City of Guthrie
Locust Street Elevated Water Tank (Contract No. 1)

## ADDENDUM No. 1

May 2, 2019
This ADDENDUM to plans, specifications and bidding documents for the subject project modifies the referenced items to the extent described herein. Items not modified by this ADDENDUM remain unchanged and in full effect. Bidders are required to acknowledge receipt of this ADDENDUM on the Bid Form.

1. Technical Specifications: Section 01-200 - Tank Rehab Scope of Work: Add to Section 1.2 "General Work Overview" - as follows to include \{Attachments: None\}:

- Replace and Install new standard 24" square roof manway ( $24 \times 24 \times 4$ minimum)
- Rocket Mounts (3) shall be 18"-24" in length with 3 gusset plates
- All climb cables to be replaced.

2. Technical Specifications: Section 01-200 - Tank Rehab Scope of Work: Modify the second paragraph of Section 2.0 "Tank Interior" - as follows to include \{Attachments: None\}:

Pits found one third to two thirds the thickness of the steel shall be filled with a material approved by the Consultant prior to application. The filler shall be applied to blast cleaned surfaces and shall be DEVCON plastic steel Mfg. number 10110, Tnemec 215 Filler \& Surfacer, or an approved equal.
3. Technical Specifications: Section 01-200 - Tank Rehab Scope of Work: Replace Section 3.0 "Tank Exterior" - as follows \{Attachments: None\}:

### 3.0 TANK EXTERIOR

Exterior Painting System - The tank exterior shall receive a paint system equal to the system(s) as described below. 100\% of the tank exterior shall be High Pressure washed 5000 psi minimum w/ a rotating tip and injection of surfactant (Simple Green no exceptions). All rusted areas shall be power hand tooled cleaned to an SSPC-SP3 and all loose paint scraped.
a. Exterior Overcoat:

Spray applied as required by supplier. All bare steel areas and corroded areas will be primed with:
Primer $\quad$ Rust-Oleum 9380 to a DFT of 3-5 mils (Spot Prime Only)
Color: Red
Intermediate: $\quad 2$ coats Rust-oleum Noxyde to a DFT of 7 mils min per coat Color: White/ Confederate blue

Finish: Rust-Oleum 9800 DFT 3-5 mils; OR
Tnemec Series 75 DFT 2-5 mils
Color: TBD
DFT shall not be less than 20 mils. Exterior color see above. The DFT specified shall be obtained; additional coats shall be applied at the contractor's expense, to achieve the specified DFT.
4. Technical Specifications: Section 01-400 - Tank Mixing System: Modify Section 13.1 "System Installation Drawings" - as follows \{Attachments: None\}:
13.1 System Installation Drawings
A. The duckbill valve manufacturer shall be responsible for providing engineering installation drawings, if requested, of the complete valve system as supplied by the manufacturer. These drawings shall include plan view of a typical piping arrangement, sections and elevations as required, support bracket installation details, duckbill valve orientation details, and all dimensions required for locating the system within the specified dimensions of the tank. The installing contractor can supply the steel pipe independent and separate from the duckbill valve manufacturer.
B. Drawings shall be a minimum of $11 \times 17$ inches.
C. Six (6) sets of plans shall be provided to the Consultant for review and approval.
D. Two (2) sets of final fabrication and installation drawings shall be included with the shipment of the duckbill valve equipment..
5. Contract Documents: Appendix: Add Appendix 2 - Preliminary Design Report for Tideflex Mixing System (Attachment: 10 pages).
6. Contract Documents: Appendix: Add Appendix 3 - Pre-Bid Meeting Minutes \& Attendance List (Attachment: 4 pages).

END OF ADDENDUM NO. 1 TEXT This ADDENDUM consists of a total of 16 page.

## TIDEFLEX MIXING SYSTEM (TMS)

## PRELIMINARY DESIGN REPORT

Rev. $A$

## Tank Name: 0.2MG Elevated Tank

 Water Utility/Owner: City of Guthrie, KYConsultant: Wet or Dry

## CONTENTS

TMS - GENERAL ARRANGEMENT DRAWING
CFD MODELING

> TMS - MIXING ANALYSIS
> WATER AGE ANALYSIS

MANIFOLD HYDRAULICS / SYSTEM HEAD CURVE- FILLING CYCLE
MANIFOLD HYDRAULICS / SYSTEM HEAD CURVE- DRAW CYCLE

ANALYSIS BY:
Kristopher Chenette, E.I.T.


Technologies A Division of Red Valve Company, ${ }^{(®)}$ Inc.



## Computational Fluid Dynamics (CFD) Modeling

Below are CFD images showing representative velocity magnitude and simulated tracer images of this TMS configuration in an elevated tank


Velocity Magnitude Contour and Vector

CFdesign for Windows 5.0


Simulated Tracer

## TIDEFLEX RESERVOIR MIXING ANALYSIS

### 0.2MG Elevated Tank <br> City of Guthrie, KY

The Reservoir Mixing Analysis (RMA) is to be supplied to the water utility/owner as it provides guidance on the tank turnover/fluctuation required to ensure complete mixing with the TMS installed. Maintaining water quality in tanks and reservoirs is a combination of achieving complete mixing AND tank turnover to minimize water age. It is critical to achieve complete mixing to prevent a localized increase in water age (and associated water quality problems) due to short-circuiting and dead zones.

The RMA calculates the dependent variables and uses the mixing time formula to calculate the "Theoretical Mixing Time" (MT) at various filling flow rates. The MT is the fill time required to achieve complete mixing. The required drawdown (in feet), \% turnover, and the required volume exchange (in gallons) are calculated based on these mixing times. These values are shown in the "Guide to Tank Fluctuation and Turnover" section of the RMA. A slightly greater drawdown/turnover is typically recommended to be conservative.

Within the "Guide to Tank Fluctuation and Turnover" is a "Minimum Tank Fluctuation Target". This is applicable for tanks that operate in fill-then-draw. This is the minimum amount the tank should be drawn down on the draw cycles to ensure complete mixing on the fill cycles. This data is intended to be used by operators in conjunction with SCADA and strip charts (where applicable) to verify adequate tank turnover and to determine "pump on" and "pump off" set points (where applicable). For tanks that operate in simultaneous fill and draw, the "Theoretical Mixing Time" (fill time required to achieve complete mixing) should be used to ensure the minimum fill time required is achieved.

The RMA also provides data on the time required to draw down the tank, at various draw rates, to the required level as determined by the mixing time calculations.

Note, the data provided on the required drawdown, \% turnover and volume exchange are to ensure complete mixing of the tank volume to prevent water quality problems associated with short-circuiting, incomplete mixing, and increased water age. A water age evaluation of the entire distribution system may dictate greater tank turnover than provided with the RMA. As long as the actual tank turnover/fluctuation is equal to or greater than that provided with the RMA, the tank will be completely mixed.

Tideffex
Nowabn reennoleo

RESERVOIR / TANK NAME:
CONSULTANT: Wet or Dry
Contact: Jay Hofman Address:
0.2MG Elevated Tank

UTILITY / OWNER: City of Guthrie, KY Contact: Address:

## phone

email
ANALYSIS BY: Kristopher Chenette, E.I.T.


|  | Time to Fill Tank from Empty to H.W.L |  | Time to Fill to 1' Depth |  | Input Fill Time (Hours) | Resulting Increase In Water level <br> (ft) | Volume Change (gallons) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| INLET FLOW RATES (gpm) |  |  |  |  |  |  |  |
| 25.0 | 133.33 | 5.56 | 283.19 | 4.72 | 6.7 | 1.4 | 10,032.79 |
| 150.0 | 22.22 | 0.93 | 47.20 | 0.79 | 1.7 | 2.2 | 15,627.66 |
| 225.0 | 14.81 | 0.62 | 31.47 | 0.52 | 1.3 | 2.4 | 17,246.42 |
| 500.0 | 6.67 | 0.28 | 14.16 | 0.24 |  | 2.9 | - 20,846.41 |



|  |  |  |  | Inlet Momentum (ft^4 / min^2) |  | GUIDE TO TANK FLUCTUATION AND TURNOVER |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\pi T$ | Jet Velocity (fps) | $J V^{\wedge} 2 / 2 g$ <br> (feet) | Reynold's Number |  | Velocity Gradient, G (1/sec) | Theoretical Mixing Time (Fill Time Req'd for Complete Mixing) MT = $K^{*} V^{\wedge}(\mathbf{2} / 3) / M^{\wedge}(1 / 2)$ (Minutes) (Hours) |  | Req'd Drawdown on Previous Draw to Mix on Next Fill (feet) | \% Turnover Required <br> (\%) | Volume Exchange Required (gallons) |
| INLET FLOW RATES (gpm) |  |  | 52,861 | 516 | 0.75 | 401.3 | 6.7 | (SEE NOTE 2) | (SEE NOTE 2) | (SEE NOTE 2) |
| 25.0 | 2.57 | 0.10 |  |  |  |  |  |  | 5.0 | 10,000.0 |
| 150.0 | 6.36 $\mathbf{0 . 6 3}$ 203,619 7,652 4.56 $\mathbf{1 0 4 . 2}$ <br> 7.83 $\mathbf{0 . 9 5}$ 276,761 14,138 6.88 $\mathbf{7 6 . 7}$ <br> $\mathbf{1 1 . 9 2}$ $\mathbf{2 . 2 1}$ 508,815 47,784 15.59 $\mathbf{4 1 . 7}$ |  |  |  |  |  | 1.7 圽 | 2.2 | 7.8 | 15,600.0 |
| 225.0 |  |  |  |  |  |  | 1.3 岂 | 2.4 | 8.6 | 17,200.0 |
| 500.0 |  |  |  |  |  |  | 0.7 | $\Rightarrow \quad 2.9$ | 10.4 | 20,800.0 |
|  |  |  |  |  |  |  | MINIMUM TANK FLUCTUATION TARGET |  |


|  | TIME TO DRAW FULL TO (Hours) | (Days) | Time to Dra <br> (Minutes) | epth <br> (Hours) | $\begin{gathered} \text { Pipe } \\ \text { Velocity } \\ \text { (fps) } \\ \hline \hline \end{gathered}$ | Volume Exchange Required (gallons) | Draw Time Required (Hours) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| OUTLET FLOW RATES (gpm) |  |  |  |  |  |  |  |  |  |
| 150 | 22.22 | 0.93 | 47.20 | 0.79 | 0.96 | 20,800 | 2.3 | @ | 150 gpm Draw Rate |
| 400 | 8.33 | 0.35 | 17.70 | 0.29 | 2.55 | 20,800 | 0.9 | @ | 400 gpm Draw Rate |
| 700 | 4.76 | 0.20 | 10.11 | 0.17 | 4.46 | 20,800 | 0.5 | @ | 700 gpm Draw Rate |
| 1000 | 3.33 | 0.14 | 7.08 | 0.12 | 6.38 | 20,800 | 0.3 | @ | 1000 gpm Draw Rate |

* NOTE: 1. TIDEFLEX VALVES ARE INHERENTLY A VARIABLE ORIFICE SO THE TMS EFFECTIVE DIAMETER VARIES WITH FLOW RATE

2. MIXING TIME EQUATIONS DO NOT ACCOUNT FOR DIFFERENCES IN TEMPERATURE BETWEEN INLET WATER AND TANK (BUOYANT JETS) THESE CALCULATIONS MAY UNDERESTIMATE THE FILL TIME REQUIRED FOR MIXING.

TMS - Mixing Time and Minimum Required Drawdown 0.2MG Elevated Tank


## Actual/Predicted Daily Turnover and Water Age

| High Water Level (HWL) $=28.25 \mathrm{ft}$ | T | 19.8 | feet | Ave. Water Age = 1.4 days |
| :---: | :---: | :---: | :---: | :---: |
| Low Water Level (LWL) = 8.47 ft | Turnover = | $\begin{gathered} 70.0 \\ 140,000 \end{gathered}$ | \% gal | (Assumes tank is mixed. CAUTION: A single inlet pipe often does not mix. Water age could be much higher |

Turnover Required for TMS to Achieve Complete Mixing
(GOAL: For Required Turnover for Complete Mixing to be Less Than Actual/Predicted Turnover)

| The TMS will mix the tank with Turnover = | 2.9 | feet | Ave. Water Age $=9.6$ days |
| :--- | :---: | :--- | :--- | :--- | :--- |
| (see Mixing Analysis) | 10.4 | $\%$ | (Water age if tank turnover was the minimum |
|  | 20,846 | gal | required to achieve complete mixing) |
|  | RESULT |  |  |

## Is Actual Turnover Greater than Required Turnover to Mix with TMS?

## WATER QUALITY:

* Maintaining storage tank water quality is a function of:

1) Maximizing volume turnover to minimize water age. See Water Age vs. Turnover Guideline below.
2) Achieving complete mixing to avoid a localized increase in water age due to incomplete mixing and short-circuiting

* The TMS design addresses \#2. Consultant and/or Owner to address \#1 by looking at the "operation" of the distribution system and tank in order to maximize turnover. See Water Age vs. Turnover Guideline below.



## TMS Manifold Hydraulics (FILL CYCLE)

```
Reservoir Name: 0.2MG Elevated Tank
    Reservoir Size: 36' Dia. x 28.25' HR
Reservoir Capacity: 0.2 MG
    End User: City of Guthrie, KY
    Consultant: Wet or Dry
```

Ambient Density $=\mathbf{6 2 . 4} \mathrm{lbm} / \mathrm{ft}^{\wedge} 3$
Effluent Density $=\mathbf{6 2 . 4} \mathrm{lbm} / \mathrm{ft}^{\wedge} 3$
$\mathrm{dS} / \mathrm{S}=\quad 0$
$\mathrm{C}=100$ Hazen Williams Coeff.
$\underline{C d=} 0.95 \mathrm{Cd}$

| Flow Rate (gpm) | Jet Velocity (fps) | Friction Headloss <br> (ft) | Total Headloss <br> (ft) |
| :---: | :---: | :---: | :---: |
| 25.0 | 2.6 | 0.00 | 0.1 |
| 150.0 | 6.4 | 0.13 | 0.8 |
| 225.0 | 7.8 | 0.27 | 1.3 |
| 500.0 | 11.9 | 1.19 | 3.5 |



## TMS Manifold Hydraulics (DRAW CYCLE)

Reservoir Name: 0.2MG Elevated Tank
Reservoir Size: 36' Dia. x 28.25' HR
Reservoir Capacity: 0.2 MG
End User: City of Guthrie, KY
Consultant: Wet or Dry

## Ambient Density $=62.4 \mathrm{lbm} / \mathrm{tt}^{\wedge} 3$ <br> Effluent Density $=\mathbf{6 2 . 4} \mathrm{lbm} / \mathrm{ft}^{\wedge} 3$

```
dS/S = 0
    C= 100 Hazen Williams Coeff.
    Cd= 0.95 Cd
```

| Flow Rate <br> $(\mathrm{gpm})$ | WF-3 <br> Headloss <br> $(\mathrm{ft})$ | Friction <br> Headloss <br> $(\mathrm{ft})$ | Total <br> Headloss <br> $(\mathrm{ft})$ |
| :---: | :---: | :---: | :---: |
| 150.0 | 0.1 | 0.00 | 0.1 |
| 400.0 | 0.3 | 0.00 | 0.3 |
| 700.0 | 0.8 | 0.00 | 0.8 |
| 1000.0 | 1.5 | 0.00 | 1.5 |




## MEMORANDUM

TO: $\quad$ City of Guthrie Administration<br>Wet Dry Water Tank Inspection Services<br>Contractors \& Sub-Contractors<br>FROM: McGhee Engineering, Inc.<br>DATE: April 24, 2019<br>SUBJECT: City of Guthrie, Kentucky<br>Locus Street Elevated Water Tank Project<br>Pre-Bid Conference

## Minutes

## Introductions \& Identification of Parties

## McGhee Engineering: Engineer Comments

McGhee Engineering will provide general project administration and funding assistance for the project on behalf of the City of Guthrie during the project. Jay Hoffman and/or representatives of his firm (Wet Dry) will provide resident inspection of the work and provide technical assistance through the project. Prior to bidding, a few items of interest shall be taken under consideration by the Bidders and the ultimately awarded Contractor. These items are as follows:

1) Quick Overview of the Project's Scope of Work: The work to be performed involves the painting, cleaning and rehabilitation of an existing 200,000 gallon elevated water tank plus the installation of a tank mixing system within the structure. The tank is located along Locust Street in Guthrie, Kentucky (Todd County). The tank was built in 1974 (Brown Steel), and the last major repainting effort was completed in 1995.
2) Budgetary Estimate $=\$ 265,000$
3) Bidding Notes:
a) This Contract is expected to be funded in part with funds provided by the Kentucky Drinking Water State Revolving Fund (SRF - Fund B) as administered by the Kentucky Infrastructure Authority (KIA). SRF requirements and provisions must be met by the Bidder and all subcontractors.
b) Federal Davis Bacon Wage Rates do not apply to this Contract.
c) Bidding Requirements: Bid Bond, addenda acknowledgement (if applicable), and Statement of Experience. Must be a registered plan holder to bid.
d) Bidding Schedule: 60 Day Award Period (max).
e) May $2^{\text {nd }} @$ 5:00 pm is the deadline for all inquiries and/or questions.
f) May $9^{\text {th }} @ 10: 00$ am (local time) is the deadline for submitting bids.
g) Contract Time $=60$ calendar days for substantial completion; 90 days for final completion.
h) Liquidated Damages $=\$ 500$ per day
4) All Bid Items in the Bid Form shall be completed. Note the request for an alternate bid price for a new logo, included in the Appendix.
5) Planholders are available at www.mcgheeengineering.com, and plans may be obtained at our Guthrie office.
6) The Project Area is located on Locust Street. You're welcome to visit the site after the meeting or prior to bid date. Contact City Hall (270.483.2511) to arrange access. During the project, the Contractor will coordinate and provide adequate notice with City Utility personnel in regards to taking the tank out of service and placing back in service. All other existing utilities (water, sewer, storm water, etc) must remain in service during construction.

## Wet Dry Tank Inspection Services' Comments

Jay Hoffman and/or representatives of his firm (Wet Dry) will provide resident inspection of the work and provide technical assistance through the project. His comments were as follows:

- Can take down fences if needed replace as is or better
- Contractors responsible for field verifying all height and dimensions. Tank does not have an address.
- No work restriction hours, until neighbors complain
- Contractor responsible for power and water, power is on-site 110 unknown amps, water available on-site, if that does not meet needs contractor needs to supply.
- Physical address for bids covered, Owner needs 2 days' notice to locate lines
- Shipments of goods can go to tank site, owner will not help unload, driver's responsibility
- 48 Hours notice minimum for contractor move in, initial move in will not be allowed on Friday, Saturday, Sunday or Monday holiday
- Owner will attempt to have tank drained and ready when contractor arrives onsite
- Project specifics were gone over during meeting
- WLI (all parts) shall be replaced and or repaired as needed
- Provisions in spec for alternate coating products
- Caulk around foundation and tank bottom Sika Flex
- Allowances for unknown repairs, do not count in base bid, do not put in base bid
- Repaint sign as is on tank, and there is an alternate that is to be bid as well
- Foreman must speak English, if they can't talk to us, we can't talk to them.
- Do not ask owner questions once you're on site, the inspector is the point of contact
- There may have been more discussed, but this covers most of it. This is not a word for word dissertation of the meeting.
- Replace screen in roof vent
- Tnemec urethane would be acceptable as a finish coat over Noxyde, from our standpoint. Contact supplier, for clarification.
- Noxyde is to be used for the tank exterior due to our long experience record with product (25+ years).
- Engineer and consultant reserve the right to have final say on foreman and workmen that can work on site.
- Prevailing wage rates are NOT required
- Comm antennas will not be removed from tank for work, City antenna can be.

After the meeting, All in attendance went to tank site.

Locust Street Elevated Water Tank Rehab Project

April 24, 2019 (10:00 am)
Pre-Bid Meeting
Attendance List


