City of Sugar Land

Lift Station Asset Management

SCOPE OF SERVICES

March 21, 2018

This project scope is to perform condition and risk assessment and establish the asset management criteria for the lift stations analysis and forecasting for rehabilitation and replacement (R&R). Sugar Land has 134 Lift Stations to be prioritized under this project.

Arcadis will provide and configure the Rehabilitation and Replacement Planning System (RRPS) to assist with near term Capital Improvement Program project planning and funding projections over the next 50 years. Results can be used to schedule future inspections and track capital projects within Cityworks and GIS

The Arcadis RRPS software tool applies service level, consequence of failure, condition and replacement cost criteria in conjunction with budget alternatives to plan for the R&R of assets such as lift stations. Assets are prioritized based on their resulting risk score to plan for full replacement or rehabilitation to extend their service life. Various budget scenarios can be modeled to show how the system-wide condition and risk change based on higher or lower funding levels as well as levels of service. This will allow the user to choose the most appropriate long-term funding to achieve its service level goals. Assets can be bundled into R&R projects by lift station or other grouping defined by the user. The resulting annual metrics include:

- R&R Budget
- Facilities and/or individual assets scheduled for rehabilitation or replacement
- Average facility and system-wide asset age, condition and risk
- Average age, condition and risk of the replaced assets

Results from the condition assessment and RRPS model can then be loaded into the Enterprise GIS and Cityworks.

TASK 1. PROJECT MANAGEMENT

Arcadis uses the Project Management Institute methodology to ensure proper execution of the following tasks to successful achieve the desired goals. Arcadis will facilitate a kick off meeting to review the scope of the project, the proposed schedule and the key success factors. Project management activities will be performed throughout the duration of the project including schedule and budget reviews, resource allocation, invoicing including monthly summaries of work performed, and any as needed status update calls between formal meetings. Prior to the

kickoff meeting, a data request will be submitted whereby the City will provide the most current asset inventory, work history and other supporting data related to the Lift Station infrastructure, if necessary and available. During the kickoff workshop, this data will be reviewed to build consensus regarding the meaning of pertinent data as well as its completeness and accuracy.

Task 1 Deliverables:

- Kick off meeting materials and minutes including a request for information
- Monthly invoicing and summary reports

TASK 2. ESTABLISH RISK METHODOLOGY

The risk assessment methodology will establish an effective and repeatable process for the City to evaluate asset risk on a consistent basis across all lift station facilities and for future use on treatment facilities.

Data Review and Asset Definition: The City is in the process of building a GIS database schema which will be used for both GIS and Cityworks. For estimating purposes, the following list represents sample Lift Station assets and possible attribute fields that will be collected in the field for each asset group. The actual assets will be determined by the City. For key information not available and readable, Arcadis will work with Operations to try to determine the information.Structures include buildings, wet wells, vaults, fences and grounds. Electrical includes MCCs, VFDs, Transformers, Control Panels and ATS equipment. Instrumentation includes RTUs and SCADA Panels.

Table 2.1 Equipment Groups and Attributes

Attributes	Lift Station Assets						
	Structures	Pumps	Piping / Valves	Electrical	Generators	Odor Control	Instrumentation
Manufacturer	X	X	X	X	X	X	X
Model		X		X	X	X	X
Serial Number		X		X	X	X	X
Type	X	X	X	X	X	X	X
Install date	X	X	X	X	X	X	X
Capacity	X	X			X	X	
Voltage		X					X
Current		X					X
Power		X			X		
Diameter	X		X				
Height	X						

Attributes	Lift Station Assets						
	Structures	Pumps	Piping / Valves	Electrical	Generators	Odor Control	Instrumentation
Width	X						
Depth	X						
Material	X		X				
LoF Score	X	X	X	X	X	X	X
CoF Score	X	X	X	X	X	X	X
Redundancy Factor	X	X	X	X	X	X	X
Risk Score	X	X	X	X	X	X	X
Replacement Cost	X	X	X	X	X	X	X

These Lift Station assets represent the asset inventory that will be imported by the City to refresh RRPS periodically, using ArcGIS Model Builder, similar to the process used for the watermains model.

Asset Condition for Likelihood of Failure (LoF): Arcadis will define the full condition assessment methodology, standards and scoring to rank asset LoF. Consistent with International Infrastructure Management Manual recommendations, the methodology will provide two condition ratings to evaluate all potential failure modes.

Physical Condition. Represents the mortality failure mode and measures the current state of repair and operation of the equipment. The Physical Condition can be determined by visual assessment alone or in combination with predictive mechanical and/or electrical testing if any is currently performed under the maintenance program.

Performance Condition. Represents the three failure modes of capacity, efficiency and level of service (includes regulatory). Performance condition is determined in multiple ways including: document reviews, maintenance/ failure history analysis, and discussions with City Lift Station Maintenance staff.

The approach to assess the physical condition will provide a standardized visual assessment using a 1 to 5 scoring and criteria descriptions for the following asset categories:

- Mechanical assets
- Electrical and I&C assets
- Structural assets

Using a standardized scale with specific descriptions will allow for an unbiased comparison between assets and also allow tracking of condition decay over time. The methodology for

assessing performance condition will address the ability of the asset to meet operational requirements now and in the future considering the three failure modes as shown in the Table below.

Table 2.2 Performance Assessment

| IIMM Failure Modes	Typical Measures	Potential Data Sources
Capacity	Ability to meet current and future requirements	Pump run time from Monthly Operating Reports, and 2017 City-wide I/I Study
Level of Service (LOS)	Regulatory and other City operating goals (see LOS discussion below).	Monthly Operating Reports, SCADA, CMMS, interviews
Efficiency	Ability to deliver lowest life cycle cost: labor, power, spare parts, etc.	SCADA, CMMS, interviews

Arcadis will facilitate a collaborative performance assessment process with interviews, data and input from key stakeholders based upon a 1 to 5 scoring approach with specific criteria assigned to each failure mode. The RRPS will capture all physical and performance condition assessment evaluation criteria and scoring to provide a comprehensive profile for individual assets or groups of similar assets.

Asset Consequence of Failure (CoF): Arcadis will develop CoF criteria to be applied across all of the City's Lift Station facilities using a best practices triple bottom line approach considering the economic, social and environmental impacts. The economic criteria measures the direct cost to the City to respond to a failure, the social criteria include service disruption and other level of service commitments to customers and the environmental criteria include regulatory non-compliance and any other environmental degradation which may result from an asset.

Asset Redundancy Calculations: Redundant equipment at the Lift Stations such as multiple pumps or motors will be evaluated based on peak flow conditions to identify potential reductions to risk.

Risk Scoring: A Risk score will be calculated in the RRPS for each asset using the equation shown below. Discussions will be held with the City to determine the acceptable level of risk and

condition, or other service levels, to drive the 5-year Capital Planning process as well as the long-term funding needs.
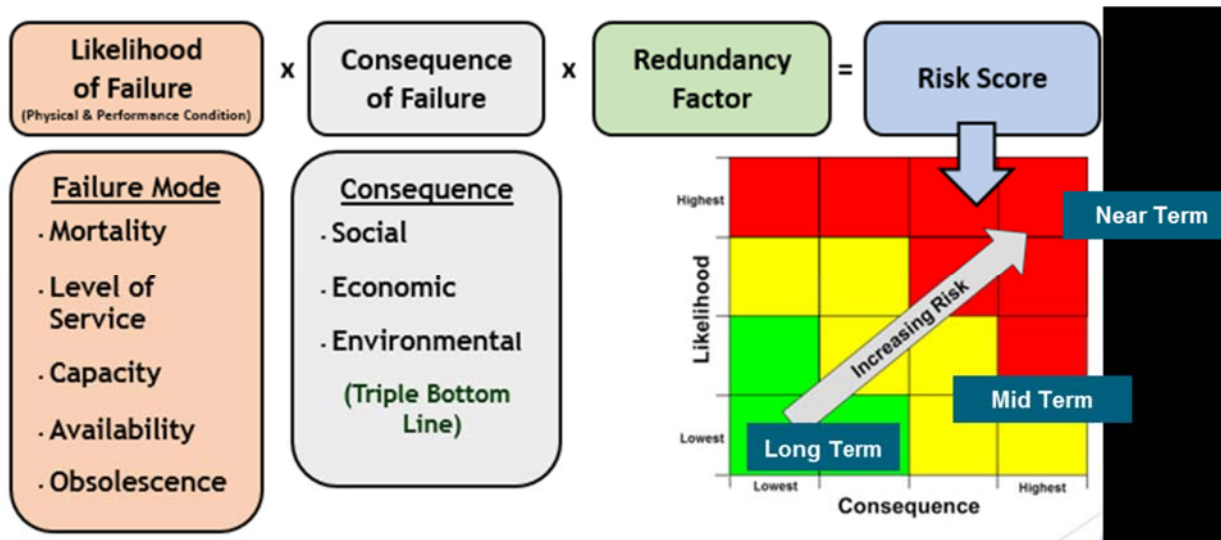
Effective Useful Life (EUL): In addition to risk scores, the concept of EUL will be used to understand how assets will decay over time to support long term planning. EUL will be established for each asset class along with a straight-line decay curve. Arcadis will bring its established list of EUL's for similar equipment gathered over the last 10 years to start the discussions with the City. Current remaining life will be calculated for each asset based upon its install date as well as its current physical condition assessed during the visual assessment. An example would be for an asset that receives a poor condition score but has half of its anticipated useful life left, its remaining life was reduced using the decay curve for this asset class.

Replacement/Rehabilitation Cost Estimates: Arcadis will calculate replacement or rehabilitation costs for the assets to support short term and long-term funding needs. The City will provide installation or replacement costs based on recent bid costs and perform any additional research and coordination with equipment manufacturers and suppliers to estimate replacement costs. Arcadis will provide a template of elements for costing to the City and review costs provided by the City.

Task 2 Deliverables:

- Three workshops to establish methodology
  a. Condition Assessment
  b. Consequence of Failure, Risk, and Service Levels
  c. Effective Useful Life and Replacement Costs

- Risk Assessment Methodology Guidelines Document

TASK 3. CONFIGURE PLANNING TOOL

The Planning Tool (RRPS) will be configured for full functionality once the Risk Methodology has been completed, to receive the asset data, attributes, service levels, effective useful life and decay curves, and replacement costs to support risk calculations, short term project identification and long-term funding need projections.

Task 3 Deliverables:

- Configured RRPS for Use

TASK 4. RISK METHODOLOGY

Field Physical Condition Assessment: Arcadis, accompanied by City Staff, will visit the lift stations to visually assess assets and capture readily available attribute data. The field assessment team will consist of a civil / mechanical engineer and staff engineer. For those lift stations deemed more critical, an estimated 12 lift stations (3 days of inspection with average rate of 4 per day), the team will be supplemented by structural and HVAC engineer. The electrical engineer will visit the same 12 lift stations as above and additional 32 stations (6 days of inspections at average rate). Field captured information for the other lift stations will be reviewed by the same engineers. Odor control systems (3 stations) will be assessed on site by a mechanical / HVAC engineer. Other stations with odor control system will be assessed remotely by review of photographs and field data by specialists. The team will utilize the Arcadis Asset Hound tablet-based data collection system which will collect the appropriate physical attributes and condition scoring based upon the proposed methodology. The use of Asset Hound speeds up the data collection process and eliminates data transcription errors. Based on the sample assets types and multiple pumps, we are anticipating cataloging 8 – 10 assets per lift station site. It is not anticipated that there will be time to populate all of the proposed database attributes in the limited time for the field assessment phase of the work. The critical information for this exercise is to confirm age, type, and capacity of the assets and assess the condition. Where attribute information is not available, a phone conference will be held with Operations to estimate the values.

Task 4 Deliverables:

- Spreadsheet of Data to be collected in the field provided in advanced of the field work.
- Full lift station dataset captured and loaded into RRPS, including updated City GIS layer / geodatabase.

TASK 5. RESULTS REVIEW AND SCENARIOS EVALUATION

An interactive workshop will be held with the City to review the results of the identified short term lift station needs as well as look at a 50-year funding needs projection based upon the decay curves and service levels configured into the RRPS. Alternate scenarios will be evaluated to identify the best plan for the City that meets their service level goals. Project bundling will also be discussed in terms of creating projects, up to 10, from the short-term assets requiring rehabilitation or replacement by asset class, facility or geography.

Task 5 Deliverables:

- Workshop materials and facilitation for results, scenarios, and project bundling
- RRPS with data configured for the selected scenario and potential short-term projects

TASK 6. TOOL DELIVERY, TRAINING, AND PRESENTATION SUPPORT

To support the City staff in taking over the replacement planning efforts in the future, Arcadis will provide staff training for the RRPS along with a user's guide. Arcadis will provide one on-site training session with City employees for transfer and use of the RRPS software. The session will coincide with installation of the RRPS on the City's network. Complete documentation and training guides will be provided to the City prior to installation and training.

Task 6 Deliverables:

- RRPS installed at the City
- One day of training for City staff
- RRPS User Manual and training materials

TASK 7. EXTRA WORK

Complete extra work as requested by the City. This may include additional meetings, site visits, trainings, presentation support, software support, and records research.

SCOPE ASSUMPTIONS

- The City will provide advance notice of any requested meetings to Arcadis to allow for appropriate preparation
- If necessary, the City will coordinate with other consultants/sub-consultants in obtaining any required data/memoranda/reports/information, etc.
- The City will respond in a timely manner to data requested Arcadis.
- The City will accompany Arcadis staff for field condition assessment activities to provide site access, open cabinets, turn on equipment, and or remove equipment.
- The City will be responsible for changes to the Cityworks application and database.
- The City will be responsible for reviewing record information to fill in any gaps in attribute data.

COST OF SERVICE

The City will pay for the services rendered by Arcadis a cost not to exceed amount of $400,000. according to the Exhibit A Fee Estimate.

SCHEDULE OF PAYMENT

Arcadis will provide a monthly invoice for engineering services and other direct costs (ODCs) based on the actual amount of work performed in the previous month. The monthly invoice will be based on the actual number of hours worked in the invoiced month in addition to other direct costs. The total cost of this project will not exceed the Exhibit A Fee Estimate unless a change in scope and fee is approved by both parties.

PROJECT TIMELINE

It is anticipated that the work order will be completed within 300 days from notice to proceed unless continued at the direction of the City. It is anticipated that the project will begin in April of 2018 and be completed by February 2019.

City of Sugar Land
Lift Station Assessment

Task No.	Task Description	Principal Consultant Hyer / Osthues	Project Manager Steed	Senior Consultant Heltzel	Engineer Electrical Young	Structural Engineer Cauley	Engineer Mechanical Tu	Data Management Lehman	Project Engineer Agarwalla	Admin Cooper	Total Hours	Total Billable	Expenses
1.0	Project Management											$6,737	
1.1	Project Management / Controls		10							10	20	$2,970	$200
1.2	Kickoff Meeting	4	2								6	$1,536	$500
1.3	Data Request	1	4	2							7	$1,531	$0
2.0	Establish Risk Methodology											$76,293	
2.1	Review Existing Data	2		6					8		16	$2,806	
2.2	Review City's Hiearchy Structure in GIS	4	8	12					8		32	$6,308	
2.3	Likelihood of Failure (Condition and Performance)	16	16	2					20		54	$10,500	
2.4	Consequence of Failure / Service Levels	16	16	2					24		58	$10,960	
2.5	Effective Useful Life and Replacement Costs	8	16	2					16		42	$7,776	
2.6	Workshops (Cond Asesmnt, COF / Risk / Service Level, EUL / Replcmnt Costs)	30	28	20					24		102	$21,306	$5,000
2.7	Risk Assessment Methodology Guidelines Document	5	16	2					52	6	81	$11,637	$0
3.0	Configure Planning Tool											$24,200	
3.1	Configure Planning Tool			110							110	$24,200	
4.0	Risk Methodology Roll-Out											$212,630	
4.1	Detailed Field Condition Assessements (25 days of Assessments)	24	220		72	24	24	84	220	2	670	$111,378	$6,200
4.2	Desktop Assessment (COF, Performance, EUL, Replacement Costs)	36	80		16	8	8	80	200		428	$68,196	
4.3	Data Loaded into RRPS		4	31				22	32		89	$14,960	
4.4	Data QA/QC	12		16				30			58	$11,896	
5.0	Results Review and Scenarios Evaluation											$40,896	
5.1	Results, Scenarios, and Project Bundling Workshop	24	12	24				20	32		112	$21,496	$2,000
5.2	RRPS Data Configured for Selected Scenario and Short Term Projects	2	4	24					36		66	$10,794	
5.3	Final Results Technical Memo	2	10	4					24	4	44	$6,606	
6.0	Tool Delivery, Training, and Presentation Support											$11,708	
6.1	RRPS Installation in City Systems			4							4	$880	
6.2	Training Sessions for City Staff (1)		2	10							12	$2,604	$1,000
6.3	RRPS User Manual and Training Materials		2	31							33	$7,224	
7.0	Extra Work (As Requested by the City)											$27,536	
	Total Hours	186	450	302	88	32	32	236	696	22	2044		
	Estimated Total Billable	$52,638	$90,900	$66,440	$14,696	$5,440	$6,144	$39,176	$80,040	$2,090			
	Total Cost Not to Exceed Fee											$400,000	

Assumptions:
5.5 Lift Stations visited per day