



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

May 14, 2014

Her Excellency, Governor Margaret Hassan
and the Honorable Council
State House
Concord, New Hampshire 03301

*Sole Source
Retroactive*

REQUESTED ACTION

Authorize the New Hampshire Department of Environmental Services (DES) to enter into a **RETROACTIVE, SOLE SOURCE** agreement with the U.S. Geological Survey (USGS), Pembroke, NH (VC# 175772), in the amount by \$25,000 to assess potential contaminant transport pathways in deep bedrock at the OK Tool Superfund Site in Milford, New Hampshire, effective as of May 1, 2014 through December 31, 2014, upon Governor and Council approval. Funding is 100% Federal.

Funding is available in the following account.

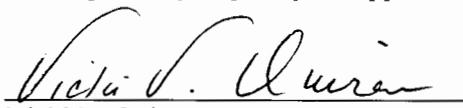
	<u>FY 2014</u>
03-44-44-444010-2590-0102-500731	\$25,000
Dept Environmental Services, CERCLA Programs, Contracts for Program Services	

EXPLANATION

The purpose of this **sole source** agreement is to fund additional bedrock investigation techniques using dye-tracers to determine how contaminants move through bedrock fractures. USGS is being utilized due to their in-depth existing site knowledge, unique bedrock field investigation capabilities and matching funds, making this project quicker to implement, less expensive and of the highest quality. High concentrations of contamination have been detected in deep bedrock at the site. This information has heightened concerns about possible impacts to nearby users of groundwater. As a result, the U.S. Environmental Protection Agency (EPA) and DES have agreed that USGS' technical support is necessary in the evaluation of the potential risk to nearby residential bedrock water supply wells. EPA, as part of a cooperative agreement with DES, is providing funding in the amount of \$25,000 for this work. This agreement is **retroactive** to May 1, 2014 as the USGS did not send the signed agreement to DES until April 28th, after the cutoff date for the last April Governor and Council meeting. USGS is providing \$25,000 in matching funds as part of this agreement. USGS has been responsive and responsible in conducting work at this site in the past as part of previous agreements between DES and EPA.

This agreement has been approved as to form, content, and execution by the Office of the Attorney General. EPA supports the contract.

We respectfully request your approval.


Vicki V. Quiram
Assistant Commissioner

**U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY**

Customer #: 6000000093
Agreement #: 14ENNH000000013
Project #: LG40FFJ/GC14LG4...
TIN #: 02-6000618
Fixed Cost Agreement NO

JOINT FUNDING AGREEMENT

FOR

WATER RESOURCES INVESTIGATIONS

THIS AGREEMENT is entered into as of the, 1st day of May, 2014 by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the STATE OF NEW HAMPSHIRE, DEPARTMENT OF ENVIRONMENTAL SERVICES, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation the additional logging of ambient borehole flow and modeling of groundwater flow in the bedrock aquifer, Savage Municipal Water Supply Well Superfund Site (OK Tool Deep Bedrock: OU-3, Milford, NH) herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of \$0.00.
 - (a) by the party of the first part during the period

Amount	Date	to	Date
\$25,000.00	May 1, 2014		December 31, 2014
 - (b) by the party of the second part during the period

Amount	Date	to	Date
\$25,000.00	May 1, 2014		December 31, 2014
 - (c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.
 - (d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.
3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.

- 7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.
- 8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.
- 9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered Quarterly. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey United States Department of the Interior USGS Point of Contact		State of New Hampshire Department of Environmental Services Customer Point of Contact	
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Email:	ptharte@usgs.gov	Email:	Robin.Mongeon@des.nh.gov

Signatures and Date

Signature:	_____	Date:	_____	Signature:	_____	Date:	_____
Name:	Keith W. Robinson		4/28/14	Name:	Vicki Quiram		
Title:	Director, New England Water Science Center			Title:	NHDES, Assistant Commissioner		

Signature:	_____	Date:	_____	Signature:	_____	Date:	_____
Name:	_____			Name:	_____		
Title:	_____			Title:	New Hampshire Assistant Attorney General		

APPROVAL BY THE ATTORNEY GENERAL (FORM, SUBSTANCE AND EXECUTION)

By: James

Date: May 23, 2014

DRAFT-USGS OU3 FY14-FY15 WORK PROPOSAL ON (1) ADDITIONAL LOGGING OF AMBIENT BOREHOLE FLOW AND (2) MODELING OF GROUNDWATER FLOW IN THE BEDROCK AQUIFER

P.T. Harte, April 9, 2014

Background

The OU3 bedrock system contains primarily granite and gneiss rocks with low bulk transmissivity and few highly transmissive fractures. Previous work by Harte and others (2014) using borehole dilution logging techniques (also called SBDT) has identified very minor ambient flow in 4 out of 7 logged bedrock wells. Table 1 provides a listing of wells where very minor flow was identified (Column 6). Prior to the work by Harte and others (2014), ambient flow had not been detected in these wells using conventional, vertical differential, flowmeter logging with heat-pulse flowmeters (HPFM) (Column 2; Table 1). For the entire site, HPFM logging results have identified only one well with ambient flow out of eighteen bedrock wells logged indicating that most flow is below the resolution of the HPFM or ambient flow is primarily horizontal (Weston Solutions, Inc., 2013). Additional SBDT testing is planned to identify if ambient flow can be detected in other key wells at the site.

Table 1. Summary identifying the detection of borehole flow from multiple methods. [SBDT-Single Borehole Dilution Tests; NT-not tested; all depths below TOC (top of casing); Yes-flow detected; No-flow not detected]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Well	Ambient flow detected with HPFM logging (Ambient HPFM)	Flow detected with HPFM logging using single well pump in that well (Pumped HPFM)	Flow detected with HPFM logging during BR-6 pump test (Test HPFM)	Tracer transport identified from this well to BR-6 during BR-6 pump test (Pump transport)	SBDT-ambient flow observed	SBDT-Mid-test flow observed	SBDT-End of test flow observed
MW-16R, Open at 100-390 ft	No	Yes at 116 ft, 156 ft, 195 ft, and 282 ft	No	NT	Potentially yes at 116 ft, 153 ft)	No	No
BR-12, Open at 116 to 422 ft	No	Yes at 116 ft, 123 ft, 147 ft, another possibly at 153 ft, and 253 ft	No	Yes	Yes at 116 ft and 123 ft	NT	Yes at 253 ft
BR-15, Open at 103 to 394 ft	No	Yes at 105 ft, 117 ft, 155 ft, 207 ft, 263 ft,	NT	NT	Yes at 105 ft, 207 ft, and 322 ft	NT	Potentially yes at 105 ft and

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Well	Ambient flow detected with HPFM logging (Ambient HPFM)	Flow detected with HPFM logging using single well pump in that well (Pumped HPFM)	Flow detected with HPFM logging during BR-6 pump test (Test HPFM)	Tracer transport identified from this well to BR-6 during BR-6 pump test (Pump transport)	SBDT-ambient flow observed	SBDT-Mid-test flow observed	SBDT-End of test flow observed
		and 322 ft					possible at 207 ft
BR-1, Open at 107 to 400 ft	No	Yes at 185 ft, 187 ft (weathered zone), 275 ft, and potentially at 340 ft	No	NT	No	No	No
BR-11, Open at 131 to 441 ft	No	Yes at 131-139 ft and 253 ft	No	NT (Large drawdown measured)	No	NT	Yes inflow at 131-139 and possibly outflow at 253 ft
BR-7, Open at 110 to 500 ft	No	No	NT	NT	No	NT	No
MW-30, Open at 161 to 440 ft but blocked at 287 ft	No	Yes at 162 ft, 207 ft, 230-235 ft, possibly at 240-250 ft, and at 270 ft	No	NT	Possible diffuse horizontal dilution from 161 to 200 ft	No	Possible diffuse horizontal dilution from 161 to 200 ft

An upgraded groundwater flow model of the OU3 area and vicinity has been completed (Harte, .P.T., in review). The model simulates groundwater flow in the overlying glacial sediments and underlying bedrock aquifer. The ability of the model to simulate hypothetical or planned remedial scenarios allows for a comprehensive assessment of potential outcomes. Water managers and regulators can use model results to optimize remedial strategies.

Further discussion in this work proposal is divided by task. Task 1 includes SBDT logging. Task 2 includes additional numerical flow model simulations.

Objective

This work proposal has multiple task-dependent objectives. For task (1), the primary objective is the identification of hydraulically active and inactive flow zones under ambient conditions in selected bedrock monitoring wells. A secondary objective includes an evaluation of potential PCE transport in logged wells and suggestions for the redesign of monitoring wells to reduce transport. For task (2), the

primary objective is identifying groundwater flow responses and potential consequences for remediation from several potential remedial alternatives and(or) varying hydrologic conditions.

Approach

Task (1)

The SBDT logging identifies flow by tracking temporal changes in a dispersed dye within the borehole column. Temporal dye changes are a function of fracture inflows and outflows. A food grade blue dye is used as a tracer. The dye is measured using a dual photometer and nephelometer probe with downhole logging equipment.

SBDT logging will be collected according to methods described by Harte and others (2014) with a notable exception. To ensure adequate dispersal of blue dye at deeper depths of the well, a modification of the dye application procedure will be followed. The modified procedure will include active injection where the injection amount is balanced by extraction of borehole water to maintain constant head. Injected dye will be uniformly distributed by removing the injection tube at a constant upward rate.

As in previous work by Harte and others (2014), the dye is dispersed throughout the borehole column (called whole well tracking). At one of the wells, a point injection procedure (called point injection tracking) will be conducted to confirm observations of flow under the whole well tracking tests. The point injection procedure will identify movement at critical fractures where outflow has been observed. Identification of outflow zones in open boreholes is important to minimize anthropogenic transport of contaminants.

A listing of wells where SBDT logging will be performed is provided in table 2. For most wells, only whole well tracking is planned. At BR-5, an additional point injection tracking will be done. A maximum of 4 logs per dye application will be collected according to the schedule shown. Wells will be logged by their relative permeability ranking from low to high.

Table 2. Schedule and wells for SBDT logging during FY-14. [SBDT-Single Borehole Dilution Tests; NT-not tested; all depths below TOC (top of casing); Yes-flow detected; No-flow not detected]

Days	BR2	BR3	BR5	BR6	BR5 point tests	Comments
1	b	b	b			b=background
2				b	b	
3	1stsweep					1st sweep , spike, 1hr wait, 1 hr iniital run, 2 hr wait, second run
4	2nd day	1st sweep				2nd day = early morning run
5		2nd day	1sweep			3rd sweep = 1 run twice(one after another)
6	3rd day		2nd day	1sweep		

7				2nd day	1sweep	
8			3rd day		2nd day	
9				3rd day		
10					3rd day	
11						
12	4th sweep	4th sweep	4th sweep			4th sweep = 1 run twice
13				4th sweep	4th sweep	

The photometer-nephelometer tool will be calibrated daily against standards and a separate stand-alone meter (Hach 2100p). Discrepancies of more than 10% will have corrections applied to the data set.

Task (2)

Additional scenario testing will be done with the model developed by the U.S. Geological Survey. Scenario testing includes simulation of groundwater flow under planned or hypothetical situations. To date for work under review (Harte, P.T., in review), scenarios have focused on advective transport to identify potential PCE pathways. We propose several additional scenarios to identify the effect of alternate placement of remedial wells on flow in the unconsolidated sediments and underlying bedrock. All scenarios will be performed under a quasi-steady state or seasonal transient conditions. Selection of scenarios will be done by a technical team from the U.S. Environmental Protection Agency (EPA), Region 1 and New Hampshire Department of Environmental Service (NHDES).

Products

Task (1) Borehole dye-tracer (SBDT) logs under ambient. Identification of wells that should have packers installed or grouted to prevent induced PCE transport. An extended abstract paper will be produced describing important findings.

Task (2) Plots of new scenario simulations and presentation of findings. Highlights of findings will be incorporated into the existing USGS model report currently under review.

Benefits

Task (1) Collection of additional SBDT logs will allow for a more comprehensive assessment of borehole flow conditions for the monitoring network. Results will assist in the design of a modified, long-term well network that incorporates information on existing transport potential of open boreholes.

Task (2) Simulation of potential remedial scenarios provides information on potential outcomes. Further, it allows for the discovery of system responses that may have been unanticipated.

Project Personnel

Philip T. Harte of the U.S. Geological Survey New England Water Science Center will be the project chief. Field assistance for task 1 may be provided on occasion when needed by personnel from the U.S. Geological Survey New York and New England Water Science Centers.

Cost

The total project cost is \$50,000 with \$25,000 USGS and \$25,000 New Hampshire Department of Environmental Service. Table 3 provides a breakdown of costs by tasks and major billing category.

	SBDT logging	Model testing	Comments
Salary	19,325.	6,330.	
Other	500.	0.	Supplies
Logging charges	2,625.	0.	Daily logging charge
Net	22,450.	6,330.	
Overhead	16,550.	4,670.	
Total gross costs	39,000.	11,000.	

We anticipate spending \$45,000 in FY14 and \$5,000 in FY15.

Duration

The field work is planned for the summer of FY14. The extended abstract will be written but not presented until sometime in the Fall of FY15. Amendment end date of September 2015.

REFERENCES

Harte, P.T., in review, Groundwater Flow Model of the Fractured-Rock Aquifer, Operable Unit 3, Savage Municipal Well Superfund site, Milford, New Hampshire, U.S. Geological Survey Open-file Report xxx-xxx, __p.

Harte, P.T., Anderson, J.A., Williams, J.H., Fuller, A., 2014, Observations from borehole dilution logging experiments in fractured crystalline rock under ambient and pump test conditions: Environmental and Engineering Geophysical Society (SAGEEP) Annual Meeting, 2014 Conference; Boston, Ma., 14 p.

Weston Solutions, Inc., 2013. Draft technical memo on bedrock investigations at the Savage Municipal Water Supply Superfund Site OU-1, 621 Elm Street, Milford, New Hampshire. Weston Solutions, Inc., 45 Constitution Avenue, Suite 100 Concord, New Hampshire 03301.