

**Attachment "A-1" Scope of Work**  
**Professional Services Agreement**  
**Bella Vista Ranch Recharge Investigation - Phase II**  
**PSA 17-09-HFP-04**

**Amendment No. 2**

The tasks listed below are the identified elements to this SOW.

**Introduction**

A feasibility study for aquifer recharge facilities on the 2,984-acre Bella Vista Ranch property is currently underway, in Phase 2 of project development. The project focus has centered on the reach of Coyote Wash located in the southeast portion of the property (project site).

Phase 2 of project development involves assessment of hydrogeological and geotechnical conditions along the Coyote Wash corridor, with the goal of planning for an aquifer recharge facility intended to increase the frequency and/or magnitude of baseflows in the San Pedro River to the maximum extent possible. The source of water to be used for aquifer recharge is intended to be urban-enhanced runoff (UER).

This Additional Services #1 scope of work is intended to refine the surface water hydrologic modeling provided under Phase 1 of the project, and evaluate stormwater capture and recharge project concepts.

**Scope of Work Outline**

The tasks listed below are the proposed elements to this Scope of Work (SOW) for Phase 2 Additional Services #1. During the performance of this SOW, the Consultant may suggest to the Project Team additional modifications to this SOW along with justification for those suggested modifications. Where needed, tasks may be performed in the sequence shown below, concurrently, or out of the sequence indicated below. All SOW modifications, including budget modifications (if any) will require approval by Cochise County.

The Consultant shall:

**Task 4A-1: Meet with Agricultural Research Service Staff**

Consultants will meet with Dave Goodrich (and/or others from ARS) to review these proposed scope additions. Any proposed changes to Tasks 4A-2 through 4A-6 below will require Cochise County approval prior to work beginning on them.

**Task 4A-2: Precipitation Data Development**

Develop a range of precipitation input data for several representative annual (five 1-year) type events and 2, 5, 10, 25, 50, and 100-year flood return interval/precipitation events with varying storm durations and intensities. Annual events will be scaled up based on NOAA Atlas 14 predicted recurrence interval precipitation depths.

### **Task 4A-3: Surface Water Hydrologic Modeling**

Use Coyote Wash HEC-1 and CWR models developed under Phase 1 to predict flow volumes, discharges, and stages at the project site under pre-development and post-development/UER conditions for the precipitation events developed in Task 4A-2.

Revise the Coyote Wash HEC-1 model as follows:

1. Analyze (input) the precipitation patterns developed in Task 4A-2 above.
2. Implement channel infiltration in hydrograph routing reaches and municipal detention basins using physical parameters developed by the City of Sierra Vista or used in the original Coyote Wash Model, or provided by the 2014 Arizona Department of Transportation (ADOT) Highway Drainage Design Manual. Channel Loss calculations will be performed using 'RL' record in the hydrograph routing portions of the HEC-1 model developed under Phase 1.
3. Impervious cover will be revised to 0% to reflect presumed pre-development conditions.
4. Time of Concentration calculations will be revised to reflect presumed pre-development conditions.

Following the performance of Task 4A-3, the CCRN Technical Team will meet to determine the need to perform the following Optional Tasks:

#### **Optional Task 4A-3b: Extension of Hydrologic Modeling to San Pedro River**

Modify HEC-1 and CWR models to predict flow volumes, discharges, and stages at the Coyote Wash – San Pedro River confluence under pre-development and post-development/UER conditions for the precipitation events developed in Task 4A-2, reflecting model modifications performed by Task 4A-3 above. The hydrologic contribution of sub-basins and routing reaches downstream from the project site will be added to the modeling.

#### **Optional Task 4A-3c: FLO-2D Modeling to San Pedro River**

Using the FLO-2D program, assess the channel transmission losses along the 2.4 miles of Coyote Wash main stem, between the proposed project site and the main stem of the San Pedro River. The initial FLO-2D computational domain would be developed as a 1,000 foot offset of the Coyote Wash main stem measures (approximately 670 acres), and initial model grid resolution is estimated to be 10 feet (square). Infiltration will be modeled using Green & Ampt infiltration parameters, as developed in Task 4A-3 above.

Hydrograph input for the FLO-2D model will be taken from the HEC-1 modeling, and the FLO-2D analysis will **not** account for the hydrologic contribution of subareas downstream from the project site.

### **Task 4A-4: Stormwater Capture and Recharge Design Concept Evaluation**

Evaluate two conceptual design scenarios at the project site to estimate the potential amount of stormwater capture volumes under post-development/UER conditions for each of the precipitation events developed in Task 4A-2. Compare the predicted capture volumes to the predicted UER volume at the project site for each storm event and over an annualized basis.

Communicate with Lacher Hydrology groundwater modeling to compare estimated recharge volumes with required volume targets for baseflow change in San Pedro River, to ensure estimated recharge volumes meet minimum amounts to positively affect baseflow change.

#### **Task 4A-5: CCRN Technical Team Meeting**

The Cochise Conservation and Recharge Network (CCRN) Technical Team will meet and determine from the results at this stage, what additional concepts, or storm events to test in the next step.

Deliverable 4A: Technical Memorandum discussing the results of the Tasks above, including maps, calculation input/output, meeting notes as attachments.

#### **Optional Task 4A-6: With-Concept Modeling Revisions**

Repeat analysis with two chosen 10% conceptual stormwater capture and facility designs in place at the project site, given the outcome of Tasks 4A-4 and 4A-5 and revisions as requested by the CCRN Technical team.

#### **Schedule**

The Consultant 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 amendment award. This Scope of Work must be completed prior to the approved extension date of March 31, 2018

**Professional Services Agreement  
PSA 17-09-HFP-04 -- Amendment No. 2**

**Task 4A - Summary Fee Estimate Sheet for the Bella Vista Phase 2 Additional Service #1 SOW**

Task	Title	Description/Deliverable (see SOW for task details)	Costs		
			JE Fuller	GSA	TOTAL
4A-1	Meet with Agricultural Research Service Staff	Meet with D. Goodrich and others Assume: Tucson location	\$639	\$585	\$1,224
4A-2	Precipitation Data Development	Annual rainfall events (5 total) of varying durations and frequencies Scale up to 2-, 5-, 10-, 25-, 50-, 100-year events based on predicted NOAA 14 depths No Analysis of spatial distribution	\$1,048	\$660	\$1,708
4A-3	Surface Water Hydrologic Modeling	Revisions to Coyote Wash HEC-1: Precipitation patterns (Task 4A-2), Channel infiltration in routing reaches, 0% impervious condition, Time of concentration for 0% impervious condition Use CWR Model to analyze precipitation events (Task 4A-2)	\$6,568	\$2,750	\$9,318
4A-4	Stormwater Capture and Recharge Design Concept Evaluation	Input two concept scenarios into Task 4A-3 HEC-1 and CWR models and estimate stormwater capture volumes	\$2,741	\$2,020	\$4,761
4A-5	CCRN Technical Team Meeting	Meet with CCRN Technical Team to discuss results and required next steps Assume: Tucson location Deliverable 4A: Technical Memorandum discussing the results of Task 4A	\$753	\$655	\$1,408
<b>ADDITIONAL SERVICE #1 BASE TOTALS</b>			<b>\$11,749</b>	<b>\$6,670</b>	<b>\$18,419</b>
Option 4A-3b	Extension of Hydrologic Modeling to San Pedro River	Extend Task 4A-3 modeling to confluence with San Pedro River	\$4,810	\$4,205	\$9,015
Option 4A-3c	FLO-2D Modeling to San Pedro River	FLO-2D model of Coyote Wash reach downstream from project site to confluence with San Pedro River, HEC-1 hydrograph input at upstream limit of model domain	\$7,077	\$145	\$7,222
Option 4A-6	With-Concept Modeling Revisions	Repeat Task 4A-4 with revisions to 2 concept designs requested during Task 4A-5	\$2,301	\$2,020	\$4,321
<b>ADDITIONAL SERVICE #1 OPTIONAL TOTALS</b>			<b>\$14,189</b>	<b>\$6,370</b>	<b>\$20,559</b>
<b>SUM ADDITIONAL SERVICE #1 TOTALS</b>			<b>\$25,937</b>	<b>\$13,040</b>	<b>\$38,977</b>

Notes:

5.00% Subconsultant markup included in JEF Cost

All fee estimates are approximate.

The total fee is a not-to-exceed (NTE) amount and individual task fees may vary within the total NTE.

Where needed tasks may be performed concurrently or out of the sequence indicated above.

Water rights legal consulting and groundwater modeling are to be provided by The Nature Conservancy and are excluded from this cost estimate

**Professional Services Agreement  
PSA 17-09-HFP-04 -- Amendment No. 2**

Task	Title	Description/Deliverable (see SOW for task details)	JEF Hours		JEF Labor Cost	JEF Direct Costs	JEF Total Cost
			PM II	PE II			
			\$135.00	\$110.00			
4A-1	Meet with Agricultural Research Service Staff	Meet with D. Goodrich and others Assume: Tucson location	2	3	\$600	\$10	\$610
4A-2	Precipitation Data Development	Annual rainfall events (5 total) of varying durations and frequencies Scale up to 2-, 5-, 10-, 25-, 50-, 100-year events based on predicted NOAA 14 depths No Analysis of spatial distribution	1	8	\$1,015	\$0	\$1,015
4A-3	Surface Water Hydrologic Modeling	Revisions to Coyote Wash HEC-1: Precipitation patterns (Task 4A-2), Channel infiltration in routing reaches, 0% impervious condition, Time of concentration for 0% impervious condition Use CWR Model to analyze precipitation events (Task 4A-2)	2	56	\$6,430	\$0	\$6,430
4A-4	Stormwater Capture and Recharge Design Concept Evaluation	Input two concept scenarios into Task 4A-3 HEC-1 and CWR models and estimate stormwater capture volumes	0	24	\$2,640	\$0	\$2,640
4A-5	CCRN Technical Team Meeting	Meet with CCRN Technical Team to discuss results and required next steps Assume: Tucson location <u>Deliverable 4A</u> : Technical Memorandum discussing the results of Task 4A	2	4	\$710	\$10	\$720
<b>ADDITIONAL SERVICE #1 BASE TOTALS</b>			<b>7</b>	<b>95</b>	<b>\$11,395</b>	<b>\$20</b>	<b>\$11,415</b>
Option 4A-3b	Extension of Hydrologic Modeling to San Pedro River	Extend Task 4A-3 modeling to confluence with San Pedro River	0	40	\$4,400	\$200	\$4,600
Option 4A-3c	FLO-2D Modeling to San Pedro River	FLO-2D model of Coyote Wash reach downstream from project site to confluence with San Pedro River, HEC-1 hydrograph input at upstream limit of model domain	2	60	\$6,870	\$200	\$7,070
Option 4A-6	With-Concept Modeling Revisions	Repeat Task 4A-4 with revisions to 2 concept designs requested during Task 4A-5	0	20	\$2,200	\$0	\$2,200
<b>ADDITIONAL SERVICE #1 OPTIONAL TOTALS</b>			<b>2</b>	<b>120</b>	<b>\$13,470</b>	<b>\$400</b>	<b>\$13,870</b>
<b>SUM ADDITIONAL SERVICE #1 TOTALS</b>			<b>9</b>	<b>215</b>	<b>\$24,865</b>	<b>\$420</b>	<b>\$25,285</b>

Notes:

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The total fee is a not-to-exceed (NTE) amount and individual task fees may vary within the total NTE.

Where needed tasks may be performed concurrently or out of the sequence indicated above.

Rates in accordance with hourly rate schedule submitted May 4, 2016 (RFQ 16-04-HFP-04)

**Professional Services Agreement  
PSA 17-09-HFP-04 -- Amendment No. 2**

Task	Title	Description/Deliverable (see SOW for task details)	GSA Manhours			GSA Labor Cost	GSA Direct Costs	GSA Total Cost
			PM	SH	Admin			
			\$145.00	\$90.00	\$60.00			
4A-1	Meet with Agricultural Research Service Staff	Assume Tucson	4	0	0	\$ 580	\$ 5	\$ 585
4A-2	Precipitation Data Development	Assume review of precip record and selection. No Analysis of spatial distribution	2	4	0	\$ 650	\$ 10	\$ 660
4A-3	Surface Water Hydrologic Modeling	Assume HEC-1 and CW models will be run and compared with tech memo	4	24	0	\$ 2,740	\$ 10	\$ 2,750
4A-4	Stormwater Capture and Recharge Design Concept Evaluation	Assume CW model will be run to evaluate efficacy of capture system	4	16	0	\$ 2,020	\$ -	\$ 2,020
4A-5	CCRN Technical Team Meeting	Assume Tucson	2	4	0	\$ 650	\$ 5	\$ 655
<b>PHASE II TOTALS</b>			<b>16</b>	<b>48</b>	<b>0</b>	<b>\$ 6,640</b>	<b>\$ 30</b>	<b>\$ 6,670</b>
Option 4A-3b	Extension of Hydrologic Modeling to San Pedro River		4	40	0	\$ 4,180	\$ 25	\$ 4,205
Option 4A-3c	FLO-2D Modeling to San Pedro River		1	0	0	\$ 145	\$ -	\$ 145
Option 4A-6	With-Concept Modeling Revisions		4	16	0	\$ 2,020	\$ -	\$ 2,020
<b>PHASE II OPTIONAL TOTALS</b>			<b>9</b>	<b>56</b>	<b>0</b>	<b>\$ 6,345</b>	<b>\$ 25</b>	<b>\$ 6,370</b>

**Notes:**

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The total fee is a not-to-exceed (NTE) amount and individual task fees may vary within the total NTE.

Where needed tasks may be performed concurrently or out of the sequence indicated above.