	-	3,344	5,075
				Rebar- Walls (125 #/cy)	25 tn	15.003 mh / tn	375	43.53 /mh	16,326	997.70	24,943	-	-	-	-	-	-	41,268	63,695
				Finish- Top of Wall	474 sf	0.008 mh / sf	4	39.17 /mh	149	-	-	-	-	-	-	-	-	149	235
				Pump Place Walls 24"	350 cy	1.150 mh / cy	403	41.39 /mh	16,662	-	-	-	-	6.65	2,327	-	-	18,990	30,076
				Pump Place Walls 30"	47 cy	1.150 mh / cy	54	41.39 /mh	2,238	-	-	-	-	6.65	313	-	-	2,550	4,039
				Pump Place Brick Ledge	1 cy	2.001 mh / cy	2	41.39 /mh	83	-	-	-	-	14.42	14	-	-	97	154
				4000 psi Concrete	398 cy			/cy		142.00	56,516	-	-	-	-	-	-	56,516	85,775
				Grind/Patch Walls	10,450 sf	0.013 mh / sf	136	39.17 /mh	5,322	0.03	314	-	-	-	-	-	-	5,635	8,899
				Rub Walls	5,225 sf	0.058 mh / sf	303	39.17 /mh	11,870	0.06	314	-	-	-	-	-	-	12,183	19,262
				Liquid Curing Compounds	10,450 sf	0.002 mh / sf	21	39.17 /mh	819	0.06	615	-	-	-	-	-	-	1,433	2,229
				03.04 Walls	396 cy		3,534		141,760	270.90	107,276			6.70	2,654			251,690	391,404
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	6,383 sf	0.180 mh / sf	1,149	39.49 /mh	45,378	2.18	13,943			-	-	-	-	59,322	92,983
				Slab Edge Form 12"	660 sf	0.250 mh / sf	165	39.49 /mh	6,517	5.17	3,413			-	-	-	-	9,930	15,494
				Strip & Oil Suspended Slab Forms	7,043 sf	0.005 mh / sf	35	39.17 /mh	1,380	0.04	289			-	-	-	-	1,668	2,622
				Superplasticizers	236 cy			-	-	8.40	1,983			-	-	-	-	1,983	3,009
				Rebar- Suspended Slab (225 #/cy)	27 tn	20.004 mh / tn	531	43.53 /mh	23,117	997.70	26,489	-	-	-	-	-	-	49,606	76,791
				Finish- Hard Trowel	6,383 sf	0.030 mh / sf	192	39.17 /mh	7,502	-	-			-	-	-	-	7,502	11,873
				Pump Place Suspended Slab 12"	236 cy	1.800 mh / cy	425	41.39 /mh	17,586	-	-			6.65	1,570	-	-	19,156	30,332
				4000 psi Concrete	236 cy			-	-	142.00	33,512			-	-	-	-	33,512	50,862
				Liquid Curing Compounds	14,086 sf	0.003 mh / sf	42	39.17 /mh	1,655	0.68	9,616			-	-	-	-	11,271	17,214
				03.06 Suspended Flat Slab	236 cy		2,539		103,135	378.15	89,244			6.65	1,570			193,949	301,180
			03.07	Suspended Beams															
				Beam Side Forms	1,354 sf	0.210 mh / sf	284	39.49 /mh	11,230	2.21	2,986	-	-	-	-	-	-	14,216	22,306
				Beam Bottom Forms	468 sf	0.210 mh / sf	98	39.49 /mh	3,882	2.21	1,032	-	-	-	-	-	-	4,914	7,710
				Chamfer	936 lf	0.015 mh / lf	14	39.49 /mh	555	0.57	531	-	-	-	-	-	-	1,085	1,683
				Strip & Oil Beam Forms	1,822 sf	0.005 mh / sf	9	39.17 /mh	357	0.03	55	-	-	-	-	-	-	412	648
				Superplasticizers @ Beams	51 cy			/cy		8.40	428	-	-	-	-	-	-	428	650
				Rebar- Beams (250 #/cy)	6 tn	15.003 mh / tn	96	43.53 /mh	4,179	997.70	6,385	-	-	-	-	-	-	10,565	16,308
				Finish- Top of Beam	468 sf	0.008 mh / sf	4	39.17 /mh	147	-	-	-	-	-	-	-	-	147	232
				Pump Place Beams @ Roof	51 cy	2.001 mh / cy	102	41.39 /mh	4,224	-	-	-	-	14.42	736	-	-	4,959	7,858
				4000 psi Concrete	51 cy			/cy		142.00	7,242	-	-	-	-	-	-	7,242	10,991
				Grind/Patch Beams	1,822 sf	0.013 mh / sf	24	39.17 /mh	928	0.03	55	-	-	-	-	-	-	983	1,552
				Rub Beams	1,822 sf	0.085 mh / sf	155	39.17 /mh	6,066	0.06	109	-	-	-	-	-	-	6,175	9,765
				Liquid Curing Compounds	2,290 sf	0.002 mh / sf	5	39.17 /mh	179	0.06	135	-	-	-	-	-	-	314	488
				03.07 Suspended Beams	51 cy		791		31,746	371.73	18,958			14.42	736			51,440	80,189
			03.08	Pads & Curbs															
				Pad Form 6"	52 sf	0.120 mh / sf	6	39.49 /mh	246	1.37	71	-	-	-	-	-	-	317	498
				Roof Parapet Curb Forms 48" h	1,145 sf	0.200 mh / sf	229	39.49 /mh	9,045	1.52	1,744	-	-	-	-	-	-	10,788	16,961
				Chamfer	571 lf	0.015 mh / lf	9	39.49 /mh	338	0.57	324	-	-	-	-	-	-	662	1,027
				Strip & Oil Equipment Pad & Curb Forms	1,197 sf	0.005 mh / sf	6	39.17 /mh	234	0.03	36	-	-	-	-	-	-	270	426
				Rebar- Pads (100 #/cy)	1 tn	18.003 mh / tn	12	43.53 /mh	509	997.70	649	-	-	-	-	-	-	1,158	1,790
				Finish- Float	124 sf	0.017 mh / sf	2	39.17 /mh	83	-	-	-	-	-	-	-	-	83	131

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.08	**Pads & Curbs**															
				Pump Place Curbs 12"	11 cy	2.501 mh / cy	28	41.39 /mh	1,138	-	-	-	-	9.86	106	-	-	1,247	1,974
				Pump Place Pads 6"	2 cy	1.601 mh / cy	3	41.39 /mh	132	-	-	-	-	7.49	15	-	-	147	234
				4000 psi Concrete	13 cy			/cy		142.00	1,846	-	-	-	-	-	-	1,846	2,802
				Liquid Curing Compounds	1,321 sf	0.003 mh / sf	4	39.17 /mh	155	0.06	78	-	-	-	-	-	-	233	354
				03.08 Pads & Curbs	**13 cy**		298		11,882	365.12	4,747			9.49	123			16,752	26,206
			03.20	**Precast Planks**															
				Precast Hollow Core Roof Planks 4' wide x 10"	4,324 sf	0.020 mh / sf	86	42.24 /mh	3,654	8.80	38,059	-	-	0.35	1,522	-	-	43,234	65,967
				03.20 Precast Planks	**4,324 sf**		86		3,654	8.80	38,059			0.35	1,522			43,234	65,967
			04.00	**Masonry**															
				8" CMU + Rigid Insulation Backup To Brick, 17' h	2,302 sf			/sf		-	-	18.00	41,444	-	-	-	-	41,444	62,901
				8" CMU Interior Partition 9.33' h	824 sf			/sf		-	-	14.00	11,538	-	-	-	-	11,538	17,512
				Brick Veneer	2,448 sf			-	-	-	-	9.00	22,036	-	-	-	-	22,036	33,446
				04.00 Masonry	**3,272 sf**							22.93	75,019					75,019	113,857
			06.00	**Wood**															
				Misc Nailers & Blocking	5,025 sf	0.010 mh / sf	50	39.67 /mh	1,994	0.40	2,017	-	-	-	-	-	-	4,011	6,217
				06.00 Wood	**1 ls**		50		1,994	2,016.69	2,017							4,011	6,217
			07.01	**Roofing**															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	5,100 sf			/sf				3.00	15,303					15,303	23,226
				Aluminum Downspouts, 4 ea x 16' each	64 vf			/vf				18.00	1,152					1,152	1,749
				Aluminum Coping @ Roof Parapet 20" wide	143 lf			/lf				25.01	3,576					3,576	5,427
				Aluminum Gutters	114 lf			/lf				15.00	1,710					1,710	2,596
				Roof Hatch 4'0" x 4'0"	3 ea			/ea				2,500.50	7,502					7,502	11,386
				Translucent Panel Skylight Frame & Panels 7' x 7', 6 ea	294 sf			/sf				38.01	11,174					11,174	16,959
				07.01 Roofing	**5,100 sf**							7.93	40,417					40,417	61,342
			08.00	**Doors, Frames & Hardware**															
				HM Door Leafs- 3'x7' 20 ga. half glass	7 ea	1.500 ea / mh	5	39.18 /mh	183	450.09	3,151	-	-	-	-	-	-	3,334	5,071
				Overhead Doors- 10'x10' 24 ga steel manual 1" insuation 26 ga back-up panel	1 ea			-	-	-	-	2,256.45	2,255	-	-	-	-	2,255	3,423
				08.00 Doors, Frames & Hardware	**8 ea**		5		183	393.83	3,151	281.93	2,255					5,589	8,494
			09.00	**Finishes**															
				Paint HM Door Frames - primer (2) coats	4 ea			/ea		-	-	100.02	400	-	-	-	-	400	607
				Paint HM Doors - primer (2) coats	7 ea			/ea		-	-	140.03	980	-	-	-	-	980	1,488
				Paint Walls- 3 coats	3,950 sf			-	-	-	-	0.94	3,713	-	-	-	-	3,713	5,636
				09.00 Finishes	**1 ls**							5,093.27	5,093					5,093	7,730
			10.00	**Specialty Items**															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	4 ea			/ea				30.01	120	-	-	-	-	120	182
				Fire Extinguisher CO2 10 lbs	3 ea			/ea				225.05	675					675	1,025
				10.00 Specialty Items	**1 ls**							3,795.76	3,796					3,796	5,761
			22.00	**Plumbing**															
				Plumbing Subcontract	5,100 sf			/sf				6.00	30,606					30,606	46,451
				22.00 Plumbing	**1 ls**							30,606.11	30,606					30,606	40,451
			23.00	**HVAC**															
				Ventilation & Unit Heater System	5,100 sf			/sf		-	-	25.01	127,525	-	-	-	-	127,525	193,547
				23.00 HVAC	**5,100 sf**							25.01	127,525					127,525	193,547
			31.01	**Dewatering**															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	35 lf			/lf				150.00	5,250			-	-	5,250	7,968
				Set & Wire Pumps	1 ea	2.000 ea / cd	24	2,249.33 /cd	1,125	25,000.00	25,000	-	-	323.92	324	-	-	26,449	40,238
				Maintenance/Operation	1 ea	1.000 ea / cd	48	2,249.33 /cd	2,249	1,000.00	1,000	-	-	647.84	648	-	-	3,897	8,109
				Suction Piping	80 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.89	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	1 ea	1.000 ea / cd	32	1,439.45 /cd	1,439	2,000.00	2,000	-	-	226.08	226	-	-	3,666	5,674
				Electric Consumption	4 mo	1.000 mo / ls		/ls		1,000.00	4,000	-	-			-	-	4,000	6,071
				31.01 Dewatering	**1 ls**		331		15,447	45,200.00	45,200	5,477.27	5,477	4,260.36	4,260			70,384	108,142
			31.02	**Piles**															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 79 ea (1 per 64 sf)	1,975 vf	0.002 cd / vf	221	2,146.97 /cd	8,482	35.16	69,434	-	-	2.58	5,096	-	-	83,012	126,917
				31.02 Piles	**79 ea**		221		8,482	878.91	69,434			64.51	5,096			83,012	126,917
			31.03	**Excavation Shoring**															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (149' x 22' deep)	3,278 sf	0.001 cd / sf	162	2,465.38 /cd	6,225	16.00	52,458	-	-	0.75	2,465	-	-	61,148	93,392
				Tie Backs (1 per 80 sf of Sheeting, 149' x 18'= 2,682 sf)	34 ea			-	-	-	-	2,377.47	80,834	-	-	-	-	80,834	122,683
				31.03 Excavation Shoring	**3,278 sf**		162		6,225	16.00	52,458	29.24	95,837	0.75	2,465			156,986	238,846
			31.10	**Structure Excavation**															
				Exc Clay-Backhoe/Truck (5,440 sf x 17.83')	3,592 cy	499.900 cy / cd	259	1,410.06 /cd	10,132	-	-	-	-	6.58	23,650	-	-	33,782	53,676
				31.10 Structure Excavation	**3,592 cy**		259		10,132					6.58	23,650			33,782	53,675
			31.12	**Structure Backfill**															
				BackFill Earth-Backhoe/Truck (149' x 4' x 17.83')	383 cy	0.002 cd / cy	25	1,327.72 /cd	1,027			-	-	4.69	1,795	-	-	2,822	4,483
				31.12 Structure Backfill	**383 cy**		25		1,027					4.69	1,795			2,822	4,483
			31.13	**Soil Disposal**															
				Spoils to Waste	3,199 cy	0.003 day / cy	288	1,410.06 /day	11,279	-	-	-	-	8.23	26,329	-	-	37,608	59,755
				31.13 Soil Disposal	**3,199 cy**		288		11,279					8.23	26,329			37,608	59,755
			31.20	**Structure Stone Base**															
				Structure Subbase Stone-Loaders/Truck - 5,440 sf x 4"	67 cy	0.003 cd / cy	8	1,609.56 /cd	327	28.28	1,895	-	-	10.02	671	-	-	2,893	4,461
				31.20 Structure Stone Base	**67 cy**		8		327	28.28	1,895			10.02	671			2,893	4,461
			40.01	**Above Ground Process Piping**															
				Paint & Stencil Exposed Piping <20"	620 lf			-	-	-	-	10.00	6,201	-	-	-	-	6,201	9,412
				Paint & Stencil Exposed Piping >20"	26 lf			-	-	-	-	25.01	650	-	-	-	-	650	987
				40.01 Above Ground Process Piping	**1 lf**							6,851.37	6,851					6,851	10,398
				00 Building & Structure Construction	**5,100 gsf**		10,606		429,038	100.64	513,267	77.04	392,878	14.25	72,694			1,407,877	2,170,009
		20		**Electrical & Instrumentation**															
			26.00	**UG Electrical**															
				Building Electrical System	5,100 sf			/sf				16.00	81,616					81,616	123,870
				26.00 UG Electrical	**1 ls**							81,616.29	81,616					81,616	123,870
			26.01	**Above Ground Electrical**															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			26.01	**Above Ground Electrical**															
				Process Electrical System	5,100 sf			/sf				30.01	153,031					153,031	232,257
				26.01 Above Ground Electrical	1 ls							153,030.55	153,031					153,031	232,257
			26.02	**Instrumentation & Controls**															
				Controls & Instrumentation	1 ls			/ls				264,180.00	264,180					264,180	400,950
				26.02 Instrumentation & Controls	1 ls							264,180.00	264,180					264,180	400,950
				26 Electrical & Instrumentation	1 ls							496,828.84	498,827					498,827	757,077
		40		**Process Piping**															
			40.00	**Under Ground Process Piping**															
				Trench Excav & Lay Pipe 0-4'	20 lf	600,000 lf / cd	2	2,539.31 /cd	85			-	-	1.88	38	-	-	122	194
				Stone Pipe Bedding	3 cy	200,000 cy / cd	1	2,896.43 /cd	43	23.29	70	-	-			-	-	113	175
				DI Pipe Push - Class 52 30	15 lf	0.440 mh / lf	7	51.34 /mh	339	167.28	2,509	-	-	-	-	-	-	2,848	4,344
				DI Pipe Push - Class 52 36	5 lf	0.500 mh / lf	3	51.34 /mh	128	225.44	1,127	-	-	-	-	-	-	1,256	1,914
				Hydrostatic Testing	20 lf	0.021 ch / lf	2	182.49 /ch	77	0.16	3	-	-	-	-	-	-	80	126
				40.00 Under Ground Process Piping	20 lf		14		572	185.47	3,709			1.88	38			4,419	6,753
			40.01	**Above Ground Process Piping**															
				Pipe Supports	4 ea	4.001 mh / ea	16	45.62 /mh	730	250.05	1,000	-	-			-	-	1,730	2,674
				Hydrostatic Testing	142 lf	0.021 ch / lf	12	182.49 /ch	544	0.16	23	-	-	-	-	-	-	567	898
				Dresser Couplings 6"	8 ea	2.400 ch / ea	19	/ch		170.00	1,360	-	-			-	-	1,360	2,064
				Restrained Joint Couplings 10"	4 ea	5.721 ch / ea	92	182.49 /ch	4,176	283.06	1,132	-	-			-	-	5,308	8,328
				Restrained Joint Couplings 24"	8 ea	13.803 ch / ea	442	182.49 /ch	20,151	684.14	5,473	-	-			-	-	25,624	40,200
				14" DI Slab Thimble 12" long	2 ea	1.501 ch / ea	12	182.49 /ch	548	325.07	650	-	-	361.32	723	-	-	1,920	3,004
				36" DI Wall Thimble 24" long	1 ea	2.500 ch / ea	10	182.49 /ch	456	1,286.26	1,286	-	-	602.00	602	-	-	2,344	3,632
				36" DI Slab Thimble 12" long	4 ea	2.501 ch / ea	40	182.49 /ch	1,825	700.14	2,801	-	-	602.12	2,408	-	-	7,034	10,972
				Gasket/Nuts/Bolt Kit 6"	22 ea	1.000 mh / ea	22	45.62 /mh	1,004	15.87	349	-	-	-	-	-	-	1,353	2,118
				Gasket/Nuts/Bolt Kit 10"	5 ea	1.000 mh / ea	5	45.62 /mh	228	37.54	188	-	-	-	-	-	-	416	646
				Gasket/Nuts/Bolt Kit 30"	3 ea	2.501 mh / ea	8	45.62 /mh	342	175.03	525	-	-	-	-	-	-	867	1,339
				DI Flanged Joint Pipe 6"	70 lf	0.900 mh / lf	63	45.62 /mh	2,874	47.39	3,317	-	-	-	-	-	-	6,191	9,583
				DI Flanged Joint Pipe 10"	46 lf	1.240 mh / lf	57	45.62 /mh	2,603	88.26	4,060	-	-	-	-	-	-	6,663	10,281
				DI Flanged Joint Pipe 30"	26 lf	3.051 mh / lf	79	45.62 /mh	3,619	310.21	8,065	-	-	-	-	-	-	11,684	17,988
				DI Flanged 90 ell 6"	5 ea	4.830 mh / ea	24	45.62 /mh	1,102	105.30	527	-	-	-	-	-	-	1,628	2,543
				DI Flanged 90 ell 10"	1 ea	6.361 mh / ea	6	45.62 /mh	290	267.35	267	-	-	-	-	-	-	558	865
				DI Flanged 90 ell 30"	2 ea	17.874 mh / ea	36	45.62 /mh	1,631	2,317.07	4,634	-	-	-	-	-	-	6,265	9,614
				DI Flanged 90 ell 36"	0 ea	20.520 mh / ea	0	45.62 /mh	9	2,989.00	30	-	-	-	-	-	-	39	60
				DI Flanged Tee 6"	4 ea	4.830 mh / ea	19	45.62 /mh	881	120.00	480	-	-	-	-	-	-	1,361	2,124
				DI Flanged Tee 10"	2 ea	6.362 mh / ea	13	45.62 /mh	580	350.00	700	-	-	-	-	-	-	1,280	1,981
				DI Flanged Tee 30"	4 ea	17.874 mh / ea	71	45.62 /mh	3,262	2,600.00	10,400	-	-	-	-	-	-	13,662	20,947
				DI Blind Flange 10"	1 ea	6.101 mh / ea	6	45.62 /mh	278	247.85	248	-	-	-	-	-	-	526	817
				DI Blind Flange 30"	1 ea	17.163 mh / ea	17	45.62 /mh	783	2,395.88	2,396	-	-	-	-	-	-	3,179	4,876
				Chemical Piping & Accessories- ALLOWANCE	500 LF	0.240 mh / LF	120	45.62 /mh	5,476	55.01	27,505	-	-	-	-	-	-	32,981	50,412
				40.01 Above Ground Process Piping	142 lf		1,190		53,393	545.19	77,417			26.29	3,733			134,542	207,943
			40.02	**Valves, Meters, Etc.**															
				Backflow Preventer Flg 6"	2 ea	12.170 mh / ea	24	45.62 /mh	1,110	5,000.00	10,000	-	-	-	-	-	-	11,110	16,936
				Magnetic Flow Meter - Inline - 24" w/ transmitter	1 ea	26.005 mh / ea	26	48.85 /mh	1,270	12,002.39	12,002	-	-	-	-	-	-	13,273	20,227
				Swing Check Valve 6"	4 ea	4.669 mh / ea	19	45.62 /mh	852	1,100.00	4,400	-	-	-	-	-	-	5,252	8,026
				Swing Check Valve 10"	2 ea	7.996 mh / ea	16	45.62 /mh	730	4,650.93	9,302	-	-	-	-	-	-	10,031	15,272
				Swing Check Valve 24"	4 ea	18.001 mh / ea	72	45.62 /mh	3,285	14,402.88	57,612	-	-	-	-	-	-	60,896	92,637
				10" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	2 ea	9.602 mh / ea	19	45.62 /mh	876	5,701.14	11,402	-	-	-	-	-	-	12,278	18,692
				24" Butterfly Valve, 125 lb class, CI Body, Flg, w/ EIM elec actuator NEMA 4	4 ea	19.204 mh / ea	77	45.62 /mh	3,504	12,502.50	50,010	-	-	-	-	-	-	53,514	81,448
				40.02 Valves, Meters, Etc.	1 ls		253		11,628	154,728.01	154,728							166,356	253,237
			40.04	**Hydropneumatic Piping System**															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				12,000.00	12,000					12,000	18,213
				40.04 Hydropneumatic Piping System	1 ls							12,000.00	12,000					12,000	18,213
				40 Process Piping	182 lf		1,456		65,692	1,456.89	235,854	74.07	12,000	23.28	3,771			317,317	486,145
		43		**Process Equipment**															
			43.00	**Pumps**															
				Recycle Pumps - Vertical Turbine Pumps 75 hp, 8 mgd	3 ea	35.007 mh / ea	105	47.77 /mh	5,017	100.02	300					54,010.78	162,032	167,350	254,315
				Water Transmission Pumps - Vert Turbine Pumps, 200 hp, 5.3 gpm, 208'TDH	4 ea	117.023 mh / ea	468	47.77 /mh	22,363	100.02	400	-	-	-	-	108,021.56	432,086	454,849	691,786
				Dewatering Pumps - - Submersible Pumps 30 hp, 350 gpm, 208'TDH	2 ea	24.005 mh / ea	48	42.59 /mh	2,045	100.02	200	-	-	-	-	29,005.79	58,012	60,256	91,585
				43.00 Pumps	1 ls		621		29,425	900.18	900					652,130.16	652,130	682,455	1,037,685
			43.16	**Swift Water Chemical Injection In-Line Blender**															
				Chemical Injection In-Line Blender	1 ea	25.005 mh / ea	25	42.40 /mh	1,060	1,500.30	1,500					50,009.98	50,010	52,570	79,856
				43.16 Swift Water Chemical Injection In-Line Blender	1 ls		25		1,060	1,500.30	1,500					50,009.98	50,010	52,570	79,856
			43.21	**Air Compressor**															
				Package Air Compressor 350 cfm	1 ea	40.000 mh / ea	40	42.40 /mh	1,696			-	-	-	-	35,000.00	35,000	36,696	55,804
				43.21 Air Compressor	1 ls		40		1,696							35,000.00	35,000	36,696	55,804
				43 Process Equipment	1 ls		686		32,181	2,400.48	2,400					737,140.14	737,140	771,721	1,173,345
				6B High Service Pump Station (New)	1 ls		12,748		526,911	751,521.75	751,522	903,704.70	903,705	76,465.00	76,465	737,140.14	737,140	2,995,742	4,586,577
				06 High Service Pump Station	1 ls		14,068		589,327	764,021.75	764,022	914,704.70	914,705	76,465.00	76,465	3,549,640.14	3,549,640	5,894,159	8,989,606

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
07				Groundwater & Surface Water															
	7A			Groundwater & Surface Water 50/50 Blend															
		70		Groundwater & Surface Water 50/50 Blend															
			70.00	Groundwater & Surface Water 50/50 Blend															
				Estimate Place Holder	*1 ls*			/ls											
				70.00 Groundwater & Surface Water 50/50 Blend	1 ls														
				70 Groundwater & Surface Water 50/50 Blend	1 ls														
				7A Groundwater & Surface Water 50/50 Blend	1 ls														
				07 Groundwater & Surface Water	1 ls														

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
08				**Electrical and E&I**															
	8A			Electrical- Rehab															
		26		Electrical & Instrumentation															
			26.01	Above Ground Electrical															
				Estimate Place Holder	*1 ls*			/ls											
				26 Electrical & Instrumentation	1 ls														
				8A Electrical- Rehab	1 ls														
	8B			E&I - Rehab															
		26		Electrical & Instrumentation															
			26.02	Instrumentation & Controls															
				Estimate Place Holder	*1 ls*			/ls											
				26.02 Instrumentation & Controls	1 ls														
				26 Electrical & Instrumentation	1 ls														
				8B E&I - Rehab	1 ls														
				08 Electrical and E&I	1 ls														

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
09				**Outfall & Floodwater System**															
	9A			Outfall & Floodwater System- Rehab															
		90		**Outfall & Floodwater System- Rehab**															
			90.00	**Outfall & Floodwater System- Rehab**															
				Outfall & Floodwater System- Rehab	1 ls			/ls				100,000.00	100,000					100,000	151,772
				90.00 Outfall & Floodwater System- Rehab	1 ls							100,000.00	100,000					100,000	151,772
				90 Outfall & Floodwater System- Rehab	1 ls							100,000.00	100,000					100,000	151,772
				9A Outfall & Floodwater System- Rehab	1 ls							100,000.00	100,000					100,000	151,772
				09 Outfall & Floodwater System	1 ls							100,000.00	100,000					100,000	151,772

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
10				Laboratory															
	10A			Laboratory- Rehab															
		10		Laboratory- Rehab															
			10.04	Laboratory- Rehab															
				Laboratory Equipment Upgrade Allowance	1 ls			/ls				50,000.00	50,000					50,000	75,886
				10.04 Laboratory- Rehab	1 ls							50,000.00	50,000					50,000	75,886
				10 Laboratory- Rehab	1 ls							50,000.00	50,000					50,000	75,886
				10A Laboratory- Rehab	1 ls							50,000.00	50,000					50,000	75,886
				10 Laboratory	1 ls							50,000.00	50,000					50,000	75,886

Estimate Totals

Description	Amount	Totals	Hours	Rate	Cost Basis	Cost per Unit	rcent of Total	
Labor	28,222,766		707,472 hrs				10.36%	
Overtime - 50 hr wk (w/ 1.5)					C			
Material	33,259,065						12.20%	
Subcontract	27,440,416						10.07%	
Equipment	8,801,548		94,226 hrs				3.23%	
Process Equip	80,218,708						29.43%	
Subtotal	177,942,503	177,942,503					65.29%	65.29%
Sales Tax (Const Equipment)	649,554			7.38 %	C		0.24%	
Mobilization/Demobilization	1,779,425			1.00 %	T		0.65%	
Safety Supplies and Equip (L)	846,683			3.00 %	C		0.31%	
Small Tools and Equip (L)	564,455			2.00 %	C		0.21%	
Consumables (L)	423,341			1.50 %	C		0.16%	
Testing & Commissioning	1,779,425			1.00 %	T		0.65%	
3rd Party Inspections	889,713			0.50 %	C		0.33%	
Tax & Misc Subtotal	6,932,596	184,875,099					2.54%	67.83%
General Conditions	17,794,250			10.00 %	C		6.53%	
General Conditions Subtotal	17,794,250	202,669,349					6.53%	74.36%
Contingency (%)	30,400,403			15.00 %	T		11.15%	
Contingency Subtotal	30,400,403	233,069,752					11.15%	85.51%
Escalation- (mid pt 2023 @ 2.68%/yr)	15,965,278			6.85 %	T		5.86%	
Escalation Subtotal	15,965,278	249,035,030					5.86%	91.37%
Market Conditions- Max					T			
Msarket Conditions		249,035,030						91.37%
Permits	1,362,751			0.50 %	T		0.50%	
All Risk Insurance	1,867,763			0.75 %	T		0.69%	
Performance & Payment Bond	2,490,350			1.00 %	T		0.91%	
Permits, Ins. & Bonds Subtotal	5,720,864	254,755,894					2.10%	93.47%
G.C Overhead and Profit	17,794,250			10.00 %	C		6.53%	
GC OH&P Subtotal	17,794,250	272,550,144					6.53%	100.00%
Total		*272,550,144*						

OUCC DR 17-7

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Please state the dates of the cost estimates in the Advanced Facility Plan were prepared and the year assumed for the costs (e.g., 2021 dollars, 2022 dollars, etc.). Please also state the level of design on which the cost estimates are based (e.g., 30% design completion).

Information Provided:

The costs were developed between in the third and fourth quarters of 2020. Estimates were based on 2020 dollars and escalated by 3%. However, it is now understood escalation has increased considerably going into 2021. The cost estimates were based on the alternative evaluations report, which is conceptual level (approximately 10% design).

OUCC DR 17-8

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

For Evansville's preferred new water treatment plant Alternate 2B, please identify the engineering costs (planning, design, bidding assistance, construction engineering, and inspection services) anticipated for the project and state the costs for each engineering component incurred to date.

Information Provided:

The following amounts have been spent or planned to be spent as follows:

Planning	$870,173	See invoices provided in response to OUCC DR 17-12	Status: complete
Preliminary Design	$620,159	See invoices provided in response to OUCC DR 17-12	Status: Current, $1,015,668 remaining contracted for task
Final Design	$7,756,696	Budgeted	Status: Not started, funds reserved and ready
Construction	$140,049,000	Planned	See Table 11-3 of submitted PER
Bidding/Con. Admin/Inspection	$6,302,000	Planned	See Table 11-3 of submitted PER

OUCC DR 17-10

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

For Evansville's water treatment plant rehabilitation Alternate 1, please provide cost support documentation for each major component lump sum cost listed in Table 9-2 Plant Alternative 1 Total Estimated Construction Cost on pages 117 and 118 of the Advanced Facility Plan (Attachment SMB-1 to Mr. Breese's case-in-chief testimony in this cause). Please provide copies of the Excel worksheets detailing quantities, unit costs, equipment costs, other data used to establish costs, and all assumptions and cost allowances. Please also provide copies of budgetary cost proposals provided by equipment vendors and material suppliers.

Information Provided:

The spreadsheet is attached as OUCC DR 17-10 - Alt 1.xls. See also OUCC DR 17-6 - Timberline Output.pdf (developed in Timberline Cost estimating software) which presents further detail for cost estimates performed early in the development of the alternatives report. See response to OUCC DR 17-6 for quotes.

Attachment:

OUCC DR 17-10.xls.

Cause No. 45545
OUCC DR 17-10 Attachment 1

Evansville Water and Sewer Utility
WTP Upgrade - Plant Alternative 1 - Capital Cost

Component Description	Cost	
Civil Site Work (Roads, Drainage, Fencing etc.)	$3,500,000	
Rehabilitate River Intake	$6,752,000	
North Plant Pretreatment Improvements	$13,610,000	
North Plant Ozone System Retrofit	$16,935,000	
Rehabilitate Gravity Filters	$17,125,000	
New Sodium Hypochlorite System	$2,092,000	
PAC Feed Improvements	$1,000,000	
Other Chemical Improvements (4 at $300k ea.)	$1,200,000	4 chemical Systems
Demolish South Plant	$1,066,000	
Construct New 6 MG Clearwell	$10,960,000	
Rehabilitate Existing 6.5 MG Clearwell	$734,000	
Rehabilitate High Service Pump Stations #2, #3	$8,733,000	
Extend 3 Plant Outfalls ($750k ea.)	$2,250,000	3 Outfalls
Building Renovations	$4,000,000	
Interconnecting Site Utility / Electrical Work	$3,500,000	
Other Demolition Work Throughout Plant	$2,000,000	
Subtotal	**$95,457,000**	
Additional Construction Contingencies (15%)	$14,319,000	
Other Misc. Plant-Wide Improvements (5%)	$4,773,000	
Phasing & Sequencing Plant Outages (5%)	$4,773,000	
Remediation & Hazardous Martials	$1,000,000	
Allowances	$500,000	
Startup and Commissioning	$1,000,000	
Total Estimated Construction Cost	**$121,822,000**	

Original Costs from Estimator

Description	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Demolition Work	$49,600	$75,000	1.512
Roof Repair / Replacement	$7,000	$10,500	1.500
Doors & Hardware Rehab	$13,000	$19,700	1.515
Building Finishes & Specialties	$34,200	$50,500	1.477
Structure and Walkway Rehabilitation	$50,000	$75,500	1.510
Process Piping and Accessories	$209,000	$317,800	1.521
Pump Replacement	$1,335,500	$2,020,400	1.513
Screen Replacement	$666,000	$1,019,100	1.530
Potassium Permanganate System	$249,000	$366,000	1.470
HVAC Replacement	$115,000	$172,000	1.496
Electrical Systems	$200,000	$302,000	1.510
Instrumentation	$84,000	$126,900	1.511
Totals	**$3,012,300**	**$4,555,400**	

Adjusted for Report

Table B1.1 - River Intake Rehabilitation, Low Service PS

Description		Estimated Cost	Cost Adjust Comments
Demolition Work		$75,000	
Roof Repair / Replacement (3,000 sf)		$60,000	X - City noted a whole new roof
Doors & Hardware Rehab		$13,000	
Building Finishes & Specialties		$35,000	
Structure and Walkway Rehabilitation		$50,000	
Process Piping and Accessories		$209,000	
Pump Replacement (6 units)		$1,336,000	
Intake Screens (3 units)		$1,300,000	X - quote of $750k for 3 screens - estimate seems to be pneumatic screens? Access from existing bridge, barge not needed
Potassium Permanganate System (1 unit)		$400,000	X - estimate seemed low - need to run piping over, hopper, storage, etc.
HVAC Replacement (3,000 sf)		$115,000	
Misc. Electrical (MCC Upgrades are Underway)		$150,000	X - MCC's are getting some upgrades
Instrumentation		$100,000	
Subtotal		**$3,843,000**	
Estimating Contingency	30%	$1,152,900	
Escalation to Midpoint	3%	$115,290	
Construction Subtotal		**$5,111,190**	
Contractor General Conditions	10%	$511,119	
Contractor Overhead and Profit	12%	$613,343	
Construction Contingencies	5%	$255,560	
Allowance: Dredge River		$260,000	
Grand Total Cost		**$6,752,000**	

Effective Multiplier 1.76

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
02.01 Demolition Work	Demolition Work	$76,883	$119,797	1.558
	Modify Existing Structure & Service	$1,906,341	$2,944,607	1.545
43.03 Baffle Walls	Baffle Walls	$346,653	$530,906	1.532
40.01 Above Ground Process Piping	Process Piping	$18,825	$28,586	1.519
43.01 Flocculators & Mixers	Flocculators & Mixers	$921,261	$1,402,364	1.522
43.02 Settlement Equipment	Settlement Equipment	$3,398,594	$5,171,988	1.522
43.20 Slide Gate w/ Operator	Slide Gate w/ Operator	$131,601	$199,566	1.516
26.01 Above Ground Electrical	Electrical	$315,783	$477,528	1.512
26.02 Instrumentation & Controls	Instrumentation & Controls	$94,735	$143,258	1.512
Grand Total Capital Construction Co	**Grand Total Capital Construction (**	**$7,210,676**	**$11,018,600**	

Adjusted for Report

Table B2.1 - Retrofit North Pretreat w/Plate Settlers

Description		Estimated Cost	Cost Adjust Comments
Demolition Work		$90,000	
Modify Existing Structure & Services		$2,307,000	X - EWSU wants influent channels and effluent launders completely rehabed - added $400k to cost
Flow Control Diffuser Wall SS 304 (360 lf)		$347,000	
Process Piping and Valves		$150,000	X - Seemed low, updated to 150K
Coagulant Injection Improvements		$75,000	
Flocculators & Mixers w/VFD (24 units)		$922,000	
Plate Settlers & Sludge Collection		$3,399,000	
Slide Gate w/ Operator (6 units)		$180,000	X - 30K to match 120K for 4 units in new option
Electrical (8% Equip Cost)		$361,000	X - Use 8% of equipment cost
Instrumentation & Controls (5% Equip Cost)		$226,000	X - Use 5% of equipment cost
Subtotal		**$8,057,000**	
Estimating Contingency	30%	$2,417,100	
Escalation to Midpoint	3%	$241,710	
Construction Subtotal		**$10,715,810**	
Contractor General Conditions	10%	$1,071,581	
Contractor Overhead and Profit	12%	$1,285,897	
Construction Contingencies	10%	$535,791	
Grand Total Cost		**$13,610,000**	

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
	Rehab North Basins # 1 - 5			
02.01 Demolition Work	Demolition Work	$308,326	$478,430	1.552
	Building Structure	$896,554	$1,389,903	1.550
31.12 Structure Backfill	Foundation and Earthwork	$542,559	$838,263	1.545
40.01 Above Ground Process Piping	Process Piping	$16,825	$25,562	1.519
	Ozone Facility			
	Buidling Structure	$364,087	$558,710	1.535
	Process Piping	$298,560	$459,056	1.538
40.02 Valves, Meters, Etc.	Valves, Meters, Etc.	$12,895	$19,597	1.520
43.10 Ozone Equipment	Ozone Equipment	$3,497,647	$5,302,139	1.516
22.00 Plumbing	Plumbing	$34,447	$52,091	1.512
23.00 HVAC	HVAC	$258,300	$390,602	1.512
	Electrical	$208,973	$316,009	1.512
26.02 Instrumentation & Controls	Instrumentation & Controls	$49,500	$74,854	1.512
	LOX Equipment			
	Buidling Structure	$23,462	$36,190	1.542
32.01 Fencing & Gates	Fencing & Gates	$5,142	$7,776	1.512
	Process Piping	$28,183	$43,688	1.550
40.02 Valves, Meters, Etc.	Valves, Meters, Etc.	$20,611	$31,273	1.517
43.17 LOX Equipment	LOX Vaporizor, Tank, Station	$890,881	$1,347,884	1.513
26.01 Above Ground Electrical	Electrical	$42,977	$64,990	1.512
26.02 Instrumentation & Controls	Instrumentation & Controls	$12,893	$19,497	1.512
Grand Total Capital Construction Cost	**Grand Total Capital Construction (**	**$7,512,822**	**$11,456,514**	

Adjusted for Report

Table B3.3 - Ozonation in Existing Basins

Description		Estimated Cost	Cost Adjust Comments
Rehab North Secondary Basins			
Demolition Work		$309,000	
Basin Modifications		$897,000	
Ozone Corrosion Additives		$100,000	X - 10% of basin modifications, added
Basin Abandon, Structural Backfill		$543,000	
Process Piping		$100,000	X - seemed low
Access Hatches (8 units)		$120,000	X - Added item
Ozone Facility			
Building Structure (5,712 sf)		$365,000	
Process Piping		$299,000	
Sampling System (pumps, piping, Analyzers)		$100,000	X - Added this item
Valves, Meters, etc.		$155,000	X - assume 35 valves (9 pumps)+15K for small valves
Ozone System, quench, destruct (2 units)		$4,498,000	X - Add 30% (1 Mill) for install
Plumbing (5,740 sf)		$75,000	
HVAC (5,740 sf)		$259,000	
Electrical		$900,000	X - 150K for Bldg and 750K for Ozone
Instrumentation & Controls (5 % Equip Cost)		$225,000	X - Ozone I&C would be higher; use higher
LOX Equipment			
Equipment Pad (1,462 sf)		$35,000	X - Make 35K based on 12" slab and $600/cy
Misc. Site and Access Improvements		$25,000	
Process Piping		$29,000	
Valves, Meters, etc.		$42,000	X - Double estimator number
LOX Vaporizer, Tank, Station (2 units)		$891,000	
Electrical (5% Equip Cost)		$45,000	
Instrumentation & Controls (1.5% Equip Cost)		$14,000	
Subtotal		**$10,026,000**	
Estimating Contingency	30%	$3,007,800	
Escalation to Midpoint	3%	$300,780	
Construction Subtotal		**$13,334,580**	
Contractor General Conditions	10%	$1,333,458	
Contractor Overhead and Profit	12%	$1,600,150	
Construction Contingencies	5%	$666,729	
Grand Total Cost		**$16,935,000**	

Table B3.3a - Ozonation in Existing Basins and Filter Rehabilitation

Description		Estimated Cost
Rehab North Secondary Basins		
Demolition Work		$309,000
Basin Modifications		$897,000
Ozone Corrosion Additives		$100,000
Basin Abandon, Structural Backfill		$543,000
Process Piping		$100,000
Access Hatches (8 units)		$120,000
Ozone Facility		
Building Structure (5,712 sf)		$365,000
Process Piping		$299,000
Sampling System (pumps, piping, Analyzers)		$100,000
Valves, Meters, etc.		$155,000
Ozone System, quench, destruct (2 units)		$4,498,000
Plumbing (5,740 sf)		$75,000
HVAC (5,740 sf)		$259,000
Electrical		$900,000
Instrumentation & Controls (5 % Equip Cost)		$225,000
LOX Equipment		
Equipment Pad (1,462 sf)		$35,000
Misc. Site and Access Improvements		$25,000
Process Piping		$29,000
Valves, Meters, etc.		$42,000
LOX Vaporizer, Tank, Station (2 units)		$891,000
Electrical (5% Equip Cost)		$45,000
Instrumentation & Controls (1.5% Equip Cost)		$14,000
Filter Rehabilitation Base Cost		$10,138,000
Subtotal		**$20,164,000**
Estimating Contingency	30%	$6,049,200
Escalation to Midpoint	3%	$604,920
Construction Subtotal		**$26,818,120**
Contractor General Conditions	10%	$2,681,812
Contractor Overhead and Profit	12%	$3,218,174
Construction Contingencies	5%	$1,340,906
Grand Total Cost		**$34,060,000**

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
	Rehab Filters 21 - 28			
02.01 Demolition Work	Demolition Work	$231,041	$363,200	1.572
03.30 Patch Cracks and Resurface Concre	Patch Cracks and Resurface Concrete	$80,975	$127,647	1.576
09.00 Finishes	Paint Finishes	$162,284	$254,077	1.566
43.05 Filtration Equipment	Filtration Equipment	$899,723	$1,384,578	1.539
	Rehab Filters 29 - 32			
02.01 Demolition Work	Demolition Work	$235,083	$369,574	1.572
03.30 Patch Cracks and Resurface Concre	Patch Cracks and Resurface Concrete	$80,975	$127,647	1.576
09.00 Finishes	Paint Finishes	$216,896	$340,293	1.569
40.01 Above Ground Process Piping	Process Piping	$137,561	$211,658	1.539
43.05 Filtration Equipment	Filtration Equipment	$914,273	$1,406,800	1.539
	Filter Building 21 - 36			
02.01 Demolition Work	Demolition Work	$264,000	$399,221	1.512
08.00 Doors, Frames & Hardware	Doors, Frames & Hardware	$520,062	$786,684	1.513
09.00 Finishes	Paint Finishes	$143,284	$220,121	1.536
23.00 HVAC	HVAC	$880,000	$1,330,738	1.512
26.01 Above Ground Electrical	Electrical	$792,000	$1,197,664	1.512
Grand Total Capital Construction Cost	**Grand Total Capital Construction Cc**	**$5,558,157**	**$8,519,902**	

Adjusted for Report

Table B3.1 - Existing Filter Rehabilitation

Description		Estimated Cost	Cost Adjust Comments
Rehab Filters 21 - 28			Filters are 28 X 37
Demolition Work		$232,000	
Patch Cracks and Resurface Concrete		$81,000	
Paint Finishes		$163,000	
Filtration Equipment and Media		$1,700,000	Too low in original
SS Air Scour Grids		$720,000	X - Assume 90K per filter;
Air Scour Blowers (2 units)		$425,000	X - Use half the cost from MGF alt blower pricing
Rehab Filters 29 - 36			Filters are 23 X 46
Demolition Work		$236,000	
Patch Cracks and Resurface Concrete		$150,000	
Paint Finishes		$217,000	
Process Piping Improvements		$138,000	
Filtration Equipment and Media		$1,400,000	
Aluminum Storefronts		$521,000	
SS Air Scour Grids		$720,000	X - Assume 90K per filter
Air Scour Blowers (2 units)		$425,000	X - Use half the cost from MGF alt blower pricing
Filter Building Improvements			
Filters 1-20 Demolition Work		$264,000	
Misc. Doors, Frames & Storefronts		$30,000	X - Filters 21-28 already have the storefront window (Delete writeup/estimate)
Paint Finishes		$144,000	
HVAC Improvements		$880,000	
Electrical Improvements		$792,000	
Instrumentation and Controls Improvements		$500,000	
Subtotal		**$10,138,000**	
Estimating Contingency	30%	$3,041,400	
Escalation to Midpoint	3%	$304,140	
Construction Subtotal		**$13,483,540**	
Contractor General Conditions	10%	$1,348,354	
Contractor Overhead and Profit	12%	$1,618,025	
Construction Contingencies	5%	$674,177	
Allowances:			
Grand Total Cost		**$17,125,000**	

Summary Table

Description		Estimated Cost
Demolition & Media Removal		$732,000
Filters 21-28 Concrete Repair		$81,000
Filters 29-32 Concrete Repair		$450,000
Pipe Resurfacing & Paint Finishes		$524,000
Pipe Replacement		$238,000
Filtration Equipment, Media & Valves		$3,100,000
Storefront Walls (Filters 29-32) & Arch. Improvements		$551,000
Air Scour Grids		$1,440,000
Air Scour Blowers (4 ea.)		$850,000
HVAC Improvements		$880,000
Electrical & I&C Improvements		$1,292,000
Subtotal		**$10,138,000**
Estimating Contingency	30%	$3,041,400
Escalation to Midpoint	3%	$304,140
Construction Subtotal		**$13,483,540**
Contractor General Conditions	10%	$1,348,354
Contractor Overhead and Profit	12%	$1,618,025
Construction Contingencies	5%	$674,177
Grand Total Cost		**$17,125,000**

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
	Building Structure	$381,041	$580,876	1.524
40.01 Above Ground Process Piping	Process Piping	$26,385	$40,184	1.523
43.00 Pumps	Pumps	$299,011	$453,245	1.516
43.13 Chemical System Equipment	Chemical System Equipment	$78,332	$119,317	1.523
21.00 Fire Protection (Wet System)	Fire Protection (Wet System)	$21,724	$32,852	1.512
22.00 Plumbing	Plumbing	$20,009	$30,258	1.512
23.00 HVAC	HVAC	$81,855	$123,781	1.512
	Electrical	$169,292	$256,114	1.513
26.02 Instrumentation & Controls	Instrumentation & Controls	$94,224	$142,486	1.512
Grand Total Capital Construction C	**Grand Total Capital Constructio**	**$1,171,873**	**$1,779,113**	

Adjusted for Report

Table B4.2 - Liquid Hypochlorite Disinfection (Bulk)

Description		Estimated Cost	Cost Adjust Comments
Building Structure (1,819 sf)		$382,000	
Process Piping		$53,000	Very low in original
Pumps (carrier, transfer, metering)		$300,000	
Liquid Chemical Feed Equipment		$179,000	X - day tanks included, but no bulk tanks
Fire Protection (Wet System, 1,819 sf)		$29,000	X - updated for square footage
Plumbing (1,819 sf)		$21,000	
HVAC (1,819 sf)		$110,000	X - Use $60/sf instead of $45/sf used elsewhere
Electrical (1,819 sf)		$170,000	
Instrumentation & Controls		$95,000	
Subtotal		**$1,339,000**	
Estimating Contingency	20%	$267,800	
Escalation to Midpoint	3%	$40,170	
Construction Subtotal		**$1,646,970**	
Contractor General Conditions	10%	$164,697	
Contractor Overhead and Profit	12%	$197,636	
Construction Contingencies	5%	$82,349	
Grand Total Cost		**$2,092,000**	

PAC System Upgrade

	Unit	Quantity	Unit Cost	Total Cost
Concrete Repair	LS	1	$50,000	$50,000
Accessories Replacement	LS	1	$80,000	$80,000
Mixers	EA	2	$15,000	$30,000
Slurry Pumps	EA	4	$10,000	$40,000
Metering Pumps	EA	8	$7,500	$60,000
HVAC Upgrades	LS	1	$80,000	$80,000
Piping & Valve Replacement	LS	1	$100,000	$100,000
Electrical and Controls	LS	1	$200,000	$200,000
Subtotal				**$640,000**
Estimating Contingency	20%			$128,000
Escalation to Midpoint	3%			$19,200
Construction Subtotal				**$787,200**
Contractor General Conditions	10%			$78,720
Contractor Overhead and Profit	12%			$94,464
Construction Contingencies	5%			$39,360
Total				**$1,000,000**

Other Chemical Systems

	Unit	Quantity	Unit Cost	Total Cost
Misc. Elec / Control Upgrades	LS	1	$80,000	$80,000
Misc. Valve / Piping Replacement	LF	500	$65	$32,500
Pump Replacement	EA	2	$7,500	$15,000
Room Hardware / Finishes	LS	1	$40,000	$40,000
HVAC Improvements	LS	1	$25,000	$25,000
Subtotal				**$192,500**
Estimating Contingency	20%			$38,500
Escalation to Midpoint	3%			$5,775
Construction Subtotal				**$236,775**
Contractor General Conditions	10%			$23,678
Contractor Overhead and Profit	12%			$28,413
Construction Contingencies	5%			$11,839
Total				**$300,000**

Demolish South Plant

Description		Estimated Cost
Demo scrapers / drives, walks		$50,000
Demo Concrete / haul (4800 CY at $150/yd)		$712,792
Site Restoration / Fill		$50,000
Subtotal		**$812,792**
Estimating Contingency	10%	$81,279
Escalation to Midpoint	3%	$24,384
Construction Subtotal		**$918,455**
Contractor General Conditions	3%	$27,554
Contractor Overhead and Profit	8%	$73,476
Construction Contingencies	5%	$45,923
Allowances:		
Grand Total Cost		**$1,066,000**

130 ft diameter primary
90 ft diameter secondary
2 ft overall thickness
18 ft depth
1843.06769 CY for walls
2908.88209 CY for floors

Reduce due to fairly defined demo work

Reduced GC's and OHP due to mainly demo wor

Reduced OHP due to demo work

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
	Structural Components	$3,507,453	$5,415,382	1.544
31.01 Dewatering	Dewatering	$109,646	$167,526	1.528
31.02 Piles	Piles	$1,133,796	$1,727,195	1.523
	Excavation	$1,734,001	$2,658,794	1.533
	Soil and Backfill	$523,109	$828,067	1.583
Grand Total Capital Construction C	**Grand Total Capital Construction Cost**	**$7,008,005**	**$10,796,964**	

Adjusted for Report

Table B5.1b - Large Clearwell (6 MG) Option

Description		Estimated Cost	Cost Adjust Comments
Structure (275'x137'x24')		$3,333,000	adjusted quantities by 95% of the 6.5 MG clearwell to accommodate 4 MG (did not adjust dewatering)
Dewatering (2 pumps, 4 mo)		$110,000	
Piles (26,975 vf)		$1,078,000	
Excavation, Shoring		$1,648,000	
Soil and Backfill		$497,000	
60-inch Transfer Piping		$200,000	60 inch piping to high service station 2
			400 ft $500 per ft
Transfer Pipe Utility coorination / site restoration		$150,000	
Subtotal		**$7,016,000**	
Estimating Contingency	20%	$1,403,200	
Escalation to Midpoint	3%	$210,480	
Construction Subtotal		**$8,629,680**	
Contractor General Conditions	10%	$862,968	
Contractor Overhead and Profit	12%	$1,035,562	
Construction Contingencies	5%	$431,484	
Allowances:			
Grand Total Cost		**$10,960,000**	

Description

31.01 Dewatering
31.02 Piles

Grand Total Capital Construction Cost

Description		Estimated Cost
Concrete Repair - Walls 1560 SY @ $40/SY		$62,507
Concrete Repair - Floor (1680 SY at $30/SY)		$50,473
New Concrete Wall (400 CY at $750/CY)		$301,333
Hatch Replacement (6 at $5k ea)		$30,000
Misc Improvements		$25,000
Subtotal		**$469,313**
Estimating Contingency	20%	$93,863
Escalation to Midpoint	3%	$14,079
Construction Subtotal		**$577,255**
Contractor General Conditions	10%	$57,726
Contractor Overhead and Profit	12%	$69,271
Construction Contingencies	5%	$28,863
Allowances:		
Grand Total Cost		**$734,000**

	Existing		New Wall	
	226	ft	2	ft wide
	67	ft	401.7777778	CY
	24	ft deep		
walls	1562.667	SY		
floors	1682.444			

Original Costs from Estimator

Description		Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
43.00 Pumps	Pumps	$2,898,416	$4,387,048	1.514
	Grand Total Capital Constructio	**$2,898,416**	**$4,387,048**	

Grand Total Capital Construction Cost

Rennovate 2 and 3

Table B6.1 - High Service Pump Rehab Option (2 and 3)

Description		Estimated Cost
Remove Vertical Turbines (3 at $10k ea)		$30,000
Remove Split Case Pumps (2 at $5k ea)		$10,000
New Vertical Turbine Pumps (3 at $900k ea)		$2,700,000
New Split case pumps (2 at $750 k ea)		$1,500,000
Minor pump rehab work (2 at $25k ea)		$50,000
Piping and Valve Rehab		$250,000
Electrical & I&C Work (15% Pump Equipment)		$630,000
Subtotal		**$5,170,000**
Estimating Contingency	30%	$1,551,000
Escalation to Midpoint	3%	$155,100
Construction Subtotal		**$6,876,100**
Contractor General Conditions	10%	$687,610
Contractor Overhead and Profit	12%	$825,132
Construction Contingencies	5%	$343,805
Grand Total Cost		**$8,733,000**

Rennovate 3 only

Description		Estimated Cost
Remove Vertical Turbines (3 at $10k ea)		$30,000
New Vertical Turbine Pumps (3 at $900k ea)		$2,700,000
Piping and Valve Rehab		$250,000
Electrical & I&C Work (15% Pump Equipment)		$405,000
Subtotal		**$3,385,000**
Estimating Contingency	30%	$1,015,500
Escalation to Midpoint	3%	$101,550
Construction Subtotal		**$4,502,050**
Contractor General Conditions	10%	$450,205
Contractor Overhead and Profit	12%	$540,246
Construction Contingencies	5%	$225,103
Grand Total Cost		**$5,718,000**

Civil Work

	Unit	Quantity	Unit Cost	Total Cost
Demo: Storm Structures	LS	1	$150,000	$150,000
Dmo: Pavement	LS	1	$100,000	$100,000
Debris Hauling / Misc Excavation	LS	1	$200,000	$200,000
Demo: Underground Strucrures	LS	1	$300,000	$300,000
New Fencing	LF	3180	$65	$206,700
Gate / Card Access	EA	2	$30,000	$60,000
New Storm Piping (smaller)	LF	2000	$100	$200,000
Large Storm Piping / Structures	LS	1	$250,000	$250,000
Stormwater Pump Station Upgrades	LS	1	$300,000	$300,000
Site Paving	SY	6100	$40	$244,000
Site Grading	LS	1	$80,000	$80,000
Additional Dewatering	LS	1	$150,000	$150,000
Subtotal				**$2,240,700**
Estimating Contingency	20%			$448,140
Escalation to Midpoint	3%			$67,221
Construction Subtotal				**$2,756,061**
Contractor General Conditions	10%			$275,606
Contractor Overhead and Profit	12%			$330,727
Construction Contingencies	5%			$137,803
Total				**$3,500,000**

Outfall Extension (each outfall)

	Unit	Quantity	Unit Cost	Total Cost
Levee excavation / army coord.	LS	1	$300,000	$300,000
Pipe Extension	LF	100	$500	$50,000
Backfill and restoration	LS	1	$100,000	$100,000
Misc. Anchoring	LS	1	$30,000	$30,000
Subtotal				**$480,000**
Estimating Contingency	20%			$96,000
Escalation to Midpoint	3%			$14,400
Construction Subtotal				**$590,400**
Contractor General Conditions	10%			$59,040
Contractor Overhead and Profit	12%			$70,848
Construction Contingencies	5%			$29,520
Total				**$750,000**

Building Rennovations

	Unit	Quantity	Unit Cost	Total Cost
Levee excavation / army coord.	LS	1	$300,000	$300,000
Pipe Extension	LF	100	$500	$50,000
Backfill and restoration	LS	1	$100,000	$100,000
Misc. Anchoring	LS	1	$30,000	$30,000
Subtotal				**$480,000**
Estimating Contingency	20%			$96,000
Escalation to Midpoint	3%			$14,400
Construction Subtotal				**$590,400**
Contractor General Conditions	10%			$59,040
Contractor Overhead and Profit	12%			$70,848
Construction Contingencies	5%			$29,520
Total				**$750,000**

Building Rennovations				
Admin area, Filters 1-20, garage	SF	51200	$50	$2,560,000
Subtotal				**$2,560,000**
Estimating Contingency	20%			$512,000
Escalation to Midpoint	3%			$76,800
Construction Subtotal				**$3,148,800**
Contractor General Conditions	10%			$314,880
Contractor Overhead and Profit	12%			$377,856
Construction Contingencies	5%			$157,440
Total				**$3,999,000**
			Use	$4,000,000

These Buildings are in the worst condition - rennovation costs are included for filters 21-36, river ntake, pump stations, etc.

Elec and Utilities				
New Electrical Ductbanks & Cabling	LF	1100	$900	$990,000
Buried Chemical Piping	LF	880	$160	$140,800
Elec Service Upgrades	LS	1	$750,000	$750,000
Larger Dia Interconnecting Pipe	LF	450	$800	$360,000
Subtotal				**$2,240,800**
Estimating Contingency	20%			$448,160
Escalation to Midpoint	3%			$67,224
Construction Subtotal				**$2,756,184**
Contractor General Conditions	10%			$275,618
Contractor Overhead and Profit	12%			$330,742
Construction Contingencies	5%			$137,809
Total				**$3,500,000**

INPUTS

Estimating Contingency (Rehab)	30%
Estimating Contingency (New)	20%
Escalation to Midpoint	3%
Contractor General Conditions	10%
Contractor Overhead and Profit	12%
Permitting	0.0%
Construction Contingencies	5%
Effective Multiplier Used (Rehab)	1.69
Effective Multiplier Used (New)	1.56

FILED
September 3, 2021
INDIANA UTILITY
REGULATORY COMMISSION

Exhibit A
SCOPE OF SERVICES

Evansville Water and Sewer Utility – Water Filtration Plant Advanced Preliminary Planning

Table of Contents

Project Understanding

A Water Master Plan was completed by HNTB in September 2016 which provided an assessment of the City of Evansville water distribution system and water treatment plant assets. The Water Master Plan serves as an excellent guide for broad planning of future capital improvement projects, but is not intended, to provide a critical analysis of the various options for new water treatment processes.

It is our understanding that the purpose of this Advanced Facility Planning effort are twofold. The first is to address critical components to improve reliability and resiliency by complimenting and expanding the work of the Master Plan to address immediate needs and concerns. The second objective is to assess the long-term drinking water needs for Evansville and determine the most appropriate water sources and treatment processes for an upgraded or new water treatment facility. An alternative analysis is particularly important at this juncture, because there is a potential option to switch partially or completely from Ohio River water source to groundwater (or riverbank filtration), changing not only the source water characteristics but also the options available for treatment. This analysis will look at the life-cycle costs of the various options.

Some of the key issues identified in previously-provided information, discussions with City Personnel, and site visits conducted by AECOM are understood as follows:

1. The North plant is beyond its useful life and significant upgrades are necessary to maintain long term reliable operation. There are issues with the settling basins, corrosion of piping, old filters, and old high service pump station #2.

2. The 6.5 MG clearwell is the primary clearwell and leaves EWSU with very little operational flexibility, as it is difficult to remove from service. Furthermore, it is suspected that there could be structural issues with this clearwell (or in-tank groundwater pressure relief valves) as turbidity is reported to increase when the Ohio River level is high.
3. Significant waterline breaks throughout the City seem to be exacerbated by low temperatures and rapidly changing water temperatures. Significant resources and funds are utilized annually to address these breaks.
4. Pressures from IDEM to address the residuals handling system continue to be brought up, and the current NPDES permit expires on July 1, 2021.
5. The City wants to move forward with a reasoned and appropriate plan to satisfy its customers, IDEM, and to allow an easier path through the IURC for the next rate case in 2021.
6. The City wants to keep the water quality consistent and of high quality going forward. If significant groundwater is located and utilized, softening of the harder groundwater and pH adjustment may be necessary.
7. The Ohio River is a major waterway and susceptible to industrial or municipal wastewater releases, fuel spills, and other sources of contaminants which any new treatment upgrades need to be capable of monitoring and mitigating.

For the purposes of this scoping document, the terms AECOM, AECOM Team, or Consultant are used interchangeably and include any and all firms under the Prime Consultant, AECOM. This team will be a cohesive team that will have fluid boundaries, and specific tasks will be delegated throughout the design. The AECOM is anticipated to consist of HNTB, Carollo Engineers, Powers Engineering, CTL, and VS Engineering.

Task 1: Kickoff Meeting and Workshop

The AECOM team will attend a project kickoff and initial workshop meeting with the City to discuss project goals and constraints, identification of high level alternatives for the project. Prior to the meeting, AECOM will provide the City with a list of requested information (**DELIVERABLE #1**) pertaining to plant operations and history. It is anticipated that some (or all) of the requested information will be made available prior to this kickoff meeting, allowing for specifics of the requested information to be discussed. An agenda shall be prepared and submitted for review prior to the meeting, that will, at a minimum, contain the following items for discussion:

1. Introduction of team members and individual roles.
2. Summary of project scope, schedules, and key issues.
3. Communication protocols between the City and AECOM team, including protocols for distributing and sharing files and other electronic data (proposed to utilize e-Builder).
4. Proposed format for progress reports and invoices.
5. Schedule for progress meetings.
6. Protocol and procedures for field reconnaissance activities.
7. City's requirements and preferences related to the facility daily continued operations.
8. Review of historical and projected water demands to establish the design flow(s);
9. Identify the project objectives as they relate to water quality and treatment (both finished water quality and potential sources of contamination).

10. Discussion of potential new sources of raw water including river bank filtration and groundwater, along with the impacts which alternative sources have on treatment technologies and water quality.
11. Identify what existing infrastructure within the North and South plants the City believes is the most vulnerable to failures and/or is unsalvageable.
12. Identify key meetings to be held with IDEM as they relate to both to drinking water requirements and residuals disposal / NPDES permit.
13. Discussion of bigger-picture preliminary treatment technologies and plant-wide improvement strategies to be considered in the alternatives analysis. Alternatives will be added and further developed in the alternatives analysis beyond this meeting, but this meeting can identify key considerations to be included in the evaluation such as operation and maintenance requirements, qualitative magnitude of capital and operational costs, impacts on water quality, residuals production and disposal, and treatment resiliency.

Following the meeting, a brief plant tour or tour of selected areas may be performed if needed. AECOM shall prepare summary meetings minutes which will be submitted as **DELIVERABLE #2** summarizing the key points, decisions, and all action items.

Task 2: Infrastructure Condition, Performance, and Vulnerability Assessment

Prior to development of long-term facility alternatives, the condition and performance of all infrastructure at the existing plant must be assessed. This task will include a full treatment/process performance assessment of the existing plant in order to benchmark the current performance. Additionally, AECOM will perform condition assessment to identify critical infrastructure and any need for immediate improvements to allow for continued plant operation (several years) until the final project is commissioned. The assessment will also include a vulnerability aspect, which will evaluate the magnitude of the consequence which could occur in the event of a failure. Existing infrastructure to be assessed as part of this task includes:

1. Intake structure including condition of screens, pumps, piping and valves, HVAC, building (structural and architectural components), and electrical systems.
2. North and south plant influent channels, flocculation, and sedimentation basins, including structural condition of concrete and handrail, mechanical condition of mixers, flocculators and sludge collection drives/equipment, piping, valves, and ancillary equipment.
3. Filters and corresponding gallery piping, valves, controls, backwash supply tanks, instrumentation and monitoring systems, and ancillary systems such as troughs and surface sweep equipment.
4. Finished water systems including filter effluent piping, clearwells, high service pumps, valves, and instrumentation and monitoring systems. This task does not include City water distribution system hydraulic or water quality modelling.
5. Condition of all chemical systems with specific attention to redundancy, feed equipment condition, control and monitoring systems, and operator safety considerations. Existing chemical feed systems include hyper-ion coagulant, powder activated carbon, chlorine gas, sulfur dioxide, ammonia, sodium hydroxide, $KMnO_4$, and fluoride.
6. Overall assessment of buildings and building systems will be included and shall involve major structural components, architectural finishes including roofs, environmental hazards such as lead paint and asbestos, HVAC systems, plumbing and sump pumps, and lighting/power systems.

7. Critical electrical infrastructure systems including the condition of incoming services, motor control centers, transformers, transfer switches, drives, disconnects, standby generator, and transmission / distribution systems throughout the plant.

DELIVERABLE #3 will be a technical memorandum which will identify any short-term projects that should be considered for immediate implementation in order to keep the plant operation during the planning and construction phases of this project. The proposed improvements or short-term projects will include order-of-magnitude costs and tentative implementation schedules based on equipment lead and installation times. Up to three (3) separate memoranda will be included as part of this task. These will include one pertaining to electrical infrastructure, one for the clearwell improvements, and a third (if needed) to cover any other miscellaneous processes or infrastructure in need of immediate improvements.

Task 3: Site Investigations

The primary components of the site to be investigated for this level of planning and design include a hydrogeological study, site survey, and geotechnical investigation. The hydrogeological investigation is currently ongoing, and shall continue to be conducted as part of this scope. Results of the hydrogeological study will be included in the Deliverable associated with Task 4, Alternatives Evaluation. A summary of hydrogeological task items include the following:

1. Continue with test drilling including construction of one larger test well (up to 16-inch diameter casing) and identify aquifer yield, draw-down rates, and water quality information.
2. Continue to work with Layne collector wells to investigate feasibility of horizontal collector wells.
3. Provide a summary report of the wellfield capacity to be included as part of Task 4. The summary report shall include options describing possible locations of vertical and/or horizontal collector wells, including estimated costs associated with these options.

The site survey will be conducted during Task 6, Preliminary Design. A summary of the site survey task items include the following:

1. Establish horizontal and vertical site control. Horizontal control will be based on Indiana Geospatial Coordinate System. Vertical control will be based on the North American Vertical Datum (NAV88). A minimum of 4 vertical benchmarks will be established on or near the site.
2. Locate and identify visible physical features (buildings, roads, drives, walks, walls, fences, signs, etc.) within the project limits. Trees and the perimeter outline of any wooded or river bank areas will also be located.
3. Identify the 100- and 500-year floodplain boundaries.
4. Determine spot elevations of critical features (finished floor levels at door openings, curbs, walks, tops, toes, swales, etc.) and at sufficient intervals throughout the site to develop 1-foot contours.
5. Locate field utility markings and visible field evidence (manholes, valves, etc.) of underground utilities to delineate underground utility locations based on a combination of assembled record documents, physical markings, and visible field evidence.
6. Generate a base map, depicting the above items at an appropriate scale, in AutoCAD format. The base map will be provided in DWG and PDF format.

The geotechnical investigation will be conducted during Task 6, Preliminary Design. A summary of the geotechnical investigation task items are as follows:

1. Perform soil borings to determine geotechnical and foundation engineering considerations as described below. The number and depth of borings is unknown at this time will be determined

during preliminary design based on the selected alternative. The cost associated with this investigation is based on the number of borings, and it is assumed that 6 will be taken as part of this task.

2. Provide field and laboratory reports in accordance with ASTM standards, including soil classification chart(s), boring surface elevations, soil thickness of each layer, groundwater elevations, sieve analyses, identification of moisture content, and USCS classification.
3. Recommendations for style of foundation support for the structures and slabs, including identifying the allowable soil bearing capacity, slope ratio requirements, estimated settlement, and allowable lateral loads.
4. Recommendations for design of any retaining walls, if necessary.
5. Compaction recommendations for fill behind walls and support floors.

Task 4: DRAFT Alternatives Assessment

Based on findings and outcomes of the previous tasks, AECOM will develop an Alternatives Evaluation Report to ultimately identify the selected project alternative. AECOM will initially create a long list of alternatives using a matrix of differing water sources/blend rates and treatment technologies/water quality goals. Sources of water in this alternatives matrix will include the Ohio River, Riverbank Filtration, and Groundwater. Treatment technologies may include, but are not limited to ballasted flocculation, plate or tube sedimentation, lime softening, high pressure membranes, low pressure membranes (including membrane gravity filtration, or MGF), ozonation, biofiltration, advanced oxidation or UV disinfection, and upgrades of existing equipment in kind among others. The long list of preliminary alternatives will be screened on criteria of feasibility, operability, capital and operational cost, and other advantages / disadvantages. From the long list, up to eight (8) alternatives will be selected to create a "short list" which will receive a detailed evaluation. The detailed evaluation for the selected alternatives will include the following tasks:

1. Each alternative will include a detailed narrative of the proposed system including the following information:
   a. Basis of design table or summary which identifies the major equipment, number of units, and corresponding flows or other operating conditions. Cut sheets of major equipment will be provided in Appendices.
   b. Quantity and quality of residual streams that need disposal.
   c. Operational and maintenance considerations.
   d. Environmental and safety considerations.
   e. Projections of chemical usage and electrical consumption.
2. Each alternative will include projected finished water quality information, including the impacts of blending of source waters. Any recommended alternative will comply with present and anticipated standards, and this task will further include attention to the robustness of the alternative. This includes considering treatment process to handle multiple contaminants, evaluating levels of redundancy, and assessing the ability to adapt to rapidly changing water quality as observed in the Ohio River. The water quality evaluation will also include any recommendations for post-treatment measures in terms of maintaining stability and prevention of corrosion within the distribution system. A distribution system hydraulic or water quality model is not included in these services.

3. Each alternative will include conceptual level site plan(s) that shall identify the location of proposed infrastructure and general routing of major utilities, including process piping, electrical and communication utilities, and access drives and/or loading areas.
4. Each alternative will include a life cycle cost analysis which will feature an estimate of project capital cost (+/- 50% planning level estimate) and operational costs based on projected electrical usage, chemical requirements, and equipment maintenance / replacement costs. The life cycle costs will be evaluated through a 40-year planning period for each alternative.
5. Following development of each of the alternatives, AECOM will conduct a ranking, or scoring based on weighted criteria. The ranking criteria shall include engineering aspects (finished water quality, resiliency, etc.), environmental issues, operational and maintenance considerations, and capital and operational costs. This ranking will assign a numerical score to each alternative to be used for selection of the proposed alternative.

As part of this task, AECOM and City Personnel will perform up to three trips to visit other water treatment plant sites and/or equipment manufacturing facilities to observe treatment equipment similar to that which is being considered for alternatives in this project. The purpose of the site visits is to better understand key advantages and disadvantages of equipment technologies, lessons learned in construction or startup, and discuss ongoing operation and maintenance requirements or issues with other plant operators.

DELIVERABLE #4 will be a DRAFT Alternatives Assessment Report and submitted as one (1) electronic PDF file and three (3) bound hard copies. The Report will provide a comprehensive summary of the items listed in this task, including the initial long list of alternatives, detailed evaluation of the individual 'short list' alternatives, and the ranking of the alternatives including identification of the selected project.

Task 5: Workshop #2, IDEM Review and FINAL Assessment Report

AECOM will conduct a follow-up meetings to facilitate transitioning from the Alternatives Assessment Report to Preliminary Engineering of the preferred alternative. Individual subtasks associated with this task include the following:

1. AECOM will meet with the City when Deliverable #4 is submitted and give a presentation which will outline alternatives evaluated in the Assessment Report and provide further explanation of the selected alternative.
2. Following the initial meeting, the City shall review the Alternatives Assessment report and provide comments to AECOM in MS Work or PDF file format.
3. AECOM and the City will host a meeting with IDEM to discuss the identified path of the project moving forward as it pertains to drinking water quality and residuals disposal.
4. AECOM will address all City and IDEM comments in the Assessments Report, and subsequently submit **DELIVERABLE #5** to the City, which is the Final Alternatives Assessment Report. The Report will be provided to the City as (1) electronic PDF file and three (3) bound hard copies.

Task 6: DRAFT Preliminary Engineering Report and Drawings

This task includes further developing the specifics of the preferred alternative established in Tasks 4 and 5 and includes developing preliminary drawings. Subtasks associated with this Task include the following:

1. AECOM will prepare a Preliminary Engineering Report. The Report will refine the alternative selected in the Alternatives Assessment and will provide the following information:
   a. Detailed description and narrative of the proposed improvements.

b. Cut sheets and budgetary quotations for major equipment, including lead times.
c. Updated estimates of project capital costs will be prepared in accordance with AACE Class 4 Estimates.
d. Further discussion of residuals disposals and any updates from ongoing conversations with IDEM.
e. Tentative design and construction schedule based on the actual date at the time of this Report.
f. The previously submitted FINAL Alternatives Assessment Report will be included as an Appendix to this Preliminary Engineering Report.

2. AECOM will prepare preliminary drawings (30% level development). The actual number of sheets will vary depending on the selected alternative, but selected alternatives would generally include a sheet set similar to the following list:

1) Cover Sheet
2) Index and General Drawing Symbols
3) General Notes and Details 1
4) General Notes and Details 2
5) Demolition Sheet 1
6) Demolition Sheet 2
7) Demolition Sheet 3
8) Demolition Sheet 4
9) Demolition Sheet 5
10) Demolition Sheet 6
11) Existing Site and Utility Plan – North
12) Existing Site and Utility Plan - South
13) Proposed Site and Utility Plan 1
14) Proposed Site and Utility Plan 2
15) Proposed Site and Utility Plan 3
16) Proposed Site and Utility Plan 4
17) Civil Details 1
18) Civil Details 2
19) Civil Details 3
20) Civil Details 4
21) Overall Process Flow Diagram and Design Information
22) Process Equipment Schedules 1
23) Process Equipment Schedules 2
24) Detailed Process Flow Diagrams 1
25) Detailed Process Flow Diagrams 2
26) Detailed Process Flow Diagrams 3
27) Detailed Process Flow Diagrams 4
28) Detailed Process Flow Diagrams 5
29) Detailed Process Flow Diagrams 6
30) Detailed Process Flow Diagrams 7
31) Detailed Process Flow Diagrams 8
32) Detailed Process Flow Diagrams 9
33) Detailed Process Flow Diagrams 10
34) Hydraulic Profiles 1
35) Hydraulic Profiles 2
36) Treatment Process Plans and Sections 1

37) Treatment Process Plans and Sections 2
38) Treatment Process Plans and Sections 3
39) Treatment Process Plans and Sections 4
40) Treatment Process Plans and Sections 5
41) Treatment Process Plans and Sections 6
42) Treatment Process Plans and Sections 7
43) Treatment Process Plans and Sections 8
44) Treatment Process Plans and Sections 9
45) Treatment Process Plans and Sections 10
46) Process Details 1
47) Process Details 2
48) Process Details 3
49) Process Details 4
50) Architectural Building Elevations 1
51) Architectural Building Elevations 2
52) Major Structural Modifications 1
53) Major Structural Modifications 2
54) Electrical Site and Power Plans 1
55) Electrical Site and Power Plans 2
56) Electrical Site and Power Plans 3
57) Electrical Site and Power Plans 4
58) Electrical One-Line Diagrams 1
59) Electrical One-Line Diagrams 2
60) Electrical One-Line Diagrams 3

3. AECOM will provide a Specification Table of Contents in CSI Division 50 Format, which will list all of the anticipated specification sections associated with the proposed design.

DELIVERABLE #6 shall be the DRAFT of the Preliminary Engineering Report, Preliminary Drawings, and Specification Table of Contents described in this section and will be provided in one (1) electronic PDF file and three (3) bound hard copies. Drawings will be provided in 11"x17" format.

Task 7: Workshop #3 and FINAL Preliminary Engineering Documents

Following submission of Deliverable #6, the City shall provide comments to AECOM in MS Word or PDF file format. Following receipt of comments, AECOM shall conduct a follow-up Workshop meeting with the City to discuss any City Comments. The Workshop will include discussion of possible modifications or other changes that could be employed to address any comments. Following the Workshop, AECOM will address all comments and issue **DELIVERABLE #7**, which is the FINAL Preliminary Engineering Documents. This FINAL document will include the Preliminary Engineering Report, Preliminary Drawings, and Specification Table of Contents. The FINAL Preliminary Engineering Report will also include an updated schedule for project implementation. Engineering Documents will be provided as one (1) electronic PDF file and three (3) bound hard copies, with drawings in 11"x17" format.

ADDITIONAL SERVICES IF AUTHORIZED

If desired by the City, AECOM can perform the following tasks:

1. AECOM can perform filter inspection of any or all of the existing gravity filters. Inspection tasks could involve any combination of the following: Media depth measurement, sampling/coring of filter media, sieve analysis, determining common filter media parameters such as L/D_{10} ratio,

uniformity coefficient, floc retention and backwash profiles, and measuring bed expansion during backwash.

2. Depending on the selected alternative to be developed in preliminary design, AECOM can perform pilot testing of the proposed technologies. Pilot testing would be anticipated if technologies such as ActiFlo, low pressure membranes (including MGF), or ozonation/biofiltration were selected. A pilot study may also be warranted for other technologies to better determine operational parameters. These requirements will be determined prior to preliminary design of the selected alternative and piloting requirements will be noted in the Alternatives Assessment. Pilot testing will follow all IDEM or other regulatory requirements including development of a piloting protocol and sampling plan, monitoring for required integrity or other performance testing, and extrapolation of long-term performance.
3. AECOM can complete an NPDES permit application for submission to IDEM based on the Preliminary Design and anticipated residuals water quality and quantity. Any IDEM or NPDES permit review fee(s) shall be paid the City.

SCHEDULE

A Gantt chart schedule has been developed and is attached to this scope of services. The schedule assumes the agreement between the City and AECOM will be completed and a Notice to Proceed issued by September 2, 2019.

e-Builder® Construction Management Software

- EWSU is implementing the use of a computer based program, e-Builder® (hereafter known as the "Program"), to standardize and better manage the planning, implementation, design, and construction for its capital projects. EWSU has purchased and will maintain the Program. ENGINEER will be required as a condition of the contract to utilize the Program and its functions to facilitate the execution of the contract. Such examples of the typical functions include, but *are not limited* to:

- Program Management
- Design Development and Review
- Consultant Proposals, Amendments, and Billings
- Purchase Orders, Contracts, and Service Agreements
- Contractor Pay Applications
- Construction Submittals
- Requests For Information
- Project Schedules and Progress Meetings
- Change Order Management
- Daily Job Site Daily Inspection Reporting
- Project Closeout and Documentation
- Asset Management
- Other Project Documentation and Communications

All submittals shall be posted in a searchable, bookmarked PDF format with the exception of Requests for Information (RFIs). RFIs shall be posted in Microsoft Word format. Maximum file size for submission shall be 50 MB. Submittals larger than 50 MB should be submitted as separate files within the same submittal.

The Program is a web based platform that requires access through the purchase of a "seat" with a user name and password. It shall be the responsibility of ENGINEER to pay for this seat and any additional seats they deem necessary to fully execute the project. Instruction and training to utilize the Program will be the responsibility of ENGINEER.

Evansville Water and Sewer Utilities
Advanced Facility Planning

Evansville WATER AND SEWER UTILITY

ID	Task Name	Start	Finish
1	Submit Deliverable No. 1 - Data Request	Wed 5/22/19	Wed 5/22/19
2	Notice to Proceed	Mon 9/2/19	Mon 9/2/19
3	Task 1: Workshop 1	Mon 9/2/19	Mon 10/14/19
4	Meeting & Data Collection	Wed 9/18/19	Fri 9/20/19
5	Deliverable No. 2 - Summary of workshop findings	Fri 10/11/19	Fri 10/11/19
6	Task 2: Condition Assessment	Wed 9/18/19	Fri 11/22/19
7	Site Evaulations	Wed 9/18/19	Fri 10/18/19
8	Filter Evaluation (If authorized)	Mon 10/14/19	Wed 10/16/19
9	Deliverable No. 3 - Immediate Needs Momorandums	Fri 11/22/19	Fri 11/22/19
10	Task 3: Site Investigations	Wed 11/15/17	Thu 3/19/20
11	Hydrogeological (Ongoing Work)	Wed 11/15/17	Thu 11/28/19
12	Survey	Mon 10/21/19	Fri 11/29/19
13	Geotechnical	Mon 1/20/20	Fri 3/20/20
14	Task 4: Draft Alternatives Assessment	Mon 10/14/19	Tue 1/28/20
15	Long list alternatives screening	Mon 10/14/19	Fri 11/1/19
16	Screened Alternatives selection	Mon 11/4/19	Fri 1/24/20
17	Deliverable No. 4 - Draft Assessment	Fri 1/24/20	Fri 1/24/20
18	Task 5: Final Alternatives Assessment	Mon 1/27/20	Fri 3/13/20
19	Workshop No. 2	Mon 1/27/20	Wed 1/29/20
20	Receive comments from EWSU/IDEM	Fri 2/21/20	Fri 2/21/20
21	Revise DRAFT Alternatives Report	Mon 2/17/20	Fri 3/13/20
22	Deliverable No. 5 - Final Alternatives Assessment	Fri 3/13/20	Fri 3/13/20
23	Task 6: Draft 30% Drawings & Design Report	Mon 3/16/20	Wed 12/23/20
24	Draft Engineering Report	Mon 3/16/20	Fri 5/22/20
25	Preliminary Drawings	Mon 3/30/20	Wed 12/23/20
26	Specification Table of Contents	Mon 11/2/20	Fri 11/13/20
27	Cost Estimates	Mon 11/16/20	Wed 12/23/20
28	Project Schedule	Mon 11/16/20	Wed 12/23/20
29	Deliverable No. 6: Submit Draft Preliminary	Wed 12/23/20	Wed 12/23/20
30	Final 30% Drawings & Design Report	Mon 12/28/20	Wed 3/31/21
31	EWSU Review	Mon 12/28/20	Mon 1/25/21
32	Workshop #3	Wed 1/6/21	Fri 1/8/21
33	Finalize Engineering Documents	Mon 1/11/21	Wed 3/31/21
34	NPDES Application	Mon 3/1/21	Fri 3/19/21
35	Deliverable No. 7 - FINAL Preliminary Engineering	Wed 3/31/21	Wed 3/31/21

Comparison of New 50 MGD WTP Alternatives 2A (existing site) and 2B (Garage site) and 40 MGD OUCC Alt. 2B

Component Description	AFP Table 9-2 Alternative 1 Rehab Existing WTP Cost	AFP Table 9-4 Alternative 2A New SWTP-Old Site Cost	AFP Table 9-9 Alternative 2B New SWTP & Site Cost	AFP Table 9-11 Alternative 3 Blended WTP & Site Cost	PER Table 21 Alternative 2B New SWTP & Site Cost	OUCC Est. at 20% Reduction Alternative 2B New SWTP & Site Cost
Civil Site Work (Rds, Drainage, Fencing)	$ 3,500,000	$ 3,500,000	$ 2,853,000	$ 3,500,000	$ 2,853,000	
Rehabilitate River Intake	$ 6,752,000	$ 6,752,000	$ 6,752,000	$ 4,823,000	$ 6,752,000	
Raw Water Piping, Metering Vault	Missing	$ 900,000	$ 1,610,000	Missing	$ 1,610,000	
North Plant Pretreatment Improvements	$ 13,610,000	NA	NA	$ 7,163,000	NA	
North Plant Ozone System Retrofit	$ 16,935,000	NA	NA	NA	NA	
Groundwater Wells and Conveyance	NA	NA	NA	$ 40,073,000	NA	
GW Pretreatment (oxidation, detention)	NA	NA	NA	$ 1,422,000	NA	
GW Pretreatment (filtration)	NA	NA	NA	$ 9,013,000	NA	
GW Membrane Softening Facility	NA	NA	NA	$ 35,979,000	NA	
New Conv. Pretreatment System	NA	$ 17,377,000	$ 17,377,000	NA	$ 17,377,000	
Ozone Facility (Generation, Basin, LOX)	NA	$ 19,630,000	$ 19,630,000	NA	$ 19,630,000	
Rehabilitate Gravity Filters	$ 17,125,000	NA	NA	$ 9,013,000	NA	
New Biologically Active Filters & Bldg.	NA	$ 33,912,000	$ 33,912,000	NA	$ 33,912,000	
New Sodium Hypochlorite System	$ 2,092,000	$ 2,092,000	See Below	$ 2,092,000	See Below	
PAC Feed Improvements	$ 1,000,000	$ 1,000,000	See Below	$ 800,000	See Below	
Other Chemical Impr. (4 at $300k ea.)	$ 1,200,000	$ 1,200,000	See Below	$ 1,200,000	See Below	
New Chemical Facilities (all)	See above	See above	$ 6,612,000	See above	$ 6,612,000	
Demolish South Plant	$ 1,066,000	$ 1,066,000	Missing	$ 693,000	Missing	
Demolish North Plant	NA	Missing	Missing	Missing	Missing	
Demolish 6.5 MG Clearwell	NA	Retained	Missing	Missing	Missing	
New 6 MG Clearwell	$ 10,960,000	$ 10,960,000	Only 1 Clearwell	$ 10,960,000	Only 1 Clearwell	
New 5 MG Clearwell	NA	NA	$ 8,804,000	NA	$ 8,804,000	
New High Service Pump Station	NA	$ 7,870,000	$ 11,130,000	NA	$ 11,130,000	
Rehabilitate Existing 6.5 MG Clearwell	$ 734,000	$ 734,000	Only 1 Clearwell	$ 734,000	Only 1 Clearwell	
Rehab. High Service Pump Station #3	$ 8,733,000	$ 5,718,000	Only 1 Clearwell	$ 8,733,000	Only 1 Clearwell	
Extend 1 Plant Outfall	$ 2,250,000	$ 750,000	Missing	$ 2,250,000	Missing	
Building Renovations	$ 4,000,000	$ 2,000,000	Missing	$ 4,000,000	Missing	
Residual Pump Station Forcemain	Missing	Missing	$ 1,575,000	Missing	$ 1,575,000	
Filter Washwater Tank	NA	NA	$ 950,000	NA	$ 950,000	
New Administration Building	NA	NA	$ 1,810,000	NA	$ 1,810,000	
New Maintenance Building	NA	NA	$ 1,040,000	NA	$ 1,040,000	
Interconnecting Site Utility / Elect. Work	$ 3,500,000	$ 3,500,000	$ 3,500,000	$ 3,500,000	$ 3,500,000	

Comparison of New 50 MGD WTP Alternatives 2A (existing site) and 2B (Garage site) and 40 MGD OUCC Alt. 2B

Component Description	AFP Table 9-2 Alternative 1 Rehab Existing WTP Cost	AFP Table 9-4 Alternative 2A New SWTP-Old Site Cost	AFP Table 9-9 Alternative 2B New SWTP & Site Cost	AFP Table 9-11 Alternative 3 Blended WTP & Site Cost	PER Table 21 Alternative 2B New SWTP & Site Cost	OUCC Est. at 20% Reduction Alternative 2B New SWTP & Site Cost
Other Demo. Work Throughout Plant	$ 2,000,000	$ 2,000,000	Missing	$ 2,000,000	Missing	
New Electric service entrance	NA	NA	$ 1,000,000	NA	$ 1,000,000	
New Generator (2,000 KW)	NA	NA	$ 1,500,000	NA	$ 1,500,000	
Dewatering	Missing	Missing	Missing	Missing	$ 27,650,000	
Subtotal	$ 95,457,000	$ 120,961,000	$ 120,055,000	$ 147,948,000	$ 147,705,000	$ 96,044,000
Additional Construction Contingencies	15% $ 14,319,000	10% $ 12,096,000	3% $ 3,602,000	10% $ 14,795,000	See Below	$ 2,881,320
Other Misc. Plant-Wide Improvements	5% $ 4,773,000	2% $ 2,419,000	1% $ 1,201,000	2% $ 2,959,000	$ 1,201,000	$ 960,440
Phasing & Sequencing Plant Outages	5% $ 4,773,000	3% $ 3,629,000	Missing	5% $ 7,397,000	Missing	Missing
Remediation & Hazardous Materials	$ 1,000,000	$ 1,000,000	Missing	$ 1,000,000	Missing	Missing
Allowances	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
Maintenance Building Relocation	NA	NA	$ 13,691,000	NA	Non SRF	$ 3,500,000
Startup and Commissioning	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000
Total Estimated Construction Cost	$ 121,822,000	$ 141,605,000	$ 140,049,000	$ 175,599,000	$ 150,406,000	$ 104,885,760
Additional Construction Contingencies	See above	See above	See above	See above	3% $ 4,512,180	
Total Construction Costs	Missing	Missing	$ 140,049,000	Missing	$ 154,919,000	$ 104,885,760
Construction Admin. and Bidding	Missing	Missing	2.5% $ 3,501,000	Missing	2.5% $ 3,872,975	$ 2,622,144
Inspection and Materials Testing	Missing	Missing	2% $ 2,801,000	Missing	2% $ 3,098,380	$ 2,097,715
Interest Incurred through Financing	Missing	Missing	2.25% $ 3,151,000	Missing	2.25% $ 3,485,678	$ 2,359,930
Permitting Fees and Legal Expenses	Missing	Missing	1% $ 1,400,000	Missing	1% $ 1,549,190	$ 1,048,858
Total Non-Construction Costs	Missing	Missing	$ 10,853,000	Missing	$ 12,006,000	$ 8,129,000
Total Project Cost	Missing	Missing	**$ 150,902,000**	Missing	**$ 166,925,000**	**$ 113,014,760**
Total Project Cost Reduction due to 40 MGD Capacity from Advanced Facility Plan Table 9-9 costs						$ 37,887,240
Use						**$ 37,875,000**

Data sources:

1) Supplemental Workpaper - *Preliminary Engineering Report*, VS Eng., June 2021 (based on the AECOM *Advanced Facility Plan*)

2) Advanced Facility Plan, AECOM, April 23, 2021

3) Evansville response to DR 17-6 Attachment 1 (cost support details - Excel worksheet), 07/19/2021

SFY 2022 - Drinking Water

Indiana Drinking Water State Revolving Fund (DWSRF) Loan Program

SFY 2022 Project Priority List, July 16, 2021, 1st Quarter Final*

Projects Applying for Financial Assistance in State Fiscal Year 2022 (July 1, 2021 - June 30, 2022)

PPL Rank [1]	PPL Score	Participant	MHI [2,3]	Population Served	PWSID No(s).	SRF Project No.	Project Description	Estimated Green Project Reserve Cost	Green Project Reserve Category [4]	Current User Rate (per 4,000 gallons) [2]	Estimated Post-Project User Rate (per 4,000 gallons) [2]	Requested Funds	Cumulative Requested Funds	SFY 2022 Fundable Range ($80 Million)
1	97	Nashville	$43,542	1,326	5207002	DW220307 01	Water Main Extension, Storage, and Distribution System Improvements	$0	N/A	$58.22	$58.22	$2,800,000	$2,800,000	Fundable Range $80 Million (Borrowers are eligible for up to $7.5 Million at a Subsidized Rate)
2	74	Wheatland	$42,292	184	5242016	DW220142 01	Distribution System Improvements	$0	N/A	$42.47	$126.02	$3,700,000	$6,500,000	
3	72	Monticello - RCA Neighborhood	$44,276	2,574	5291011	DW220791 02	Distribution System Improvements and Lead Service Line Replacement	$0	N/A	$22.05	$25.07	$1,400,000	$7,900,000	
4	70	Evansville - Treatment Plant	$42,600	173,000	5282002	DW220482 03	New Treatment Plant	TBD	TBD	$33.74	$45.86	$250,000,000	$257,900,000	
5	53	Fort Wayne	$49,855	270,402	5202020	DW210212 05	Supply, Storage, Distribution System, and Treatment Improvements; Lead Service Line Replacement	TBD	WE	$25.32	$30.32	$45,000,000	$302,900,000	
6	50	Jackson County Water Utility	$49,506	14,155	5236003 5263008	DW210336 04	Distribution System Improvements and Lead Service Line Replacement	$0	N/A	$46.15	TBD	$3,500,000	$306,400,000	
7	50	Grabill	$55,536	1,250	5202006	DW201302 02	Supply, Treatment, and Distribution System Improvements	$296,000	EE, WE	$17.96	$41.14	$5,200,000	$311,600,000	
8	47	Lapel	$52,841	2,068	5248013	DW210548 02	Supply, Storage, and Distribution System Improvements	$0	N/A	$35.10	$59.47	$9,300,000	$320,900,000	
9	47	Maysville Regional Water and Sewer District	$62,504	487	5202037	DW220502 01	Water Main Extension, Storage, and Distribution System Improvements	$0	N/A	$36.25	$65.00	$2,500,000	$323,400,000	
10	46	Andrews	$40,333	1,149	5235001	DW160935 01	New Plant	TBD	TBD	$29.60	$121.04	$6,000,000	$329,400,000	
11	43	Monticello - Water Main Replacement	$44,276	5,300	5291011	DW210191 02	Distribution System Improvements	$0	N/A	$22.05	$25.07	$2,200,000	$331,600,000	
12	36	Cromwell	$43,229	550	5257004	DW211657 02	Supply, Treatment, Storage, and Distribution System Improvements	$32,000	EE	$45.26	$97.31	$3,500,000	$335,100,000	
13	35	L & M Regional Water District	$29,722	490	5268013	DW211568 01	Distribution System Improvements	$5,000	WE	$36.20	$41.36	$1,600,000	$336,700,000	
14	35	Dillsboro	$40,250	2,000	5215002	DW201515 01	Storage and Distribution System Improvements	$0	N/A	$34.64	$54.11	$2,600,000	$339,300,000	
15	35	Hoosier Hills Regional Water District	$44,734	8,642	5269002	DW210469 01	Storage and Distribution System Improvements and Water Main Extension	TBD	TBD	$34.82	$37.00	$3,300,000	$342,600,000	
16	34	Edwardsville Water Corporation	$30,300	10,200	5222001	DW201122 01	Storage and Distribution System Improvements	TBD	GI, EE	$38.26	$42.47	$8,000,000	$350,600,000	
17	33	Leavenworth	$31,772	233	5213004	DW210913 01	Storage and Distribution System Improvements	$0	N/A	$21.69	$34.15	$1,900,000	$352,500,000	
18	31	Lebanon	$50,480	16,098	5206003	DW181306 02	Storage and Distribution System Improvements	$0	N/A	$34.26	$40.16	$8,300,000	$360,800,000	
19	31	Brown County Water Utility	$61,455	11,300	5207001	DW201407 03	Supply and Distribution System Improvements	$0	N/A	$55.32	TBD	$4,300,000	$365,100,000	
20	30	Northwest Jasper Regional Water District Distribution System Improvements	$47,083	3,815	5237015	DW191737 01	Supply, Plant and Distribution System Improvements	$0	N/A	$44.01	$49.50	$5,498,933	$370,598,933	
21	30	North Dearborn Water Corporation	$65,096	5,435	5215008	DW201615 02	Supply, Plant and Distribution System Improvements	TBD	WE	$26.07	TBD	$3,800,000	$374,398,933	
22	29	New Market	$62,917	765	5254008	DW210754 02	Plant and Distribution System Improvements	TBD	WE	$57.14	$65.42	$1,900,000	$376,298,933	
23	28	Edinburgh	$50,200	4,792	5241002	DW211041 01	New Supply, Supply Improvements, and New Plant	$0	N/A	$20.98	$23.48	$5,800,000	$382,098,933	
24	28	Russellville	$51,250	380	5267008	DW201867 02	Storage and Distribution System Improvements	$0	N/A	$45.00	$100.47	$2,400,000	$384,498,933	
25	27	Dana	$45,804	660	5283005	DW200483 01	Plant, Storage and Distribution System Improvements	$0	N/A	$39.02	$87.58	$1,900,000	$386,398,933	
26	26	Van Bibber Lake Conservancy District	$25,313	830	5267010	DW191067 01	Distribution System Improvements	$0	N/A	$78.00	$253.91	$8,700,000	$395,098,933	
27	25	Evansville - Main Replacement	$42,600	173,000	5282002	DW181282 02	Distribution System Improvements	$0	N/A	$33.74	$45.86	$97,000,000	$492,098,933	
28	25	Chandler	$50,904	19,295	5287002	DW181987 03	Distribution System Improvements	$0	N/A	$35.21	$35.21	$18,000,000	$510,098,933	
29	25	Cedar Lake	$65,067	5,550	5245047 5245067	DW201745 04	Supply, Storage, and Distribution System Improvements	$0	N/A	$36.04	$40.18	$4,000,000	$514,098,933	
30	24	New Chicago	$37,037	5,500	5245032	DW210645 02	Distribution System Improvements	$0	N/A	TBD	TBD	$2,300,000	$516,398,933	
31	24	Carmel	$113,714	88,077	5229004	DW181129 01	Plant, Storage and Distribution System Improvements	TBD	TBD	$25.31	$29.87	$51,000,000	$567,398,933	
32	23	IN Recreation Development Commission / Charlestown State Park	N/A	83	2100018	DW220210 02	New Supply and Treatment Expansion	$0	N/A	N/A	TBD	$6,400,000	$573,798,933	
33	21	Gibson Water, Inc.	$63,056	4,390	5226009	DW180826 02	Distribution System Improvements	TBD	TBD	$38.80	$38.80	$2,400,000	$576,198,933	

PPL Rank [1]	PPL Score	Participant	MHI [2, 3]	Population Served	PWSID No(s).	SRF Project No.	Project Description	Estimated Green Project Reserve Cost	Green Project Reserve Category [4]	Current User Rate (per 4,000 gallons) [2]	Estimated Post-Project User Rate (per 4,000 gallons) [2]	Requested Funds	Cumulative Requested Funds	SFY 2022 Fundable Range ($80 Million)
34	21	Tri-Township Water Corporation	$68,658	9,725	521509	DW220615 01	Storage and Distribution System Improvements	$775,000	WE	$26.46	TBD	$4,600,000	$580,798,933	
35	17	Columbus	$63,405	44,061	5203002	DW211403 01	New Supply	$0	N/A	$9.82	$17.49	$15,400,000	$596,198,933	
36	16	Washington	$40,645	13,690	5214007	DW190414 01	Distribution System Improvements	$0	N/A	$33.79	$38.86	$3,300,000	$599,498,933	
--	21	Attica	$49,167	1,360	5223001	DW220823 01	Treatment, Storage, and Distribution System Improvements	$0	N/A	$33.25	$40.88	$2,400,000	$601,898,933	
TOTAL REQUESTED FUNDS - PRELIMINARY ENGINEERING REPORTS (PERs)								$1,108,000				$601,898,933		

PPL Rank [1]	PPL Score	Participant	MHI [2, 3]	Population Served	PWSID No(s).	SRF Project No.	Project Description	Estimated Green Project Reserve Cost	Green Project Reserve Category [4]	Current User Rate (per 4,000 gallons) [2]	Estimated Post-Project User Rate (per 4,000 gallons) [2]	Estimated Total Project Cost	Cumulative Total
Application Only		Loogootee	$44,125	3,915	5251005	DW210251 01	Storage and Distribution System Improvements	TBD	TBD	$31.54	$46.35	$2,700,000	$2,700,000
Application Only		Madison	$40,231	6,471	5239006	DW22093903	Plant, Storage and Distribution System Improvements	TBD	TBD	$9.48	$15.12	$12,400,000	$15,100,000
TOTAL REQUESTED FUNDS - APPLICATIONS ONLY								$0				$15,100,000	

TOTAL REQUESTED FUNDS - PERs & APPLICATIONS	Estimated Green Project Reserve Cost	Requested Funds
	$1,108,000	$616,998,933

Footnotes:

[1] A community must submit a complete Preliminary Engineering Report to the DWSRF Loan Program in order for the project to be scored and ranked on the Project Priority List (PPL).

[2] Additional subsidization may be provided to participants who have a low Median Household Income (MHI) and/or high post-project user rates as outlined in the Intended Use Plan (IUP). The amount of the additional subsidization shall be determined and set forth in the financial assistance agreement.

[3] The Indiana DWSRF Loan Program defines a Disadvantaged Community in Section VII of the IUP.

[4] EE = Energy Efficiency, EI = Environmentally Innovative, GI = Green Infrastructure, WE = Water Efficiency, CR = Climate Resiliency.

* This project priority list was published on July 2, 2021 for a 2-week comment period.

New Water Treatment Plant Alt 2B - River Intake Rehabilitation Cost Support / Comparison

Advanced Facility Plan, Attachment SMB-1, pp. 50-51					Multiplier	Timberline Output			
Table 7-5 Cost Estimate for River Intake Rehabilitation			DR 17-6 Attach. 1.xlsm		from	DR 17-6 Attach. 2.pdf		OUCC Estimate	
Description		Est. Cost	Total Cost	Total Price	Estimate	Total Cost	Total Price		Amount
Demolition Work		$75,000	$49,600	$75,000	1.512	$ 49,562	$ 75,292		$ 49,600
Roof Repair / Replacement (3,000 sf)		$60,000	$7,000	$10,500	1.500	$ 6,955	$ 10,556		$ 7,000
Doors & Hardware Rehab		$13,000	$13,000	$19,700	1.515	$ 12,925	$ 19,784		$ 13,000
Building Finishes & Specialties		$35,000	$34,200	$50,500	1.477	$ 31,037	$ 47,859		$ 34,200
Structure and Walkway Rehabilitation		$50,000	$50,000	$75,500	1.510	$ 37,676	$ 58,298		$ 37,676
Process Piping and Accessories		$209,000	$209,000	$317,800	1.521	$ 207,113	$ 316,440		$ 209,000
Pump Replacement (6 units)		$1,336,000	$1,335,500	$2,020,400	1.513	$ 1,323,368	$ 2,011,165	(3) & 25%	$ 1,274,760
Intake Screens (3 units)		$1,300,000	$ 666,000	$ 1,019,100	1.530	$ 370,321	$ 571,280	(2) & 25%	$ 966,075
Potassium Permanganate System (1 unit)		$400,000	$249,000	$366,000	1.470	$ 12,281	$ 18,787	(4) & 25%	$ 62,500
HVAC Replacement (3,000 sf)		$115,000	$115,000	$172,000	1.496	$ 114,015	$ 173,042		$ 115,000
Misc. Electrical (MCC Upgrades are Underway)		$150,000	$200,000	$302,000	1.510	$ 200,000	$ 303,543		$ 150,000
Instrumentation		$100,000	$84,000	$126,900	1.511	$ 84,000	$ 127,488		$ 100,000
Subtotal		$3,843,000	$ 3,012,300	$ 4,555,400		$ 2,449,253	$ 3,733,534		$ 3,018,811
Estimating Contingency 30%	30%	$1,152,900	$903,690	$1,366,620		$734,776	$1,120,060	10%	$ 301,881
Escalation to Midpoint 3%	3%	$115,290	$90,369	$136,662		$73,478	$112,006	3%	$ 90,564
Construction Subtotal		$5,111,190	$4,006,359	$6,058,682		$3,257,506	$4,965,600		$ 3,411,256
Contractor General Conditions 10%	10%	$511,119	$301,230	$455,540		$244,925	$373,353	10%	$ 301,881
Contractor Overhead and Profit 12%	12%	$613,343	$361,476	$546,648		$293,910	$448,024	12%	$ 362,257
Construction Contingencies 5%	5%	$255,560	$150,615	$227,770		$122,463	$186,677	0%	$ -
Allowance: Dredge River		$260,000	$ 250,000	$ 378,051		$ 250,000	$ 379,429		$ -
Grand Total Cost		**$6,752,000**	$ 5,069,680	$ 7,666,691		$ 4,168,805	$ 6,353,083		**$ 4,075,395**

Notes:

(1) Budgetary Cost for 3 Johnson T54MF Screens (17-6 Att 1)	$ 212,874	Jan. 2020 quote from Aqseptence Group
(2) Budgetary Cost for three Evoqua Travelling Screens	$ 772,860	Feb. 2021 quote - Includes equip I&C and VFDs
(3) Budgetary Cost for Six Floway Low Service Pumps	$ 1,019,808	March 3, 2021 quote from Trillium Pumps USA, Inc.
(4) Budgetary Cost for KMnO4 system	$ 50,000	March 11, 2021 quote from BL Anderson

(5) Yellow shaded cells show costs that are approximately equal

(6) Black text shows AECOM estimated costs and assumed percentages.

(7) Red text shows OUCC calculated costs and assumed percentages.

Preapred by: Jim Parks / OUCC
August 19, 2021

Original Costs from Estimator

Description	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Demolition Work	$49,600	$75,000	1.512
Roof Repair / Replacement	$7,000	$10,500	1.500
Doors & Hardware Rehab	$13,000	$19,700	1.515
Building Finishes & Specialties	$34,200	$50,500	1.477
Structure and Walkway Rehabilitation	$50,000	$75,500	1.510
Process Piping and Accessories	$209,000	$317,800	1.521
Pump Replacement	$1,335,500	$2,020,400	1.513
Screen Replacement	$666,000	$1,019,100	1.530
Potassium Permanganate System	$249,000	$366,000	1.470
HVAC Replacement	$115,000	$172,000	1.496
Electrical Systems	$200,000	$302,000	1.510
Instrumentation	$84,000	$126,900	1.511
Totals	**$3,012,300**	**$4,555,400**	

Adjusted for Report

Table B1.1 - River Intake Rehabilitation, Low Service PS

Description		Estimated Cost	Cost Adjust Comments
Demolition Work		$75,000	
Roof Repair / Replacement (3,000 sf)		$60,000	X - City noted a whole new roof
Doors & Hardware Rehab		$13,000	
Building Finishes & Specialties		$35,000	
Structure and Walkway Rehabilitation		$50,000	
Process Piping and Accessories		$209,000	
Pump Replacement (6 units)		$1,336,000	
Intake Screens (3 units)		$1,300,000	X - quote of $750k for 3 screens - estimate seems to be pneumatic screens so updated
Potassium Permanganate System (1 unit)		$400,000	X - estimate seemed low - need to run piping over, hopper, storage, etc.
HVAC Replacement (3,000 sf)		$115,000	
Misc. Electrical (MCC Upgrades are Underway)		$150,000	X - MCC's are getting some upgrades
Instrumentation		$100,000	
Subtotal		**$3,843,000**	
Estimating Contingency	30%	$1,152,900	
Escalation to Midpoint	3%	$115,290	
Construction Subtotal		**$5,111,190**	
Contractor General Conditions	10%	$511,119	
Contractor Overhead and Profit	12%	$613,343	
Construction Contingencies	5%	$255,560	
Allowance: Dredge River		$260,000	
Grand Total Cost		**$6,752,000**	

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
01				**River Intake & Low Service Pump Station**															
	1A			River Intake & LSPS Rehab															
		02		**Modify Existing Structure & Services**															
			02.01	**Demolition Work**															
				Non-Hazardous Waste Transport and Disposal.	1 ls			-	-	-	-	500.00	500	-	-	-	-	500	759
				Demo Entrance Sidewalk & Handrail	6 cy	0.300 ch / cy	4	88.76 /ch	160	-	-	-	-	12.69	76	-	-	236	374
				Demo Single Door & Frame	3 ea	1.000 ch / ea	3	117.52 /ch	353	-	-	-	-	28.26	85	-	-	437	693
				Demo Double Door & Frame	2 ea	1.333 ch / ea	8	117.52 /ch	313	-	-	-	-	37.68	75	-	-	389	616
				Demo HVAC System (Includes Exhaust Fans, Heaters, Louvers & Ductwork)	3,000 sf			-	-	-	-	10.00	30,000	-	-	-	-	30,000	45,531
				Demo Electrical System (Includes I&C System & Lights)	3,000 sf			/sf				6.00	18,000					18,000	27,319
				02.01 Demolition Work	1 ls		21		826			48,500.00	48,500	236.28	236			49,562	75,292
			02.10	**Intake Pipe Rehab**															
				Temporary support ex. 42" pipe discharge	3 ea	3.000 ch / ea	45	194.58 /ch	1,751	-	-	-	-	839.05	2,517	-	-	4,268	6,778
				Demo Conc Ftg/Pier	3 ea	1.000 cd / ea	48	679.61 /cd	2,039	-	-	-	-	2,149.16	6,447	-	-	8,486	13,488
				Neoprened Pad	3 ea	2.500 mh / ea	8	45.62 /mh	342	60.00	180	-	-	-	-	-	-	523	815
				CIP Footing - 5'w x 2'w x 2'd	3 cy			-	-	-	-	1,500.00	4,500	-	-	-	-	4,500	6,830
				CIP Pier - 5'w x 2'w x 4'd	5 cy			-	-	-	-	1,500.00	7,500	-	-	-	-	7,500	11,383
				Gasket/Nuts/Bolt Kit 42"	9 ea	1.000 mh / ea	9	45.62 /mh	411	425.00	3,825	-	-	-	-	-	-	4,236	6,455
				Carbon Steel Flange Thrust Assemblies - 42" interior	9 ea	6.000 mh / ea	54	45.62 /mh	2,464	500.00	4,500	-	-	-	-	-	-	6,964	10,729
				02.10 Intake Pipe Rehab	3 ea		164		7,006	2,835.00	8,505	4,000.00	12,000	2,988.21	8,965			36,476	56,477
			07.01	**Roofing**															
				Inspect & Patch Roof System (Patchwork Voids Warranty)	3,300 sf			/sf				1.50	4,950					4,950	7,513
				Patch Aluminum Downspouts	40 lf			/lf				18.00	720					720	1,093
				Patch Aluminum Coping @ Roof Parapet 12" wide	257 lf			/lf				5.00	1,285					1,285	1,950
				07.01 Roofing	3,300 sf							2.11	6,955					6,955	10,556
			08.00	**Doors, Frames & Hardware**															
				HM Single Frames- 16 ga 3'x7'	5 ea	1.000 mh / ea	5	39.18 /mh	196	180.04	900	-	-	-	-	-	-	1,096	1,676
				HM Door Leafs- 3'x7' 20 ga, half glass	7 ea	1.500 ea / mh	5	39.18 /mh	183	450.09	3,151	-	-	-	-	-	-	3,333	5,071
				Finish Hardware by Leaf- Allowance	7 ea	8.002 mh / ea	56	39.18 /mh	2,194	900.18	6,301	-	-	-	-	-	-	8,496	13,036
				08.00 Doors, Frames & Hardware	7 ea		66		2,573	1,476.87	10,352							12,925	19,784
			09.00	**Finishes**															
				Paint HM Door Frames - primer (2) coats	5 ea			/ea		-	-	100.02	500	-	-	-	-	500	759
				Paint HM Doors - primer (2) coats	7 ea			/ea		-	-	140.03	980	-	-	-	-	980	1,488
				Paint CMU Block - block filler & (2) coat	6,300 sf			-	-	-	-	1.35	8,505	-	-	-	-	8,505	12,908
				Upgrade Architectural Finishes	1 ls			-	-	-	-	4,000.00	4,000	-	-	-	-	4,000	6,071
				Paint 6" Pipe	505 lf	0.140 mh / lf	71	27.53 /mh	1,947	0.69	350	-	-	4.24	2,141	-	-	4,437	7,018
				Paint 18" Pipe	85 lf	0.200 mh / lf	17	27.53 /mh	468	2.08	177	-	-	6.06	515	-	-	1,159	1,820
				Paint 24" Pipe	7 lf	0.350 mh / lf	2	27.53 /mh	67	2.77	19	-	-	7.07	49	-	-	136	215
				Paint 30" Pipe	54 lf	0.438 mh / lf	24	27.53 /mh	650	3.46	187	-	-	4.12	223	-	-	1,060	1,667
				Paint 36" Pipe	34 lf	0.526 mh / lf	18	27.53 /mh	491	4.15	141	-	-	4.95	169	-	-	801	1,260
				Paint 42" Pipe	223 lf	0.525 mh / lf	117	27.53 /mh	3,223	4.85	1,081	-	-	4.95	1,103	-	-	5,407	8,497
				09.00 Finishes	3,300 ls		249		6,848	0.59	1,955	4.24	13,985	1.27	4,198			26,986	41,711
			10.00	**Specialty Items**															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	5 ea			/ea				30.01	150	-	-	-	-	150	228
				Fire Extinguisher CO2 10 lbs	4 ea			/ea				225.05	900					900	1,366
				10.00 Specialty Items	3,300 ls							1.23	4,051					4,051	6,148
			23.00	**HVAC**															
				Replace HVAC System (Includes Exhaust Fans, Heaters, Louvers & Ductwork)	3,000 sf			/sf		-	-	25.01	75,015	-	-	-	-	75,015	113,851
				Replace Ancillary Building Systems	3,000 sf			/sf		-	-	13.00	39,000	-	-	-	-	39,000	59,191
				23.00 HVAC	3,300 sf							34.55	114,015					114,015	173,042
			31.00	**Dredging**															
				Hydraulic Dredging- Allowance	1 ls			-	-	-	-	250,000.00	250,000	-	-	-	-	250,000	379,429
				31.00 Dredging	1 ls							250,000.00	250,000					250,000	379,429
			32.00	**Site Improvements**															
				Replace Entrance Sidewalks & Handrail	1 ls			/ls				1,200.00	1,200					1,200	1,821
				32.00 Site Improvements	1 ls							1,200.00	1,200					1,200	1,821
				02 Modify Existing Structure & Services	1 ls		499		17,233	20,011.62	20,812	450,706.22	450,706	13,399.15	13,399			502,170	764,261
		26		**Electrical & Instrumentation**															
			26.01	**Above Ground Electrical**															
				Electrical Work For New Pumps & Lights	1 ls			/ls				200,000.00	200,000					200,000	303,543
				26.01 Above Ground Electrical	1 ls							200,000.00	200,000					200,000	303,543
			26.02	**Instrumentation & Controls**															
				Controls & Instrumentation Work For New Pumps	1 ls			/ls				84,000.00	84,000					84,000	127,488
				26.02 Instrumentation & Controls	1 ls							84,000.00	84,000					84,000	127,488
				26 Electrical & Instrumentation	3,300 ls							86.06	284,000					284,000	431,031
		40		**Process Piping**															
			40.01	**Above Ground Process Piping**															
				Replace Water Supply, PCC, Chlorine Solution and Potassium Permanganate Piping	600 lf	0.900 mh / lf	540	45.62 /mh	24,636	47.39	28,432	-	-	-	-	-	-	53,068	82,143
				40.01 Above Ground Process Piping	600 lf		540		24,636	47.39	28,432							53,068	82,143
			40.02	**Valves, Meters, Etc.**															
				Backflow Preventer Flg 6"	1 ea	12.170 mh / ea	12	45.62 /mh	555	5,000.00	5,000	-	-	-	-	-	-	5,555	8,457
				Magnetic Flow Meter, Inline - 30" w/ transmitter	2 ea	38.000 mh / ea	76	43.67 /mh	3,319	19,000.00	38,000	-	-	-	-	-	-	41,319	62,928
				Resurface All Large Discharge Valves & Replace Actuators 24"	6 ea	10.000 mh / ea	60	30.57 /mh	1,834	7,800.00	46,800	-	-	-	-	-	-	48,634	73,932
				Resurface All Large Discharge Valves & Replace Actuators 36"	1 ea	14.000 mh / ea	14	30.57 /mh	428	11,700.00	11,700	-	-	-	-	-	-	12,128	18,435
				Resurface All Large Discharge Valves & Replace Actuators 42"	3 ea	17.000 mh / ea	51	30.57 /mh	1,559	14,950.00	44,850	-	-	-	-	-	-	46,409	70,537
				40.02 Valves, Meters, Etc.			213		7,695		146,350							154,045	234,297
				40 Process Piping	600 lf		753		32,331	291.30	174,782							207,113	316,440
		43		**Process Equipment**															
			43.00	**Pumps**															
				Pump Inspection	6 ea	24.000 mh / ea	144	42.40 /mh	6,105	-	-	2,200.00	13,200	-	-	-	-	19,305	29,696
				Freight On Pumps To Jobsite	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Verified Performance Test	6 day	8.000 ch / day	48	29.43 /ch	1,413			-	-	-	-	1,500.00	9,000	10,413	15,896
				Vendor Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				Vendor Witnessed, Verified Performance Test	6 ea			/ea								1,500.00	9,000	9,000	13,659
				System Disinfection	1 day	8.000 ch / day	8	29.43 /ch	235	750.00	750							985	1,511
				Equipment Unloading	6 ea	4.000 ch / ea	132	182.62 /ch	4,383	500.00	3,000	-	-	381.61	2,290	-	-	9,673	15,134

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			43.00	Pumps															
				Equipment Rigging / Rough Set - Pumps	6 ea	4.000 ch / ea	144	195.85 /ch	4,700	500.00	3,000	-	-	401.59	2,410	-	-	10,110	15,827
				Equipment - Final Setting Grout Base - Pumps	6 ea	4.000 ch / ea	72	103.33 /ch	2,480	50.00	300	-	-	346.18	2,077	-	-	4,857	7,686
				Variable Frequency Drives 150 HP	6 ea	40.000 mh / ea	240	28.14 /mh	6,753	31,995.00	191,970	-	-	-	-	-	-	198,723	302,044
				Replace Vertical Turbine Can Low Service Pumps 150 HP	6 ea			/ea								165,000.00	990,000	990,000	1,502,536
				Demo Existing Low Service Pumps 150 hp	6 ea	30.000 mh / ea	180	34.45 /mh	6,200			-	-	-	-			6,200	9,813
				Add Large Sump Pump To Lower Level	1 ea	32.000 mh / ea	32	34.45 /mh	1,102	-	-	-	-	-	-	45,000.00	45,000	46,102	70,042
				43.00 Pumps	1 ls		1,000		33,372	199,020.00	199,020	13,200.00	13,200	6,776.18	6,776	1,071,000.00	1,071,000	1,323,368	2,011,165
			43.08	Intake Screens															
				3-Man Dive Team - (1) Diver, (1) Tender, (1) Standby Diver	180 ch			-	-	-	-	560.00	100,800	555.56	100,000	-	-	200,800	312,137
				Rebuild Intake Screens	3 ea	60.000 mh / ea	180	32.90 /mh	5,923	-	-	-	-	6,657.60	19,973	47,875.00	143,625	169,521	259,143
				43.08 Intake Screens	3 ea		180		5,923			33,600.00	100,800	39,990.93	119,973	47,875.00	143,625	370,321	571,280
			43.09	Potassium Permanganate System															
				Purchase Chemicals: Potassium Permangnate By Owner)	1 ls			-	-			-	-	-	-	-	-		
				Automated Potassium Permanganate w/ Mixing Tank (by Carus Corp)	1 ls	50.000 mh / ls	50	45.62 /mh	2,281	-	-					10,000.00	10,000	12,281	18,787
				43.09 Potassium Permanganate System			50		2,281								10,000	12,281	18,787
				43 Process Equipment	1 ls		1,230		41,576	199,020.00	199,020	114,000.00	114,000	126,748.98	126,749	1,224,625.00	1,224,625	1,705,970	2,601,233
				1A River Intake & LSPS Rehab	1 ls		2,482		91,159	394,613.41	394,613	848,706.22	848,706	140,148.13	140,148	1,224,625.00	1,224,625	2,699,252	4,112,985
	1B			New River Intake & LSPS															
		00		Building & Structure Construction															
			03.00	Foundation Mat															
				Keyway 6"	650 lf	0.050 mh / lf	33	39.49 /mh	1,264	0.67	437	-	-	-	-	-	-	1,721	2,695
				Mat Foundation Edge Form 24"	366 sf	0.350 mh / sf	128	39.49 /mh	5,059	1.31	480	-	-	-	-	-	-	5,540	8,737
				Mat Foundation Edge Form 30"	510 sf	0.350 mh / sf	179	39.49 /mh	7,050	1.31	670	-	-	-	-	-	-	7,720	12,174
				Waterstop 6" Flat	650 lf	0.110 mh / lf	72	39.18 /mh	2,802	2.10	1,365	-	-	-	-	-	-	4,167	6,506
				Strip & Oil Mat Found. Form	878 sf	0.005 mh / sf	4	39.17 /mh	172	0.03	26	-	-	-	-	-	-	198	311
				Rebar- Foundation Mat (100 #/cy)	13 tn	28.008 mh / tn	368	43.53 /mh	16,030	997.70	13,120	-	-	-	-	-	-	29,150	45,283
				Rebar Support - bricks (.12/sf)	368 ea	0.002 mh / ea	1	43.53 /mh	32	0.26	97	-	-	-	-	-	-	129	197
				Finish- Hard Trowel	3,070 sf	0.023 mh / sf	71	39.17 /mh	2,766	-	-	-	-	-	-	-	-	2,766	4,378
				Pump Place Mat Foundation 24"	83 cy	0.500 mh / cy	42	41.39 /mh	1,718	-	-	-	-	4.59	381	-	-	2,098	3,325
				Pump Place Mat Foundation 30"	180 cy	0.500 mh / cy	90	41.39 /mh	3,725	-	-	-	-	4.59	826	-	-	4,551	7,310
				4000 psi Concrete	263 cy			/cy		142.00	37,346	-	-	-	-	-	-	37,346	56,681
				Liquid Curing Compounds	3,846 sf	0.003 mh / sf	12	39.17 /mh	464	0.06	232	-	-	-	-	-	-	696	1,086
				6 Mil. Vapor Barrier	4,400 sf	0.002 mh / sf	9	43.53 /mh	383	0.05	231	-	-	-	-	-	-	614	957
				03.00 Foundation Mat			1,007		41,484		54,004				1,207			96,694	149,540
			03.03	Columns															
				Form Rectangle Columns 14' & 25.33'h	1,525 sf	0.165 mh / sf	252	39.49 /mh	9,936	1.60	2,434	-	-	-	-	-	-	12,371	19,421
				Chamfer	1,144 lf	0.015 mh / lf	17	39.49 /mh	678	0.57	649	-	-	-	-	-	-	1,326	2,057
				Strip & Oil Column Form	1,525 sf	0.005 mh / sf	8	39.17 /mh	299	0.03	46	-	-	-	-	-	-	344	542
				Superplasticizers @ Columns	19 cy			/cy		8.40	160	-	-	-	-	-	-	160	242
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	23	43.53 /mh	993	997.70	1,137	-	-	-	-	-	-	2,130	3,287
				Finish- Float	69 sf	0.017 mh / sf	1	39.17 /mh	46	-	-	-	-	-	-	-	-	46	73
				Pump Place Columns 18 ea	19 cy	1.600 mh / cy	30	41.39 /mh	1,258	-	-	-	-	7.50	142	-	-	1,401	2,218
				4000 psi Concrete	19 cy			/cy		142.00	2,698	-	-	-	-	-	-	2,698	4,095
				Grind/Patch Columns	1,525 sf	0.013 mh / sf	20	39.17 /mh	777	0.03	45	-	-	-	-	-	-	822	1,299
				Rub Columns	1,525 sf	0.065 mh / sf	99	39.17 /mh	3,882	0.06	92	-	-	-	-	-	-	3,974	6,284
				Liquid Curing Compounds	1,525 sf	0.003 mh / sf	5	39.17 /mh	179	0.06	90	-	-	-	-	-	-	269	420
				03.03 Columns			454		18,048		7,351				142			25,541	39,948
			03.04	Walls															
				Brick Ledge Forms	257 lf	0.300 mh / lf	77	39.49 /mh	3,045	2.21	567	-	-	-	-	-	-	3,612	5,680
				Keyway 6"	1,004 lf	0.050 mh / lf	50	39.49 /mh	1,983	0.67	675	-	-	-	-	-	-	2,657	4,182
				Vertical Wall Keyway 6"	272 lf	0.110 mh / lf	30	39.49 /mh	1,182	0.67	183	-	-	-	-	-	-	1,365	2,148
				Panel Form System 12-16'	2,250 sf	0.170 mh / sf	383	39.49 /mh	15,104	1.84	4,134	-	-	-	-	-	-	19,239	30,180
				Panel Form System > 16' h	12,695 sf	0.190 mh / sf	2,413	39.49 /mh	95,265	1.84	23,332	-	-	-	-	-	-	118,598	186,190
				Waterstop 6" Flat	1,276 lf	0.110 mh / lf	140	39.18 /mh	5,500	2.10	2,680	-	-	-	-	-	-	8,180	12,772
				Strip & Oil Wall Forms	14,495 sf	0.005 mh / sf	72	39.17 /mh	2,839	0.03	435	-	-	-	-	-	-	3,274	5,154
				Superplasticizers @ Walls	553 cy			/cy		8.40	4,646	-	-	-	-	-	-	4,646	7,051
				Rebar- Walls (125 #/cy)	35 tn	15.003 mh / tn	525	43.53 /mh	22,856	997.70	34,920	-	-	-	-	-	-	57,776	85,173
				Finish- Top of Wall	2,008 sf	0.008 mh / sf	16	39.17 /mh	629	-	-	-	-	-	-	-	-	629	996
				Pump Place Walls 24"	553 cy	1.150 mh / cy	636	41.38 /mh	26,327	-	-	-	-	6.65	3,677	-	-	30,004	47,520
				Pump Place Brick Ledge	14 cy	2.001 mh / cy	28	41.39 /mh	1,159	-	-	-	-	14.42	202	-	-	1,361	2,156
				4000 psi Concrete	567 cy			/cy		142.00	80,514	-	-	-	-	-	-	80,514	122,197
				Grind/Patch Walls	14,495 sf	0.013 mh / sf	188	39.17 /mh	7,382	0.03	435	-	-	-	-	-	-	7,817	12,344
				Rub Walls	7,473 sf	0.058 mh / sf	433	39.17 /mh	16,976	0.06	448	-	-	-	-	-	-	17,425	27,549
				Liquid Curing Compounds	15,303 sf	0.002 mh / sf	31	39.17 /mh	1,199	0.06	900	-	-	-	-	-	-	2,099	3,284
				03.04 Walls			5,023		201,447		153,858				3,879			359,195	558,536
			03.05	Slab On Grade															
				Slab Edge Form 28"	249 sf	0.350 mh / sf	87	39.49 /mh	3,443	1.31	327	-	-	-	-	-	-	3,769	5,944
				Rebar- SOG (125 #/cy)	2 tn	14.003 mh / tn	22	43.53 /mh	951	997.70	1,556	-	-	-	-	-	-	2,507	3,857
				Mesh Support - bricks (.12/sf)	75 ea	0.002 mh / ea	0	43.53 /mh	7	0.26	20	-	-	-	-	-	-	26	40
				Finish- Hard Trowel	624 sf	0.015 mh / sf	9	39.17 /mh	367	-	-	-	-	-	-	-	-	367	580
				Pump Place Slab on Grade 6" @ Electrical Room	16 cy	0.500 mh / cy	8	41.38 /mh	331	-	-	-	-	3.67	59	-	-	390	618
				Pump Place Thickened Slab 28" x 20"	10 cy	0.500 mh / cy	5	41.39 /mh	207	-	-	-	-	3.67	37	-	-	244	386
				4000 psi Concrete	26 cy			/cy		142.00	3,692	-	-	-	-	-	-	3,692	5,803
				Saw Cut S-O-G (.08/sf)	50 lf	0.030 mh / lf	2	39.17 /mh	59	0.17	9	-	-	0.95	48	-	-	115	182
				Liquid Curing Compounds	873 sf	0.002 mh / sf	2	39.17 /mh	68	0.06	51	-	-	-	-	-	-	120	186
				Seal Floors	624 sf	0.002 mh / sf	1	39.17 /mh	49	0.09	58	-	-	-	-	-	-	107	165
				6 Mil. Vapor Barrier	700 sf	0.002 mh / sf	1	43.53 /mh	61	0.05	37	-	-	-	-	-	-	98	152
				Gravel Fill Under Slab 4"	8 cy	0.004 cd / cy	1	1,412.15 /cd	43	29.26	234	-	-	3.84	31	-	-	308	472
				03.05 Slab On Grade			138		5,584		5,983				174			11,741	18,196
			03.06	Suspended Flat Slab															
				Form Suspended Slab Bottom	2,312 sf	0.180 mh / sf	416	39.49 /mh	16,437	2.18	5,050			-	-	-	-	21,487	33,680
				Slab Edge Form 12"	207 sf	0.250 mh / sf	52	39.49 /mh	2,044	5.17	1,070			-	-	-	-	3,114	4,860
				Strip & Oil Suspended Slab Forms	2,519 sf	0.005 mh / sf	13	39.17 /mh	493	0.04	103			-	-	-	-	597	935
				Superplasticizers	57 cy			-	-	8.40	479			-	-	-	-	479	727
				Rebar- Suspended Slab (225 #/cy)	6 tn	20.004 mh / tn	128	43.53 /mh	5,581	997.70	6,395	-	-	-	-	-	-	11,977	18,540
				Finish- Hard Trowel	2,312 sf	0.030 mh / sf	69	39.17 /mh	2,717	-	-			-	-	-	-	2,717	4,301
				Pump Place Suspended Slab 12"	57 cy	1.800 mh / cy	103	41.39 /mh	4,247	-	-			6.65	379	-	-	4,637	7,326
				4000 psi Concrete	57 cy			-	-	142.00	8,094			-	-	-	-	8,094	12,284
				Liquid Curing Compounds	4,831 sf	0.003 mh / sf	14	39.17 /mh	568	0.68	3,298			-	-	-	-	3,865	5,904

EWSU WATER PLANT ALTERNATIVES ANALYSIS
INTAKE ALTERNATIVE 1 - REHABILITATE EXISTING SYSTEM
LIFE CYCLE COST ANALYSIS (30 YEARS)

Capital Costs			Capital Cost 2020$
Total Capital Cost			**$ 6,752,000**
O&M Costs	**Current $ Annual**		**30 Yr Life Cycle Cost 2020$**
Chemicals & Consumables	**$ 67,835**		**$ 2,035,058**
Potassium Permanganate (3300 lb bins)	$ 67,835		$ 2,035,058
PAC (incl. in Pretreatment costs)	$ -		$ -
Energy Costs	**$ 318,081**		**$ 9,542,431**
Screens & Backwash Water	$ 1,742		$ 52,259
Low Service Pumps & Drives (6@150HP)	$ 313,552		$ 9,406,558
KMNO4 System (PAC in Pretreatment)	$ 697		$ 20,903
HVAC (A.C. for VFD only)	$ 2,090		$ 62,710
(Insignificant for controls)	$ -		$ -
			$ -
Equipment Maintenance Costs	**$ 25,500**		**$ 765,000**
River Sediment Removal (Est 2X in 30 Yrs)	$ 16,000		$ 480,000
Traveling Screens & Backwash Water	$ 5,000		$ 150,000
Low Service Pumps & Motors & Valves	$ 4,500		$ 135,000
Total O&M Costs	**$ 411,416**		**$ 12,343,000**
Replacement Costs	**Useful Life in Years**	**Times Replaced**	**30 Yr Life Cycle Cost 2020$**
Roof Replacement	20	1	$ 50,000
Process Piping	20	1	$ 20,900
Pumps	20	1	$ 200,400
Screen Replacement	20	1	$ 195,000
Potassium Permanganate System	15	2	$ 112,500
HVAC	15	2	$ 23,000
Electrical and I&C	15	2	$ 26,800
Total Replacement Costs			**$ 629,000**
Salvage Value 2020$ to Reflect Remaining Useful Life at Year 30			
Roof Replacement	20	Years	$ (25,000)
Process Piping	20	Years	$ (10,450)
Pumps	20	Years	$ (100,200)
Screen Replacement	20	Years	$ (97,500)
Potassium Permanganate System	15	Years	$ (56,250)
HVAC	15	Years	$ (11,500)
Electrical and I&C	15	Years	$ (13,400)
Total Salvage Value of Remaining Useful Life			**$ (315,000)**
Total Present Worth 30 Year Life Cycle Cost			**$ 19,409,000**

New Water Treatment Plant Alt 2B - High Service Pump Station #4 Cost Support / Comparison

DR 17-6 Attach. 1.xlsm						Timberline Output			
Table B6.2 - New High Service Pumps Option (not in WTPAFP)			DR 17-6 Attach. 1.xlsm			DR 17-6 Attach. 2.pdf		OUCC Estimate	
Description		**Est. Cost**	**Est. Base Cost (from est.)**	**Est. Loaded Cost (from est.)**	**Multiplier from Estimate**	**Total Amount**	**Grand Total Amount**		**Amount**
Pump Building (5,100 sf)		$ 513,600	$855,407	$1,318,619	1.542			3,000 SF	$ 503,181
Dewatering			$70,384	$107,754	1.531				
Foundation and Earthwork		$ 159,000	$317,103	$486,388	1.534	$ 1,407,877	$ 2,170,009		$ 317,103
Plumbing (5,100 sf)		$ 18,600	$30,606	$46,283	1.512			3,000 SF	$ 30,606
HVAC (5,100 sf)		$ 76,800	$127,525	$192,844	1.512				$ 75,015
Process Piping		$ 158,000	$157,812	$242,437	1.536	$ 317,317	$ 486,145		$ 157,812
Valves, Meters, etc.		$ 167,000	$166,356	$252,319	1.517				$ 166,356
Vertical Turbine Pumps (4 units at 800ea)		$ 3,200,000	$682,455	$1,033,923	1.515				$ 682,455
Swift Chem. Injection In-Line Blender X - Not to be included			$52,570	$79,566	1.514	$ 771,721	$ 1,173,345		
Air Compressor X - Not to be included			$36,696	$55,602	1.515				
Electrical (15% equipment)		$ 480,000	$234,647	$354,833	1.512	$ 498,827	$ 757,077		$ 162,246
Instrumentation & Controls		$ 265,000	$264,180	$399,494	1.512				$ 264,180
Subtotal		$ 5,038,000	**$2,995,741**	**$4,570,062**		**$2,995,742**	**$4,586,576**		$ 2,358,953
Estimating Contingency	20%	$ 1,007,600	$599,148	$914,012		$599,148	$917,315	10%	$ 235,895
Escalation to Midpoint	3%	$ 151,140	$89,872	$137,102		$89,872	$137,597	3%	$ 70,769
Construction Subtotal		$ 6,196,740	$3,684,761	$5,621,176		$3,684,763	$5,641,488		$ 2,665,617
Contractor General Conditions	10%	$ 619,674	$299,574	$457,006		$299,574	$458,658	10%	$ 266,562
Contractor Overhead and Profit	12%	$ 743,609	$359,489	$548,407		$359,489	$550,389	12%	$ 319,874
Construction Contingencies	5%	$ 309,837	$149,787	$228,503		$149,787	$229,329	0%	$ -
Grand Total Cost		$ 7,869,860	$ 4,493,612	$ 6,855,093		$ 4,493,613	$ 6,879,864		**$ 3,252,053**
Cost to use for alt 2B		**$11,130,000**							
Original Est. was for effectively replacing high service #2									

Notes: (1) Yellow shaded cells show costs that are approximately equal
(2) Black text shows AECOM estimated costs and assumed percentages.
(3) Red text shows OUCC calculated costs and assumed percentages.

Original Costs from Estimator

	Estimated Base Cost (from estimate)	Estimated Loaded Cost (from estimate)	Multiplier from Estimate
Building Structure	$855,407	$1,318,619	1.542
Dewatering	$70,384	$107,754	1.531
Foundation and Earthwork	$317,103	$486,388	1.534
Process Piping	$157,812	$242,437	1.536
Valves, Meters, Etc.	$166,356	$252,319	1.517
Pumps	$682,455	$1,033,923	1.515
Swift Water Chemical Injectic	$52,570	$79,566	1.514
Air Compressor	$36,696	$55,602	1.515
Plumbing	$30,606	$46,283	1.512
HVAC	$127,525	$192,844	1.512
Electrical	$234,647	$354,833	1.512
Instrumentation & Controls	$264,180	$399,494	1.512
Grand Total Capital Construc	**$2,995,741**	**$4,570,062**	

Adjusted for Report

Table B6.2 - New High Service Pumps Option

Description		Estimated Cost	Cost Adjust Comments
Pump Building (5,100 sf)		$513,600	Reduce to 3,000 SF
Dewatering			No dewatering - build on top of clearwell
Foundation and Earthwork		$159,000	Reduced - built on top of clearwell
Process Piping		$158,000	
Valves, Meters, etc.		$167,000	
Vertical Turbine Pumps (4 units at 800ea)		$3,200,000	
			X - Not to be included
			X - Not to be included
Plumbing (5,100 sf)		$18,600	
HVAC (5,100 sf)		$76,800	Reduce to 3000 SF
Electrical (15% equipment)		$480,000	
Instrumentation & Controls		$265,000	
Subtotal		**$5,038,000**	
Estimating Contingency	20%	$1,007,600	
Escalation to Midpoint	3%	$151,140	
Construction Subtotal		**$6,196,740**	
Contractor General Conditions	10%	$619,674	
Contractor Overhead and Profit	12%	$743,609	
Construction Contingencies	5%	$309,837	
Allowances:			
Grand Total Cost		**$7,870,000**	

Cost to use for alt 2B $11,130,000.00 Original Estiamte was for effectiveltly replacing high service #2

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
06				**High Service Pump Station**															
	6A			High Service Pump Station (Retrofit)															
		43		**Process Equipment**															
			43.00	**Pumps**															
				Pump Inspection	5 ea	24.000 mh / ea	120	42.40 /mh	5,087	-	-	2,200.00	11,000	-	-	-	-	16,087	24,747
				HSPS Vert Turbine Can Pump - 1250 hp	5 ea	240.000 mh / ea	1,200	47.77 /mh	57,329	2,500.00	12,500	-	-	-	-	562,500.00	2,812,500	2,882,329	4,378,282
				43.00 Pumps	1 ls		1,320		62,416	12,500.00	12,500	11,000.00	11,000			2,812,500.00	2,812,500	2,898,416	4,403,029
				43 Process Equipment	1 ls		1,320		62,416	12,500.00	12,500	11,000.00	11,000			2,812,500.00	2,812,500	2,898,416	4,403,029
				6A High Service Pump Station (Retrofit)	1 ls		1,320		62,416	12,500.00	12,500	11,000.00	11,000			2,812,500.00	2,812,500	2,898,416	4,403,029
	6B			High Service Pump Station (New)															
		00		**Building & Structure Construction**															
			03.00	**Foundation Mat**															
				Keyway 6"	504 lf	0.050 mh / lf	25	39.49 /mh	995	0.67	339	-	-	-	-	-	-	1,334	2,089
				Mat Foundation Edge Form 12"	260 sf	0.350 mh / sf	91	39.48 /mh	3,594	1.31	341	-	-	-	-	-	-	3,935	6,207
				Mat Foundation Edge Form 30"	1,870 sf	0.350 mh / sf	655	39.49 /mh	25,850	1.31	2,455	-	-	-	-	-	-	28,305	44,639
				Waterstop 6" Flat	504 lf	0.110 mh / lf	55	39.18 /mh	2,172	2.10	1,059	-	-	-	-	-	-	3,231	5,045
				Strip & Oil Mat Found. Form	2,130 sf	0.005 mh / sf	11	39.17 /mh	417	0.03	64	-	-			-	-	481	757
				Rebar- Foundation Mat (100 #/cy)	17 tn	28.006 mh / tn	489	43.53 /mh	21,272	997.70	17,410	-	-	-	-	-	-	38,681	60,090
				Rebar Support - bricks (.12/sf)	608 ea	0.002 mh / ea	1	43.53 /mh	53	0.26	160	-	-	-	-	-	-	213	326
				Finish- Hard Trowel	5,067 sf	0.023 mh / sf	117	39.17 /mh	4,565	-	-	-	-	-	-	-	-	4,565	7,226
				Pump Place Mat Foundation 12"	81 cy	0.500 mh / cy	41	41.39 /mh	1,676	-	-	-	-	4.59	372	-	-	2,048	3,245
				Pump Place Mat Foundation 30"	268 cy	0.500 mh / cy	134	41.38 /mh	5,546	-	-	-	-	4.59	1,230	-	-	6,776	10,735
				Pump Place Thickened Mat 36" x 12"	14 cy	0.500 mh / cy	7	41.39 /mh	290	-	-	-	-	4.59	64	-	-	354	561
				4000 psi Concrete	363 cy			/cy		142.00	51,546	-	-	-	-	-	-	51,546	78,232
				Liquid Curing Compounds	7,197 sf	0.003 mh / sf	22	39.17 /mh	846	0.08	423	-	-	-	-	-	-	1,269	1,981
				6 Mil. Vapor Barrier	5,600 sf	0.002 mh / sf	11	43.53 /mh	488	0.05	294	-	-	-	-	-	-	782	1,218
				03.00 Foundation Mat	363 cy		1,658		67,765	204.11	74,090			4.59	1,665			143,520	222,351
			03.03	**Columns**															
				Form Rectangle Columns 9.33' & 9.58'	1,128 sf	0.165 mh / sf	186	39.49 /mh	7,350	1.60	1,801	-	-	-	-	-	-	9,150	14,365
				Chamfer	565 lf	0.015 mh / lf	8	39.49 /mh	335	0.57	320	-	-	-	-	-	-	655	1,016
				Strip & Oil Column Form	1,128 sf	0.005 mh / sf	6	39.17 /mh	221	0.03	34	-	-	-	-	-	-	255	401
				Superplasticizers @ Columns	21 cy			/cy		8.40	176	-	-	-	-	-	-	176	269
				Column Rebar (120 #/cy)	1 tn	20.004 mh / tn	25	43.53 /mh	1,097	897.70	1,257	-	-	-	-	-	-	2,354	3,644
				Finish- Float	44 sf	0.017 mh / sf	1	39.17 /mh	29	-	-	-	-	-	-	-	-	29	46
				Pump Place Columns 15 ea	21 cy	1.600 mh / cy	34	41.39 /mh	1,391	-	-	-	-	7.50	157	-	-	1,548	2,452
				4000 psi Concrete	21 cy			/cy		142.00	2,982	-	-	-	-	-	-	2,982	4,526
				Grind/Patch Columns	1,128 sf	0.013 mh / sf	15	39.17 /mh	574	0.03	34	-	-	-	-	-	-	608	961
				Rub Columns	1,128 sf	0.065 mh / sf	73	39.17 /mh	2,872	0.06	68	-	-	-	-	-	-	2,939	4,648
				Liquid Curing Compounds	1,128 sf	0.003 mh / sf	3	39.17 /mh	133	0.06	66	-	-	-	-	-	-	199	310
				03.03 Columns	21 cy		351		14,001	320.87	6,738			7.50	157			20,897	32,637
			03.04	**Walls**															
				Brick Ledge Forms	161 sf	0.300 mh / sf	48	39.49 /mh	1,909	2.21	355	-	-	-	-	-	-	2,263	3,558
				Keyway 6"	327 lf	0.050 mh / lf	16	39.49 /mh	646	0.67	220	-	-	-	-	-	-	866	1,356
				Vertical Wall Keyway 6"	95 lf	0.110 mh / lf	10	39.49 /mh	413	0.67	64	-	-	-	-	-	-	477	750
				Panel Form System 16' h	10,450 sf	0.190 mh / sf	1,986	39.49 /mh	78,419	1.84	19,206	-	-	-	-	-	-	97,625	153,264
				Wall Box Out For Weir, 34 lf	140 sf	0.550 mh / sf	77	39.49 /mh	3,041	1.34	188	-	-	-	-	-	-	3,229	5,099
				Waterstop 6" Flat	422 lf	0.110 mh / lf	46	39.18 /mh	1,819	2.10	886	-	-	-	-	-	-	2,705	4,224
				Strip & Oil Wall Forms	10,450 sf	0.005 mh / sf	52	39.17 /mh	2,047	0.03	314	-	-	-	-	-	-	2,360	3,715
				Superplasticizers @ Walls	398 cy			/cy		8.40	3,344	-	-	-	-	-	-	3,344	5,075
				Rebar- Walls (125 #/cy)	25 tn	15.003 mh / tn	375	43.53 /mh	16,326	997.70	24,943	-	-	-	-	-	-	41,268	63,695
				Finish- Top of Wall	474 sf	0.008 mh / sf	4	39.17 /mh	149	-	-	-	-	-	-	-	-	149	235
				Pump Place Walls 24"	350 cy	1.150 mh / cy	403	41.39 /mh	16,662	-	-	-	-	6.65	2,327	-	-	18,990	30,076
				Pump Place Walls 30"	47 cy	1.150 mh / cy	54	41.39 /mh	2,238	-	-	-	-	6.65	313	-	-	2,550	4,039
				Pump Place Brick Ledge	1 cy	2.001 mh / cy	2	41.39 /mh	83	-	-	-	-	14.42	14	-	-	97	154
				4000 psi Concrete	398 cy			/cy		142.00	56,516	-	-	-	-	-	-	56,516	85,775
				Grind/Patch Walls	10,450 sf	0.013 mh / sf	136	39.17 /mh	5,322	0.03	314	-	-	-	-	-	-	5,635	8,899
				Rub Walls	5,225 sf	0.058 mh / sf	303	39.17 /mh	11,870	0.06	314	-	-	-	-	-	-	12,183	19,262
				Liquid Curing Compounds	10,450 sf	0.002 mh / sf	21	39.17 /mh	819	0.06	615	-	-	-	-	-	-	1,433	2,220
				03.04 Walls	396 cy		3,534		141,760	270.90	107,276			6.70	2,654			251,690	391,404
			03.06	**Suspended Flat Slab**															
				Form Suspended Slab Bottom	6,383 sf	0.180 mh / sf	1,149	39.49 /mh	45,378	2.18	13,943			-	-	-	-	59,322	92,987
				Slab Edge Form 12"	660 sf	0.250 mh / sf	165	39.49 /mh	6,517	5.17	3,413			-	-	-	-	9,930	15,494
				Strip & Oil Suspended Slab Forms	7,043 sf	0.005 mh / sf	35	39.17 /mh	1,380	0.04	289			-	-	-	-	1,668	2,622
				Superplasticizers	236 cy			-	-	8.40	1,983			-	-	-	-	1,983	3,009
				Rebar- Suspended Slab (225 #/cy)	27 tn	20.004 mh / tn	531	43.53 /mh	23,117	987.70	26,489	-	-	-	-	-	-	49,606	76,791
				Finish- Hard Trowel	6,383 sf	0.030 mh / sf	192	39.17 /mh	7,502	-	-			-	-	-	-	7,502	11,873
				Pump Place Suspended Slab 12"	236 cy	1.800 mh / cy	425	41.39 /mh	17,586	-	-			6.65	1,570	-	-	19,156	30,332
				4000 psi Concrete	236 cy			-	-	142.00	33,512			-	-	-	-	33,512	50,862
				Liquid Curing Compounds	14,086 sf	0.003 mh / sf	42	39.17 /mh	1,655	0.68	9,616			-	-	-	-	11,271	17,214
				03.06 Suspended Flat Slab	236 cy		2,539		103,135	378.15	89,244			6.65	1,570			193,949	301,180
			03.07	**Suspended Beams**															
				Beam Side Forms	1,354 sf	0.210 mh / sf	284	39.49 /mh	11,230	2.21	2,986	-	-	-	-	-	-	14,216	22,306
				Beam Bottom Forms	468 sf	0.210 mh / sf	98	39.49 /mh	3,882	2.21	1,032	-	-	-	-	-	-	4,914	7,710
				Chamfer	936 lf	0.015 mh / lf	14	39.49 /mh	555	0.57	531	-	-	-	-	-	-	1,085	1,683
				Strip & Oil Beam Forms	1,822 sf	0.005 mh / sf	9	39.17 /mh	357	0.03	55	-	-	-	-	-	-	412	648
				Superplasticizers @ Beams	51 cy			/cy		8.40	428	-	-	-	-	-	-	428	650
				Rebar- Beams (250 #/cy)	6 tn	15.003 mh / tn	96	43.53 /mh	4,179	997.70	6,385	-	-	-	-	-	-	10,565	16,306
				Finish- Top of Beam	468 sf	0.008 mh / sf	4	39.17 /mh	147	-	-	-	-	-	-	-	-	147	232
				Pump Place Beams @ Roof	51 cy	2.001 mh / cy	102	41.39 /mh	4,224	-	-	-	-	14.42	736	-	-	4,959	7,856
				4000 psi Concrete	51 cy			/cy		142.00	7,242	-	-	-	-	-	-	7,242	10,991
				Grind/Patch Beams	1,822 sf	0.013 mh / sf	24	39.17 /mh	928	0.03	55	-	-	-	-	-	-	983	1,552
				Rub Beams	1,822 sf	0.085 mh / sf	155	39.17 /mh	6,066	0.06	109	-	-	-	-	-	-	6,175	9,766
				Liquid Curing Compounds	2,290 sf	0.002 mh / sf	5	39.17 /mh	179	0.06	135	-	-	-	-	-	-	314	488
				03.07 Suspended Beams	51 cy		791		31,746	371.73	18,958			14.42	736			51,440	80,189
			03.08	**Pads & Curbs**															
				Pad Form 8"	52 sf	0.120 mh / sf	6	39.49 /mh	246	1.37	71	-	-	-	-	-	-	317	498
				Roof Parapet Curb Forms 48" h	1,145 sf	0.200 mh / sf	229	39.48 /mh	9,045	1.52	1,744	-	-	-	-	-	-	10,788	16,951
				Chamfer	571 lf	0.015 mh / lf	9	39.49 /mh	338	0.57	324	-	-	-	-	-	-	662	1,027
				Strip & Oil Equipment Pad & Curb Forms	1,197 sf	0.005 mh / sf	6	39.17 /mh	234	0.03	36	-	-	-	-	-	-	270	426
				Rebar- Pads (100 #/cy)	1 tn	18.003 mh / tn	12	43.53 /mh	509	997.70	649	-	-	-	-	-	-	1,158	1,790
				Finish- Float	124 sf	0.017 mh / sf	2	39.17 /mh	83	-	-	-	-	-	-	-	-	83	131

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			03.08	Pads & Curbs															
				Pump Place Curbs 12"	11 cy	2.501 mh / cy	28	41.39 /mh	1,138	-	-	-	-	9.86	108	-	-	1,247	1,974
				Pump Place Pads 6"	2 cy	1.501 mh / cy	3	41.39 /mh	132	-	-	-	-	7.49	15	-	-	147	234
				4000 psi Concrete	13 cy			/cy		142.00	1,846	-	-	-	-	-	-	1,846	2,801
				Liquid Curing Compounds	1,321 sf	0.003 mh / sf	4	39.17 /mh	155	0.06	78	-	-	-	-	-	-	233	364
				03.08 Pads & Curbs	13 cy		298		11,882	365.12	4,747			9.49	123			16,752	26,206
			03.20	Precast Planks															
				Precast Hollow Core Roof Planks 4' wide x 10"	4,324 sf	0.020 mh / sf	86	42.24 /mh	3,654	8.80	38,059	-	-	0.35	1,522	-	-	43,234	65,957
				03.20 Precast Planks	4,324 sf		86		3,654	8.80	38,059			0.35	1,522			43,234	65,967
			04.00	Masonry															
				8" CMU + Rigid Insulation Backup To Brick, 17' h	2,302 sf			/sf		-	-	18.00	41,444	-	-	-	-	41,444	62,901
				8" CMU Interior Partition 9.33' h	824 sf			/sf		-	-	14.00	11,538	-	-	-	-	11,538	17,552
				Brick Veneer	2,448 sf			-	-	-	-	9.00	22,036	-	-	-	-	22,036	33,445
				04.00 Masonry	3,272 sf							22.93	75,019					75,019	113,857
			06.00	Wood															
				Misc Nailers & Blocking	5,025 sf	0.010 mh / sf	50	39.67 /mh	1,994	0.40	2,017	-	-	-	-	-	-	4,011	6,217
				06.00 Wood	1 ls		50		1,994	2,016.69	2,017							4,011	6,217
			07.01	Roofing															
				Membrane Roofing- 60 mil EPDM Mechanically Attached w/ 3" Insulation	5,100 sf			/sf				3.00	15,303					15,303	23,226
				Aluminum Downspouts, 4 ea x 16' each	64 vf			/vf				18.00	1,152					1,152	1,749
				Aluminum Coping @ Roof Parapet 20" wide	143 lf			/lf				25.01	3,576					3,576	5,427
				Aluminum Gutters	114 lf			/lf				15.00	1,710					1,710	2,596
				Roof Hatch 4'0" x 4'0"	3 ea			/ea				2,500.50	7,502					7,502	11,385
				Translucent Panel Skylight Frame & Panels 7' x 7', 6 ea	294 sf			/sf				38.01	11,174					11,174	16,959
				07.01 Roofing	5,100 sf							7.93	40,417					40,417	61,342
			08.00	Doors, Frames & Hardware															
				HM Door Leafs- 3'x7' 20 ga, half glass	7 ea	1.500 ea / mh	5	39.18 /mh	183	450.09	3,151	-	-	-	-	-	-	3,334	5,071
				Overhead Doors- 10'x10' 24 ga steel manual 1" insuation 26 ga back-up panel	1 ea			-	-	-	-	2,255.45	2,255	-	-	-	-	2,255	3,423
				08.00 Doors, Frames & Hardware	8 ea		5		183	393.83	3,151	281.93	2,255					5,589	8,494
			09.00	Finishes															
				Paint HM Door Frames - primer (2) coats	4 ea			/ea		-	-	100.02	400	-	-	-	-	400	607
				Paint HM Doors - primer (2) coats	7 ea			/ea		-	-	140.03	980	-	-	-	-	980	1,488
				Paint Walls- 3 coats	3,950 sf			-	-	-	-	0.94	3,713	-	-	-	-	3,713	5,635
				09.00 Finishes	1 ls							5,093.27	5,093					5,093	7,730
			10.00	Specialty Items															
				Signs - Building ID	1 ea			/ea				3,000.60	3,001					3,001	4,554
				Signs - Doors	4 ea			/ea				30.01	120	-	-	-	-	120	182
				Fire Extinguisher CO2 10 lbs	3 ea			/ea				225.05	675					675	1,025
				10.00 Specialty Items	1 ls							3,795.76	3,796					3,796	5,761
			22.00	Plumbing															
				Plumbing Subcontract	5,100 sf			/sf				6.00	30,606					30,606	46,451
				22.00 Plumbing	1 ls							30,606.11	30,606					30,606	46,451
			23.00	HVAC															
				Ventilation & Unit Heater System	5,100 sf			/sf		-	-	25.01	127,525	-	-	-	-	127,525	193,547
				23.00 HVAC	5,100 sf							25.01	127,525					127,525	193,547
			31.01	Dewatering															
				Remove Dewatering System	1 ls	2.000 cd / ls	96	2,249.33 /cd	4,499			227.27	227	1,295.68	1,296	-	-	6,022	9,527
				24" Wells, well casing, pea gravel	35 lf			/lf				150.00	5,250			-	-	5,250	7,968
				Set & Wire Pumps	1 ea	2.000 ea / cd	24	2,249.33 /cd	1,125	25,000.00	25,000	-	-	323.92	324	-	-	26,449	40,238
				Maintenance/Operation	1 ea	1.000 ea / cd	48	2,249.33 /cd	2,249	1,000.00	1,000	-	-	647.84	648	-	-	3,897	6,109
				Suction Piping	80 lf	110.000 lf / cd	35	2,249.33 /cd	1,636	15.00	1,200	-	-	5.89	471	-	-	3,307	5,160
				Header Piping	200 lf	200.000 lf / cd	48	2,249.33 /cd	2,249	35.00	7,000	-	-	3.24	648	-	-	9,897	15,215
				Valving	1 ls	1.000 ls / cd	48	2,249.33 /cd	2,249	5,000.00	5,000	-	-	647.84	648	-	-	7,897	12,180
				Run Temp Power to Pumps	1 ea	1.000 ea / cd	32	1,439.45 /cd	1,439	2,000.00	2,000	-	-	226.06	226	-	-	3,665	5,674
				Electric Consumption	4 mo	1.000 mo / ls		/ls		1,000.00	4,000	-	-			-	-	4,000	6,071
				31.01 Dewatering	1 ls		331		15,447	45,200.00	45,200	5,477.27	5,477	4,260.36	4,260			70,384	109,142
			31.02	Piles															
				Augered Piles CIP 18" x @ 25 ft depth, 10' oc = 79 ea (1 per 64 sf)	1,975 vf	0.002 cd / vf	221	2,146.97 /cd	8,482	35.16	69,434	-	-	2.58	5,096	-	-	83,012	126,917
				31.02 Piles	79 ea		221		8,482	878.91	69,434			64.51	5,096			83,012	126,917
			31.03	Excavation Shoring															
				Shoring System Design Engineer	1 ls			-	-	-	-	15,003.00	15,003	-	-	-	-	15,003	22,770
				Structure Sheeting (149' x 22' deep)	3,278 sf	0.001 cd / sf	162	2,465.38 /cd	6,225	16.00	52,458	-	-	0.75	2,465	-	-	61,148	93,392
				Tie Backs (1 per 80 sf of Sheeting, 149' x 18'= 2,682 sf)	34 ea			-	-	-	-	2,377.47	80,834	-	-	-	-	80,834	122,683
				31.03 Excavation Shoring	3,278 sf		162		6,225	16.00	52,458	29.24	95,837	0.75	2,465			156,986	238,846
			31.10	Structure Excavation															
				Exc Clay-Backhoe/Truck (5,440 sf x 17.83')	3,592 cy	499.900 cy / cd	259	1,410.06 /cd	10,132	-	-	-	-	6.58	23,650	-	-	33,782	53,675
				31.10 Structure Excavation	3,592 cy		259		10,132					6.58	23,650			33,782	53,675
			31.12	Structure Backfill															
				Backfill Earth-Backhoe/Truck (149' x 4' x 17.83')	383 cy	0.002 cd / cy	25	1,327.72 /cd	1,027			-	-	4.69	1,795	-	-	2,822	4,483
				31.12 Structure Backfill	383 cy		25		1,027					4.69	1,795			2,822	4,483
			31.13	Soil Disposal															
				Spoils to Waste	3,199 cy	0.003 day / cy	288	1,410.06 /day	11,279	-	-	-	-	8.23	26,329	-	-	37,608	59,755
				31.13 Soil Disposal	3,199 cy		288		11,279					8.23	26,329			37,608	59,755
			31.20	Structure Stone Base															
				Structure Subbase Stone-Loaders/Truck - 5,440 sf x 4"	67 cy	0.003 cd / cy	8	1,609.56 /cd	327	28.28	1,895	-	-	10.02	671	-	-	2,893	4,461
				31.20 Structure Stone Base	67 cy		8		327	28.28	1,895			10.02	671			2,893	4,461
			40.01	Above Ground Process Piping															
				Paint & Stencil Exposed Piping <20"	620 lf			-	-	-	-	10.00	6,201	-	-	-	-	6,201	9,412
				Paint & Stencil Exposed Piping >20"	26 lf			-	-	-	-	25.01	650	-	-	-	-	650	987
				40.01 Above Ground Process Piping	1 lf							6,851.37	6,851					6,851	10,398
				00 Building & Structure Construction	5,100 gsf		10,605		429,038	100.64	513,267	77.04	392,878	14.25	72,694			1,407,877	2,170,009
		26		Electrical & Instrumentation															
			26.00	UG Electrical															
				Building Electrical System	5,100 sf			/sf				16.00	81,616					81,616	123,870
				26.00 UG Electrical	1 ls							81,616.29	81,616					81,616	123,870
			26.01	Above Ground Electrical															

WBS Lvl 1	WBS Lvl 2	WBS Lvl 3	WBS Lvl 4	Description	Takeoff Quantity	Labor Productivity	Man Hours	Labor Price	Labor Amount	Material Cost/Unit	Material Amount	Subcontract Cost/Unit	Subcontract Amount	Const Equip Cost/Unit	Const Equip Amount	Process Equip Cost/Unit	Process Equip Amount	Total Amount	Grand Total Amount
			26.01	**Above Ground Electrical**															
				Process Electrical System	5,100 sf			/sf				30.01	153,031					153,031	232,257
				26.01 Above Ground Electrical	1 ls							153,030.55	153,031					153,031	232,257
			26.02	**Instrumentation & Controls**															
				Controls & Instrumentation	1 ls			/ls				264,180.00	264,180					264,180	400,950
				26.02 Instrumentation & Controls	1 ls							264,180.00	264,180					264,180	400,950
				26 Electrical & Instrumentation	1 ls							493,828.84	498,827					498,827	757,077
		40		**Process Piping**															
			40.00	**Under Ground Process Piping**															
				Trench Excav & Lay Pipe 0- 4'	20 lf	600.000 lf / cd	2	2,539.31 /cd	85			-	-	1.88	38	-	-	122	194
				Stone Pipe Bedding	3 cy	200.000 cy / cd	1	2,896.43 /cd	43	23.29	70	-	-			-	-	113	175
				DI Pipe Push - Class 52 30	15 lf	0.440 mh / lf	7	51.34 /mh	339	167.28	2,509	-	-	-	-	-	-	2,848	4,344
				DI Pipe Push - Class 52 36	5 lf	0.500 mh / lf	3	51.34 /mh	128	225.44	1,127	-	-	-	-	-	-	1,256	1,914
				Hydrostatic Testing	20 lf	0.021 ch / lf	1	182.49 /ch	77	0.16	3	-	-	-	-	-	-	80	126
				40.00 Under Ground Process Piping	20 lf		14		672	185.47	3,709			1.88	38			4,419	6,753
			40.01	**Above Ground Process Piping**															
				Pipe Supports	4 ea	4.001 mh / ea	16	45.62 /mh	730	250.05	1,000	-	-			-	-	1,730	2,674
				Hydrostatic Testing	142 lf	0.021 ch / lf	12	182.48 /ch	544	0.16	23	-	-	-	-	-	-	567	895
				Dresser Couplings 6"	8 ea	2.400 ch / ea	19	/ch		170.00	1,360	-	-			-	-	1,360	2,064
				Restrained Joint Couplings 10"	4 ea	5.721 ch / ea	92	182.48 /ch	4,175	283.08	1,132	-	-			-	-	5,308	8,328
				Restrained Joint Couplings 24"	8 ea	13.803 ch / ea	442	182.48 /ch	20,151	684.14	5,473	-	-			-	-	25,624	40,200
				14" DI Stab Thimble 12" long	2 ea	1.501 ch / ea	12	182.48 /ch	548	325.07	650	-	-	361.32	723	-	-	1,920	3,004
				36" DI Wall Thimble 24" long	1 ea	2.500 ch / ea	10	182.49 /ch	456	1,286.26	1,286	-	-	602.00	602	-	-	2,344	3,632
				36" DI Stab Thimble 12" long	4 ea	2.501 ch / ea	40	182.48 /ch	1,825	700.14	2,801	-	-	602.12	2,408	-	-	7,034	10,972
				Gasket/Nuts/Bolt Kit 6"	22 ea	1.000 mh / ea	22	45.62 /mh	1,004	15.87	349	-	-	-	-	-	-	1,353	2,118
				Gasket/Nuts/Bolt Kit 10"	5 ea	1.000 mh / ea	5	45.62 /mh	228	37.54	188	-	-	-	-	-	-	416	646
				Gasket/Nuts/Bolt Kit 30"	3 ea	2.501 mh / ea	8	45.62 /mh	342	175.03	525	-	-	-	-	-	-	867	1,339
				DI Flanged Joint Pipe 6"	70 lf	0.900 mh / lf	63	45.62 /mh	2,874	47.39	3,317	-	-	-	-	-	-	6,191	9,583
				DI Flanged Joint Pipe 10"	46 lf	1.240 mh / lf	57	45.62 /mh	2,603	88.26	4,060	-	-	-	-	-	-	6,663	10,281
				DI Flanged Joint Pipe 30"	26 lf	3.051 mh / lf	79	45.62 /mh	3,619	310.21	8,065	-	-	-	-	-	-	11,684	17,968
				DI Flanged 90 ell 6"	5 ea	4.830 mh / ea	24	45.62 /mh	1,102	105.30	527	-	-	-	-	-	-	1,628	2,543
				DI Flanged 90 ell 10"	1 ea	6.361 mh / ea	6	45.62 /mh	290	267.35	267	-	-	-	-	-	-	558	865
				DI Flanged 90 ell 30"	2 ea	17.874 mh / ea	36	45.62 /mh	1,631	2,317.07	4,634	-	-	-	-	-	-	6,265	9,614
				DI Flanged 90 ell 36"	0 ea	20.520 mh / ea	0	45.62 /mh	9	2,989.00	30	-	-	-	-	-	-	39	60
				DI Flanged Tee 6"	4 ea	4.830 mh / ea	19	45.62 /mh	881	120.00	480	-	-	-	-	-	-	1,361	2,124
				DI Flanged Tee 10"	2 ea	8.362 mh / ea	13	45.62 /mh	580	350.00	700	-	-	-	-	-	-	1,280	1,981
				DI Flanged Tee 30"	4 ea	17.874 mh / ea	71	45.62 /mh	3,262	2,800.00	10,400	-	-	-	-	-	-	13,662	20,947
				DI Blind Flange 10"	1 ea	6.101 mh / ea	6	45.62 /mh	278	247.85	248	-	-	-	-	-	-	526	817
				DI Blind Flange 30"	1 ea	17.163 mh / ea	17	45.62 /mh	783	2,395.88	2,396	-	-	-	-	-	-	3,179	4,876
				Chemical Piping & Accessories- ALLOWANCE	500 LF	0.240 mh / LF	120	45.62 /mh	5,476	55.01	27,505	-	-	-	-	-	-	32,981	50,412
				40.01 Above Ground Process Piping	142 lf		1,190		53,393	545.19	77,417			26.29	3,733			134,542	207,943
			40.02	**Valves, Meters, Etc.**															
				Backflow Preventer Flg 6"	2 ea	12.170 mh / ea	24	45.62 /mh	1,110	5,000.00	10,000	-	-	-	-	-	-	11,110	16,835
				Magnetic Flow Meter - Inline - 24" w/ transmitter	1 ea	26.005 mh / ea	26	48.85 /mh	1,270	12,002.39	12,002	-	-	-	-	-	-	13,273	20,237
				Swing Check Valve 6"	4 ea	4.669 mh / ea	19	45.62 /mh	852	1,100.00	4,400	-	-	-	-	-	-	5,252	8,026
				Swing Check Valve 10"	2 ea	7.996 mh / ea	16	45.62 /mh	730	4,650.93	9,302	-	-	-	-	-	-	10,031	15,272
				Swing Check Valve 24"	4 ea	18.001 mh / ea	72	45.62 /mh	3,285	14,402.88	57,612	-	-	-	-	-	-	60,896	92,637
				10" Butterfly Valve, 125 lb class, CI Body, Flg. w/ EIM elec actuator NEMA 4	2 ea	9.602 mh / ea	19	45.62 /mh	876	5,701.14	11,402	-	-	-	-	-	-	12,278	18,692
				24" Butterfly Valve, 125 lb class, CI Body, Flg. w/ EIM elec actuator NEMA 4	4 ea	19.204 mh / ea	77	45.62 /mh	3,504	12,502.50	50,010	-	-	-	-	-	-	53,514	81,448
				40.02 Valves, Meters, Etc.	1 ls		253		11,628	154,728.01	154,728							166,356	253,237
			40.04	**Hydropneumatic Piping System**															
				Hydropneumatic Piping, Fitting & Valve Allowance	1 ls	mh / ls		45.62 /mh				12,000.00	12,000					12,000	18,213
				40.04 Hydropneumatic Piping System	1 ls							12,000.00	12,000					12,000	18,213
				40 Process Piping	162 lf		1,456		65,692	1,455.89	235,854	74.07	12,000	23.28	3,771			317,317	486,145
		43		**Process Equipment**															
			43.00	**Pumps**															
				Recycle Pumps - Vertical Turbine Pumps 75 hp, 8 mgd	3 ea	35.007 mh / ea	105	47.77 /mh	5,017	100.02	300					54,010.78	162,032	167,350	254,315
				Water Transmision Pumps - Vert Turbine Pumps, 200 hp, 5.3 gpm, 208'TDH	4 ea	117.023 mh / ea	468	47.77 /mh	22,353	100.02	400	-	-	-	-	108,021.56	432,086	454,849	691,785
				Dewatering Pumps -- Submersible Pumps 30 hp, 350 gpm, 208'TDH	2 ea	24.005 mh / ea	48	42.59 /mh	2,045	100.02	200	-	-	-	-	29,005.79	58,012	60,256	91,585
				43.00 Pumps	1 ls		621		29,425	900.16	900					652,130.16	652,130	682,455	1,037,685
			43.16	**Swift Water Chemical Injection In-Line Blender**															
				Chemical Injection In-Line Blender	1 ea	25.005 mh / ea	25	42.40 /mh	1,060	1,500.30	1,500					50,009.98	50,010	52,570	79,856
				43.16 Swift Water Chemical Injection In-Line Blender	1 ls		25		1,060	1,500.30	1,500					50,009.98	50,010	52,570	79,856
			43.21	**Air Compressor**															
				Package Air Compressor 350 cfm	1 ea	40.000 mh / ea	40	42.40 /mh	1,696			-	-	-	-	35,000.00	35,000	36,696	55,804
				43.21 Air Compressor	1 ls		40		1,696							35,000.00	35,000	36,696	55,804
				43 Process Equipment	1 ls		686		32,181	2,400.48	2,400					737,140.14	737,140	771,721	1,173,345
				6B High Service Pump Station (New)	1 ls		12,743		526,911	751,521.75	751,521	903,704.70	903,705	76,465.00	76,465	737,140.14	737,140	2,995,742	4,586,577
				06 High Service Pump Station	1 ls		14,068		589,327	764,021.75	764,022	914,704.70	914,705	76,465.00	76,465	3,549,640.14	3,549,640	5,894,159	8,989,606

OUCC Attachment JTP-11
Cause No. 45545
Page 1 of 3

General Information

Parcel Number
82-06-31-022-080.008-029

Local Parcel Number
11-170-22-080-008

Tax ID:

Routing Number

Property Class 640
Exempt, Municipality

Year: 2021

Location Information

County
Vanderburgh

Township
PIGEON TOWNSHIP

District 029 (Local 011)
EVANSVILLE CITY-PIGEON

School Corp 7995
EVANSVILLE-VANDERBURGH

Neighborhood 456-029
MIXED USE FAIR 029

Section/Plat
31

Location Address (1)
1400 WATERWORKS RD
EVANSVILLE, IN 47713

Zoning

Subdivision

Lot

Market Model
456-029 - Commercial

Characteristics

Topography	Flood Hazard
	☐
Public Utilities	ERA
	☐
Streets or Roads	TIF
	☐

Neighborhood Life Cycle Stage
Other

Printed Friday, May 7, 2021

Review Group 2024

Ownership

CITY OF EVANSVILLE INDIANA BOA
1 NW MLK JR BLVD RM 300
EVANSVILLE, IN 47708

Legal

PT FRAC 31-6-10 & DUNHAM TRACT PT LT 26
AKA WATERWORKS PARCELIZATION PARCEL 2

Transfer of Ownership

Date	Owner	Doc ID	Code	Book/Page	Adj Sale Price	V/I
02/20/2019	CITY OF EVANSVILLE	pl track	PT	19/3253	$0	I

Notes

4/10/2019 EASE: 4/5/2019 Inst No 2019R6391 PLTR 11371 Electric Distribution Line ESMT for SIGECO at .452 AC and .009 AC.

4/10/2019 SPLIT/COMBINE: 20p21 SPLT PLTR 11329 cut.253 AC from 2.311 AC in 22-080-005 & delete 13.049 AC in 22-080-004 to create 22-080-008 wtih WD 2019R3253 and Waterworks Parcelization map.

Exempt

Valuation Records (Work In Progress values are not certified values and are subject to change)

2021	Assessment Year	2021	2020
WIP	Reason For Change	AA	AA
02/26/2021	As Of Date	04/09/2021	05/01/2020
Indiana Cost Mod	Valuation Method	Indiana Cost Mod	Indiana Cost Mod
1.0000	Equalization Factor	1.0000	1.0000
	Notice Required	☑	☑
$566,400	**Land**	$566,400	$566,400
$0	Land Res (1)	$0	$0
$0	Land Non Res (2)	$0	$0
$566,400	Land Non Res (3)	$566,400	$566,400
$812,700	**Improvement**	$812,700	$812,700
$0	Imp Res (1)	$0	$0
$0	Imp Non Res (2)	$0	$0
$812,700	Imp Non Res (3)	$812,700	$812,700
$1,379,100	**Total**	$1,379,100	$1,379,100
$0	Total Res (1)	$0	$0
$0	Total Non Res (2)	$0	$0
$1,379,100	Total Non Res (3)	$1,379,100	$1,379,100

Land Data (Standard Depth: Res 132', CI 132' Base Lot: Res 0' X 0', CI 0' X 0')

Land Type	Pricing Method	Soil ID	Act Front.	Size	Factor	Rate	Adj. Rate	Ext. Value	Infl. %	Res Elig %	Market Factor	Value
11	S		0	268167.9	1.00	$2	$2	$536,336	0%	0%	1.0000	$536,340
14	S		0	300128.4	1.00	$.1	$.1	$30,013	0%	0%	1.0000	$30,010

Land Computations

Calculated Acreage	13.05
Actual Frontage	0
Developer Discount	☐
Parcel Acreage	13.05
81 Legal Drain NV	0.00
82 Public Roads NV	0.00
83 UT Towers NV	0.00
9 Homesite	0.00
91/92 Acres	0.00
Total Acres Farmland	13.05
Farmland Value	$0
Measured Acreage	0.00
Avg Farmland Value/Acre	0.0
Value of Farmland	$0
Classified Total	$0
Farm / Classifed Value	$0
Homesite(s) Value	$0
91/92 Value	$0
Supp. Page Land Value	
CAP 1 Value	$0
CAP 2 Value	$0
CAP 3 Value	$566,400
Total Value	**$566,400**

Data Source N/A Collector 12/27/2000 dj Appraiser 12/27/2000 dj

OUCC Attachment JTP-11
Cause No. 45545
Page 2 of 3

General Information

Occupancy	C/I Building	**Pre. Use**	Small Shop
Description	C/I Building C 01	**Pre. Framing**	Fire Resistant
Story Height	1	**Pre. Finish**	Semi-Finished
Type	N/A	**# of Units**	0

	SB	B	1	U
Wall Type			1: 2(316')	
Heating			5400 sqft	
A/C			2532 sqft	
Sprinkler				

Plumbing RES/CI

	#	TF	#	TF
Full Bath	0	0	2	6
Half Bath	0	0	0	0
Kitchen Sinks		0		0
Water Heaters		0		0
Add Fixtures	0	0	6	6
Total	0	0	8	12

Roofing

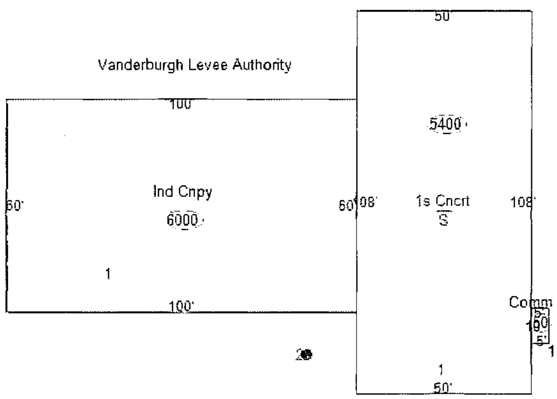
☐ Built Up ☐ Tile ☐ Metal ☐ Wood ☐ Asphalt ☐ Slate ☐ Other

GCK Adjustments

☐ Low Prof ☐ Ext Sheat ☐ Insulatio ☐ SteelGP ☐ AluSR ☐ Int Liner ☐ HGSR ☐ PPS ☐ Sand Pnl

Exterior Features

Description	Area	Value



Floor/Use Computations

Pricing Key	GCI	GCI
Use	INDOFF	SMSHOP
Use Area	2532 sqft	2868 sqft
Area Not in Use	0 sqft	0 sqft
Use %	46.9%	53.1%
Eff Perimeter	316'	316'
PAR	6	6
# of Units / AC	0 / N	0 / N
Avg Unit sz|dpth		
Floor	1	1
Wall Height	16'	16'
Base Rate	**$94.09**	**$65.66**
Frame Adj	$0.00	$0.00
Wall Height Adj	$9.16	$3.52
Dock Floor	$0.00	$0.00
Roof Deck	$0.00	$0.00
Adj Base Rate	**$103.25**	**$69.18**
BPA Factor	1.00	1.00
Sub Total (rate)	**$103.25**	**$69.18**
Interior Finish	$0.00	$0.00
Partitions	$0.00	$0.00
Heating	$0.00	$0.00
A/C	$0.00	$0.00
Sprinkler	$0.00	$0.00
Lighting	$0.00	$0.00
Unit Finish/SR	$0.00	$0.00
GCK Adj.	$0.00	$0.00
S.F. Price	**$103.25**	**$69.18**
Sub-Total		
Unit Cost	$0.00	$0.00
Elevated Floor	$0.00	$0.00
Total (Use)	**$261,429**	**$198,408**

Special Features

Description	Value
Can, IT 6000sqft	$86,760
Can, CT 50sqft	$1,040

Other Plumbing

Description	Value
1 x Ref Wat Cooler	$1300

Building Computations

Sub-Total (all floors)	$459,837	Garages	$0
Racquetball/Squash	$0	Fireplaces	$0
Theater Balcony	$0	**Sub-Total (building)**	$568,137
Plumbing	$19,200	Quality (Grade)	$568,138
Other Plumbing	$1,300	Location Multiplier	1.00
Special Features	$87,800	**Repl. Cost New**	$568,137
Exterior Features	$0		

Summary of Improvements

Description	Res Eligibl	Story Height	Construction	Grade	Year Built	Eff Year	Eff Age	Co nd	Base Rate	LCM	Adj Rate	Size	RCN	Norm Dep	Remain. Value	Abn Obs	PC	Nbhd	Mrkt	Improv Value
1: C/I Building C 01	0%	1	Concrete	C	1967	1967	54	A		1.00		5,400 sqft	$568,137	80%	$113,630	0%	100%	1.0000	1.0000	$113,600
2: Paving C 01	0%	1	Concrete	C	1967	1967	54	A	$3.51	1.00	$3.51	20,162 sqft	$70,769	80%	$14,150	0%	100%	1.0000	1.0000	$14,200

Total all pages $812,700 **Total this page** $127,800

OUCC Attachment JTP-11
Cause No. 45545
Page 3 of 3

General Information

Occupancy	C/I Building	Pre. Use	Commercial Garage
Description	C/I Building C 02	Pre. Framing	Fire Resistant
Story Height	1	Pre. Finish	Semi-Finished
Type	N/A	# of Units	0

	SB	B	1	U
Wall Type			1: 2(1004')	
Heating			52800 sqft	
A/C			52800 sqft	
Sprinkler			52800 sqft	

Plumbing RES/CI

	#	TF	#	TF
Full Bath	0	0	5	15
Half Bath	0	0	0	0
Kitchen Sinks		0		0
Water Heaters		0		0
Add Fixtures	0	0	5	5
Total	0	0	10	20

Roofing

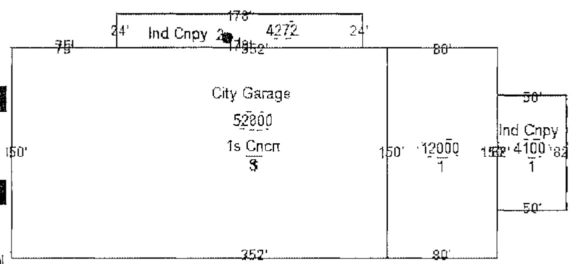
☐ Built Up ☐ Tile ☐ Metal
☐ Wood ☐ Asphalt ☐ Slate
☐ Other

GCK Adjustments

☐ Low Prof ☐ Ext Sheat ☐ Insulatio
☐ SteelGP ☐ AluSR ☐ Int Liner
☐ HGSR ☐ PPS ☐ Sand Pnl

Exterior Features

Description	Area	Value



Floor/Use Computations

Pricing Key	GCI
Use	COMGAR
Use Area	52800 sqft
Area Not in Use	0 sqft
Use %	100.0%
Eff Perimeter	1004'
PAR	2
# of Units / AC	0 / N
Avg Unit sz|dpth	
Floor	1
Wall Height	20'
Base Rate	**$37.97**
Frame Adj	$0.00
Wall Height Adj	$3.78
Dock Floor	$0.00
Roof Deck	$0.00
Adj Base Rate	**$41.75**
BPA Factor	1.00
Sub Total (rate)	**$41.75**
Interior Finish	$0.00
Partitions	$0.00
Heating	$0.00
A/C	$3.99
Sprinkler	$2.68
Lighting	$0.00
Unit Finish/SR	$0.00
GCK Adj.	$0.00
S.F. Price	**$48.42**
Sub-Total	
Unit Cost	$0.00
Elevated Floor	$0.00
Total (Use)	**$2,556,576**

Special Features

Description	Value
Mezz 12000sqft	$346,320
DF, LD 4100sqft	$30,750
Can, IT 4100sqft	$59,290
Can, IT 4272sqft	$61,770

Other Plumbing

Description	Value
3 x Ref Wat Cooler	$3900
1 x Emerg Shower	$1400

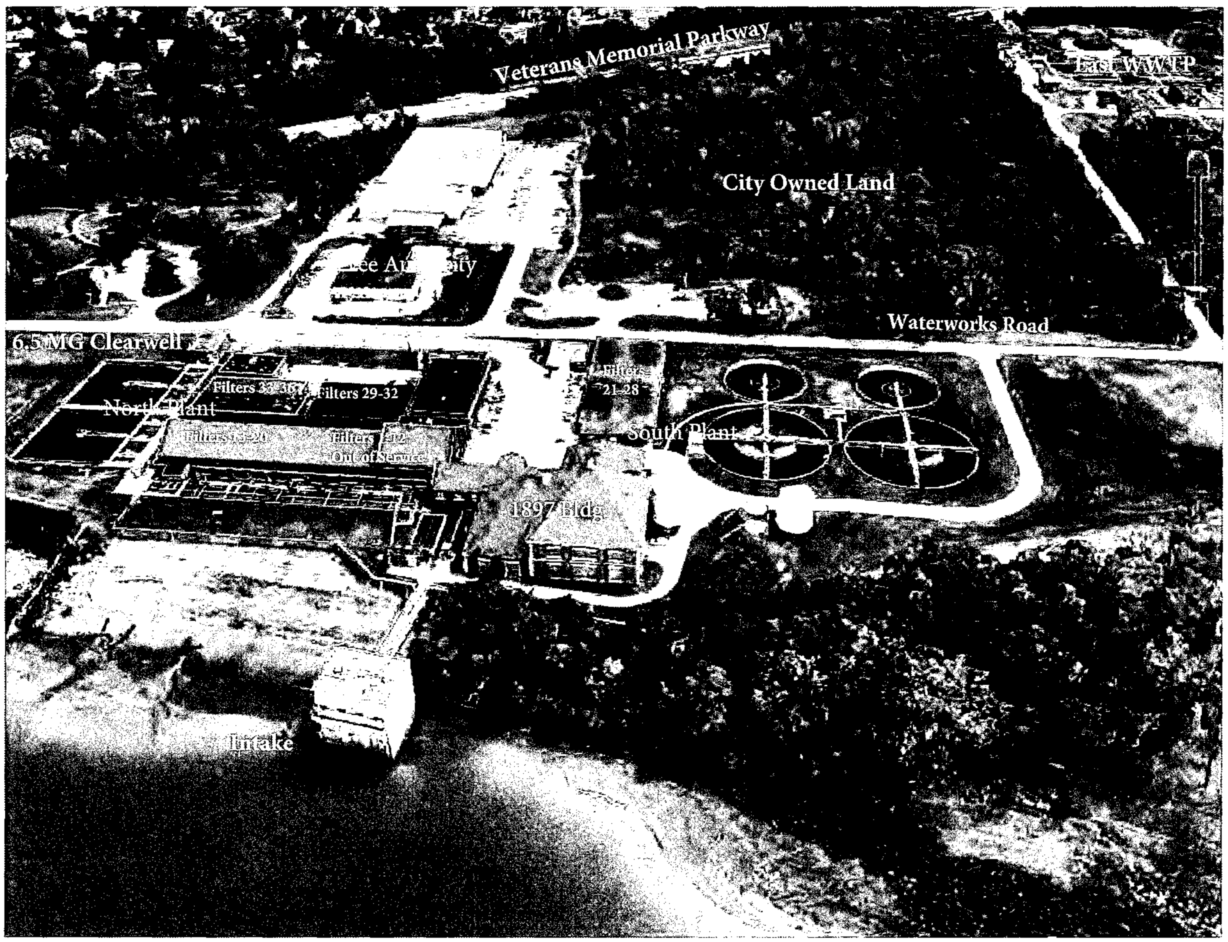
Building Computations

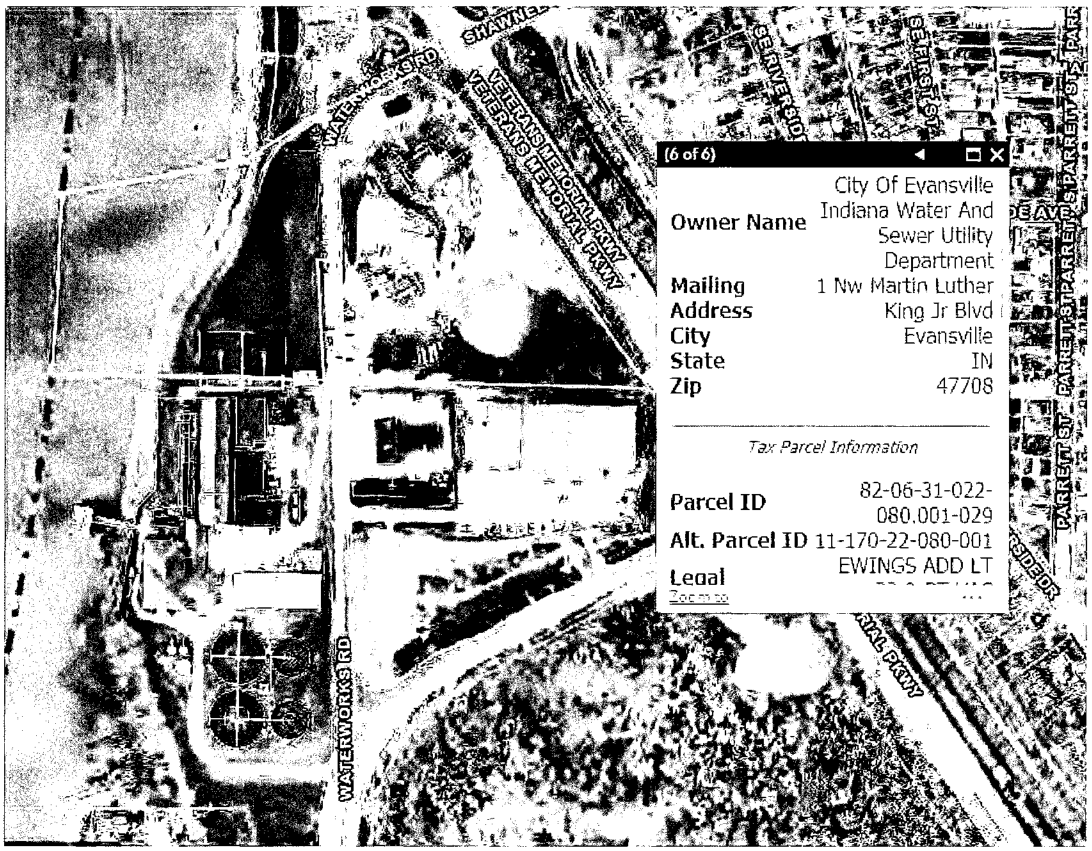
Sub-Total (all floors)	$2,556,576	Garages	$0
Racquetball/Squash	$0	Fireplaces	$0
Theater Balcony	$0	**Sub-Total (building)**	$3,092,006
Plumbing	$32,000	Quality (Grade)	$3,092,007
Other Plumbing	$5,300	Location Multiplier	1.00
Special Features	$498,130	**Repl. Cost New**	$3,092,006
Exterior Features	$0		

Summary of Improvements

Description	Res Eligibl	Story Height	Construction	Grade	Year Built	Eff Year	Eff Co Age nd	Base Rate	LCM	Adj Rate	Size	RCN	Norm Dep	Remain. Value	Abn Obs	PC	Nbhd	Mrkt	Improv Value
1: C/I Building C 02	0%	1	Concrete	C	1985	1985	36 A		1.00		52,800 sqft	$3,092,006	78%	$680,240	0%	100%	1.0000	1.0000	$680,200
2: Paving	0%	1	Concrete	C	1985	1985	36 A	$3.51	1.00	$3.51	6,648 sqft	$23,334	80%	$4,670	0%	100%	1.0000	1.0000	$4,700

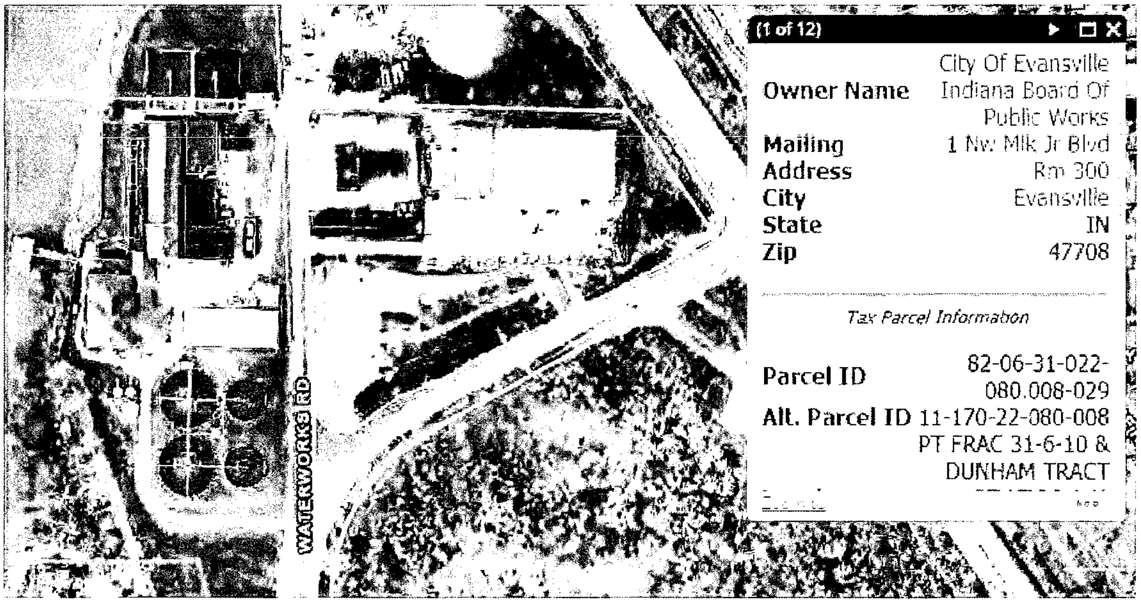
Total all pages $812,700 **Total this page** $684,900


Veterans Memorial Parkway
City Owned Land
Waterworks Road
6.5 MG Clearwell
Filters 29-32
North Plant
Filters
21-28
South Plant
1897 Bldg
Intake

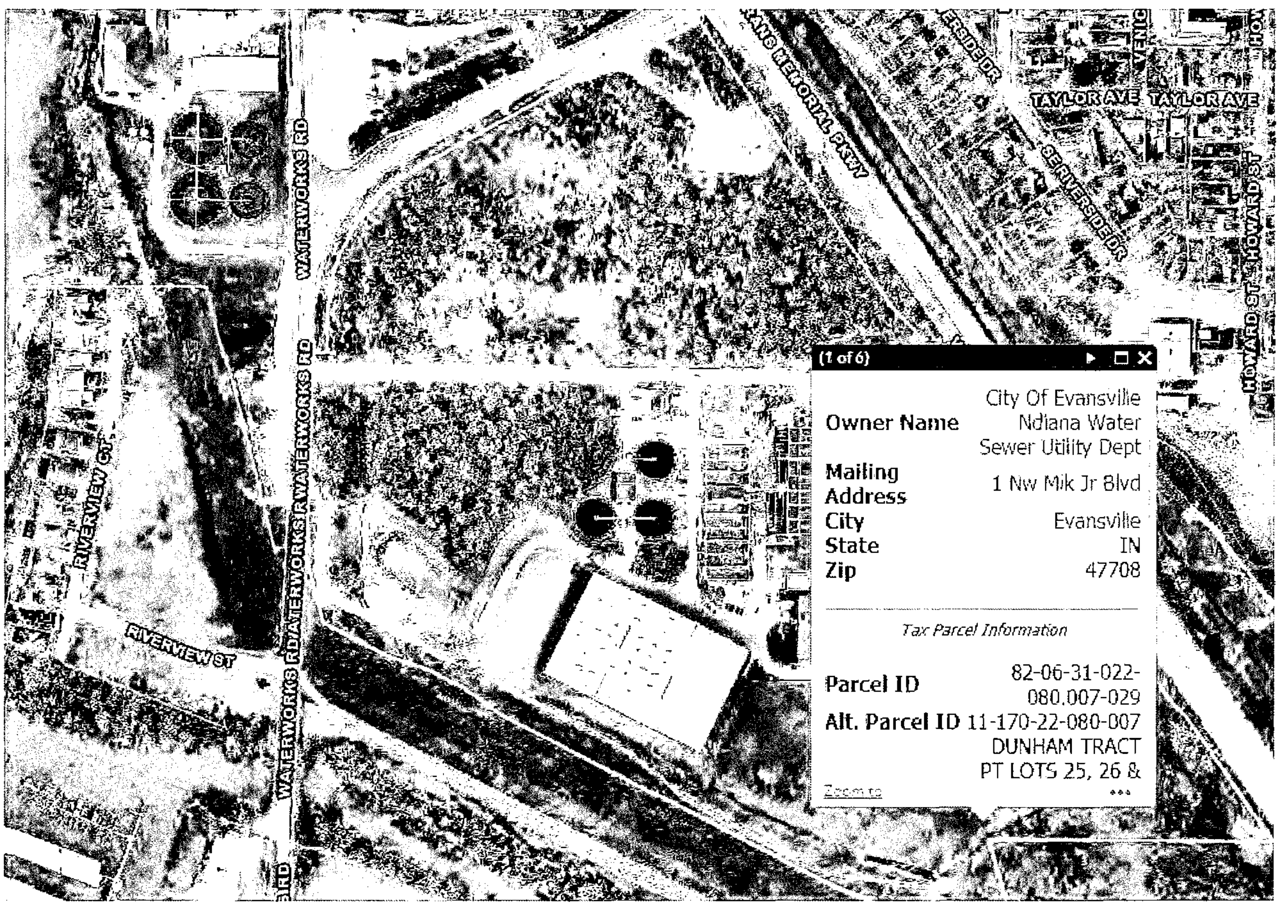


Existing Evansville Water Treatment Plant site (Parcel 1 of 2) showing the North Plant Primary Sedimentation tanks, High Service Pump Station No. 3 and the 6.5 MG Clearwell (not visible due to its underground location). 1200 Waterworks Road

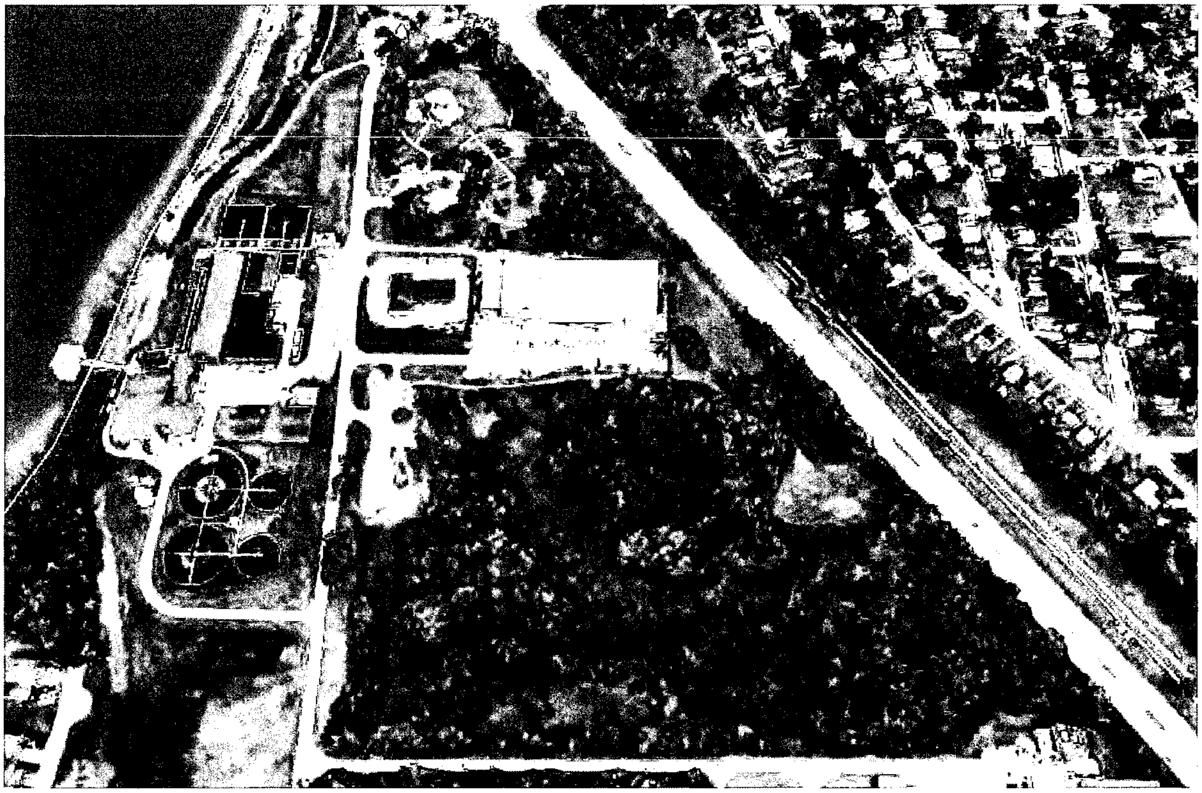
Existing Evansville Water Treatment Plant site (Parcel 2 of 2) - 1301 Waterworks Road. This parcel includes the majority of the water treatment plant but does not include the North Plant Primary Sedimentation tanks, a portion of High Service Pump Station No. 3 or the 6.5 MG Clearwell,



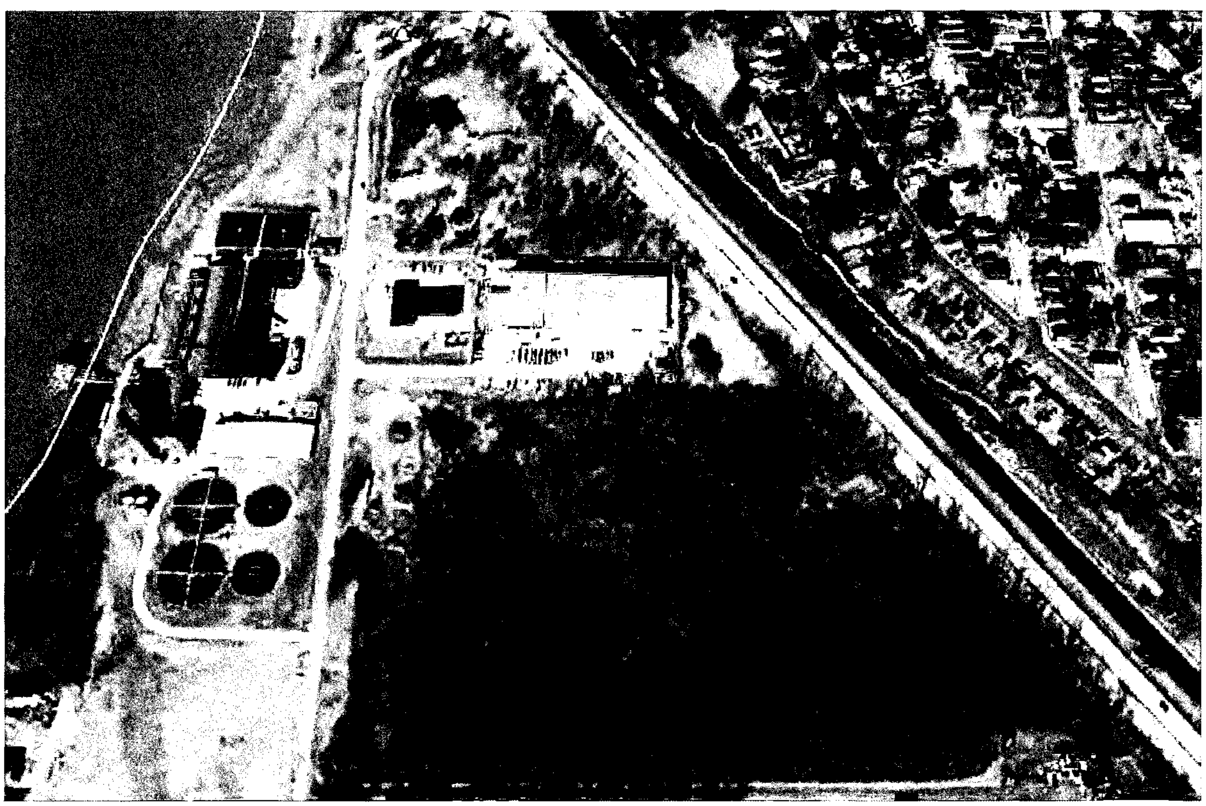
1400 Waterworks Road (13.05 acres). The exiting WTP is at the left. The Levee Authority Building is at the upper left of the parcel and the City garage is at the upper right.



1500 Waterworks Road (East WWTP) 62.80 acres

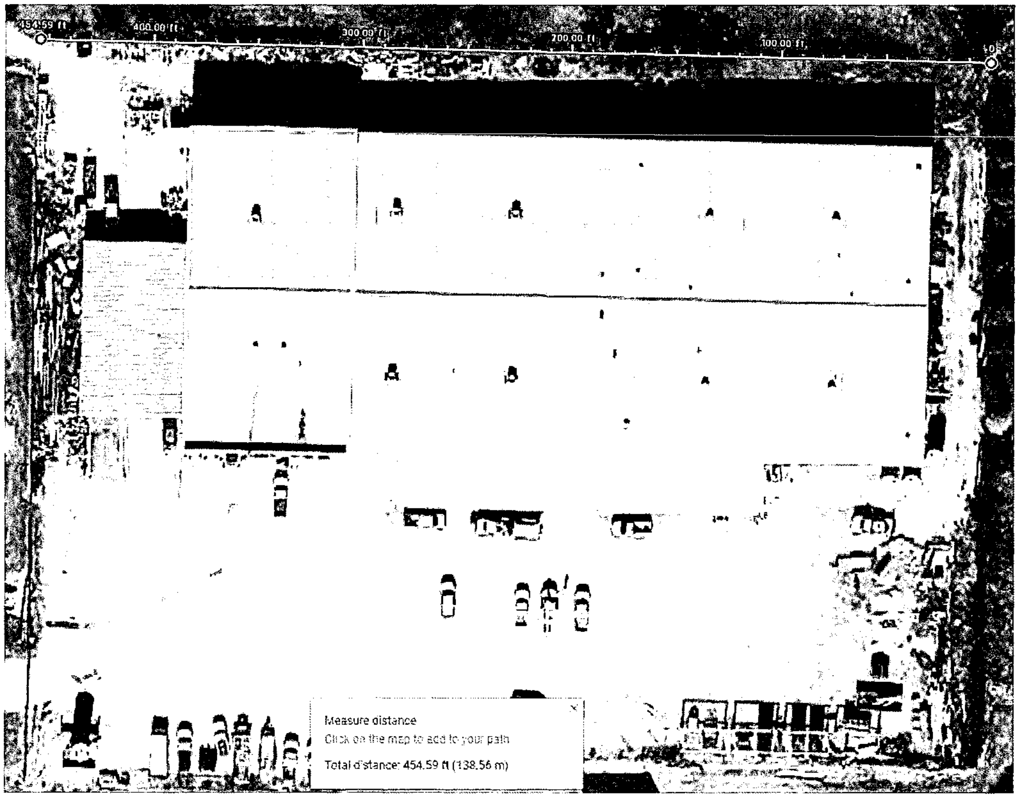


Pre 2019 aerial view

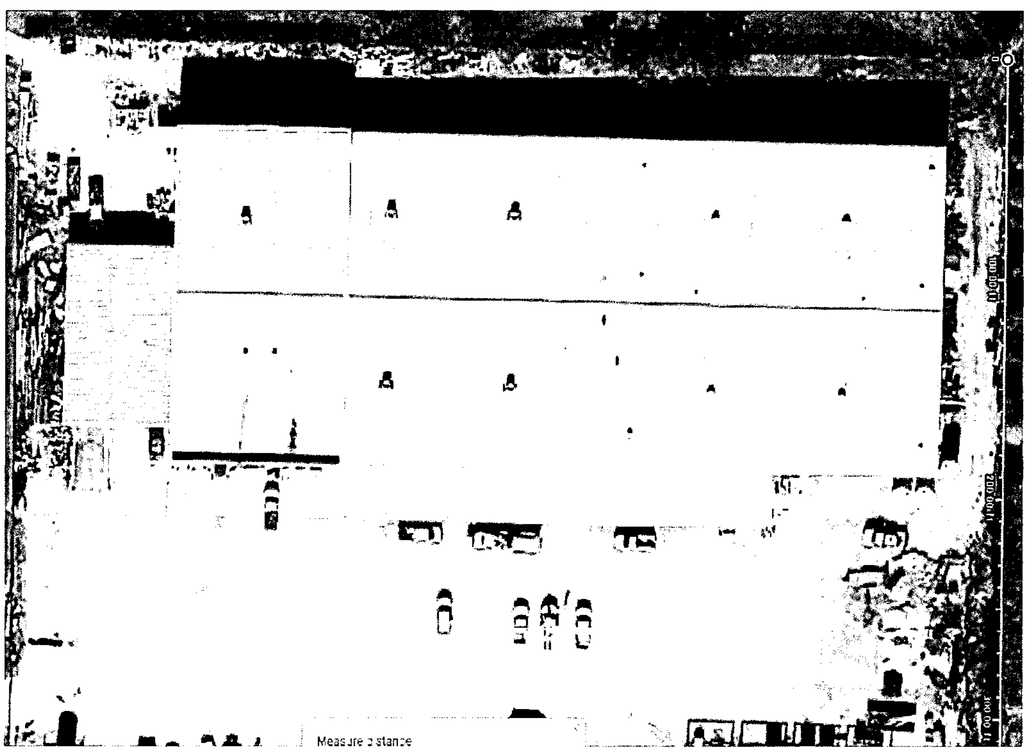


2/11/2018

2019 aerial photo



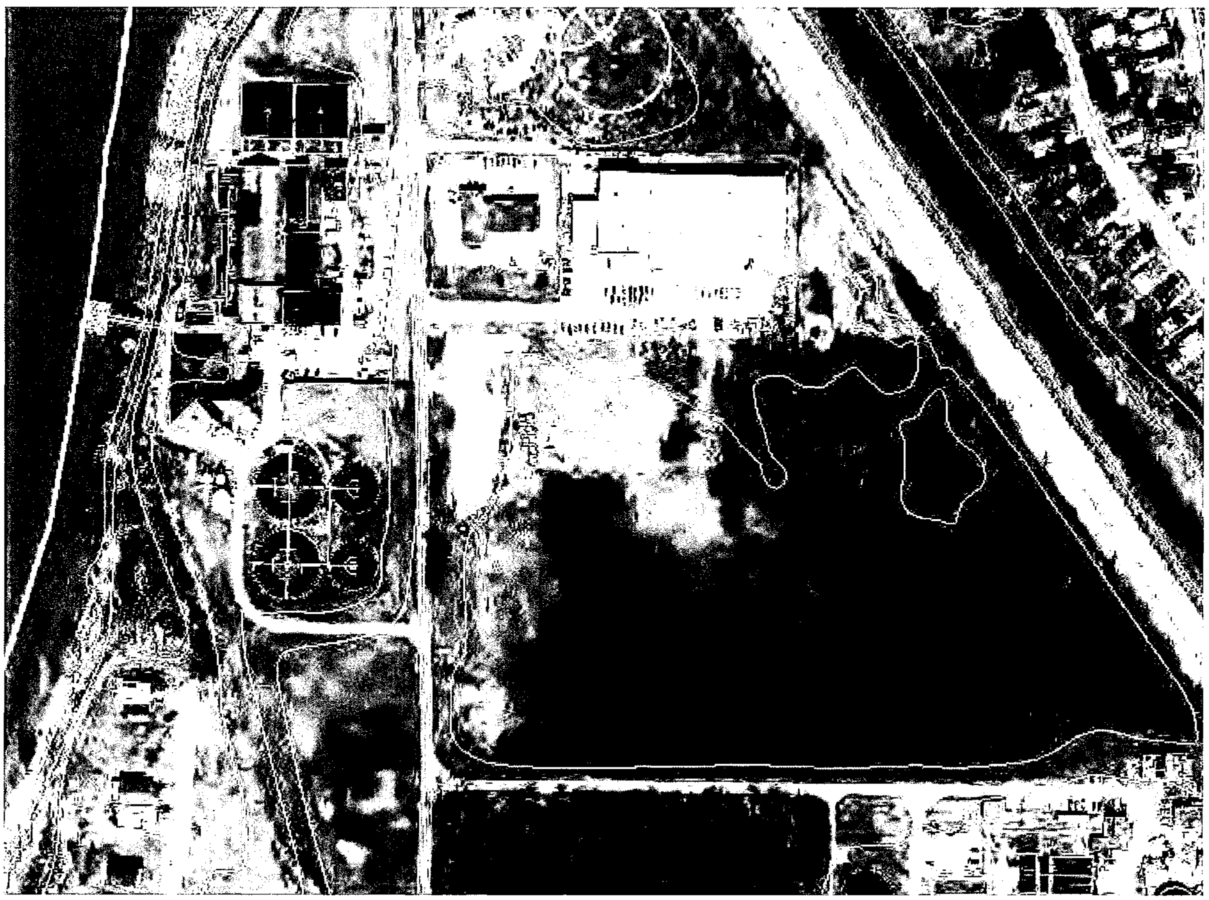
East – west lot dimension – 455 feet



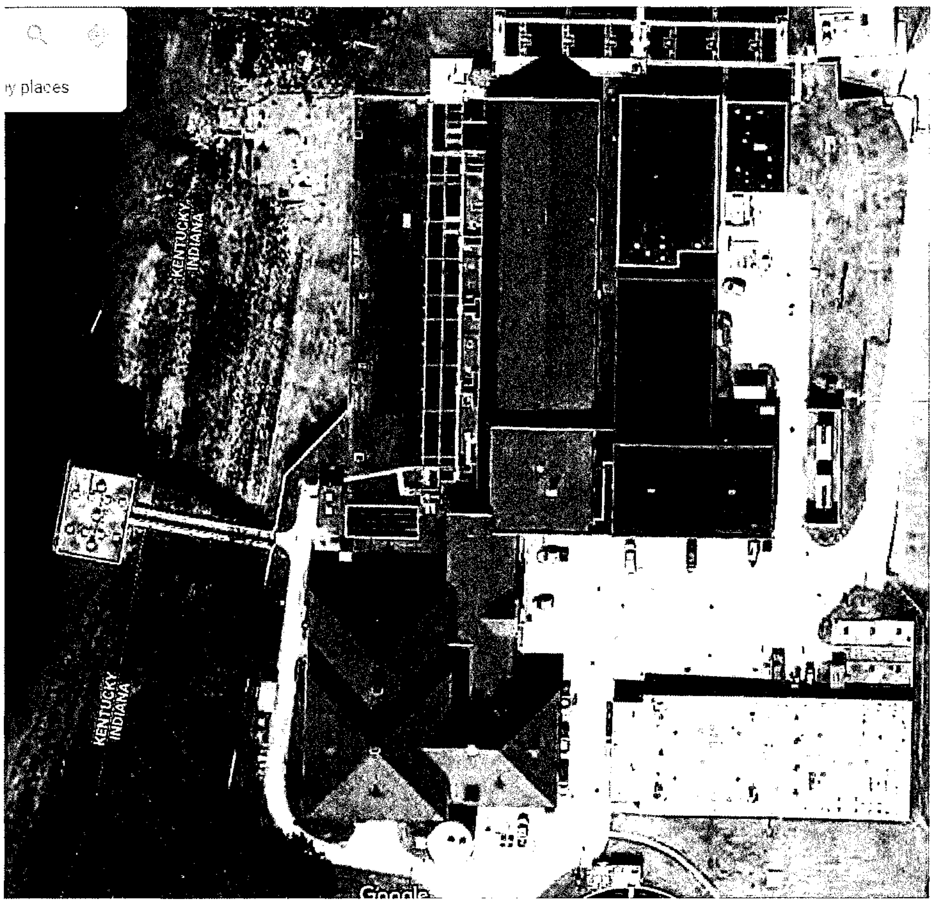
North-south lot dimension = 335 feet

Total site acreage = 455 ft (E-W) x 335 feet (N-S) = 152,425 square feet = 3.5 acres.

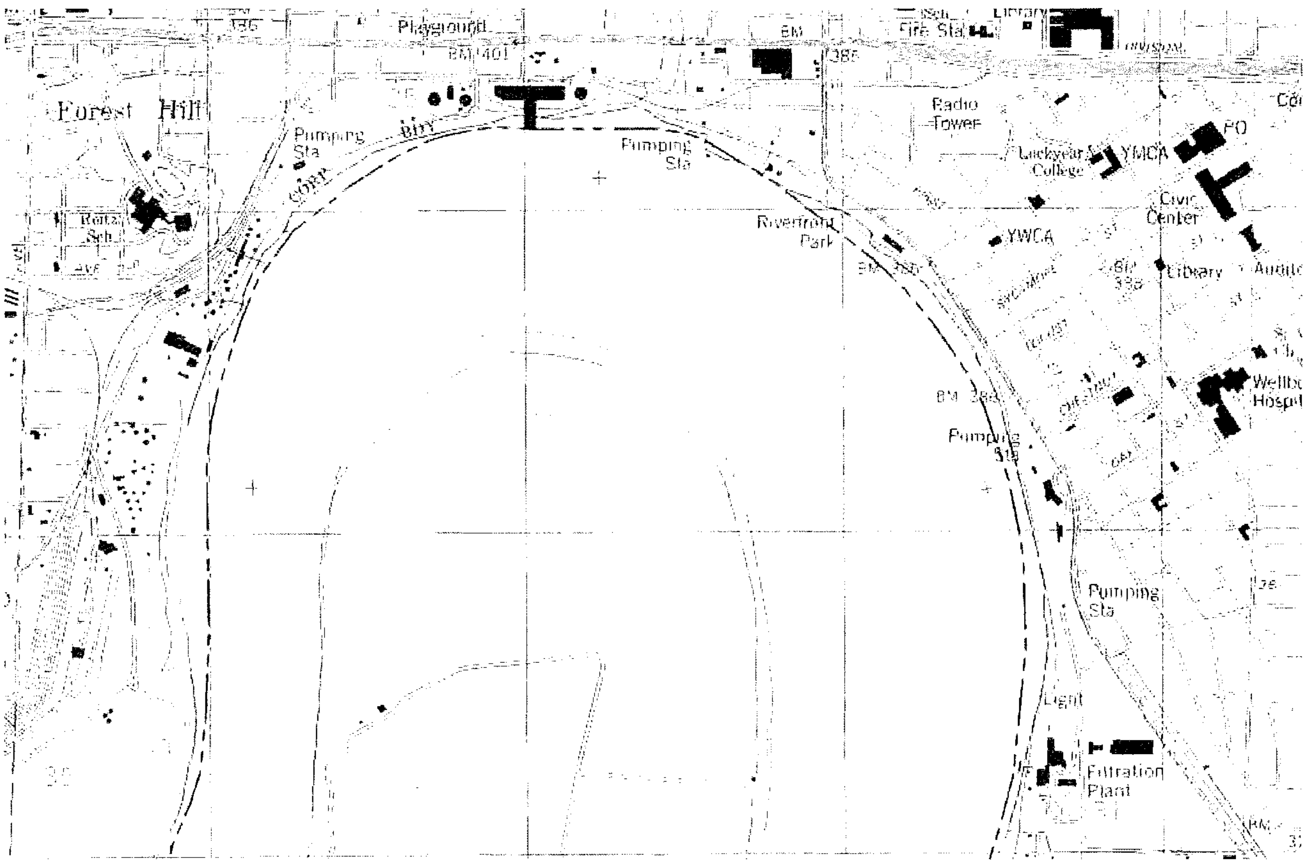
Pre 2019 aerial photo



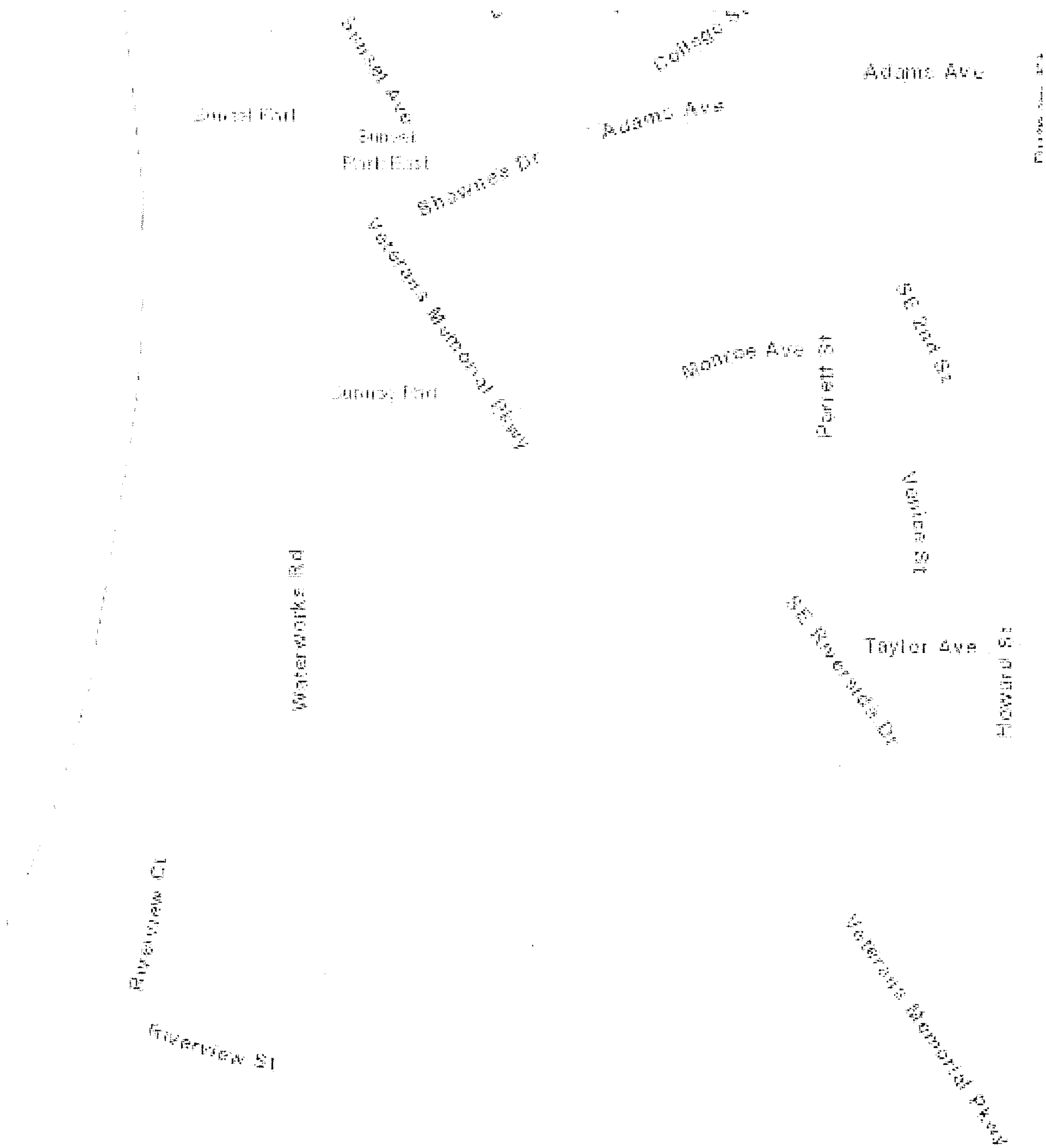
10 feet contour interval – DNR website 05/25/21 (pre 2019 aerial photo)



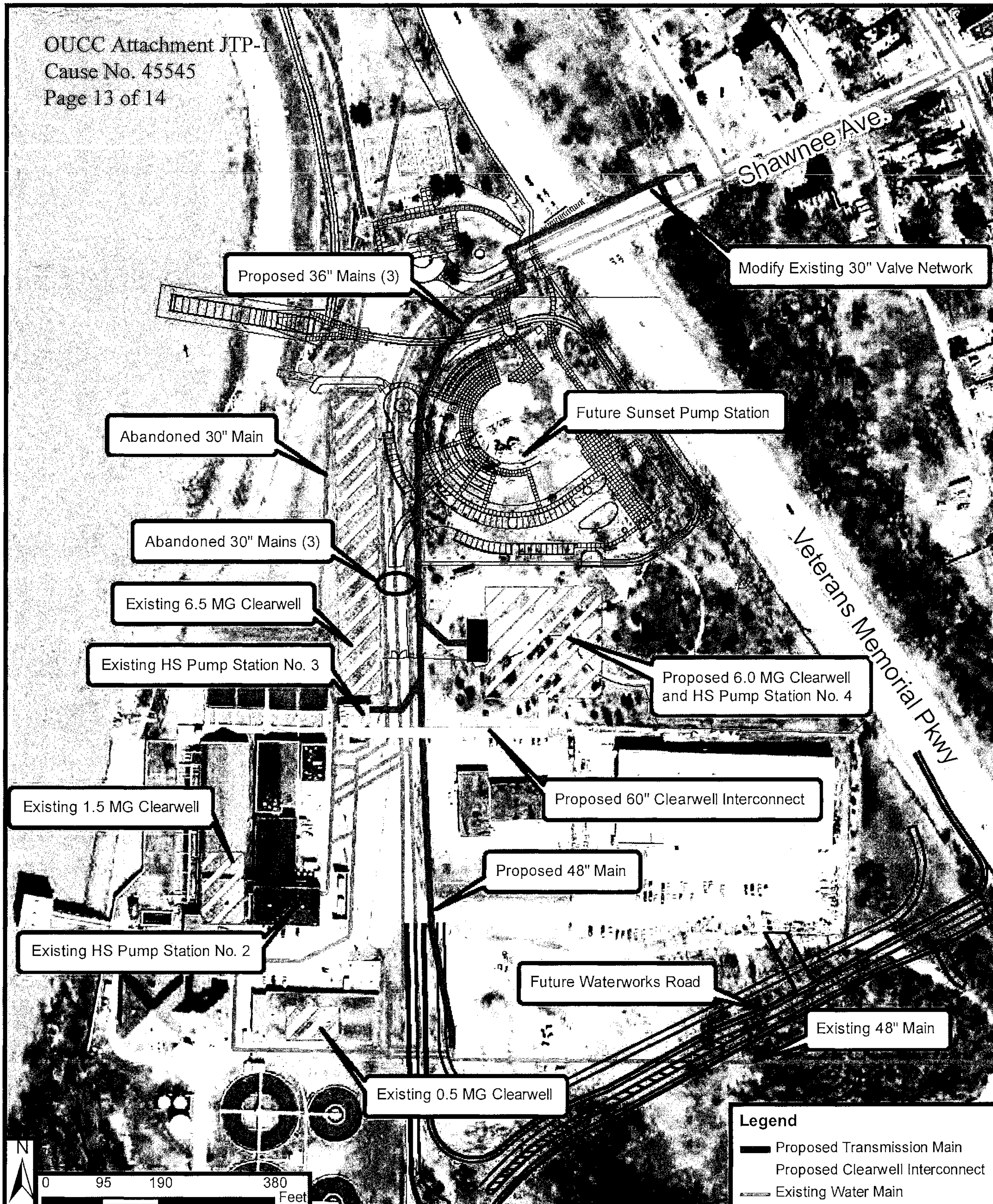
Evansville water treatment plant



1999 Topographic map showing the Filtration plant, Levee Authority and Street Department Maintenance garage (at lower right)



Site map of the Evansville water treatment plant, Levee Authority Building, City garage, Veterans Memorial Parkway, and Waterworks Road



VS ENGINEERING	Evansville Water and Sewer Utility	**Exhibit 25-23** **Proposed Project Layout**
HNTB	refresh EVANSVILLE	High Service Pump Station and Clearwell Project No. 25 June 2018

Table 25-9: Alternative 3A - Preliminary Project Cost Summary

Item No.	Item Description	Quantity	Unit	Unit Cost	Total Cost
1	36" Water Main, Ductile Iron (Open Cut)	3,200	LFT	$600	$1,920,000
2	36" Water Main, Ductile Iron (Jack/Bore)	500	LFT	$1,500	$750,000
3	48" Water Main, Ductile Iron	600	LFT	$700	$420,000
4	36" Fittings	20	EA	$15,000	$300,000
5	48" Fittings	5	EA	$25,000	$125,000
6	36" Gate Valve	12	EA	$40,000	$480,000
7	36" Valve Bevel Kit	12	EA	$15,000	$180,000
8	Valve Vault	12	EA	$15,000	$180,000
9	Flow Meter	2	EA	$50,000	$100,000
10	Connection to Existing 30" Main	6	EA	$25,000	$150,000
11	Granular Backfill/Paving	1	LS	$150,000	$150,000
12	Meter Telemetry and Electrical	1	LS	$50,000	$50,000
13	Water Main Abandonment (Cellular Grout Fill)	3,700	LF	$100	$370,000
Clearwell Interconnection					
14	60" Equalizer Piping	500	LF	$1,500	$750,000
15	Equalizer Gate Structure	2	LS	$200,000	$400,000
Clearwell and HSPs					
16	Clearwell (Post Tension)	1	LS	$4,225,000	$4,225,000
17	Clearwell Appurtenances (7% Clearwell Estimate)	1	LS	$295,750	$295,750
18	Excavation (10% Clearwell Estimate)	1	LS	$422,500	$422,500
19	Auger Cast Piles	484	EA	$4,500	$2,178,000
20	High Service Pump Station	1	LS	$3,000,000	$3,000,000
21	36" Discharge Piping, Ductile Iron (Open Cut)	300	LF	$600	$180,000
				Subtotal	**$16,626,250**
22	Mob./Demob., Clearing ROW, and MOT	1	15%	$2,493,938	$2,493,938
23	Contingency	1	10%	$1,912,019	$1,912,019
				Total Construction Cost	**$21,032,206**

D. Proposed Schedule

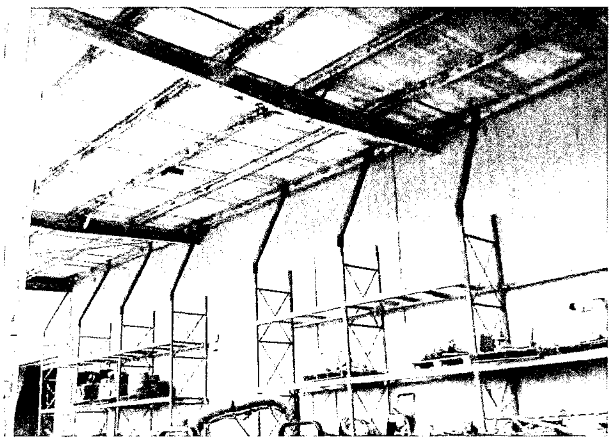
The proposed schedule spans **Time,** beginning with the notice to proceed in **Month** of 2020 and culmination with final completion of construction in **Month 2021.** Phasing of the proposed booster station will not be required for the proposed project. The proposed project schedule is shown in **Table 25-10.**

City garage – view looking north (OUCC photos - July 21, 2021)

City garage – view looking northeast of the south canopy

City garage – view looking northeast of the two-story office

City garage lot – view looking east of the equipment yard


City garage – view showing the condition of the south canopy

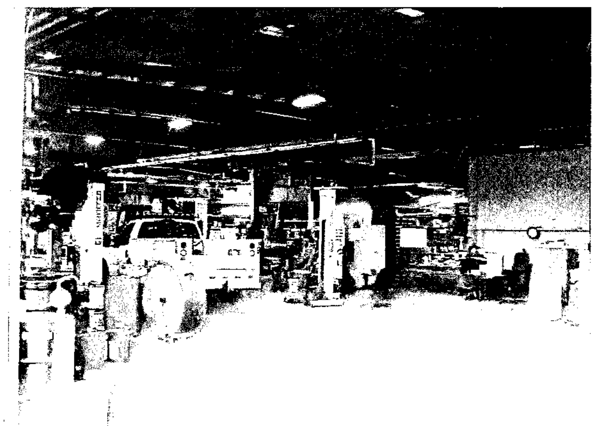

City garage – south canopy steel condition


City garage – view looking east from south canopy

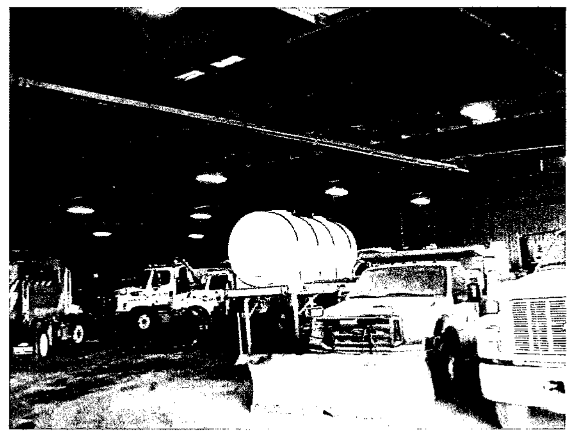

View west with the water treatment plant in the background

City garage – view looking east

City garage – view looking west

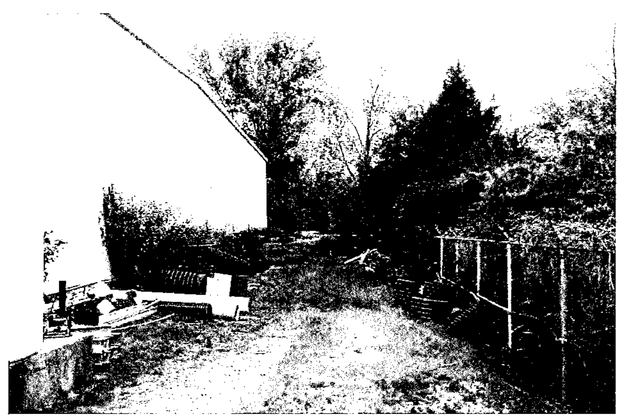


City garage – interior view



City garage – interior view

City garage – interior view



City garage – view looking north along east side of garage

Summary of Water Mains

Size In Inches	Laid Prior to 1922		Laid During 1922		Removed	Abandoned	TOTAL	
	Feet	Miles	Feet	Miles	Feet	Feet	Feet	Miles
1½	6,151	1.16	...			...	6,151	1.16
2	25,371	4.80	4,254	.80		...	29,625	5.61
3	5,200	.98	..	..			5,200	.98
4	70,822	13.41					70,822	13.41
6	433,000	82.00	8,010	1.52	750		440,260	83.30
8	96,817	18.33	10,835	2.05	...		107,652	20.40
10	12,789	2.42	...	...	...	....	12,788	2.42
12	66,734	12.63	2,035	.39	..		68,769	13.00
14	29,929	5.66	.....	...			29,929	5.66
16	350	.06	.....	...			350	.06
20	11,920	2.26	..				11,920	2.26
24	2,300	.44	....	...			2,300	.44
30	11,230	2.12						
Total	761,382	144.20	25,134	4.76	750		785,766	148.80

Valves in Distribution System, Dec. 31, 1922

Exclusive of Service

	1½"	2"	4"	6"	8"	10"	12"	16"	20"	24"	30"	Total
Distribution Mains	4	66	149	1,024	199	20	105	26	14	1	4	1,612
Hydrants	..		6	968								974
Fire Cisterns				27								27
Drains			6	11								17
Total	4	66	161	2,030	199	20	105	26	14	1	4	2,640

1922 Evansville Water Department Report
Water Mains

Water Mains Laid During Year of 1922

On	From	To	Feet	Size	Hyd.	Labor Cost	Material Cost	Total Cost
[illegible]	[illegible]	[illegible]	[illegible]	12"		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	700	12"		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	4975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]						
[illegible]	Franklin St.	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	Country Club [illegible]	[illegible]	[illegible]				
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Intersection	[illegible]	and Lincoln Ave.	[illegible]	[illegible]				
Intersection	[illegible]	and Lincoln Ave.	[illegible]	[illegible]				
Intersection	[illegible]	[illegible]	16	[illegible]				
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Intersection	[illegible]	Lincoln Ave.	[illegible]	[illegible]				
Intersection	[illegible]	[illegible]	45	[illegible]				
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Intersection	[illegible]	[illegible]	[illegible]	[illegible]				
Intersection	[illegible]	[illegible]	[illegible]	[illegible]				
Intersection	[illegible]	[illegible]	[illegible]	[illegible]				
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