EXECUTIVE SUMMARY

Automated Geospatial Watershed Assessment (AGWA) to Aid in Sustaining Military Mission and Training

ESTCP Project RC-201308

SEPTEMBER 2019

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Project: RC-201308

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ACRONYMS AND ABBREVIATIONS

AEC	Army Environmental Command
AGWA	Automated Geospatial Watershed Assessment Tool
DoD	Department of Defense
DSS	Decision Support System; also file extension for Facilitator input file
DVD	Digital Versatile Disc
EC	Erosion Control (dams)
EISA	Energy Independence and Security Act
GIS	Geographic Information System
ha	hectare
IMCOM	Installation Management Command
IT	Information Technology
ITAM	Integrated Training Area Management
K2	KINEROS2
KINEROS2	Kinematic Runoff and Erosion Model, which includes RHEM
M	million
PCMS	Piñon Canyon Maneuver Site
PO	Performance Objective
RHEM	Rangeland Hydrology and Erosion Model
SRP	Sustainable Range Program
SUS	System Usability Scale
SWAT	Soil and Water Assessment Tool
TER-S	Threatened, endangered, and at-risk species
USGS	United States Geological Survey

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1.0 INTRODUCTION

Nationally, the Department of Defense (DoD) manages about 25 million acres (~10 Million (M) hectares (ha)) of land on about 500 active installations (DoD, 2015) to meet its mission and maintain its stewardship commitment. Proper management of these lands, including protection of natural and water resources and associated biodiversity, is necessary for sustainable military testing and training. Vegetation and soil disturbances associated with military training activities such as from military vehicles, heavy foot traffic, and deployment encampments risk disruption of the ecological integrity of an installation, potentially jeopardizing the military mission. Degraded landscapes fail to provide realistic training opportunities and limit the areas available for training.

To address this issue, the DoD implemented a Natural Resources Program to ensure that both the land and its resources are preserved for continued support of mission-related activities, and that installations comply with all federal and state environmental laws and regulations (DoD 4715.03). This program recommends a watershed-based approach for natural resources management of installations, as they are often the source of essential water resources for installation operations and for sustaining habitat for numerous threatened, endangered, and at-risk species ([TER-S]; Stein et al., 2008). Essential elements of watershed protection include identification of areas prone to erosion, degraded areas most amenable to mitigation, and areas providing water for military personnel and TER-S. In addition, watershed modeling and decision tools are essential to assess the potential impacts of future installation growth and training.

This report presents the demonstration of the Automated Geospatial Watershed Assessment (AGWA)-Facilitator tool that couples a watershed modeling tool with a decision support system to allow the user to explore the effects of different management scenarios. The demonstrations were conducted at Pinon Canyon Maneuver Site (PCMS) and Fort Carson, Colorado, and Fort Bliss, Texas/New Mexico. AGWA (Miller et al., 2007; www.tucson.ars.ag./agwa) incorporates the hydrologic and erosion models KINEROS2 (KINematic Runoff and EROSion, [K2]; Smith et al., 1995; Semmens et al., 2008; Goodrich et al., 2012; www.tucson.ars.ag.gov/kineros), RHEM (Rangeland Hydrology and Erosion model; Nearing et al., 2011; https://apps.tucson.ars.ag.gov/rhem/docs/), and SWAT (Soil and Water Assessment Tool versions 2000 and 2005; Arnold et al., 1998; Arnold and Fohrer, 2005; http://swat.tamu.edu/). The Facilitator Decision Support System (DSS) (https://sourceforge.net/projects/facilitator/) uses AGWA outputs either through a tool that writes directly to a Facilitator input file, or by manually entering the information in the DSS.

The PCMS Demonstration was initiated in January 2015 and completed in July 2016. The Fort Carson Demonstration was initiated in January 2017 and completed in February 2018. The Fort Bliss Demonstration was initiated in December 2016 and completed in March 2018. Although Fort Carson and PCMS are managed by the same staff located at Fort Carson, their management issues and land uses are different, resulting in different potential applications of our tools, and separate demonstrations. The calibration, validation, and data quality analysis of the watershed models, KINEROS2, RHEM, and SWAT, was also presented.

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2.0 OBJECTIVES

This project's main objective was to demonstrate the AGWA coupled with the Facilitator DSS for scientifically based watershed assessments on three DoD installations to aid installation managers in sustaining their mission and meeting stewardship requirements in support of testing and training. The thirteen Performance Objectives (POs) were grouped into three general areas: POs 1, 2, 6, and 7 apply to AGWA-Facilitator and its general application at military installations, POs 3, 4 and 5 apply to the model calibration/validation work, and POs 8 through 13 apply to the AGWA-Facilitator trainings and survey responses. The demonstrations consisted of two 1.5-2-day trainings at each installation. The purpose was to show how AGWA-Facilitator could address installation watershed management concerns of water supply, water quality, rehabilitation of disturbed areas, and planning for future installation growth and mission expansion. A secondary objective of this demonstration was to determine via calibration, validation, and data quality analysis of the models, AGWA's applicability to DoD installation management issues, and suggest an appropriate configuration of rainfall and streamflow gauges to support watershed modeling.

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3.0 TECHNOLOGY DESCRIPTION

The demonstrated technologies are the AGWA tool coupled with the Facilitator multi-objective DSS. AGWA is a publicly available Geographic Information Systems (GIS) interface that automates the parameterization and execution of a suite of hydrologic and erosion models (K2, RHEM, and SWAT) within the AGWA framework that enables users to conduct watershed modeling and assessments at multiple temporal and spatial scales over a range of environmental conditions using freely available national data. The recommended use of AGWA is to investigate via a relative change assessment, the effects of land cover change and management to identify sensitive and "at-risk" areas on-site and downstream of locations of interest within the watershed.

The Facilitator DSS provides a flexible, easy to use, framework to structure and document installation manager knowledge and experience, expert opinion, and AGWA simulation model results to select a preferred management action. The Facilitator can be used to graphically compare alternatives, ultimately leading to the selection and implementation of an alternative management action that improves on the status quo as defined by the stakeholders ranking of base criteria. Two types of HTML reports are available to document and support the decision process: an indexed report and a flat report.

The AGWA-Facilitator Export Tool in AGWA provides for the transfer of AGWA model results (i.e., peak flow and sediment yield) directly into a Facilitator decision analysis document, to link the two tools. The Tool is included in AGWA.

Technology transfer and determination of usability of these tools was accomplished mainly through our AGWA-Facilitator 1.5 to 2-day trainings. These trainings were comprised of presentations, discussions, and hands-on tutorial exercises that reflect specific management concerns identified by installation personnel, thus making the application of the tools more transparent and meaningful. Two trainings were conducted at each installation, and all training participants filled out surveys at the end of each training to assess the usability of the tools and the effectiveness of the training.

The surveys are based on the System Usability Scale (SUS), which is a Likert scale developed by Brooke (1986). It employs ten forced-choice questions, where the respondent indicates the degree of agreement or disagreement on a 5-point scale with 1 being "strongly disagree" to 5 "strongly agree". The questions are carefully worded to represent extreme expressions of the attitudes being captured and alternate as positive and negative responses to force the respondent to think about whether they agree or disagree with each question. Both the Usability and Training Effectiveness surveys employed at our trainings have slight modifications to the wording of the questions but maintain the overall format and intent of the SUS. The Usability survey focuses on whether the participant felt the tools were useful and intends to use them. The Training Effectiveness survey focuses on how well the training taught the participant to use and understand the tools. Both surveys include 3 additional optional questions not included in the final scoring that assess their comfort with using GIS, their background in hydrologic principals or modeling, and their name and primary job responsibility (optional). Copies of the final surveys are attached as Appendix B.

In addition to the surveys, discussion sessions were held during the trainings to obtain additional feedback on the AGWA-Facilitator tools, tutorials, and training format. We also monitored each participant during the trainings to determine whether they had any difficulty performing the tutorial tasks, which tasks gave them trouble, if there were any issues with the tutorials themselves, and how long it took each participant to complete each tutorial. This information, along with their GIS skill level and background in hydrologic principals or modeling (provided in the surveys), was used to better understand the appropriate knowledge and skill level required to best utilize our tools.

After the second (final) training at each installation, we provided the installation managers with a digital versatile disc (DVD) containing all of the tutorials and supporting data, the AGWA package and add-in, and the Facilitator application. While we provide some ongoing technical support for users of AGWA-Facilitator, support of these tools is not our primary function. AGWA-Facilitator was specifically developed and designed for non-watershed modeling specialists. Many other watershed modeling systems assume a higher level of watershed modeling knowledge and expertise, presenting a barrier to the adoption and use by natural resources professional lacking watershed modeling or hydrologic expertise.

The hydrologic models were calibrated and validated to assess the improvement in performance using local stream flow and precipitation data, and varying levels of data quality. Although uncalibrated, unvalidated, well tested, distributed, physically-based watershed models can provide useful information regarding relative change and relative spatial differences in watershed response (Goodrich et al., 2012), if adequate input data are available (basin characterization data, runoff observations, and spatially distributed precipitation data) greater confidence in model predictions and associated uncertainty can be provided. This analysis will aid in establishing the level of confidence and type of applications for which the models can be used by installation resources managers. An additional outcome will be an assessment of the value of the current precipitation and streamflow gauges to help derive recommendations for a minimum number of gauges and other ancillary monitoring needed for installation watershed management and regulatory needs.

4.0 PERFORMANCE ASSESSMENT – DEMONSTRATION RESULTS

The thirteen POs were grouped into three general areas: POs 1, 2, 6, and 7 apply to AGWA-Facilitator and its general application at military installations, POs 3, 4 and 5 apply to the model calibration/validation work, and POs 8 through 13 apply to the AGWA-Facilitator trainings and survey responses.

Results for the POs are as follows:

- PO1 Assess the ability to use nationally available input datasets for an uncalibrated, out of the box AGWA set up at demonstration installations: Met, for all three study watersheds at PCMS.
- PO2 Package AGWA-Facilitator for distribution and installation on military computers: Met, all data and installation files were delivered on DVDs and installed on staff computers at all three installations.
- PO3 Determine the ceiling for model execution time: Met, for both K2 and SWAT without Monte Carlo simulations, runtimes were under 10 minutes; Not Met for simulations with Monte Carlo, runtimes were greater than 6 hours.
- PO4 Assess the improvement in performance of the models when calibrated with varying levels of data to determine the degree to which the models need to be calibrated and validated in order to be used for regulatory purposes: Met for RHEM, successfully calibrated and validated with the best available dataset at PCMS. Met for K2, successfully calibrated with the out-of-the-box dataset. Met for evaluation of input data quality on model predictions. Partially met for calibration of SWAT, parameterized with national soil and vegetation assuming consistent conditions, although validation partially failed. Met for the Fort Carson analysis to demonstrate utility of K2 for Energy Independence and Security Act (EISA) Section 438 stormwater analysis. Met for demonstration of application as a relative change tool at Fort Bliss.
- PO5 Assess the ability of AGWA to identify the relative ranking of model outputs: Met, relative rankings of predicted runoff, peak flow, and sediment yield were achieved with varying levels of input data and compared with the rankings created from the calibrated model.
- PO6 Relate training disturbance to change in vegetation cover and soil properties: Met, using published literature and expert knowledge from installation staff, and based on three levels of training disturbance (light, moderate, and heavy).
- PO7 Assess the ability to parameterize the Facilitator Decision Support System with AGWA model outputs and additional criteria defined by decision makers: Met, via the AGWA-Facilitator Export Tool.

The following POs address the two AGWA-Facilitator trainings held at each installation. The trainings were evaluated based on results from two surveys given to participants, and addressed Training Effectiveness, and Tool Usability. The trainings utilized hands-on tutorials in addition to presentations, discussion sessions, and surveys. The goal of the surveys was to have a total score of at least 68 for each survey, with no one response being less than 50. Each survey included a request for additional comments and suggestions. Responses were summarized and converted to a scale from 0 to 100, where higher scores indicate a more effective training or greater tool usability.

The surveys from each training were scored and then averaged to get an overall final score for Training Effectiveness and for Usability of the tools.

- PO8 Assess the effectiveness of first AGWA-Facilitator training and needs assessment: Not met based on overall survey scores, low scores due to trainings too short, and missing managers who would authorize use of the tools.
- PO9 Define the resources and expertise required to set up the model by a GIS specialist level individual: Met based on Training Effectiveness survey question #9, trainees are able to set up the models on their own within one week.
- PO10 Determine the expertise required to interpret the results of the models by an individual trained on the AGWA-Facilitator tools: Not met based on Training Effectiveness survey question #4, trainees felt they needed more time and training to interpret the results.
- PO11 Evaluate the effectiveness of second AGWA-Facilitator training: Not met based on overall survey scores, participants felt the trainings were too short to fully understand the tools and functionality, they had no management support to use the tools in their daily tasks and the tools were therefore not applicable to their job.
- PO12 Determine the ability of trained individuals to develop and run new scenarios: Met based on Training Effectiveness survey question #10, trainees felt they could develop and run a new scenario within 1-2 days.
- PO13 Evaluate overall user acceptance of the modeling system and intent to use it in decision-making: Not met based on overall results for Usability Survey, but ***was met*** based on question #1 "I think that I would like to incorporate AGWA or AGWA-Facilitator into my workflow when possible."

Final overall scores were low for both surveys: Training Effectiveness: 64, Usability: 61. We did not meet Performance Objectives 8, 10, 11, or 13. Based on the participants GIS and hydrologic skill levels, job duties, and verbal feedback, we attribute these low scores to several factors:

1. These tools are not currently required for their typical job duties, and participants did not feel they could use them or incorporate them into their workflow (i.e., low usability).
2. The products and analyses from these tools are not required for their jobs. A participant who gave particularly low scores noted that his "customers are soldiers who only want maps", and his supervisor does not request the types of analyses available with our tools (i.e., low usability).
3. While AGWA is designed for resource managers and not necessarily hydrologic modelers, some background in hydrology is still needed to be able to interpret the results. For example, a participant commented that while they can run the tools, their lack of background and ability to interpret the results decreases the credibility of their analyses.
4. The trainings were not long enough for participants to learn the tools (i.e., low training effectiveness).

5.0 COST ASSESSMENT

The types of management issues of concern at an installation and the geospatial data available will influence how and if AGWA-Facilitator should be implemented. This includes collection of field data on specific additional attributes such as additional climate or stream flow data, or data regarding the locations of erosion control dams or other features that would affect model parameterization and results, and the degree of stakeholder engagement. Inclusion of non-installation stakeholders in the stakeholder engagement process and/or the need for quantification of stakeholder preferences will significantly increase costs. Most of the data used in the AGWA-Facilitator are currently available at all military installations, and personnel typically have computers capable of running the tools, including a DoD site license for the ArcGIS software (required to run AGWA), therefore there would be little cost associated with data or hardware. There are no costs associated with acquiring AGWA-Facilitator; both tools are public domain and can be downloaded without cost via the internet.

The following personnel types and costs (includes fringe benefits and overhead at ~34.7%) were assumed for calculating the cost estimates in the table below. Average salary data were obtained from USA Jobs website (https://www.usajobs.gov/; accessed August 17, 2016 and April 20, 2018), searching for job postings for the U.S. Army for these job titles in Natural Resources or Administration, and using the average salary listings divided by 2080 hours to get hourly rates. Time required for each cost element is assumed based on experience at AGWA trainings for this project and others such as for Burned Area Emergency Response teams, universities, and federal agencies, and from estimates from AGWA Team members in Tucson, Arizona.

- GIS Specialist: Average $70,000 annual cost, $34/hr.
- AGWA/GIS Programmer: Average $101,000 annual cost, $49/hr.
- Natural Resources Officer: Average $94,500 annual cost, $45/hr.
- Project Manager/Supervisor: Average $135,000 annual cost, $65/hr.

Table 1. Cost Elements for Project Cost Assessment (based on 2016 and 2018 data)

Cost Element	Data Tracked During the Demonstration	Estimated Costs
1. AGWA Setup	• Time required to gather data and use AGWA to characterize the military installation and parameterize the models, with existing data and for preparing new data.	• GIS Specialist: 3 hours, $102 • Non-GIS user or Natural Resources staff: 8 hours, $360 • Additional GIS Specialist time to gather and prepare all new data: 4 hours, $136
2. Model refinement	• Time to complete performance objectives. • Time required to calibrate and validate the model if possible.	• Approximately 2 years, one supervisor, two GIS specialists, two GIS programmers, $954,000 • Approximately 6 months, one GIS specialist, $35,000
3. Modify AGWA	• Time and cost to modify AGWA to assess different scenarios, if required. • Military Disturbance Tool • Erosion Control Dams Pond Tool • Facilitator DSS	• AGWA Programming Costs: $20,850 – Military Disturbance Tool: GIS specialist, 80 hours $2,720, plus GIS programmer, 60 hours $2,940, Total $5,660 – Pond Tool: GIS programmer, 190 hours, $9,310 • Facilitator: GIS programmer, 120 hours, $5,880

Table 1. Cost Elements for Project Cost Assessment (Continued)

Cost Element	Data Tracked During the Demonstration	Estimated Costs
	•	–
4. Equipment	• Procurement costs associated with computers, and data storage.	• Computer: $3,500 • Data storage 2 TB: $60
5. Training	• Time and costs associated with training military land managers how to use AGWA and the Facilitator DSS, 1.5 – 2-day training.	• Training Personnel: two Supervisors, two GIS Programmers, 4 days, $11,696 • Training Materials Preparation: three Programmers, 80 hrs. each, $11,760
6. Field work	• Time and costs associated with field trips to gather and interpret military vegetation monitoring, soils, and remotely-sensed data as appropriate.	• Site visits: Two project supervisors, three AGWA GIS programmers, 4 days, $13,264
7. Data Preparation	• Time and costs associated with preparing local data for entry into AGWA. • Time and costs associated with preparing input data for the Facilitator	• Prepare new data including downloading from internet, clipping, and projecting to study area: GIS Specialist, 4 hours, $136 • Prepare input data for erosion control dams (locations, and stage-discharge data) using AGWA Pond Toolbox and Add Storage Tool: GIS Specialist $12 per pond/erosion control (EC) dam. Add $25 per pond/EC dam if added manually. Assume 50 EC dams added using the tool, $600. • Identify and prepare input data for alternatives and criteria for the Facilitator, no non-installation stakeholders: Two project supervisors, 4 hours, $260, two natural resource officers, 4 hours, $180 = $440 • Identify and prepare input data for alternatives and criteria for the Facilitator, with outside stakeholders: Two project supervisors, 8 hours, $520, two natural resource officers, 8 hours, $360 = $880
8. Alternative approaches	• Time required to run the United States Geological Survey (USGS) StreamStats stream gauged based runoff regression relationships at each of the PCMS gauging stations.	• GIS specialist: 1 hour, $34
9. Personnel	• Identify the personnel requirements for the operational deployment of AGWA on a military installation.	• Information Technology (IT) or GIS staff to install AGWA-Facilitator on personnel computers, GIS staff to prepare and distribute data, and Natural Resources and Integrated Training Area Management (ITAM) staff familiar with ArcGIS to operate AGWA-Facilitator and provide expert knowledge of the site; GIS Programmer, $49/hr, GIS Specialist $34/hr, Natural Resources/ ITAM staff $45/hr, project manager/ supervisor $65/hr

Table 1. Cost Elements for Project Cost Assessment (Continued)

Cost Element	Data Tracked During the Demonstration	Estimated Costs
Total costs		• AGWA-Facilitator operation, all data prepared, no EC dams, or outside stakeholders, $902 • AGWA-Facilitator operation, new data acquired and prepared, $1,038 • AGWA-Facilitator operation, all data prepared, with EC dams, no outside stakeholders, $1,502 • AGWA-Facilitator operation, all data prepared, with EC dams, with outside stakeholders, $1,942 • Training cost (personnel and materials preparation), $23,456 • AGWA-Facilitator modifications (EC Dams and Add Storage Tools, Military Training Disturbance Tool, AGWA-Facilitator coupling), $20,850

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6.0 IMPLEMENTATION ISSUES

Participants at the trainings had generally favorable reactions to the tools and their potential usefulness in their job duties; however, they did not have the authority to approve use of the tools in their workflow. We identified several issues that impede implementation of the tools at these locations, and possible courses of action to facilitate implementation.

Issue #1:

GIS staff (DoD employees and contractors) need a request from management to apply AGWA and perform an analysis; they cannot do it on their own. However, most managers do not know about the program or its capabilities.

Course of Action: Identify managers likely to require these analyses (ITAM, Storm Water, Conservation/Fire, Sustainable Range, Master Planning, etc.) and provide a project brief with a short demo of the tools (1-2 hours, including discussion). Follow up with additional material and/or trainings.

Issue #2:

Although several managers were at the trainings, a directive from higher up may be needed for them to be able to incorporate the tools into their typical workflow. For example, an operations order would come from the Army Environmental Command (AEC) at the Installation Management Command (IMCOM) to the Directorates and Garrison, and then be implemented by each Directorate and Branch in the Directorate of Public Works. For ITAM, this would be through the Deputy Chief of Staff G-3 and the Sustainable Range Program (SRP). Wording would have to be included by the Directorates in the contracts for contractors.

Course of action: Presentations of our tools to higher management in the military system, such as AEC/IMCOM and G-3-SRP/ITAM, may be a way to facilitate their use. Presentations at relevant conferences and meetings is also recommended.

Issue #3:

Frequent staff turnover makes incorporating these tools into their regular workflow difficult. Although we provide a DVD with all materials needed to use the tools, once trained staff are gone, no one is aware of the tools or the DVD.

Course of Action: Knowledge of these tools by upper management in the Directorates, AEC, G-3, and so on, would increase their visibility and the likelihood that their use would be requested. Overall acceptance by DoD as an approved tool would increase implementation. Online courses or YouTube Video would make the materials more accessible by new staff.

Issue #4:

A successful model calibration/validation in a watershed that is exposed to frequent training activities requires high quality observed streamflow and rainfall data, a network of rain gauges, and local soils and vegetation data that can capture the changes in vegetation and soil caused by training and land rehabilitation disturbances. These data were not available for the calibration/validation at PCMS. Only seven rain gauges were available for the Red Rock Canyon watershed, no local soils data were available, and only three sets of vegetation data were available for our 10-year study period. However, the current data are adequate for relative change analyses in AGWA.

Course of Action: Place more rain gauges and stream flow gauges in the watersheds, and collect vegetation data more frequently, especially before and after major training events. This would improve the data available for model applications and management decision-making.

7.0 REFERENCES

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Appendix B: Training Effectiveness and System Usability Surveys

AGWA-Facilitator Survey: Evaluate the effectiveness of this Final Training

1. I think that the training was worthwhile.

Strongly Disagree 1	2	3	4	Strongly Agree 5

2. I found the training was too short to cover the material adequately.

Strongly Disagree 1	2	3	4	Strongly Agree 5

3. I think I will want to use the results from an AGWA or AGWA-Facilitator analysis.

Strongly Disagree 1	2	3	4	Strongly Agree 5

4. I think that I would need more training to be able to interpret the results from the AGWA-Facilitator decision-support system.

Strongly Disagree 1	2	3	4	Strongly Agree 5

5. I found the training contained a sufficient mix of background material and hands-on use of the tools.

Strongly Disagree 1	2	3	4	Strongly Agree 5

6. I found the training was missing critical components or information needed for me to successfully integrate AGWA-Facilitator into my workflow.

Strongly Disagree 1	2	3	4	Strongly Agree 5

7. I found the training was equally accessible to individuals with backgrounds in GIS, and individuals with backgrounds in range management, hydrology, watershed modeling, biology, or forestry.

Strongly Disagree 1	2	3	4	Strongly Agree 5

8. I found the training did **not** improve my ability to make more informed and/or better management decisions.

Strongly Disagree 1	2	3	4	Strongly Agree 5

9. I think that this training gave me the skills to gather and organize the data to set up the model within a regular 40 hour week, with some remote assistance (if necessary).

Strongly Disagree 1	2	3	4	Strongly Agree 5

10. I do **not** think I could set up, run, and interpret a new scenario with minimal technical support in AGWA-Facilitator in 1-2 days.

Strongly Disagree 1	2	3	4	Strongly Agree 5

11. I feel comfortable using GIS.

Strongly Disagree 1	2	3	4	Strongly Agree 5

12. I do not have a strong background in hydrologic principals or modeling.

Strongly Disagree 1	2	3	4	Strongly Agree 5

13. Optional
    a. Name _____
    b. Primary Job Responsibility_____

Please use the reverse side of this paper for additional comments. Thank You for your participation!

Email or mail this completed survey to Lainie Levick, llevick@email.arizona.edu
USDA-ARS/SWRC, 2000 E. Allen Road, Tucson, AZ 85719

ESTCP Project RC201308 – Fort Bliss Demonstration 2 – March 7-8, 2018

AGWA-Facilitator Final Survey on System Usability
Evaluate your overall acceptance and intent to use this system in decision-making

1. I think that I would like to incorporate AGWA or AGWA-Facilitator into my workflow when possible.

Strongly Disagree 1	2	3	4	Strongly Agree 5

2. I found both AGWA and the AGWA-Facilitator tool unnecessarily complex.

Strongly Disagree 1	2	3	4	Strongly Agree 5

3. I thought both AGWA and the AGWA-Facilitator tool were easy to use.

Strongly Disagree 1	2	3	4	Strongly Agree 5

4. I think that I would need the support of a technical person to be able to use AGWA or AGWA-Facilitator.

Strongly Disagree 1	2	3	4	Strongly Agree 5

5. I don't have the expertise/time to use this tool, but I see value in it if someone could perform an analysis for me.

Strongly Disagree 1	2	3	4	Strongly Agree 5

6. I think the tutorials, supporting online documentation, and data need revision or additional content to provide sufficient background for me to be able to use this system.

Strongly Disagree 1	2	3	4	Strongly Agree 5

7. I think that most people could learn to use the AGWA or the AGWA-Facilitator tool quickly.

Strongly Disagree 1	2	3	4	Strongly Agree 5

8. I do **not** think that AGWA-Facilitator can help document the decision-making process.

Strongly Disagree 1	2	3	4	Strongly Agree 5

9. I felt very confident using AGWA and/or the AGWA-Facilitator tool in the tutorials.

Strongly Disagree 1	2	3	4	Strongly Agree 5

10. I need to learn a lot of things before I could get going with AGWA and AGWA-Facilitator.

Strongly Disagree 1	2	3	4	Strongly Agree 5

11. I feel comfortable using GIS.

Strongly Disagree 1	2	3	4	Strongly Agree 5

12. I do not have a strong background in hydrologic principals or modeling.

Strongly Disagree 1	2	3	4	Strongly Agree 5

13. Optional
    a. Name _____
    b. Primary Job Responsibility_____

Please use the reverse side of this paper for additional comments. Thank You for your participation!

Email or mail this completed survey to Lainie Levick, llevick@email.arizona.edu
USDA-ARS/SWRC, 2000 E. Allen Road, Tucson, AZ 85719