



**dallas water utilities**  
**city of dallas**

## **AVERAGE COSTS MANUAL**

**FOR PIPELINE CONSTRUCTION COST ESTIMATION**

**SEPTEMBER 2021**

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## I. INTRODUCTION AND PURPOSE

The purpose of this *Average Costs Manual* is to aid the City Engineers and Consultants in estimating costs associated with pipeline construction. **This manual is not to be used for bidding purposes.** This manual should be used in conjunction with the following Manuals:

- *DWU Bid Item and Cost Estimating Manual.*
- *Dallas Water Utilities Standard Drawings for Water & Wastewater Construction.*
- *Dallas Water Utilities Water and Wastewater Procedures and Design Manual.*
- *City of Dallas Pavement Cut Manual.*

These manuals can be found on the City website at:

[https://dallascityhall.com/departments/waterutilities/Pages/dwu\\_design\\_standards.aspx](https://dallascityhall.com/departments/waterutilities/Pages/dwu_design_standards.aspx)  
<https://dallascityhall.com/departments/public-works/Pages/ConstructionStandards.aspx>

## II. METHODOLOGY AND APPROACH

The data used for the analysis in this manual was taken from all the bids for pipeline replacement contracts between February 2016 and March 2021. Bid prices from Joint Contracts (F) with agencies other than DWU and Private Contracts executed by developers were excluded from this analysis.

The Mean ( $\mu$ ) and Standard Deviation ( $\sigma$ ) was calculated from the following **Equation 1** and **Equation 2**, respectively.

### *Equation 1*

$\mu$ : Mean, N: Number of Bids, x: Bid Price

$$\mu = \frac{\sum_{i=1}^n x_i}{N}$$

### *Equation 2*

$\mu$ : Mean, N: Number of Bids, x: Bid Price,  $\sigma$ : Standard Deviation

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \mu)^2}{N}}$$

Bid Prices were only considered competitive if the cumulative probability was between 0.1 and 0.9. From the Z-Value Chart the cumulative probabilities for 0.1 and 0.9 would equal Z-values -1.2816 and 1.2816, respectively. The Z-Value Chart used can be found in the **Appendix**. The Z-Value (Z) was calculated from the following **Equation 3**.

**Equation 3**

$\mu$ : Mean,  $x$ : Bid Price,  $\sigma$ : Standard Deviation, Z: Z-value

$$Z_i = \frac{x_i - \mu}{\sigma}$$

The noncompetitive bids were omitted from the data and the Means and Standard Deviations were calculated from **Equation 1** and **Equation 2**, respectively.

DWU recognizes that other approaches are feasible and urges caution when utilizing this manual for all types of construction bids. Any questions regarding our chosen statistical approach can be discussed with DWU Engineering Services.

### III. BID ITEM PRICE CHART

There were 23 contracts included in this analysis consisting of bids from 86 separate bidders. These bids include 386 individual items and 6492 bid prices. 1110 of the bid prices were excluded as noncompetitive. A total of 5382 bid prices were used in the final analyst, 82.9% of possible data.

Item	Description	Unit	Mean	St.Dev	Count
1100D	2" Temporary Water Main	LS	\$127.00	\$103.00	4
1100H	6" Temporary Water Main	LS	\$100.00	\$0.00	2
1200D	2" Copper Water Main	LF	\$127.00	\$71.00	16
1500F	4" Ductile Iron Water Pipe	LF	\$149.00	\$54.00	6
1500H	6" Ductile Iron Water Pipe	LF	\$145.00	\$37.00	9
1500J	8" Ductile Iron Water Pipe	LF	\$164.00	\$61.00	10
1500K	10" Ductile Iron Water Pipe	LF	\$205.00	\$69.00	6
1500L	12" Ductile Iron Water Pipe	LF	\$462.00	\$83.00	4
1500Q	16" Ductile Iron Water Pipe	LF	\$345.00	\$144.00	26
1500S	20" Ductile Iron Water Pipe	LF	\$534.00	\$253.00	7
1500V	24" Ductile Iron Water Pipe	LF	\$818.00	\$464.00	7
1505J	8" Ductile Iron Water Pipe Aerial Crossing	LF	\$218.00	\$46.00	3
1505Q	16" Ductile Iron Water Pipe Aerial Crossing	LF	\$574.00	\$351.00	6
1600Y	30" Steel Water Pipe	LF	\$417.00	\$64.00	5
1600AE	48" Steel Water Pipe	LF	\$576.00	\$104.00	5
1600AJ	72" Steel Water Pipe	LF	\$1,744.00	\$44.00	2
1800F	4" PVC Water Pipe	LF	\$85.00	\$18.00	47
1800H	6" PVC Water Pipe	LF	\$92.00	\$24.00	59
1800J	8" PVC Water Pipe	LF	\$101.00	\$24.00	65
1800K	10" PVC Water Pipe	LF	\$135.00	\$0.00	1
1800L	12" PVC Water Pipe	LF	\$165.00	\$51.00	52
1805Q	16" PVC Water Pipe	LF	\$252.00	\$112.00	22
1810F	4" Fusible PVC Water Pipe	LF	\$75.00	\$47.00	7
2000S	20" Bar-Wrapped Concrete Cylinder Pipe	LF	\$411.00	\$26.00	3
2000V	24" Bar-Wrapped Concrete Cylinder Pipe	LF	\$1,021.00	\$246.00	7
2000Y	30" Bar-Wrapped Concrete Cylinder Pipe	LF	\$682.00	\$18.00	2
2010Q	16" Prestressed Concrete Cylinder Pipe	LF	\$696.00	\$205.00	4
2010V	24" Prestressed Concrete Cylinder Pipe	LF	\$971.00	\$209.00	6
2010AA	36" Prestressed Concrete Cylinder Pipe	LF	\$519.00	\$212.00	9
2010AF	54" Prestressed Concrete Cylinder Pipe	LF	\$2,162.00	\$1,045.00	6
2010AJ	72" Prestressed Concrete Cylinder Pipe	LF	\$1,039.00	\$178.00	6
2100QX	16" Extra Depth Water Pipe (+20')	LF	\$402.00	\$70.00	3
2100AJX	72" Extra Depth Water Pipe (+20')	LF	\$101.00	\$100.00	2

Item	Description	Unit	Mean	St.Dev	Count
2200J	Rehabilitation of Existing 8" Water Main	LF	\$112.00	\$35.00	3
3000J	8" Clay Wastewater Pipe	LF	\$127.00	\$10.00	3
3000L	12" Clay Wastewater Pipe	LF	\$217.00	\$29.00	3
3000N	15" Clay Wastewater Pipe	LF	\$199.00	\$7.00	2
3100J	8" PVC Wastewater Pipe	LF	\$88.00	\$10.00	11
3100K	10" PVC Wastewater Pipe	LF	\$103.00	\$3.00	2
3100L	12" PVC Wastewater Pipe	LF	\$132.00	\$18.00	2
3100N	15" PVC Wastewater Pipe	LF	\$157.00	\$32.00	9
3100R	18" PVC Wastewater Pipe	LF	\$219.00	\$144.00	6
3100U	21" PVC Wastewater Pipe	LF	\$243.00	\$7.00	2
3100V	24" PVC Wastewater Pipe	LF	\$275.00	\$49.00	5
3100W	27" PVC Wastewater Pipe	LF	\$352.00	\$52.00	3
3100Y	30" PVC Wastewater Pipe	LF	\$400.00	\$71.00	3
3110D	2" PVC Pressure Rated Wastewater Pipe	LF	\$65.00	\$0.00	2
3110H	6" PVC Pressure Rated Wastewater Pipe	LF	\$132.00	\$70.00	9
3110J	8" PVC Pressure Rated Wastewater Pipe	LF	\$100.00	\$17.00	48
3110K	10" PVC Pressure Rated Wastewater Pipe	LF	\$115.00	\$23.00	20
3110L	12" PVC Pressure Rated Wastewater Pipe	LF	\$131.00	\$28.00	47
3110V	24" PVC Pressure Rated Wastewater Pipe	LF	\$247.00	\$42.00	5
3120Q	16" PVC Pressure Rated Wastewater Pipe	LF	\$189.00	\$41.00	25
3120R	18" PVC Pressure Rated Wastewater Pipe	LF	\$201.00	\$49.00	12
3120S	20" PVC Pressure Rated Wastewater Pipe	LF	\$250.00	\$30.00	3
3120V	24" PVC Pressure Rated Wastewater Pipe	LF	\$274.00	\$47.00	4
3120Y	30" PVC Pressure Rated Wastewater Pipe	LF	\$253.00	\$7.00	2
3120AA	36" PVC Pressure Rated Wastewater Pipe	LF	\$264.00	\$6.00	2
3410R	30" Reinforced Concrete Wastewater Pipe	LF	\$252.00	\$12.00	2
3420W	27" RTRP Wastewater Pipe	LF	\$516.00	\$304.00	7
3420Y	30" RTRP Wastewater Pipe	LF	\$497.00	\$44.00	3
3420Z	33" RTRP Wastewater Pipe	LF	\$317.00	\$52.00	5
3420AC	42" RTRP Wastewater Pipe	LF	\$676.00	\$338.00	3
3420AE	48" RTRP Wastewater Pipe	LF	\$942.00	\$117.00	4
3420AF	54" RTRP Wastewater Pipe	LF	\$941.00	\$591.00	8
3420AG	60" RTRP Wastewater Pipe	LF	\$420.00	\$80.00	2
3420AK	78" RTRP Wastewater Pipe	LF	\$488.00	\$63.00	2
3420AL	84" RTRP Wastewater Pipe	LF	\$575.00	\$25.00	2
3420AN	96" RTRP Wastewater Pipe	LF	\$1,839.00	\$39.00	2
3420AQ	102" RTRP Wastewater Pipe	LF	\$573.00	\$28.00	2
3420AU	120" RTRP Wastewater Pipe	LF	\$875.00	\$25.00	2
3430R	18" HDPE Wastewater Pipe	LF	\$331.00	\$120.00	6
3520H	Rehabilitation of Existing 6" Wastewater Main	LF	\$71.00	\$13.00	7

Item	Description	Unit	Mean	St.Dev	Count
3520J	Rehabilitation of Existing 8" Wastewater Main	LF	\$76.00	\$40.00	20
3520K	Rehabilitation of Existing 10" Wastewater Main	LF	\$200.00	\$0.00	2
3520L	Rehabilitation of Existing 12" Wastewater Main	LF	\$146.00	\$53.00	6
3520N	Rehabilitation of Existing 15" Wastewater Main	LF	\$177.00	\$69.00	6
3520Q	Rehabilitation of Existing 16" Wastewater Main	LF	\$353.00	\$158.00	3
3520R	Rehabilitation of Existing 18" Wastewater Main	LF	\$220.00	\$60.00	9
3520U	Rehabilitation of Existing 21" Wastewater Main	LF	\$193.00	\$59.00	6
3520AB	Rehabilitation of Existing 39" Wastewater Main	LF	\$470.00	\$141.00	3
3520AF	Rehabilitation of Existing 54" Wastewater Main	LF	\$467.00	\$119.00	5
3520AK	Rehabilitation of Existing 78" Wastewater Main	LF	\$1,465.00	\$65.00	2
3540H	Point Repair of 6" Wastewater Main	EA	\$1,799.00	\$688.00	6
3540J	Point Repair of 8" Wastewater Main	EA	\$1,597.00	\$1,100.00	16
3540K	Point Repair of 10" Wastewater Main	EA	\$1,630.00	\$1,058.00	12
3540L	Point Repair of 12" Wastewater Main	EA	\$2,671.00	\$1,524.00	8
3540N	Point Repair of 15" Wastewater Main	EA	\$4,289.00	\$1,541.00	5
3540U	Point Repair of 21" Wastewater Main	EA	\$7,302.00	\$3,016.00	6
3540AB	Point Repair of 39" Wastewater Main	EA	\$12,000.00	\$1,000.00	2
3540AF	Point Repair of 54" Wastewater Main	EA	\$8,765.00	\$2,556.00	4
3550	Removal of Internal Obstructions for Wastewater Mains	EA	\$791.00	\$511.00	22
3560	Connection to Existing Manhole	EA	\$2,469.00	\$1,589.00	38
3570HxJ	Pipe Bursting (6" to 8")	LF	\$107.00	\$25.00	23
3570JxJ	Pipe Bursting (8" to 8")	LF	\$103.00	\$22.00	16
3570JxL	Pipe Bursting (8" to 12")	LF	\$118.00	\$17.00	3
3570KxL	Pipe Bursting (10" to 12")	LF	\$141.00	\$36.00	13
3570LxQ	Pipe Bursting (12" to 16")	LF	\$186.00	\$22.00	3
3570LxR	Pipe Bursting (12" to 18")	LF	\$209.00	\$42.00	9
3570RxR	Pipe Bursting (18" to 18")	LF	\$171.00	\$0.00	1
3570UxV	Pipe Bursting (21" to 24")	LF	\$399.00	\$41.00	4
3700JX	8" Extra Depth Wastewater Pipe (+20')	LF	\$217.00	\$13.00	3
3700AEX	48" Extra Depth Wastewater Pipe (+20')	LF	\$1.00	\$1.00	2
5020	Extra Iron Fittings for Non-Plan Alignment Changes	TN	\$649.00	\$1,127.00	60
5050	Water Service	EA	\$1,510.00	\$496.00	61
5060FxF	4" Combined Service with 4" Meter and Transfer	EA	\$14,964.00	\$2,442.00	5
5060HxH	6" Combined Service with 6" Meter and Transfer	EA	\$15,250.00	\$1,250.00	2
5061FxE	4" Domestic Service with 3" Meter and Transfer	EA	\$12,690.00	\$2,570.00	6
5061FxF	4" Domestic Service with 4" Meter and Transfer	EA	\$10,539.00	\$2,556.00	7
5062HxH	6" Closed Fireline Service with 6" D.C. Device and Transfer	EA	\$9,209.00	\$761.00	6
5062JxH	8" Closed Fireline Service with 6" D.C. Device and Transfer	EA	\$8,700.00	\$300.00	2
5062JxJ	8" Closed Fireline Service with 8" D.C. Device and Transfer	EA	\$9,785.00	\$2,215.00	2
5064FxF	4" Combined Service with 4" Meter	EA	\$12,443.00	\$2,169.00	4

Item	Description	Unit	Mean	St.Dev	Count
5064HxH	6" Combined Service with 6" Meter	EA	\$14,038.00	\$1,964.00	4
5064JxH	8" Combined Service with 6" Meter	EA	\$14,815.00	\$1,104.00	4
5064JxJ	8" Combined Service with 8" Meter	EA	\$15,484.00	\$1,252.00	3
5066FxF	4" Closed Fireline Service with 4" D.C. Device	EA	\$5,940.00	\$1,660.00	4
5066HxH	6" Closed Fireline Service with 6" D.C. Device	EA	\$5,747.00	\$1,056.00	4
5066JxJ	8" Closed Fireline Service with 8" D.C. Device	EA	\$6,088.00	\$899.00	4
5080	Reconnect Existing Water Service	EA	\$1,690.00	\$869.00	11
5091	Install Fire Hydrant	EA	\$3,464.00	\$806.00	61
5092	Remove Existing Fire Hydrant	EA	\$373.00	\$217.00	68
5093	Deliver Fire Hydrant	EA	\$92.00	\$60.00	65
5100F	4" Gate Valve	EA	\$881.00	\$206.00	44
5100H	6" Gate Valve	EA	\$1,214.00	\$387.00	62
5100J	8" Gate Valve	EA	\$1,601.00	\$448.00	62
5100L	12" Gate Valve	EA	\$2,624.00	\$468.00	52
5100Q	16" Gate Valve	EA	\$14,689.00	\$2,600.00	24
5100S	20" Gate Valve	EA	\$50,319.00	\$8,191.00	6
5100Y	30" Gate Valve	EA	\$106,845.00	\$15,099.00	7
5100AA	36" Gate Valve	EA	\$29,182.00	\$10,002.00	5
5105S	20" Gate Valve (Place Only)	EA	\$25,750.00	\$0.00	1
5105V	24" Gate Valve (Place Only)	EA	\$31,167.00	\$4,589.00	3
5105AA	36" Gate Valve (Place Only)	EA	\$37,400.00	\$5,310.00	3
5110JxH	8"x6" Tapping Sleeve	EA	\$2,750.00	\$250.00	2
5110LxJ	12"x8" Tapping Sleeve	EA	\$2,863.00	\$875.00	8
5110QxF	16"x4" Tapping Sleeve	EA	\$3,917.00	\$1,638.00	3
5110QxJ	16"x8" Tapping Sleeve	EA	\$5,639.00	\$1,822.00	18
5110VxL	24"x12" Tapping Sleeve	EA	\$9,162.00	\$3,283.00	5
5110YxL	30"x12" Tapping Sleeve	EA	\$7,050.00	\$450.00	2
5110RxJ	18"x8" Tapping Sleeve	EA	\$4,500.00	\$500.00	2
5110JxF	8"x4" Tapping Sleeve	EA	\$1,710.00	\$290.00	2
5110YxJ	30"x8" Tapping Sleeve	EA	\$8,567.00	\$2,953.00	6
5110AAxJ	36"x8" Tapping Sleeve	EA	\$11,359.00	\$1,432.00	3
5110AExQ	48"x16" Tapping Sleeve	EA	\$11,000.00	\$1,000.00	2
5110AExAE	48"x48" Tapping Sleeve	EA	\$24,000.00	\$1,000.00	2
5110AGxL	60"x12" Tapping Sleeve	EA	\$33,750.00	\$1,250.00	2
5120H	Remove, Salvage, & Deliver 6" Valve	EA	\$800.00	\$0.00	2
5120J	Remove, Salvage, & Deliver 8" Valve	EA	\$850.00	\$50.00	2
5120V	Remove, Salvage, & Deliver 24" Valve	EA	\$2,425.00	\$862.00	4
5130H	6" Cut-In Valve	EA	\$4,150.00	\$550.00	2
5130J	8" Cut-In Valve	EA	\$3,597.00	\$1,483.00	9
5140J	8" Flap Valve	EA	\$1,610.00	\$678.00	5

Item	Description	Unit	Mean	St.Dev	Count
5150AG	60" Access Manhole	EA	\$10,000.00	\$0.00	2
5150AJ	72" Access Manhole	EA	\$24,767.00	\$23,648.00	29
5150AL	84" Access Manhole	EA	\$19,300.00	\$2,700.00	2
5150ALX	84" Access Manhole (+20')	EA	\$23,350.00	\$1,650.00	2
5155AE	48" Access Manhole with Blowoff	EA	\$71,115.00	\$0.00	1
5155AJ	72" Access Manhole with Blowoff	EA	\$28,940.00	\$12,057.00	24
5160AG	60" Diameter Water Manhole	EA	\$15,861.00	\$4,616.00	18
5160AJ	72" Diameter Water Manhole	EA	\$18,832.00	\$3,725.00	19
5180AJX	72" Water Manhole -Extra Depth (+20')	EA	\$64,675.00	\$40,164.00	4
5200AE	48" Butterfly Valve	EA	\$58,124.00	\$8,107.00	6
5200AJ	72" Butterfly Valve	EA	\$108,250.00	\$16,750.00	2
5205AE	48" Butterfly Valve (Place Only)	EA	\$455,108.00	\$0.00	1
5205AJ	72" Butterfly Valve (Place Only)	EA	\$45,000.00	\$2,161.00	3
5306	Impressed Current Cathodic Protection System	EA	\$44,767.00	\$4,096.00	3
5310	Corrosion Control Test Station	EA	\$4,242.00	\$4,213.00	17
5500J	8" Water Main (BOTO C)	LF	\$323.00	\$52.00	27
5500L	12" Water Main (BOTO C)	LF	\$492.00	\$152.00	16
5500Q	16" Water Main (BOTO C)	LF	\$738.00	\$274.00	10
5500AA	36" Water Main (BOTO C)	LF	\$1,877.00	\$294.00	4
5500AJ	72" Water Main (BOTO C)	LF	\$7,944.00	\$450.00	3
5505F	4" Water Main by Horiz. Directional Drilling	LF	\$143.00	\$44.00	4
5510L	12" Water, Highway Crossing (BOTO C)	LF	\$606.00	\$128.00	5
5510Q	16" Water, Highway Crossing (BOTO C)	LF	\$503.00	\$58.00	5
5510AJ	72" Water, Highway Crossing (BOTO C)	LF	\$4,805.00	\$2,746.00	8
5520J	8" Water, Highway Crossing (by Open Cut)	LF	\$135.00	\$22.00	3
5520L	12" Water, Highway Crossing (by Open Cut)	LF	\$260.00	\$0.00	2
5520Q	16" Water, Highway Crossing (by Open Cut)	LF	\$239.00	\$43.00	7
5530L	12" Water, RR Crossing (BOTO C)	LF	\$497.00	\$97.00	2
5530Q	16" Water, RR Crossing (BOTO C)	LF	\$1,846.00	\$184.00	4
5530AA	36" Water, RR Crossing (BOTO C)	LF	\$2,179.00	\$238.00	3
5530AJ	72" Water, RR Crossing (BOTO C)	LF	\$6,935.00	\$735.00	2
5540L	12" Water, RR Crossing (by Open Cut)	LF	\$173.00	\$17.00	2
5550F	4" Water Main Crossing (BOTO C)	LF	\$335.00	\$35.00	2
5550H	6" Water Main Crossing (BOTO C)	LF	\$324.00	\$62.00	3
5550J	8" Water Main Crossing (BOTO C)	LF	\$289.00	\$51.00	8
5560H	6" Water Main Crossing (by Open Cut)	LF	\$153.00	\$29.00	3
5560J	8" Water Main Crossing (by Open Cut)	LF	\$189.00	\$34.00	17
5560L	12" Water Main Crossing (by Open Cut)	LF	\$200.00	\$60.00	16
5560Q	16" Water Main Crossing (by Open Cut)	LF	\$284.00	\$145.00	13
5580S	20" Dished Head Plug	EA	\$3,300.00	\$990.00	3

Item	Description	Unit	Mean	St.Dev	Count
5580AA	36" Dished Head Plug	EA	\$6,673.00	\$2,251.00	9
5580AJ	72" Dished Head Plug	EA	\$4,047.00	\$2,011.00	6
5585Y	30" Test Fitting	EA	\$3,300.00	\$2,500.00	8
5585AA	36" Test Fitting	EA	\$18,235.00	\$1,656.00	4
5585AE	48" Test Fitting	EA	\$6,098.00	\$2,722.00	4
5585AJ	72" Test Fitting	EA	\$3,689.00	\$2,585.00	5
5590Y	30" Night Cap Plug	EA	\$1,171.00	\$656.00	6
5590AA	36" Night Cap Plug	EA	\$1,938.00	\$1,026.00	6
5590AE	48" Night Cap Plug	EA	\$1,737.00	\$883.00	6
5590AF	54" Night Cap Plug	EA	\$1,775.00	\$550.00	4
5590AJ	72" Night Cap Plug	EA	\$2,117.00	\$934.00	11
5600	Cut and Plug Existing Water Main	EA	\$1,114.00	\$1,139.00	69
5605	Cut and Plug Existing Asbestos-Cement Water Main	EA	\$251.00	\$250.00	2
5610	Cut and Plug Water Main for Test	EA	\$680.00	\$717.00	57
5650	Remove & Dispose of Lead Pipe Joint	EA	\$1,035.00	\$847.00	49
5660	Connection to Existing Asbestos-Cement Water Main	EA	\$1,850.00	\$150.00	2
5750B	1" Flush Point	EA	\$1,312.00	\$387.00	10
5750D	2" Flush Point	EA	\$2,329.00	\$605.00	22
5755B	Automated 1" Flush Point	EA	\$7,250.00	\$987.00	17
5755D	Automated 2" Flush Point	EA	\$7,852.00	\$1,164.00	27
5761	Type 1 Air Valve Installation	EA	\$6,671.00	\$1,546.00	18
5762D	2" Type 2 Air Valve Installation	EA	\$12,000.00	\$2,161.00	3
5762E	3" Type 2 Air Valve Installation	EA	\$22,296.00	\$2,576.00	6
5762F	4" Type 2 Air Valve Installation	EA	\$13,175.00	\$5,542.00	4
5762H	6" Type 2 Air Valve Installation	EA	\$18,085.00	\$7,069.00	11
5762J	8" Type 2 Air Valve Installation	EA	\$15,916.00	\$4,031.00	7
5770J	Standard 8" Water Main Lowering	EA	\$7,625.00	\$1,125.00	2
5990F	4" Wastewater Main (BOTO)	LF	\$223.00	\$43.00	2
5990J	8" Wastewater Main (BOTO)	LF	\$355.00	\$97.00	17
5990K	10" Wastewater Main (BOTO)	LF	\$612.00	\$144.00	7
5990L	12" Wastewater Main (BOTO)	LF	\$452.00	\$141.00	18
5990N	15" Wastewater Main (BOTO)	LF	\$499.00	\$48.00	5
5990Q	16" Wastewater Main (BOTO)	LF	\$595.00	\$152.00	6
5990R	18" Wastewater Main (BOTO)	LF	\$535.00	\$15.00	2
5990V	24" Wastewater Main (BOTO)	LF	\$876.00	\$104.00	5
5990W	27" Wastewater Main (BOTO)	LF	\$816.00	\$132.00	3
5990Y	30" Wastewater Main (BOTO)	LF	\$870.00	\$69.00	3
5990AC	42" Wastewater Main (BOTO)	LF	\$2,846.00	\$155.00	2
5990AL	84" Wastewater Main (BOTO)	LF	\$2,568.00	\$388.00	2
5990AQ	102" Wastewater Main (BOTO)	LF	\$4,069.00	\$616.00	2

Item	Description	Unit	Mean	St.Dev	Count
5990AU	120" Wastewater Main (BOTO)	LF	\$3,636.00	\$321.00	2
6000J	8" Wastewater, Highway Crossing (BOTO)	LF	\$733.00	\$143.00	2
6000V	24" Wastewater, Highway Crossing (BOTO)	LF	\$855.00	\$152.00	5
6000Y	30" Wastewater, Highway Crossing (BOTO)	LF	\$899.00	\$2.00	2
6010J	8" Wastewater, Highway Crossing (by Open Cut)	LF	\$150.00	\$36.00	3
6010K	10" Wastewater, Highway Crossing (by Open Cut)	LF	\$225.00	\$25.00	2
6010Q	16" Wastewater, Highway Crossing (by Open Cut)	LF	\$205.00	\$33.00	3
6020R	18" Wastewater, RR Crossing (BOTO)	LF	\$729.00	\$139.00	3
6040J	8" Wastewater Main Crossing (BOTO)	LF	\$338.00	\$49.00	4
6040L	12" Wastewater Main Crossing (BOTO)	LF	\$440.00	\$86.00	5
6040Q	16" Wastewater Main Crossing (BOTO)	LF	\$460.00	\$10.00	2
6040R	18" Wastewater Main Crossing (BOTO)	LF	\$880.00	\$58.00	3
6040AE	48" Wastewater Main Crossing (BOTO)	LF	\$1,873.00	\$127.00	2
6050J	8" Wastewater Main Crossing (by Open Cut)	LF	\$164.00	\$56.00	10
6050K	10" Wastewater Main Crossing (by Open Cut)	LF	\$241.00	\$37.00	5
6050L	12" Wastewater Main Crossing (by Open Cut)	LF	\$199.00	\$76.00	15
6060	Wastewater Lateral	EA	\$1,499.00	\$419.00	61
6061	6" Wastewater Lateral with Cleanout	EA	\$2,242.00	\$395.00	6
6062	6" Wastewater Lateral (Extra Length)	LF	\$55.00	\$16.00	2
6063	Wastewater Lateral in Creek	EA	\$4,015.00	\$185.00	2
6065X	Wastewater Lateral - Extra Depth (+20')	LF	\$387.00	\$161.00	3
6070	External Wastewater Lateral Connection	EA	\$2,166.00	\$484.00	33
6075	Internal Wastewater Lateral Connection	EA	\$411.00	\$157.00	16
6080	Standard Mainline Cleanout	EA	\$996.00	\$266.00	9
6090	Adjust Existing Wastewater Lateral	EA	\$850.00	\$350.00	2
6100	Wastewater Access Device	EA	\$2,610.00	\$440.00	50
6110AE	48" Drop Manhole	EA	\$10,823.00	\$2,639.00	49
6110AG	60" Drop Manhole	EA	\$18,906.00	\$7,784.00	21
6110AJ	72" Drop Manhole	EA	\$42,517.00	\$9,485.00	3
6111AEX	48" Drop Manhole - Extra Depth (+20')	EA	\$22,600.00	\$433.00	3
6120AE	48" Pressure Type Manhole	EA	\$11,895.00	\$3,792.00	16
6120AG	60" Pressure Type Manhole	EA	\$14,004.00	\$2,589.00	15
6120AJ	72" Pressure Type Manhole	EA	\$20,446.00	\$4,578.00	11
6121AGX	60" Pressure Type Manhole - Extra Depth (+20')	EA	\$18,500.00	\$2,500.00	2
6125AE	48" Pressure Type Drop Manhole	EA	\$8,900.00	\$912.00	4
6125AG	60" Pressure Type Drop Manhole	EA	\$15,675.00	\$1,675.00	2
6126AEX	48" Pressure Type Drop Manhole - Extra Depth (+20')	EA	\$25,934.00	\$5,611.00	3
6130AE	48" Wastewater Manhole	EA	\$8,555.00	\$1,418.00	54
6130AG	60" Wastewater Manhole	EA	\$15,462.00	\$5,318.00	26
6130AJ	72" Wastewater Manhole	EA	\$24,420.00	\$5,449.00	11

Item	Description	Unit	Mean	St.Dev	Count
6130AL	84" Wastewater Manhole	EA	\$46,873.00	\$11,723.00	8
6130AN	96" Wastewater Manhole	EA	\$37,363.00	\$9,439.00	7
6131AEX	48" Wastewater Manhole - Extra Depth (+20')	EA	\$19,829.00	\$4,939.00	7
6140	Abandon Existing Manhole	EA	\$911.00	\$373.00	52
6141	Vacuum Test for Wastewater Manhole	EA	\$186.00	\$61.00	59
6142	Drop Connection to Existing Manhole	EA	\$3,420.00	\$420.00	2
6150AE	48" Manhole Rehabilitation	EA	\$2,840.00	\$257.00	17
6150AF	54" Manhole Rehabilitation	EA	\$5,955.00	\$2,735.00	11
6150AG	60" Manhole Rehabilitation	EA	\$2,550.00	\$300.00	2
6150AL	84" Manhole Rehabilitation	EA	\$8,050.00	\$50.00	2
6150AJ	72" Manhole Rehabilitation	EA	\$7,000.00	\$500.00	2
6150EX	Protective Surface Coating (250 mils for Ex. Concrete WW Structure)	SF	\$16.00	\$1.00	2
6150NX	Protective Surface Coating (125 mils for New Concrete WW Structure)	SF	\$15.00	\$3.00	3
6151AFX	54" Manhole Rehabilitation - Extra Depth (+20')	EA	\$9,250.00	\$650.00	2
6155AF	54" Drop Manhole Rehabilitation	EA	\$6,734.00	\$2,614.00	3
6160AG	60" Special Manhole	EA	\$17,267.00	\$1,935.00	3
6160AJ	72" Special Manhole	EA	\$20,180.00	\$8,022.00	5
6160AL	84" Special Manhole	EA	\$36,050.00	\$1,050.00	2
6160AN	96" Special Manhole	EA	\$36,600.00	\$5,600.00	2
6161ANX	96" Special Manhole - Extra Depth (+20')	EA	\$25,500.00	\$5,500.00	2
6180AE	48" Gas Sealed Drop Manhole	EA	\$14,000.00	\$1,000.00	2
6180AJ	72" Gas Sealed Drop Manhole	EA	\$31,117.00	\$3,125.00	3
6240	Tree	EA	\$1,262.00	\$798.00	25
6250	Shrubs, Flowers, Ground Cover, Etc..	EA	\$4,111.00	\$5,756.00	5
6260	Clearing & Grubbing	LS	\$121,637.00	\$112,000.00	11
6270	Fence Replacement	LF	\$37.00	\$18.00	49
6800	Project Partnering	LS	\$9,665.00	\$2,720.00	69
6900	Place Grass Sod	SY	\$8.00	\$0.00	2
6902	Place Block Sod	SY	\$8.00	\$1.00	23
6904	Hydromulch	SY	\$2.00	\$2.00	8
6905	Seed	SY	\$5.00	\$3.00	21
6908	Place Brick Paving	SY	\$128.00	\$36.00	11
6910	Cobblestone Sidewalk Pavers	SY	\$112.00	\$23.00	4
6911	Corsol/Brick Intersection Pavers	SY	\$123.00	\$43.00	9
6920	Television Inspection	LF	\$2.00	\$1.00	57
6921	Television Inspection	LF	\$2.00	\$1.00	3
6925	Trench Safety & Support	LF	\$4.00	\$7.00	88
6930Q	16" Closure Section	EA	\$9,250.00	\$250.00	2
6930S	20" Closure Section	EA	\$12,227.00	\$1,918.00	3
6930V	24" Closure Section	EA	\$9,422.00	\$3,711.00	7

Item	Description	Unit	Mean	St.Dev	Count
6930Y	30" Closure Section	EA	\$9,117.00	\$2,164.00	4
6930AA	36" Closure Section	EA	\$13,213.00	\$3,607.00	5
6930AE	48" Closure Section	EA	\$13,613.00	\$4,798.00	4
6930AJ	72" Closure Section	EA	\$12,056.00	\$5,445.00	7
6942	Street Surface Milling	SY	\$8.00	\$2.00	25
6950	Gabions for Slope Protection	CY	\$424.00	\$109.00	5
6960Y	Remove 30" Internal Test Plug	EA	\$1,196.00	\$981.00	6
6960AA	Remove 36" Internal Test Plug	EA	\$4,708.00	\$2,468.00	5
6960AE	Remove 48" Internal Test Plug	EA	\$996.00	\$480.00	6
6960AF	Remove 54" Internal Test Plug	EA	\$2,038.00	\$1,656.00	4
6960AJ	Remove 72" Internal Test Plug	EA	\$3,693.00	\$2,250.00	7
6970	Pipe to Soil Potential Monitoring Station	EA	\$3,718.00	\$3,954.00	13
6980J	Encasement for 8" Wastewater Pipe through Storm Sewer	LF	\$200.00	\$32.00	3
6980L	Encasement for 12" Wastewater Pipe through Storm Sewer	LF	\$160.00	\$0.00	2
6980Q	Encasement for 16" Wastewater Pipe through Storm Sewer	LF	\$180.00	\$0.00	2
6980V	Encasement for 24" Wastewater Pipe through Storm Sewer	LF	\$300.00	\$0.00	2
6980Y	Encasement for 30" Wastewater Pipe through Storm Sewer	LF	\$390.00	\$40.00	2
7020	Steel Guard Post (Bollard)	EA	\$350.00	\$50.00	2
7030	Rock Foundation	CY	\$46.00	\$19.00	88
7040	Stabilized Backfill	CY	\$71.00	\$27.00	45
7041	Flowable Backfill	CY	\$128.00	\$26.00	61
7042	Modified Flowable Backfill	CY	\$107.00	\$24.00	4
7043	Four "F" Flowable Backfill	CY	\$129.00	\$25.00	28
7044	Four "F" Flowable Base - High Strength & Fast Set	CY	\$218.00	\$55.00	48
7045	Grout for Pipeline Abandonment	CY	\$160.00	\$53.00	26
7050	Sand Backfill	CY	\$27.00	\$11.00	54
7051	Topsoil	CY	\$18.00	\$13.00	11
7052	Cement Treated Base Backfill	CY	\$89.00	\$23.00	39
7053	Cement Stabilized Sand Backfill	CY	\$72.00	\$22.00	19
7060	Concrete Backfill	CY	\$162.00	\$31.00	3
7061	Class 'B' Concrete Backfill	CY	\$156.00	\$14.00	3
7070	Class "A" Concrete	CY	\$146.00	\$13.00	6
7071	Class "B" Concrete	CY	\$144.00	\$36.00	78
7090	Furnish and Place Rip Rap	SY	\$100.00	\$22.00	8
7095	Furnish and Place Dry Rip Rap (Type A)	SY	\$130.00	\$10.00	2
7096	Furnish and Place Grouted Rip Rap (Type A and Type B)	SY	\$160.00	\$91.00	6
7200AE	48" Diameter Storm Sewer Manhole for Wastewater Passthrough	EA	\$9,010.00	\$1,527.00	5
7200AG	60" Diameter Storm Sewer Manhole for Wastewater Passthrough	EA	\$8,150.00	\$2,717.00	3
7200AJ	72" Diameter Storm Sewer Manhole for Wastewater Passthrough	EA	\$9,167.00	\$3,881.00	3

Item	Description	Unit	Mean	St.Dev	Count
7520	Temporary Paving (Hot Mix or High-Performance Mix)	TN	\$153.00	\$5.00	8
7525	Flex Base (Crushed Rock) Alley Surface	CY	\$72.00	\$21.00	36
7530	Concrete Curb and/or Gutter	LF	\$37.00	\$12.00	62
7532	Concrete Gutter	LF	\$28.00	\$3.00	3
7540	Concrete Curb	LF	\$15.00	\$8.00	39
7560	Crushed Rock for Temporary Paving Base	CY	\$58.00	\$11.00	51
7570	Reinforced Concrete Paving	CY	\$302.00	\$72.00	70
7575	Type 3K-2 Reinforced Concrete Paving	CY	\$713.00	\$95.00	53
7580	Reinforced Concrete Sidewalk	SY	\$59.00	\$15.00	70
7582	Reinforced Concrete Paving	SY	\$88.00	\$13.00	5
7583	Reinforced Concrete Driveway	SY	\$73.00	\$12.00	55
7584	Slurry Seal Surface Treatment	SY	\$7.00	\$1.00	50
7585	Barrier Free Ramp	EA	\$2,180.00	\$544.00	53
7590	Reinforced Concrete Driveway	CY	\$374.00	\$73.00	14
7600	Reinforced Concrete Base	CY	\$288.00	\$70.00	75
7605	Type 3K-2 Reinforced Concrete Base	CY	\$646.00	\$105.00	33
7655	Hot Mix Asphalt Concrete Pavement	TN	\$176.00	\$80.00	78
7700	Geotextile Fabric (Erosion Control)	LF	\$4.00	\$1.00	2
7701	Geotextile Fabric (Erosion Control)	SY	\$2.00	\$0.00	2
7703	Geotextile Fabric (Embedment)	SY	\$4.00	\$5.00	9
7710	Silt Fence	LF	\$2.00	\$1.00	2
7711	Silt Fence and Hay Bales	LF	\$3.00	\$1.00	3
7712	Storm Water Pollution Prevention Plan	EA	\$12,401.00	\$7,951.00	78
7713	Erosion Control	LS	\$10,591.00	\$10,110.00	6
7730	Disposal of Heavy Chlorinated Water Main Flushing Water	LS	\$5,461.00	\$3,837.00	80
7768	Health, Safety, and Monitoring Plan	LS	\$3,000.00	\$0.00	1
7814	Storm Drain Manhole Adjustment	EA	\$2,000.00	\$409.00	3
7820	General Requirements for Asphalt Base Recycling	SY	\$95.00	\$44.00	17
7834	Adjustment of Wastewater Access Device	EA	\$467.00	\$165.00	3
8011	Construction Surveying & Staking (Water & WW Mains)	LF	\$2.00	\$1.00	87
8012	Construction Surveying & Staking (Paving)	LF	\$2.00	\$1.00	74
8200	Traffic Detour	LS	\$24,500.00	\$5,824.00	6
20360	Adjust Wastewater Manhole	EA	\$1,150.00	\$650.00	2
20500	Investigation	EA	\$1,507.00	\$1,589.00	87

**APPENDIX**

**Z Value Table**

	<b>0</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
<b>-1.5</b>	0.067	0.068	0.069	0.071	0.072	0.074	0.075	0.076	0.078	0.079
<b>-1.4</b>	0.081	0.082	0.084	0.085	0.087	0.089	0.090	0.092	0.093	0.095
<b>-1.3</b>	0.097	0.099	0.100	0.102	0.104	0.106	0.107	0.109	0.111	0.113
<b>-1.2</b>	0.115	0.117	0.119	0.121	0.123	0.125	0.127	0.129	0.131	0.133
<b>-1.1</b>	0.136	0.138	0.140	0.142	0.145	0.147	0.149	0.152	0.154	0.156
<b>-1</b>	0.159	0.161	0.164	0.166	0.169	0.171	0.174	0.176	0.179	0.181
<b>-0.9</b>	0.184	0.187	0.189	0.192	0.195	0.198	0.200	0.203	0.206	0.209
<b>-0.8</b>	0.212	0.215	0.218	0.221	0.224	0.227	0.230	0.233	0.236	0.239
<b>-0.7</b>	0.242	0.245	0.248	0.251	0.255	0.258	0.261	0.264	0.268	0.271
<b>-0.6</b>	0.274	0.278	0.281	0.284	0.288	0.291	0.295	0.298	0.302	0.305
<b>-0.5</b>	0.309	0.312	0.316	0.319	0.323	0.326	0.330	0.334	0.337	0.341
<b>-0.4</b>	0.345	0.348	0.352	0.356	0.359	0.363	0.367	0.371	0.374	0.378
<b>-0.3</b>	0.382	0.386	0.390	0.394	0.397	0.401	0.405	0.409	0.413	0.417
<b>-0.2</b>	0.421	0.425	0.429	0.433	0.436	0.440	0.444	0.448	0.452	0.456
<b>-0.1</b>	0.460	0.464	0.468	0.472	0.476	0.480	0.484	0.488	0.492	0.496
<b>0</b>	0.500	0.504	0.508	0.512	0.516	0.520	0.524	0.528	0.532	0.536
<b>0.1</b>	0.540	0.544	0.548	0.552	0.556	0.560	0.564	0.567	0.571	0.575
<b>0.2</b>	0.579	0.583	0.587	0.591	0.595	0.599	0.603	0.606	0.610	0.614
<b>0.3</b>	0.618	0.622	0.626	0.629	0.633	0.637	0.641	0.644	0.648	0.652
<b>0.4</b>	0.655	0.659	0.663	0.666	0.670	0.674	0.677	0.681	0.684	0.688
<b>0.5</b>	0.691	0.695	0.698	0.702	0.705	0.709	0.712	0.716	0.719	0.722
<b>0.6</b>	0.726	0.729	0.732	0.736	0.739	0.742	0.745	0.749	0.752	0.755
<b>0.7</b>	0.758	0.761	0.764	0.767	0.770	0.773	0.776	0.779	0.782	0.785
<b>0.8</b>	0.788	0.791	0.794	0.797	0.800	0.802	0.805	0.808	0.811	0.813
<b>0.9</b>	0.816	0.819	0.821	0.824	0.826	0.829	0.831	0.834	0.836	0.839
<b>1</b>	0.841	0.844	0.846	0.848	0.851	0.853	0.855	0.858	0.860	0.862
<b>1.1</b>	0.864	0.867	0.869	0.871	0.873	0.875	0.877	0.879	0.881	0.883
<b>1.2</b>	0.885	0.887	0.889	0.891	0.893	0.894	0.896	0.898	0.900	0.901
<b>1.3</b>	0.903	0.905	0.907	0.908	0.910	0.911	0.913	0.915	0.916	0.918
<b>1.4</b>	0.919	0.921	0.922	0.924	0.925	0.926	0.928	0.929	0.931	0.932
<b>1.5</b>	0.933	0.934	0.936	0.937	0.938	0.939	0.941	0.942	0.943	0.944

**References**

R., S. (2002). "Identifying Non-Competitive Bids in Construction Contract Auctions". *OMEGA: International Journal of Management Science* ISSN:2310-2829, Vol.30(6), 443-449.