New Production Water Well #18
Proposal for Hydrogeological Services

February 4, 2022

Prepared for:
City of Douglas, Arizona

Prepared by:
Stantec Consulting Services, Inc.
3133 West Frye Road, Suite 300
Chandler, Arizona 85226

Table of Contents

Attachments

Section 1 – Introduction

1.2 Project Understanding and Objectives

The City of Douglas, Arizona (City) is progressing with varying alternatives to provide additional water supply to the City's municipal distribution system. One of these alternatives includes the design and installation of a new production well (Well 18) to be located on the north side of the City near North A Avenue and 25th Street.

Proposed Well 18 is anticipated to be completed to approximately 800 to 1,000 ft depth with production rates of 1,000 to 1,500 gallons per minute (gpm), based on available aquifer data in the area. To meet these design requirements, the City is seeking hydrogeological support for well design, including specifications and well diagram to be issued for a solicitation of bids for the drilling construction scope of work (SOW). Additionally, part-time drilling oversight and field data collection is proposed to document drilling, well installation, development, and hydraulic performance testing.

Stantec understands the SOW for this project includes the following major elements:

- Prepare technical specifications, conceptual well design details, and bid tabulation for City's issuance to drilling contractors
- Prepare all permits required for drilling and provide to the City representative for issuance to appropriate agencies
- Part-time oversight of well drilling activities
- Finalize well design based on well drilling data
- Part-time oversight of well construction and installation activities
- Oversight of well development and testing, including rig development, pump development, step-rate pumping test, and constant rate pumping test
- Prepare a well completion report documenting all activities and testing results
- Project Management including routine progress meeting, project schedule, and financial forecasts

Please note that Stantec is prepared to support the City with the well site design, including civil, mechanical, electrical, and instrument and controls (I&C) to bring the completed well on-line. However, these engineering design services will be provided in a separate proposal to be delivered at a later date. For now, the City has requested preparation of well drilling specifications so that they may begin the bidding process with drilling contractors as soon as practical.

Section 2 –Scope of Work

The SOW is divided into the tasks as described below and included in the Estimated Cost (Section 5 and **Attachment A**).

2.1 Well Design, Installation, Testing, Reporting, and Project Management

Task 100.100 – Well 18 Technical Specifications and Conceptual Drawings

Stantec will prepare the technical specifications covering well drilling, construction, installation, and testing for the City to issue to drilling contractors (bidders) and for use in selecting a drilling contractor. The City will be responsible for preparation of the contracting package and management of the selection and the City / Contractor contracting. A conceptual well diagram will be attached to the specifications including all pertinent elements of the well design. A Bid Tabulation will be prepared that includes appropriate line items for drilling and construction costs in order to have a uniform bid summary from all contractors. Stantec will prepare these documents in the following formats for City review and comment:

- 90% Draft
- Final - Issued for Construction (IFC)

Once the specifications are final, Stantec will assist the City with coordination and distribution to selected drilling contractors. Stantec will be prepared to field contractor questions, issue addenda (if necessary) and coordinate logistics of the bidding process. When all drilling contractor bids are submitted, Stantec will review bids and make a recommendation to the City. Once the drilling is contracted, Stantec will lead a pre-construction meeting anticipated to be held on site with the drilling contractor and City personnel.

Assumptions

- Design “drawings” will only include “below ground” well construction details (conceptual well design diagram). Drawings will not include Well 18 ‘above ground’ detailed design of the site civil, mechanical / electrical, instrumentation and control, water treatment systems, etc. Drawings will not include equipment (e.g., pump, discharge piping, meters, motor controls, etc.). APS power supply or ADEQ Approval of Construction will not be included.
- Site survey will be conducted by the City and provided to Stantec. The well coordinates will be chosen by Stantec, in coordination with the City, to be in a favorable location considering future design elements at the site (e.g., power supply, existing conveyance piping, etc.).
- No more than 2 addenda of the technical specifications will be required.
- A pre-bid meeting for drilling contractors is not included in the scope; however, a pre-construction or kick-off meeting with the selected contractor will be attended on site.

Deliverables

Stantec will provide the following deliverables:

- 90% and IFC package for the technical specifications, drawings, and drillers bid tabulation

Task 100.200 – Preparation and Execution of Permits

This task includes the completion of necessary permits for drilling, including the Arizona Department of Water Resources (ADWR) Notice of Intention (NOI) to drill a new well. Any other environmental permits required by the City (e.g., erosion control, right-of-way permits, etc.) will be coordinated with the City and completed. Stantec will provide draft and final copies of all permit documents to the City personnel for submittal to the appropriate agencies. Stantec will deliver the NOI application to ADWR.

Assumptions

- Water rights permitting or support is not included.
- ADEQ permits, including Approval to Construct (ATC) is not included in this phase of the project.
- APS power supply permitting is not included.
- Site survey will be conducted by the City and provided to Stantec.

Deliverables

- Draft and final permit applications (NOI for drilling, and other environmental permits, if necessary)

Task 100.300 – Oversight of Drilling Activity and Zonal Testing

Stantec's field staff is not only technically sound and experienced with drilling oversight and documentation, but we are grounded in our cultural commitment to safety and will ensure that all personnel on site, including other contractors, put safety first. If health and safety issues are identified in the field, they will be reported immediately to the City and the Stantec Supervisor.

This task includes the field oversight of the drilling activity and completion of zonal testing of the borehole. Stantec will provide experienced hydrogeologists on site (part-time) during drilling operations to ensure adherence with the technical specifications, to document drilling activity and progress, and review and document formation cuttings. Part-time oversight of borehole drilling includes up to seven (7) days on site (day shift only).

Following borehole completion to total depth (anticipated to be a 16-inch pilot borehole), Stantec will review the lithologic and geophysical data and recommend depth intervals for zonal testing. Stantec will review the recommended zonal testing program with the City and ensure that field data collection supports the overall project goals and data quality objectives. Zonal testing will be critical in identifying potential water quality concerns and estimated production rates from varying depths within the aquifer. The results of the zonal sampling will be used to confirm or modify the final well design for optimization. Stantec will perform oversight and data collection for the zonal testing program, including up to seven (7) days on site (day shift only).

The zonal testing tools and procedures will be detailed in the well drilling specifications but are anticipated to consist of a 20-foot perforated drill pipe that will be completed as a temporary well within the borehole (with gravel pack annulus and temporary bentonite seals above and below the screened interval). The

drilling contractor will develop the constructed zonal interval(s) for a directed period of time (anticipated to be approximately 8 to 12-hours), and Stantec will work with the drilling contractor to test the zonal intervals. Stantec staff will deploy a pressure transducer (Figure 2-1) into the zonal testing tool and perform falling head (slug) tests to estimate hydraulic conductivity. These results will be applied to representative portions of the borehole (as indicated from lithology and geophysical data) to calculate transmissivity and estimated well production.

Figure 2-1: Example Level Transducer used for Zonal Falling Head Testing

Following zonal testing completion, Stantec will review all collected data, including lithology and grain size, geophysics (Task 200.400), and zonal testing results, and will make a recommendation for the final well design to the City. Modifications to the conceptual well design may include length of perforated interval or slot size of the perforations. Stantec will issue an updated well diagram (Drawing) to the City for review and approval. The drilling contractor will then ream the borehole to final diameter (anticipated to be 28-inches or 32-inches).

Assumptions

- The drilling contractor (or delegated subcontractor) shall be responsible for hand-auger or pot-holing to clear the boring location of utilities prior to drilling. The drilling contractor shall be responsible for the protection of all utilities and other site infrastructure throughout the duration of the drilling program.
- Dust control, erosion control, flagging, and barricading will be within the selected drilling contractor's scope of work (not completed by Stantec).
- Stantec will not be held responsible for utility locate services (e.g., Blue Stake Services), providing portable toilets, hand wash stations, and/or trash containers.
- Stantec may use or rely upon the support facilities that are provided by the drilling contractor, if agreeable, including a "dog house" or dedicated space within a trailer / shelter.
- Stantec field oversight during borehole drilling will include up to seven (7) days (day-shift only). Stantec will also provide oversight and execution of the zonal testing program for up to seven (7) days, in addition to borehole drilling oversight (day-shift only).
- Zonal testing will include a maximum of five zone intervals, including three (3) falling head tests per zone and one water quality sample per zone. Samples will be analyzed for arsenic, total dissolved solids (TDS), fluoride, nitrate, iron, manganese, and chloride. Stantec will coordinate with the

laboratory and arrange for the shipping of samples and pay for lab analyses. A three-day rush turn-around time will be requested.

- Geophysical logging will be completed (contracted) by the drilling company and logs will be provided to Stantec upon completion. This will be included in the drilling specifications.

- Lithologic grain size samples will be provided to the well casing supplier by the drilling contractor for analyses immediately upon reaching total depth of the borehole. Results will be provided to Stantec immediately upon analysis completion (assumed to be completed within five days). This will be included in the drilling specifications.

- Throughout borehole drilling and reaming, the Contractor will record drilling fluid properties and will ensure the fluids are within the parameter ranges that will be provided in the well drilling specifications. The drilling contractor will be required to document and report the drilling fluid properties to Stantec and may be asked to provide a mud engineer to support the drilling program. Stantec will provide the specifications but will not be responsible for managing or supervising the drilling fluid program.

- A recommendation for the final well design will be provided to the City via email and/or verbal communication within 72 hours of receiving the final lithologic grain size analyses, geophysical results, and zonal testing results (including water quality). The City will be prepared to review and final well design recommendation promptly (within 24 hours) to reduce material order and delivery time, and driller stand-by time.

Deliverables

- Daily report(s) documenting drilling / construction / testing activity (for days when Stantec is on site)
- Final well design recommendations and diagram following lithologic grain size analyses, geophysical results, and zonal testing results (including water quality). Diagram will be provided via email.

Task 100.400 – Oversight of Well Construction Activities, Development, and Testing

This task includes the oversight of the well construction, including screen, casing, sounding tube, and annular materials installation. Stantec will provide part-time oversight up to seven (7) days (day-shift only) to document construction details, casing lengths, and annular material volumes. Stantec field staff will ensure materials are in accordance with the specifications and will review bill of materials for casing and other supplies. Stantec staff will calculate theoretical borehole volumes for annular material and will track and document the actual volume of material installed. Any disagreement between the calculated and actual volumes could indicate a compromised borehole or bridging of the materials, and Stantec field staff will work with the drilling contractor to rectify the condition.

Figure 2-2: Well Casing and Sounding Tube Materials – Stantec will inspect all materials for conformance with the specifications.

Well development is one of the most critical elements of the well construction process for overall well performance. Stantec hydrogeologists understand the nuances of well development and testing and will provide part-time oversight, up to seven (7) days (day-shift only) for well development. Stantec will oversee development activity and will document well development metrics (i.e., sand content, depth intervals, estimated production rates). We will communicate closely with the City throughout the development process to confirm all are satisfied with the development results. It is important to closely monitor development progress to confirm proper energy is being applied to the appropriate depth intervals of the well to maximize results, and to determine that the proper development time is invested in this critical piece of the project.

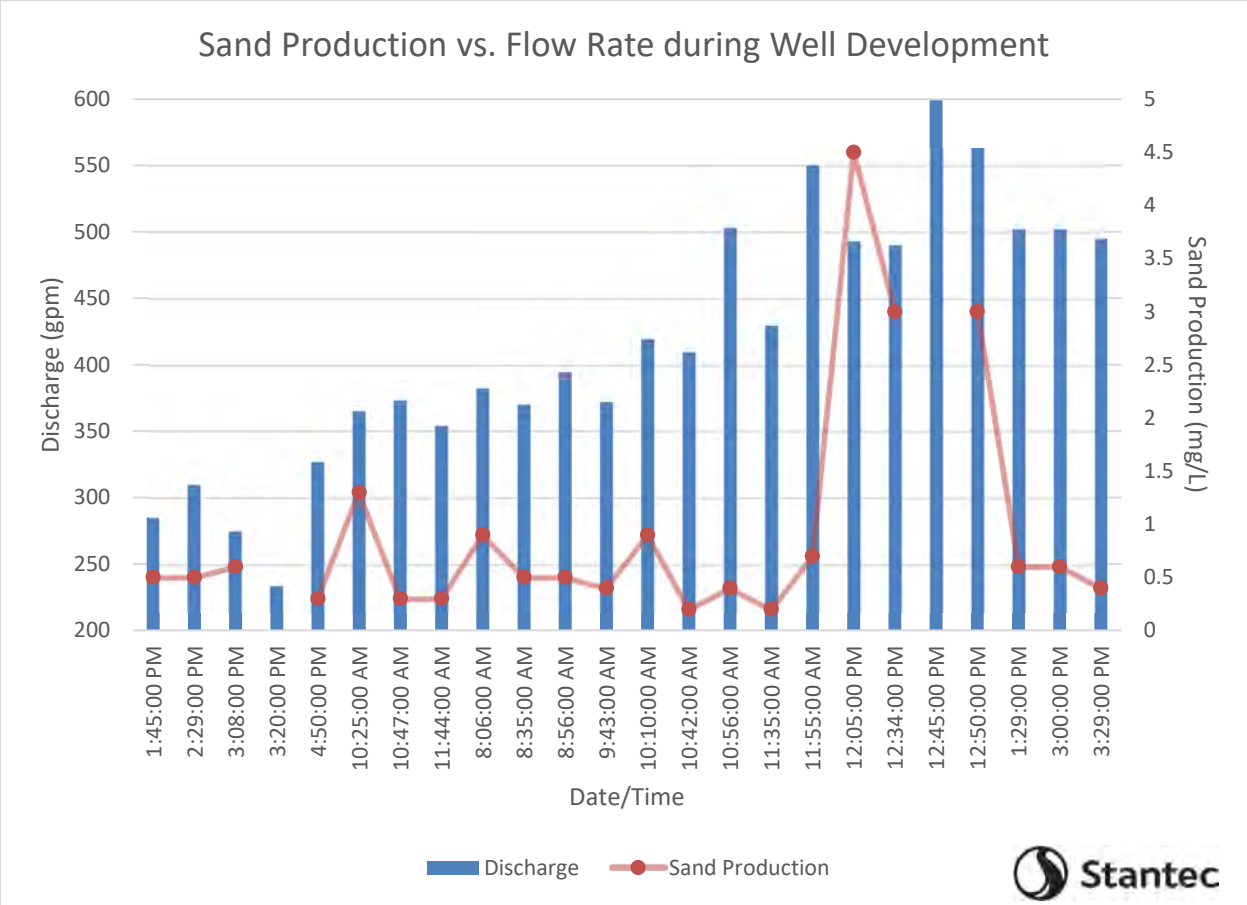
First, the drilling contractor shall "thin" the residual drilling mud within the well using specified chemical additives. The drilling contractor will perform well development in accordance with the specifications, including swab and airlift development to clear the well of drilling fluids and formation fines. The "rig" development will be followed by pump development via the installation of a temporary pump and discharge appurtenances. Development water will be routed away from the well and discharged to the ground in an area approved by the City. The well will be pumped and surged for a minimum time period, but development should be performance-based (i.e., sand production and/or specific capacity metrics).

Figure 2-3: Progression of Well Development – Stantec will closely monitor development progress to track well performance and sand production.

Following rig development, the drilling contractor will install the temporary pump and discharge piping (provided by the driller or driller's delegated subcontractor). Stantec field staff will advise the pump crew on installation criteria (e.g., pump intake depth, discharge effluent, temporary piping routes, etc.), with City's input. The development program will be specified for optimal well performance, and Stantec field staff are experienced with making field decisions to modify the development specifications based on results. For example, surging may be specified once per hour, but nearing completion of development, if well performance has stabilized, surging frequency may be increased to evaluate sand production and to ensure performance remains within specification.

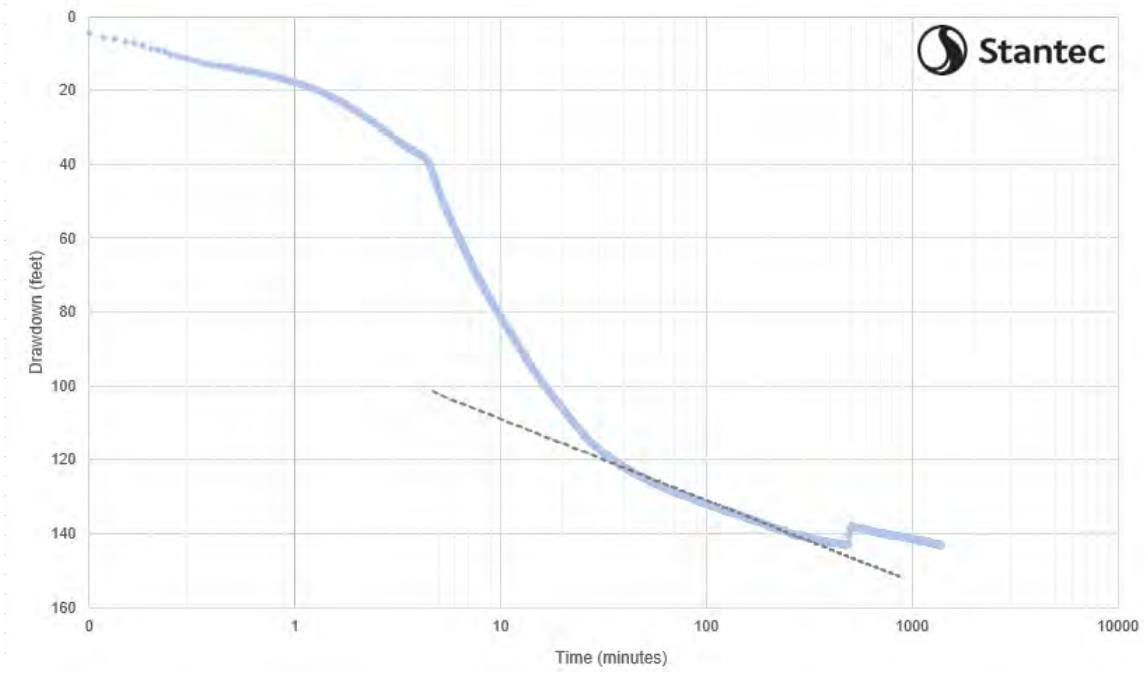
Figure 2-4: Rossum Sand Tester on Development Discharge Line – Stantec will closely monitor develop progress to track well performance and sand production.

Figure 2-5: Sand Production Versus Flow Rate – example graph for tracking development progress.



Once well development is complete, well testing will commence with the same temporary pump installed for development. Stantec will perform full-time field oversight for the pump test (including up to four [4] days of oversight, day-shift only). A pressure transducer will be installed within the well for recording water levels and manual water level checks will be performed periodically. Water levels will be monitored to confirm recovery and equilibrium is achieved prior to the start of pump testing. Testing is anticipated to include a 12-hour step-rate test with four "steps" or pumping rates progressively increasing, followed by a 12-hour recovery period. Once water levels have equilibrated from the step-test to approximately 90% of pre-test pumping levels, or per Stantec's judgement, a 24-hour constant rate production test will be performed (anticipated at 1,000 gpm). Stantec staff will document flow rates and water levels throughout the test and will advise the pump operator to modify flow rates (if needed) based on observations. Discharge effluent will also be monitored to confirm no erosion or sediment control issues develop.

Figure 2-8: Example Pump Test Drawdown Curve



Nearing the completion of the pump test, Stantec will collect a water quality sample for laboratory analysis for the parameters identified by the Arizona Department of Environmental Quality (ADEQ) for a New Source Approval (NSA). The drilling contractor shall install a sample tap on the discharge line suitable for collection of the water quality sample. Stantec will arrange for delivery to the laboratory and will include all analytical costs. Stantec will monitor a 24-hour recovery period following the pump test and will collect water level data for calculations of aquifer parameters (e.g., transmissivity).

Once all testing is completed, the drilling contractor shall coordinate the completion of a downhole video survey and gyroscopic survey. The subcontractor will be notified prior to pump testing so that delays in mobilization are not incurred. Stantec will view the video and gyroscopic surveys results and notify the City of any concerns (e.g., deviations, damage to well casing, accumulated fill that may need to be bailed, etc.). If necessary, Stantec will coordinate with the drilling contractor to complete any necessary well improvements or repairs. Field oversight of the well video and gyroscopic survey is not included.

Assumptions

- This scope includes Stantec oversight for up to seven (7) days of well construction activity, up to seven (7) additional days for well development, and up to four (4) additional days for pump testing.
- Temporary pump procurement, installation, and operation will be performed by the drilling contractor (or subcontracted delegate).
- Pump testing will include a 12-hour step-test and 12-hour recovery period, followed by a 24-hour constant rate test and 24-hour recovery period. Pump test observations will only be performed for Well 18 (no other observation wells).

- Oversight of well video and gyroscopic survey and any well improvements following the video and gyroscopic surveys (should they be necessary) are not included in this scope and total estimated fee, but Stantec could perform additional oversight (if necessary) at the contracted unit rates.

Deliverables

- Daily report(s) documenting drilling / construction / development / testing activity (for days when Stantec is on site)

Task 100.500 – Well Completion Report Preparation

Stantec will prepare a Well Completion Report documenting all drilling, construction, development, and testing details. The following items will be addressed in the Well Completion Report, including recommendations for a permanent pump placement, pumping rates, and estimated long-term drawdown:

- Introduction and Background
- Hydrogeologic Setting
- Well Permits and Documentation
- Surface Casing Installation
- Borehole Drilling
- Lithologic Log
- Zonal Testing
- Geophysical Surveys
- Zonal Testing
- Final Well Design
- Borehole Reaming
- Well and Annular Materials Installation
- Well Development and Results
- Pump Testing and Results
- Water Quality
- Final Well Completion (video survey and gyroscopic survey)
- Conclusions and Recommendations

An as-built diagram of the completed well will also be provided, showing any deviations from the original well design. The Well Completion Report will be prepared, reviewed, and stamped by Registered Geologists in the State of Arizona.

Deliverables

- Draft and Final Well Completion Report

Task 100.600 – Project Management and Progress Meetings

Stantec's Technical Lead and Project Manager will hold bi-weekly progress meetings with City personnel during the drilling and construction phase of the project. The progress meetings will be used to discuss drilling/construction progress, schedule status, health and safety, and any identified issues. It is anticipated that the selected drilling contractor will also provide a delegate to the bi-weekly progress meetings. Stantec will prepare agenda(s) and meeting minutes for each meeting. The project schedule will be reviewed (and updated, if necessary) in the weekly progress meetings.

Assumptions

- Bi-weekly progress meetings will be held via conference call and attended by two Stantec personnel. (Note: A pre-construction meeting on site is anticipated with the Drilling Contractor, City, and Stantec once the drilling contract is executed, and is included in Task 100.100.)

Deliverables

- Agendas and meeting minutes for the bi-weekly progress meetings.

Section 3 – Health and Safety

Stantec's Health, Safety, Security, and Environment (HSSE) policy is the cornerstone of our Health and Safety Management System. In turn, the Health and Safety Management System is part of Stantec's Integrated Management System, which is ISO certified and inspected by an independent private firm. Stantec is an ISO certified company that is compliant with the Occupational Health and Safety Management (OHSAS 18001). We are Browz compliant (account #63AE46N5) and have worked on projects of similar size and scale for many years in a safe and responsible manner.

At all times, Stantec will comply with our internal policies, and any additional City policies dealing with, among other things: site visit regulations, COVID-19 best practices, site safety, occupational health, loss prevention, and drug and alcohol policies. Stantec has implemented the following COVID-19 practices and our leadership routinely communicates these policies to all staff to ensure adherence throughout the company:

- Fit for duty check and documentation each day on the job site or in the office
    - vaccine mandates for all staff entering offices or performing select field work
    - verification that potential exposure has not occurred from tested positive or suspected positive individuals and
    - recent travel to "hot spots" has not occurred

- Stantec has a contact tracing and reporting policy in place. All field visits require our Business Center Operations Level notification. Any office visits require a sign-in / sign-out. Any employee testing positive is requested to notify our Human Resources department so that others who may have been in contact may be notified and shall quarantine.
- All overnight travel must be approved at our Business Center Operations Level and only hotels that have been vetted and meet Stantec criteria for safety precautions
- Staff are restricted to two individuals per vehicle and passengers must sit in the passenger-side back seat; both individuals are required to wear masks
- Stantec has published a thorough guidance document for field work during the COVID-19 pandemic that includes standard operating procedures (mandatory masks, social distancing practices, cleaning and disinfection procedures, safe food and drink handling, etc.). All staff are required to be familiar with the practices and include the guidance document in our health and safety plan for all projects.

Section 4 – Schedule

Stantec's proposed and estimated schedule is summarized below in **Table 4-1** as keyed to the individual tasks outlined in **Section 2**. This schedule is derived upon numerous assumptions, which are listed below, but estimated timeframes are based upon Stantec's experience with similar projects. The total costs (**Section 5**) will be dependent upon the progression of drilling and amount of time needed for field supervision. The schedule will be reviewed bi-weekly with the City and updated (if necessary) throughout the duration of the project, as field schedules may change due to unknown conditions or delays.

Table 4-1: Scope of Work Simplified Task Schedule

Work Task	Description	Task Completion Date
100.100	Technical Specifications and Drawing	11-Mar-22
100.200	Permits	11-Mar-22
--	Drilling Mobilization*	10-Jun-22
100.300	Oversight of Drilling Activity and Zonal Testing*	22-Jul-22
100.400	Oversight of Well Construction, Development, and Testing*	2-Sep-22
100.500	Well Completion Report Preparation*	30-Sep-22

Note: Project Management, Meetings, Supervision, and Quality Control will be ongoing throughout the project
* Schedule contingent upon drilling contractor schedule

Assumptions

- Schedule is contingent upon Notice to Proceed by February 11, 2022.
- Schedule is contingent upon drilling contractor, including mobilization date and progress of drilling activities.
- Drilling contractor is anticipated to mobilize by June 10, 2022.
- Drilling contractor is assumed to work 24/7.
- Demobilization of drilling rig, mobilization of pump rig, and temporary pump installation (for pump development and testing) is assumed to occur seamlessly without delay.
- Assumes 3 days of pump development, followed by 4 days of pump testing (step test, constant rate test, and respective recovery times).
- Project management, meetings, supervision, and quality control will be ongoing throughout the project.

Section 5 – Estimated Cost

Stantec services for tasks included in this proposal will be provided on a time and materials basis per the unit rates as defined in **Attachment A**. Stantec's estimated cost to complete the SOW is $149,820 as summarized in **Attachment A**. Stantec will invoice on a monthly basis for services provided the previous month, with the assumptions provided herein.

Attachment A – Cost Summary Detail

FEE ESTIMATE - Douglas Well 18 Design

Name	Principal Engineer	Hydrogeologist, Technical Lead	Water Resources Engineer	Hydrogeologist	Senior Hydrogeologist, Quality Review	Project Manager	Travel costs (mileage, lodging, meals, etc.)	NOI Permit fee	Laboratory costs	Field Equipment
	Bryck, Jack	Graves, Dustin	Wang, Sixue	Ward, Michael	Weinig, Walter	Raman, Aaditya				
Project Billing Rate	$225.00	$153.00	$141.00	$141.00	$215.00	$191.00	$1.00	$1.00	$1.00	$1.00
Total Units (T&M)	34	306	340	52	8	60	9200	150	15800	1750
Fee (T&M)	$7,650.00	$46,818.00	$47,940.00	$7,332.00	$1,720.00	$11,460.00	$9,200.00	$150.00	$15,800.00	$1,750.00

Project Summary	Hours	Labour	Expense	Subs	Total
Fixed Fee	0	$0.00	$0.00	$0.00	**$0.00**
Time & Material	800	$122,920.00	$26,900.00	$0.00	**$149,820.00**
Total	800	$122,920.00	$26,900.00	$0.00	**$149,820.00**

WBS Code	Task Code	Task Name	Units								Task Type	Hours	Labour	Expense	Subs	Total
1	100.100	Technical Specifications and Drawings	2	60		16	2				Time & Material	80	$12,316.00	$0.00	$0.00	$12,316.00
2	100.200	Permits		6		2			150		Time & Material	8	$1,200.00	$150.00	$0.00	$1,350.00
3	100.300	Oversight of Drilling and Zonal Testing	8	100	130	4	2	3600	800	250	Time & Material	244	$36,424.00	$4,650.00	$0.00	$41,074.00
4	100.400	Well Construction, Development, and Testing	8	120	170			5600	15000	1500	Time & Material	298	$44,130.00	$22,100.00	$0.00	$66,230.00
5	100.500	Well Completion Report	4	20	40	30	4				Time & Material	98	$14,690.00	$0.00	$0.00	$14,690.00
6	100.600	Project Administration and Management	12				60				Time & Material	72	$14,160.00	$0.00	$0.00	$14,160.00

SUMMARY REPORT

Project Company	Stantec US Business Group
Project Currency	US Dollar
Contract Type	Time & Material

Project Number	1813.xxxx
Project Name	Douglas Well 18 Design
Client Name	City of Douglas, Arizona
Business Centre	2330
Project Manager	Aaditya Raman
Project Technical Lead	Jack Bryck

Project Summary	**Total Fee**
Labour	$122,920.00
Expense	$26,900.00
Subs	$0.00
Total	**$149,820.00**

Planned Start Date	**Planned End Date**
2022-02-11	2022-09-30

Name	Role	Billing Rate	Hours	Sub-Total Fee
Bryck, Jack	Principal Engineer	$225.00	34.00	$7,650.00
Graves, Dustin	Hydrogeologist, Technical Lead	$153.00	306.00	$46,818.00
Wang, Sixue	Water Resources Engineer	$141.00	340.00	$47,940.00
Ward, Michael	Hydrogeologist	$141.00	52.00	$7,332.00
Weinig, Walter	Senior Hydrogeologist, Quality Review	$215.00	8.00	$1,720.00
Raman, Aaditya	Project Manager	$191.00	60.00	$11,460.00
			800.00	**$122,920.00**

Expense	Billing Rate	Units	Sub-Total Fee
Travel costs (mileage, lodging, meals, etc.)	$1.00	9,200.00	$9,200.00
NOI Permit fee	$1.00	150.00	$150.00
Laboratory costs	$1.00	15,800.00	$15,800.00
Field Equipment	$1.00	1,750.00	$1,750.00
			$26,900.00