Memo

To: Clay Pearson, City Manager

From: Skipper Jones, Assistant Director of Projects

CC: Jon Branson, Deputy City Manager
Trent Epperson, Assistant City Manager
Robert Upton, Director of Engineering & Projects
Eric Wilson, Director of Public Works
Andrea Brinkley, Assistant Director of Public Wor

Date: May 4, 2017

Re: Barry Rose Water Reclamation Facility Expansion

5/4/2017
To: Mayor and City Council members
Update on water reclamation plant work and heads-up on forthcoming pilot program. Clay

The intent of this memo is to provide a brief update on the status of the above project and to provide information regarding a future contract amendment.

Background:
In October, 2016 Council awarded a contract for Preliminary Engineering Report (PER) Services to MWH/ Stantec for the expansion of the Barry Rose Water Reclamation Facility (WRF) that would be required as part of the plan to abandon the Longwood WRF in the move towards regionalization of wastewater treatment. The scope of work was detailed in the September 27, 2016 Memo.

Progress to Date:
Flow calculations and calibrations were completed in late February for both the Longwood and Barry Rose wastewater service area basins. In March, Staff received the Draft Service Area Analysis Technical Memorandum. This document contained the flow analysis for both Longwood and Barry Rose basins at current, ten year and build out time frames. This document was produced to provide reliable flow data to make recommendations for both short term (i.e. ten year) and long term (i.e. build out) plant capacity requirements. Population growth projections and current City land use maps were incorporated with flow calculations to develop the Equivalent Single Family Dwellings (ESD) factor of 192 gallons per day (GPD). This process was identical to the analyses performed for Reflection Bay and JHEC facilities. Based on development timing, land use projections and the plan to divert Longwood flows to Barry Rose, this projected a plant capacity need of 8.53 MGD for the ten year (2026) and 9.62 MGD for build-out (2042).

Future Work:
The PER scope of work includes the development of preliminary design criteria for the analysis of two treatment processes; Sequential Batch Reactors (SBR) and Membrane Bio-Reactors (MBR). The current treatment process is SBR. MBR is being analyzed because of its smaller footprint and its ability to accommodate additional regulations expected within the lifetime of the expansion. The analysis is to focus on current and future flows, the projected ultimate plant capacity, the ability of the site to accommodate each process, the advantages of each to accommodate future nutrient removal regulations, and the life cycle cost in order to make a final process recommendation.

In early March, Staff became aware of a new membrane technology entering the U.S. market with over a decade of operations in demanding treatment environments in Europe. ReUse Innovations, Inc., in conjunction with A-3 USA (membrane manufacturer) contacted Public Works with a proposal to pilot test their product at the Barry Rose WRF. A bench scale test was performed over the course of 18-20 days in February during which time the pilot plant was subjected to harsh operating conditions such as a high mixed liquor suspended solids (MLSS) concentration (>12,000 mg/l) For comparison, the City's typical plant operating range is between 3000-5000 mg/l. The results of this test indicated full pilot scale testing of the ReUse flat plate membranes could provide valuable operational data and life cycle costs for use in the analysis of process design criteria.

On March 24, Staff met with ReUse Innovations along with lead members of the MWH/Stantec Team and established a preliminary schedule for delivery, connection and operation of a full pilot scale test to run at Barry Rose for three and a half months and subject to the full spectrum of flow variations that the plant experiences. The cost to move-in, off-load, operate and clean and move out is projected to be $48,750. These costs are incorporated into a Contract Amendment with MWH/Stantec who will provide oversight and review of findings that will be incorporated into the final PER. The total cost of the amended scope contained in this amendment will be $89,495 inclusive of ReUse's fees for the pilot plant. This Contract Amendment will be presented to Council on May 22nd for approval.

The full pilot scale test will allow a real world evaluation of the MBR technology on our specific influent flows, which will be used for the analysis and comparison to the SBR technology.

Contract Amendment:
While the pilot plant will be operated by ReUse personnel, MWH/Stantec will review and recommend changes to the operational protocols, provide Start Up and Commissioning oversight, provide field engineering services (multiple site visits by a mid-level engineer to verify operational conformance), review and analyze continuous data from both influent and effluent streams and provide a written report summarizing the activities conducted during the study period. The information from this report will then be integrated into the Preliminary Engineering Report to justify the process model and determining the ultimate recommended plant process. At the time of this memo, costs for MWH/Stantec's portion of the proposed contract amendment are being reviewed. Staff expects to bring this Contract Amendment to Council for approval in May.

The ultimate objective of this effort is to model, in real-time, a viable membrane process technology, to develop operational and maintenance cost data on this process for comparison with SBR technology in order to determine the ultimate treatment process to be used for the plant capacity expansion. This effort will extend the time needed for the development of the PER, originally scheduled for the end of July, by as much as four months and impact the start of

any final design activities. **By conducting these additional activities and reviewing an advanced treatment methodology, a more accurate recommendation, treatment costs and life cycle costs can be developed to determine to most beneficial treatment process to meet current and future regulations.**

Previous Memos: 9/27/16

Exhibit A
Barry Rose Water Reclamation Facility
Scope of Services for Amendment #1

PROJECT SUMMARY

The City of Pearland (CITY or CLIENT) has requested additional services from Stantec Consulting Services, Inc. (CONSULTANT) to procure ReUse Innovations, Inc. (CONTRACTOR) for the piloting of the Maxflow Membrane Bioreactor (MBR) system at the Barry Rose WWTP in Pearland, Texas. The MBR Pilot Study will be completed under existing Project Number WW1502, PO #207-00000574, Resolution No. R206-171 for a testing duration of 12 weeks. The services (the "PROJECT") will include review and development of a pilot study protocol, pilot testing, commissioning services, field engineering services, results analysis in accordance with current design standards, regulatory requirements, and CITY requirements.

DOCUMENT VERSION CONTROL AND REVISIONS

This SOW document will be maintained throughout the duration of the contract, and will be modified to reflect changes authorized through contract amendments. Each modification will apply a track-changes mode to identify deletions (strikethrough) or additions (underline) in comparison to the previously authorized version. Table 1 summarizes SOW versions and dates, and indicates the current version.

Table 1 - Document Version Control

SOW Version	Date	Purpose
1.0	04/18/2017	Draft Amendment No. 1 Submittal
2.0	04/24/2017	Revised per City comments

ADDITIONAL ASSUMPTIONS

The following are project assumptions:

- Consultant will perform the Tasks in Amendment No.1 on a Time and Materials basis to the extent funding is available.

18000 Task 8 Additional Services – Piloting Testing

18310 Membrane Bioreactor (MBR) Pilot Study

The CONSULTANT will review the pilot testing protocol provided by ReUSe (CONTRACTOR) for performing the Pilot Study and recommend additional requirements. Additional requirements include but are not limited to, sampling protocols and locations, flux rate limitations, maintenance record keeping, operation tracking, etc.

Deliverables:

- Membrane Bio-Reactor (MBR) Pilot Study Protocol

18320 Field Engineering Services

CONSULTANT will conduct field engineering services per approved Protocol or as required by CITY.

Deliverables:

- Daily Inspection Report

18330 Pilot Results & Analysis Technical Memorandum

After the Pilot Study is completed, CONSULTANT will prepare a draft Technical Memorandum to document the following:

- The methodology used to perform the study.
- Inspection reports and photographic documentation of the pilot plant.
- Known operational and maintenance issues.
- Documentation of influent and effluent results.
- Results Analysis and Process Optimization Analysis.
- Cost Analysis to determine cost per 1000 gallons to treat wastewater.

18340 Preliminary Engineering Report Integration

CONSULTANT will amend Preliminary Engineering Report, reconcile, and re-run the process model once results have been received and the technical memorandum has been finalized.

Attachment - Engineering Staff Hour Estimate

18000 TASK 8: ADDITIONAL SERVICES
Fee Estimate for Amendment No.1
MBR Piloting Study

18000 TASK 8: ADDITIONAL SERVICES	FIRM PRINCIPAL	PROJECT MANAGER	SR PROJECT MANAGER	FIRM PRINCIPALS (PROJECT TECHNICAL LEAD)	SR. PROJECT ENGINEER	SR PROJECT ENGINEER (MECHANICAL)	SR PROJECT ENGINEER (ELECTRICAL)	SR PROJECT ENGINEER (I&C)	STRUCTURAL ENGINEER	PROJECT ENGINEER	SR. CONSTRUCTION MANAGER	SR DESIGNER	CLERICAL	TOTAL HOURS	TOTAL MWH LABOR FEE
18310 Membrane Bioreactor (MBR) Pilot Study	1	4		6	6	8								25	$ 5,190.00
18320 Field Engineering Services	1	8	4	6	60							30		109	$ 17,380.00
18330 Pilot Results & Analysis Technical Memorandum	1	2	1	4	24							8		40	$ 6,810.00
18340 Preliminary Engineering Report Integration	1	2	1	4	16							8		32	$ 5,490.00
														0	$ -
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TOTAL STAFF HOURS	4	16	6	20	106	8	0	0	0	0	0	46	0	206	
MWH BILLING RATE (a)	300.00	175.00	200.00	280.00	165.00	190.00	190.00	190.00	190.00	165.00	210.00	110.00	80.00		$ 34,870.00
TOTAL MWH LABOR FEE	$ 1,200.00	$ 2,800.00	$ 1,200.00	$ 5,600.00	$ 17,490.00	$ 1,520.00	$ -	$ -	$ -	$ -	$ -	$ 5,060.00	$ -		

NOTES & COMMENTS

(T&E) Indicates tasked to be billed by Time &

SUMMARY OF SUB-CONSULTANT SERVICES

SUB-CONSULTANT NAME	DISCIPLINE	FEE
ReUse Innovations, Inc.	MBR Equipment Supplier	$ 48,750.00
		$ -
(See Attached Detailed Fee Estimate by ReUse)		
	SUB-CONSULTANT ADMINISTRATIVE FEE @ 10%	$ 4,875.00

REVISIONS

DATE	BY	DESCRIPTION
4/27/2017	FJC	Revised per Client Comments

SUMMARY OF PROJECTED DIRECT EXPENSES

Type of Expenses	Unit	Cost per unit	TOTAL
Reimbursible Expenses			$ 1,000.00
		TOTAL DIRECT EXPENSES	$ 1,000.00
		TOTAL (MWH Labor Fee, Sub-Consultants Fee, Direct Expenses)	$ 40,745.00
		GRAND-TOTAL (MWH Labor Fee, Sub-Consultants, Direct Expenses)	**$ 89,495.00**

(a) Average rate by category. Actual rates will vary by individual within each category

Mr. David Irvine
Mr. Javier Cantu, *et al*
Stantec
Houston, Texas

On behalf of Eric Wilson, the City of Pearland

Mr. Irvine –

Thank you for the opportunity to submit a proposal for the piloting of the MaxFlow MBR at the Barry Rose WWTP in Pearland, Texas. It is our intent to allow you to thoroughly review the A3-USA MaxFlow membrane in a variety of scenarios, and prove its ability to provide what the City needs for long-term membrane treatment. The following proposal stems from the discussions ReUse Innovations has had jointly with Stantec and the City.

Intent & Duration

Pilot a small MBR equipped with the A3 MaxFlow membrane over approximately a 3.5-month period (2 weeks startup, 12 weeks operation) at the Barry Rose wastewater treatment plant in Pearland, Texas. The plant will sit alongside the MCC building on the existing concrete slab.

The pilot will follow a protocol developed jointly by A3 and ReUse, and refined by Stantec and the City. It will be intended to demonstrate the membrane's performance across a variety of flux rates and other variables, and result in a data set useful for comparing the MaxFlow membrane to competing membranes and other non-MBR technologies.

System

ReUse is proposing to use a skid-mounted MBR arranged in a cellular format. The skid is approximately 12'W x 45'L, and contains three (3) HDPE tanks contained in a coated carbon steel frame. All equipment and controls are mounted on the same skid, making it a true packaged plant, arriving plumbed and wired.

Influent will be pumped from adjacent manhole into influent fine screen.

Operation

ReUse and A3 will jointly provide startup and operation labor. Startup will be fully staffed, and once operational, the plant will have half-time operation on staff (2 full weeks/month). The system will also be continually monitored via ReUse and A3 remotely.

ReUse and A3 welcome and encourage engagement by City staff and operators throughout the piloting process, so that the City might better acquaint itself with the operation and functionality of the MBR.

Cost

ReUse and A3 request the following funds for the pilot study.

Shipping: $10,000
Cranes: $10,000
Operation by ReUse/A3: $8,750 (3.5 months x $2,500/month)
System preparation and mothballing: $20,000

Total: $48,750

City/Stantec Responsibilities

The City and/or Stantec will be responsible for the following items:

Providing 100amp service to site, & electric for pilot
Providing telecommunications line to plant (Cat 5E [point of service must be within 300'])
Conducting all lab testing required for pilot, per protocol
Providing activated sludge for seeding
Disposal of screenings, waste sludge and effluent from pilot unit
Pressurized clean water line for system decommissioning

Thank you again for the opportunity to pilot the A3 membrane for the City of Pearland. We look forward to a successful trial, and the potential of working together in the future.

Regards,

Randall Nelson
Design Team Leader
ReUse Innovations, Inc.
71 Ledford Drive
Franklin, NC 28734

Overview

The Pilot Study Phase is designed to provide background research, criteria for sizing of the full-scale treatment equipment, installation guides, and actual testing of the proposed system to achieve the effluent discharge parameters that may be placed on the project should regulatory agency approval be granted.

The membrane module flux rate and biological testing of the treated product have been identified as the prime objectives of the study. The pilot plant equipment components will be evaluated relative to their ability to achieve reliable, uninterrupted, and guaranteed process performance. The effluent monitoring parameters and effluent limits are to be generated in the infant phase of the project. The full-scale equipment needs will be determined and the project cost refined for the full-scale needs of the project.

Note: Even if the pilot study should demonstrate possible higher membrane flux rates than proposed for the ultimate final plant at 10 MGD, we do not recommend changing the final design parameters. The pilot study will be only operating for 3 months; it will not mimic 10+ years of actual operational life. Because equipment lifespan is critical to project feasibility, and lifespan may be strongly correlated with conservative flux rates, it is important that all MBR suppliers be evaluated based on an equal design flux rate. Thus, we recommend that the annual daily average flux rate be limited in the final bid documents / specifications, so as to provide accurate cost comparisons for MBR systems that will operate for the timeframes desired by the City.

Process/Protocol

The mixed liquor will be started by pumping mixed liquor from the existing wastewater plant. The mixed liquor will be pumped through the screen for the pilot plant before being introduced into the pilot plant. The first mixed liquor threshold operating point will be 8,000 mg/l in the anoxic and oxic cells and a 10,000 mg/l in the membrane cell with an average daily flow of 30,000 GPD. The corresponding membrane flux will be at 6.2 gfd. This flux is 1.6 times higher than the proposed annual average design flux rate for ultimate MBR plant @ 10 MGD. The optimum F/M ratio and SRT will be demonstrated. Daily flow variations will be simulated during the first two week at this threshold level. During the last week at this threshold level the plant will be stressed to the highest flux rate demonstrable at this operating level and held for 48 hours with influent wasted water at 1/4 strength. Each day a composite 24-hour raw BOD, COD, TSS. Ammonia, TN and Phosphorus sample will be sampled and sent to laboratory for testing. Each day a composite 24-hour effluent BOD, COD, TSS. Ammonia, TN and Phosphorus sample will be sampled and sent to laboratory for testing.

The second mixed liquor threshold operating point will be 12,000 mg/l in the anoxic and oxic cells and a 14,000 mg/l in the membrane cell with an average daily flow of 50,000 gpd. The corresponding membrane flux will be at 10.3 gfd. This flux is 2.7 times higher than the proposed annual average design flux rate for ultimate MBR plant @ 10 MGD. The optimum F/M ratio and SRT will be demonstrated. Daily flow variations will be simulated during the first two week at this threshold level. During the last week at this threshold level the plant will be stressed to the highest flux rate demonstrable at this operating level and held for 48 hours with influent wasted water at 1/4 strength. Each day a composite 24-hour raw BOD, COD, TSS. Ammonia, TN and Phosphorus sample will be sampled and sent to laboratory for testing. Each day a composite 24-hour effluent BOD, COD, TSS. Ammonia, TN and Phosphorus sample will be sampled and sent to laboratory for testing.

The third mixed liquor threshold operating point will be 18,000 mg/l in the anoxic and oxic cells and a 20,000 mg/l in the membrane cell with an average daily flow of 75,000 gpd. The corresponding membrane flux will be at 15.4 gfd. This flux is 4 times higher than the proposed annual average design flux rate for ultimate MBR plant @ 10 MGD. The optimum F/M ratio and SRT will be demonstrated. Daily flow variations will be simulated during the first two week at this threshold level. During the last week at this threshold level the plant will be stressed to the highest flux rate demonstrable at this operating level and held for 48 hours with influent wasted water at 1/4 strength. Each day a composite 24-hour raw BOD, COD, TSS. Ammonia, TN and Phosphorus sample will be sampled and sent to laboratory for testing. Each day a composite 24-hour effluent BOD, COD, TSS. Ammonia, TN and Phosphorus sample will be sampled and sent to laboratory for testing.

The sludge from the pilot unit will be wasted to the City's existing sludge digester.

The raw wastewater will be pumped into the pilot's screen from the City's existing influent pump station. A grinder pump will be used to pump the raw wastewater.

TCEQ Notes

The economic feasibility of primary sedimentation would normally be evaluated for facilities designed for an average daily flow of 5.0 million gallons per day or more under TCEQ regulations.

Primary Sedimentation will not be explored in this pilot test. Although the Berry Rose WWTP will ultimately be greater than 5.0 mgd ultimately, this pilot is not intended to evaluate primary sedimentation.

The design sludge retention time (SRT) for an MBR must be at least 10 days, but not more than 25 days. An MBR system designed for an SRT or MLSS outside the range above requires a pilot study to provide data that demonstrates that the design parameters are sustainable and can achieve the expected performance to the executive director's satisfaction.

The working SRT for final design is a primary important evaluation issue in this pilot study. A3-USA normally would operate its facility at an SRT above 25 days. It would be necessary to show in this pilot that the process will work properly at an SRT greater than 25 days. The levels of testing and data recording outlined above should satisfy this TCEQ requirement.

An MBR system with a peak flow rate that is greater than 2.5 times the average daily flow must use an equalization basin, off-line storage, or reserve membrane capacity to accommodate the higher peak flow.

The current facility experiences multiple peaks per year in the range of four times the average daily flow for periods more than 48 hours during which the plant influent wastewater strength drops to approximately 1/4 strength. Therefore, the pilot study will mimic at various levels of mixed liquor, F/M ratio, MLSS, MLVSS both the diurnal flow variations and the peak flow variations.

Conclusion

The pilot study will be designed to evaluate the membrane performance under actual operational conditions, including flow variations and influent wastewater characteristics as outlined previously.

The treatment and pretreatment processes evaluated in a pilot study will be equivalent to the processes that will be used in the wastewater treatment facility final design.

The results of the pilot study will include the following recommendations:

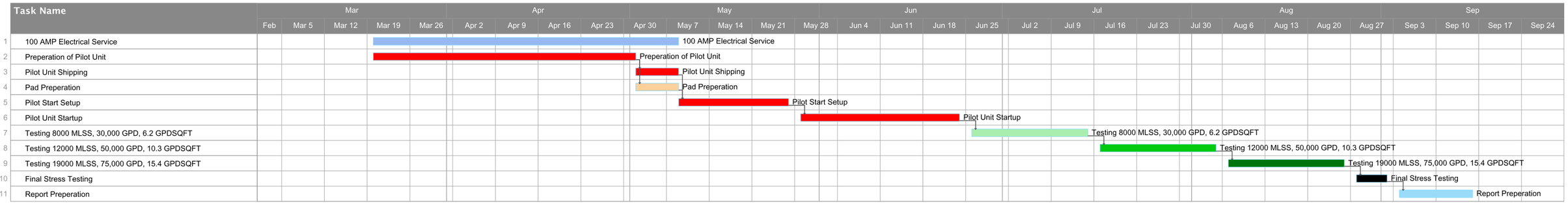
(I) net flux rates for design flow and peak flow;
(II) average and maximum transmembrane pressure;
(III) cleaning and backwash intervals;
(IV) expected percent chemical recovery after chemical cleaning;
(V) dissolved oxygen concentrations for reactors and membrane basins;
(VI) MLSS concentrations for reactors and membrane basins;
(VII) SRTs for reactors and membrane basins; and
(VIII) expected effluent concentrations of conventional pollutants and nutrients, including the pollutants and nutrients that will be limited or monitored in the wastewater treatment facility's wastewater permit.
(IX) Redundancy.

The study will demonstrate that the proposed wastewater treatment facility will be able to operate at normal operating parameters and conditions for design flow with the largest MBR unit or train out of service.

The study will demonstrate that the proposed wastewater treatment facility will provide acceptable methods of providing redundancy. The final pilot study report will include calculations that demonstrate adequate redundancy within the wastewater treatment facility.

The pilot study will be designed to begin the training of current operational staff to follow the manufacturer's recommended frequency for MBR component inspection, testing, and maintenance. During the pilot study a preliminary operating and maintenance manual will be developed for use in the design and permitting phase of the project.

Pearland Pilot Protocol



PILOT PLANT LOCATION

1:1,200

1 inch = 100 feet

NORTH

This product is for informational purposes only and may not be prepared or be suitable for legal, engineering, or surveying purposes.

MAP PREPARED: APRIL 20, 2017
GIS DEPARTMENT

BARRY ROSE WATER RECLAMATION FACILITY LOCATION

1:6,000

1 inch = 500 feet

NORTH

This product is for informational purposes only and may not be prepared or be suitable for legal, engineering, or surveying purposes.

MAP PREPARED: MAY 4, 2017
GIS DEPARTMENT