COCHISE COUNTY
PROCUREMENT DEPARTMENT

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19-33-HFP-01
Attachment 2 – Scope of Work

In accordance with 19-33-HFP-01, the CONTRACTOR shall provide all labor, materials, transportation and expertise in order to accomplish Cochise County ("COUNTY") San Pedro Watershed Monitoring services to the satisfaction of the COUNTY.

The tasks listed below are the identified elements to this Scope of Work (SOW). Palominas Monitoring tasks are denoted by a 'B' prefix, and Ephemeral Streamflow/Groundwater Monitoring activities are denoted by a 'C' prefix.

1.0 Task A: Project Management

1.1 Task A1: The CONTRACTOR shall:

- Identify a project manager who will be responsible for managing the budget, schedule, and deliverables throughout the project, including the management of budget, schedule, and deliverables of any Sub-Contractors, as well as report directly to the COUNTY's project manager;
- Identify all Sub-Contractors who will be involved in the project;
- Schedule and coordinate field work, including equipment installation, data collection, and periodic data downloads;
- Participate in and lead conference calls/meetings for the duration of the contract, including the regularly-scheduled quarterly Cochise Conservation and Recharge Network (CCRN) Technical Team Meetings (6 meetings assumed);
- Assign roles and communication system for CONTRACTOR and Sub-Contractor project team members; and
- Identify key stakeholders' groups, contacts for each group, and timing for project participation with assistance from the Project Team.

2.0 Task B: Palominas Monitoring

2.1 Task B1: Palominas Monitoring System Data Collection and Management

Dataloggers at the Palominas recharge facility record sensor measurements of groundwater elevation (4-hour intervals); basin water level elevations (15-minute intervals); drywell and infiltration trench water level elevations (15-minute intervals); and soil matric potential and soil water content in vadose zone boreholes (4-hour intervals). Three rain gauges record total precipitation and average temperature precipitation on 15-minute intervals.

United States Department of Agriculture-Agricultural Research Service (USDA-ARS) staff will download data quarterly during the monitoring period (4 events from January to December 2019). One data download site visit is budgeted for staff to allow for concurrent maintenance and calibration of monitoring equipment, as needed (Task B2). Data will be checked and processed at least quarterly. Spreadsheet processing will include calibrations, corrections, and time-series plotting of sensor measurements, and modeled estimates of stormwater capture and groundwater
recharge. The monitoring period ends December 31, 2019.

Assumptions include:

- 2 field days per data download trip (1 person)
- 2 field days to troubleshoot and replace datalogger equipment as needed in 2019 (1 person)
- USDA-ARS will download data from the Palominas facility on a quarterly basis

2.2 Task B2: Palominas Monitoring System Maintenance

Monitoring station maintenance will consist of up to two site visits, as necessary, to troubleshoot and fix any problems. To the extent practicable, maintenance visits will be scheduled together with data downloading visits. For budgeting purposes, and because equipment is now five years old, $3,000 for instrument replacement during the annual monitoring period is estimated.

2.3 Task B3: Palominas Data Analysis and Annual Report

Data analysis will include estimates of precipitation, evaporation, basin-specific infiltration volumes using the mass balance and field-based approaches, duration of ponding, water flow between basins, recharge enhancement feature infiltration volumes, groundwater elevations and gradients, and soil moisture trends.

2.4 Task B4: Palominas Facility Inspection and Memo

The facility will be inspected once in March and once in September 2019. A memorandum will be prepared following each inspection visit detailing the observations made and recommendations for facility maintenance. Recommended maintenance actions will be ranked for priority using 3 categories: critical, high priority, low priority. It is assumed that COUNTY will perform all maintenance

3.0 <u>Task C: Ephemeral Streamflow and Groundwater Monitoring</u>

3.1 Task C1: Survey of Monitored Channel Reaches/Stations

Ephemeral streamflow monitoring stations installed during the first year of monitoring activities were surveyed using real-time kinematic (RTK) satellite positioning during installation. Stream flow events have the potential to alter cross section geometry, presenting the need to update the cross-section geometry used in the analyses. Each sensor location will

be visually assessed for changes since installation/survey to evaluate the need for re-survey. Where re-survey is warranted, the sensor locations will be re-surveyed using RTK.

Information gathered during site surveys will be used to modify monitoring sensor placement locations as needed, and to generate data necessary for input into the CSA2SAC computer model, the HEC-RAS files, and the roadway crossing analyses.

3.2 Task C2: Ephemeral Streamflow and Groundwater Monitoring and Reporting

3.2.1 Task C2a: Quarterly and Mid-Monsoon Data Downloads

Data will be manually downloaded from all monitoring equipment at Bella Vista, Riverstone, Horseshow Draw and Palominas watershed five times during the annual monitoring period. Also included is download of pressure transducer data installed under separate contract at the Babocomari River groundwater well installed on The Nature Conservancy property. All pressure transducers, rain gauges, and the surface water imagery stations will be assessed for functionality, battery life, and sensor and clock drift. Data trends will be examined in the field to assure data quality, and any necessary adjustments will be made. Precipitation data from on-site rain gages will also be downloaded during the data downloads.

Five data download visits (March 2019, June 2019, August 2019, September 2019, and December 2019) are assumed with one staff for two days each visit.

3.2.2 Task C2b: Equipment Maintenance

Flow events at the sensor stations may create the need to routinely clear vegetation and other debris from the sensors in order to allow for accurate measurement readings. Minor debris removal will occur coincidentally with the data downloads. Large flow events have the potential to scour channel bottoms and erode channel banks, which may necessitate adjustments to sensor installation locations and depths, as well as resurvey of channel cross sections and characteristics (roughness, uniformity, etc). One additional site visit shall be assumed to allow for such maintenance, as changes may not be evident until data has been processed and analyzed.

3.2.3 Task C2c: Data Processing and Analysis

Data from the third-year monitoring period at all CSA stations will be analyzed following methods provided in Smith et al (2010), and using HEC-RAS, depending on the station. Data for individual runoff events will be pre-processed and formatted as necessary for input into the SAMDC program developed by Trent University or HEC-RAS. Output files provide instantaneous stream discharge estimates which will be used to develop complete event hydrographs of discharge.

Data from the third year of monitoring activities at roadway crossing stations will be analyzed following accepted engineering methods provided by the FHWA. At roadway crossing stations (Palominas watershed), culvert and/or roadway overtopping rating

curves/tables will be generated to provide stage-discharge relationships to estimate flow volumes.

Data collected at the stock pond installations within the Riverstone property will be analyzed using the COUNTY's 2-foot contour resolution mapping, in order to develop a stage/storage relationship to translate recorded depths to volumes. The Ramsey drop structure data will be analyzed through the use of a broad-crested weir rating, to translate recorded flow depths to volumes.

3.2.4 Task C2d: Reporting-Ephemeral Streamflow Monitoring

Following analysis of monitoring data, an annual report will be generated which summarizes project findings. The following metrics will be calculated for each of the monitoring stations:

- Complete event hydrographs of discharge
- Total annual and individual event flow volumes (acre-feet)
- Peak channel discharge (cubic feet per second)
- Event flow durations (hours)

Data from the surface water imagery station will be summarized to provide estimates of water depth and extent during flow events.

3.2.5 Task C2e: Reporting-Groundwater Monitoring

Groundwater data for the annual monitoring period will be summarized in a data memo (subtask 3e) and provided to Cochise COUNTY and The Nature Conservancy in support of development of the Walton Family Foundation's Groundwater Metric.

3.2.6 Task C2f: Annual Results Presentation

See deliverables 4 through 7.

4.0 <u>Deliverables</u>

4.1 Deliverable 1: Monthly Reports and Invoices and Quarterly Conference Calls/Meetings

4.2 Deliverable 2: A 2019 calendar year annual report will be provided by March 31, 2020. Preliminary tabular data summaries will be provided as requested by CCRN members following any of the quarterly monitoring data downloads.

4.3 Deliverable 3: Two inspection report memos including all site photos will be provided within one week following the inspections

4.4 Deliverable 4: A Draft Annual Monitoring Report will be submitted to the project team at the end of the one-year monitoring period. All project activities will be clearly documented, including data interpretation and analysis. All associated data will be provided in electronic format, as an appendix to the draft and final reports.

4.5 Deliverable 5: A Final Annual Monitoring Report will be submitted within one month of receipt of comments from the project team.

4.6 Deliverable 6: A memorandum summarizing the groundwater monitoring data will be submitted to the project team.

4.7 Deliverable 7: Following report submittal, a meeting will be held with the CCRN technical team to present results for year 2 ESM monitoring

Task	Sub-Task	Title	Deliverable
A	1	Project Management	**Deliverable 1:** Monthly Reports and Invoices and Quarterly Meetings/Conference Calls
B	1	Monitoring System Data Collection and Management	**Deliverable 2:** 2019 Calendar Year Annual Report
	2	Monitoring System Maintenance	
	3	Data Analysis and Annual Report	
	4	Facility Inspection and Report	**Deliverable 3:** Bi-Annual Facility Inspection Reports
C	1	Survey of Monitored Channel Reaches/Stations	N/A
	2a	Quarterly & Mid-Monsoon Data Downloads	**Deliverable 4:** A draft annual monitoring report will be submitted to the project team at the end of the one-year monitoring period. All project activities will be clearly documented, including data interpretations and analysis. All associated data will be provided in electronic format, as an appendix to the draft and final reports. **Deliverable 5:** A final annual monitoring report will be submitted within one-month of receipt of comments from the project team. **Deliverable 6:** A memorandum summarizing the groundwater monitoring data will be submitted to the project team. **Deliverable 7:** Following report submittal, a meeting will be held with the CCRN technical team to present results for year 2 ESM monitoring
	2b	Equipment Maintenance	
	2c	Data Processing and Analysis	
	2d	Reporting-Ephemeral Streamflow Monitoring	
	2e	Reporting-Groundwater Monitoring	
	2f	Annual Results Presentation	

5.0 Schedule

The CONTRACTOR shall work closely with the COUNTY's project manager to develop a schedule for review and approval by the Project Team within 10 days of contract award. Manual data downloads (Task C2a) will occur during March 2019, June 2019, August 2019, September 2019, and December 2019). All reporting for this monitoring project will be completed before 31 March 2020.