The Restoration Research Award Program funds key restoration questions focused on the effectiveness of watershed restoration practices, including stream practices.

Information Session: December 11 from 11 am to 12 pm, webinar details in the “Information Session” section

Applicant Q&A with Review Panel: April 16, 2018 (12 pm to 1 pm)

**Deadline:** 4:00 pm, February 21, 2018

Submit Your Application by following instructions at: www.cbtrust.org/restorationresearch

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**Background and Goal of the Program**

The Chesapeake Bay Trust (the Trust), the Maryland Department of Natural Resources, the Maryland Department of Transportation’s State Highway Administration, Montgomery County Department of Environmental Protection, and other partners announce a request for proposals for our jointly funded Restoration Research Program.

Efforts to restore the Chesapeake Bay and its tributaries call for a significant increase in the number of watershed restoration projects intended to improve both water quality and habitat. Questions about the performance and function of some of these practices persist in the regulatory community as well as the restoration practitioner community.

The goal of this award program is to answer several key restoration questions. Funding partners hope that answering these questions will ultimately lead to increased confidence in proposed restoration project outcomes, clarification of the optimal site conditions in which to apply particular restoration techniques, information useful to regulatory agencies in project permitting, and information that will help guide monitoring programs.

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**Resources to Support Proposal Development**

**Information Session**

A workshop at which the program will be described and questions from potential applicants will be answered will be held December 11, 2017, from 11 am to 12 pm. Interested parties may attend via webinar at https://cbtrust.webex.com/cbtrust/j.php?MTID=mb93c401c06b9cd7c6f28b91c36764ae8 with audio connection: 1-240-454-0887 (US toll free) and access code: 854 979 510.

**Existing Scientific Literature**

A list, though not exhaustive, of relevant literature is presented at: www.cbtrust.org/restorationresearch.

**Current Research**

Fifteen projects focusing on these and related research questions have been funded over the past three years. To become acquainted with the scope of ongoing work, forge partnerships, and avoid duplication of effort, visit www.cbtrust.org/restorationresearch and see the “Previously Funded Projects.”
Restoration Project List
Given budget constraints, investigators are encouraged to couple efforts with planned or completed restoration projects where appropriate. The Trust and collaborators will work to provide project list(s) of relevant restoration projects as they become available in the “Additional Resources to Support Project Development” section on the program’s webpage (www.cbtrust.org/restorationresearch).

Types of Activities that May be Supported

Members of the regulatory and restoration communities have worked together to identify several key restoration questions. Investigators may request funds to undertake the following pertaining to any of these questions:

a) Conduct a literature review/synthesis, if the case can be made that enough is already known about a question; or
b) Answer a component of the question with a research project in which specific hypotheses are tested. Research projects may include:
   i. experimental or descriptive work in the field;
   ii. experimental work in the laboratory;
   iii. modeling studies; and/or
   iv. use of existing data, if deemed appropriately suited (properly collected with appropriate metadata).

Key Restoration Questions

The following 7 research questions are organized into four themes:

A. Effectiveness of restoration programs at the watershed/catchment scale
B. Effectiveness of restoration practices at the project scale
C. Construction techniques
D. Trade-offs in resource improvements incurred by restoration practices and creating net ecological uplift

A. Effectiveness of restoration programs at the watershed/catchment-scale

1. Watershed restoration assessment: What are the cumulative effects of watershed restoration activities within a watershed? Of interest in the restoration community is whether, given the high temporal and spatial variability of nutrient concentrations and flows, a signal from the restoration activities even in a highly targeted, small watershed can be measured relative to a control site (before vs. after restoration activities). A related question: What percentage of the impervious surface in a watershed must be treated with best management practices (BMPs) before a difference can be measured at the outfall? Does BMP type (e.g., stream restoration, environmental site design (ESD) practices, and stormwater wetlands) influence that percentage? We recognize that this question is extensive and reviewers will accept proposals that address a component of this research question.

   Possible Elements of the Experimental Design: Select multiple watersheds (to allow for replication) of similar characteristics in which 0 to a significant percentage (e.g., 20%) of the impervious area can be treated. Some hypothesize that due to variability driven by spatial forces (e.g., watershed characteristics) or temporal forces (e.g., rainfall) at least 20% of the watershed
must be treated to enable demonstration of an impact of restoration in the watershed. In choosing watersheds, ensure that watershed characteristics remain as consistent as possible, including factors of size, land use, and type and scale of BMPs to be used to treat impervious cover. Regress load reductions in total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and other pollutants of interest (loads measured after vs. loads measured before restoration at a point where the watershed drains into the stream) against % of impervious surface treated in the watershed, considering the untreated watershed(s) as a control.

2. Stormwater management assessment: What is the effectiveness of stormwater management practices (implemented, for example, at a level required under the latest stormwater management regulations) on stream channel protection? What percentage of a catchment needs to be treated with environmental site design (ESD) practices to reduce water flow enough to protect stream channels? Does the location of ESD practices within the catchment make a difference in protecting the stream banks?

Possible Elements of the Experimental Design: Select multiple catchments with similar characteristics (to allow for replication) in which 0 to a significant percentage (e.g., 20%) of impervious area will be treated with ESD practices. In choosing catchments, ensure that catchment characteristics remain as consistent as possible, including factors of size, land use, and type and scale of ESD practices to be used to treat impervious cover. Regress degree of bank loss (measured with cross sections and/or other method both before and after ESD installation) and load reductions in TSS (loads measured after vs. loads measured before restoration at the outfall) against % of impervious surface in the catchment treated with ESD practices, considering the untreated catchment(s) as a control.

3. Level of monitoring effort: Monitoring is expensive and money spent on monitoring is by definition not spent on pollution reduction implementation. What degree of representative sampling is required to determine levels of pollutant discharge at a county scale? What sample size is needed to capture variability? What is the cost of such a monitoring program? Can a reduced monitoring regime, either in terms of number of sampling stations or parameters measured at a station, or a factor such as % impervious surface treated in the region be used as a proxy?

Possible Elements of the Experimental Design: To test whether % impervious cover treated can be used as a proxy for the region’s pollutant load reduction, choose regions or counties with varying rates of % impervious cover treated and regress against measured pollutant load reductions at a representative sample size of outfalls in each region.

B. Effectiveness of restoration practices at the project scale

4. Comparisons of water quality benefit among restoration techniques, approaches (functions sought to be restored), or site conditions. While many studies present data on a single restoration technique in a single set of conditions, few studies compare restoration effectiveness across restoration approaches, across different restoration techniques, or across a range of site conditions. Here we ask: How does water quality benefit (defined here as reduction in nutrient and sediment loads) compare among different restoration approaches or techniques and/or (depending on ability to replicate) across site conditions? The types of restoration approaches in which we are interested are those that aim for different function (e.g., degree of floodplain
reconnection, frequency of inundation, bank stabilization, etc.). Those approaches can be accomplished with several techniques or a mixture of multiple techniques, including regenerative stormwater conveyance (RSC), natural channel design (NCD), and stream valley restoration/legacy sediment removal). The site condition factors in which we are interested include differences in land use, % impervious cover, watershed condition, valley type, and/or watershed position (headwaters vs. downstream near the receiving waters).

Possible Experimental Design Options:

a) Test technique, keeping approach and site condition constant: Compare TN, TP, and TSS load reductions among two or more different techniques that aim for the same function (e.g., RSCs, NCDs, stream valley restorations/legacy sediment removal, or a combination of those techniques that aim for the same degree of floodplain reconnection), keeping site condition constant. Be sure to include enough sites to capture variability.

b) Test approach, keeping technique and site condition constant: Compare TN, TP, and TSS load reductions at restoration projects that use the same technique (e.g., RSC) to accomplish different functions (e.g., different degree of floodplain reconnection), keeping site condition constant.

c) Test site condition, keeping approach and technique constant: Compare TN, TP, and TSS load reductions across a range of one of the site condition factors, keeping other site condition factors, restoration approach, and technique constant.

For any of the options, be sure to include enough sites to capture variability. We also encourage proposers to include evidence that a power analysis to determine replication level has been performed. If enough replication is possible, it may be possible to address multiple factors (technique, approach, AND site condition) within the same analysis, but if not, please focus. The most robust analyses will be facilitated by using paired control and experimental (before and after the restoration activity) sites.

Methodological Guidance for Question 4

- Studies that simply produce nutrient and sediment reduction values for one stream restoration technique in one set of site conditions will not be supported. We are looking for comparative studies.
- Levels of the factor(s) (either restoration technique, approach, or site condition) to be compared must be clearly articulated in the description of the experimental design and a justification provided for their selection. Potentially confounding factors must be considered and, if sample size does not allow it, kept constant. Additional factors can be added as sample size allows.
- The strongest proposals will use paired series (Osenberg, et al., 2006) or BACI (before-after-control-impact) designs with sufficient replication to capture variability and control sites to capture variability due to other factors. However, “space for time” experimental design will be considered, if justified (i.e., no “before” data were collected, but the sites provide particularly good opportunity to test the question).
- Sample size to be used must be justified. As discussed above, applicants are encouraged to perform power analysis to determine whether the sample size chosen/possible is enough to be able to detect differences among treatments.

All water quality sampling projects intended to quantify loads must include methodology that captures both base flow and storm flow in a representative way. The best way to achieve this standard is flow-paced sampling using automated samplers. See Thompson, et al. (2014) for water quality sampling methods, associated error, and optimal sampling to reduce error.

5. **Stability of restoration practices.** Research is needed to better understand why and when stream restoration practices “fail” in order to reduce “failures” and increase “successes.” We recognize that there is no standard definition of “failure,” definition of “stability,” or agreed upon tolerance for stream material movement within or from a project. The investigator will have to define those for the purposes of his/her study approach. In addition, we recognize that sometimes designs intentionally do not promote fixed banks, which can be either “good” or “bad.” Sometimes, features are designed to aggrade sediment, but rapid aggradation can prevent vegetation establishment and reduce “success” from a biological perspective, if not a physical one.

a) What are the flow conditions under which different in-stream channel structures that are currently used in stream restoration projects (e.g., vanes, step pools, constructed riffles, large woody debris) or approaches (e.g., RSCs, NCDs, stream valley restorations/legacy sediment removal, or a combination of those techniques that aim for the same degree of floodplain reconnection) function and remain stable? What are the energy tolerances beyond which the structures or approaches begin to fail? Even if structures or approaches remain stable within the restoration project area, do they have negative impact (lead to degradation) on other reaches?

**Possible Elements of the Experimental Design:** Within one stream restoration technique or structure, compare stream cross sections at a subset (a large enough sample size to capture variability) of projects with variable flow rates. Regress change in cross section against flow rate. Repeat for other restoration structure types and compare flow rates at which “unacceptable” % change in cross section occurs.

b) How well can various modelling approaches (1D vs 2D) predict the structural “success” or “failure” for the various stream restoration techniques and structures? What variables must be included in the models to make accurate predictions for stream restoration “success” or “failure” at the site?

**Possible Elements of the Experimental Design:** Compare 1D and 2D model predictions with real life “success” or “failure” (i.e., degree of sediment movement, degree of loss of materials), including enough replicate study sites to capture variability.

C. **Construction Techniques**

6. What is the difference in effects on water quality (turbidity), total sediment load delivered downstream, riparian habitat, and other biological effects between stream restoration work “in the wet” (construction without diverting the stream) vs. work “in the dry” (construction accomplished through diversion of the water flow)? All aspects of work in the wet vs work in the dry that affect sediment input must be considered, including:

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a) Installing a diversion when working in the dry, which may release sediment for some period of time at some high concentration (e.g., > than the water quality standard of 150 NTU) during the installation.

b) Removing the diversion, which may also release sediment

c) Duration of construction (hypothesized to be shorter for work in the wet)

You will be required to articulate potential covariates, such as restoration type, restoration size, project duration, sediment type, substrate type, slope, stream size, stream flow, land use, drainage area, area disturbed, and other factors. Your experimental design must include the replication needed for scientifically defensible results, and you must justify the number of replicates chosen. You are encouraged to perform a power analysis to ensure that your sample size is large enough to detect the hypothesized difference. Reviewers will be sensitive to the degree of replication proposed.

Possible Elements of the Experimental Design: Compare the sediment load (and biological parameters, such as vegetative cover) before and during stream restoration using “work in the wet” construction techniques to “work in the dry” construction techniques. Make sure to keep any factors that could confound the results constant, such as the restoration type, restoration size, project duration, sediment type, substrate type, slope, stream size, stream flow, land use, drainage area, and area disturbed.

D. Trade-offs in resource improvements incurred by restoration practices and creating net ecological uplift

7. Resource trade-offs in different types of restoration projects. The decision to install a restoration project at any given site by definition implies that an existing condition at that site will be modified, replaced, and/or improved. The hypothesis of the restoration practitioner is that the net condition will be improved. However, a value judgment is placed on the existing condition, deeming the existing condition to be inferior to the desired “restored” condition that is often not based on quantification. In addition, there is an accompanying value judgment on the proposed resulting condition that may not take into account reductions of certain functions.

The goal of this question is to encourage quantification of the resources present prior to the activity compared to quantification of the resources available after an “intervention” or activity, calculating net ecological impact after evaluation of individual functional components. With certain kinds of restoration projects or practices, are we maximizing certain benefits (nutrients, sediment, habitat, hydrology, and biological resources) at the expense of other benefits in an unacceptable way? This research should allow restoration practitioners to more accurately calculate the resource’s functional uplift at a particular site in order to optimize system functions in their decision making.

a) Wetland trade-offs in stream restoration projects: Certain stream restoration practices can impact type and function of existing wetlands. Impacts can include changes to the wetland’s hydrology and plant community extent and distribution.

What are the changes to the wetland community and does this result in a loss of wetland function compared to the benefit of the other elements of the restoration practice?
b) Tree trade-offs in stream restoration projects: Certain stream restoration practices by necessity can result in removal of trees: 1) trees may need to be removed on a short-term basis for construction site access; 2) trees may be removed for various methods of stream restoration in nontidal forested wetlands; 3) trees may be removed to accomplish legacy sediment removal in which the stream banks are forested; and 4) trees, even when remaining after restoration, may experience mortality due to changes in hydrology leading to higher water levels/inundation.

What is the water quality and habitat cost of tree removal of certain practices compared to the benefit of the other elements of the restoration practice?

**Proposal Guidance**

All proposals must be organized as follows:

- **I. Introduction and Literature Review:** Begin with a short review of the literature to support the research direction and methodology chosen.
- **II. Hypothesis Section:** Clearly identify the specific hypothesis to be tested. Hypotheses proposed must be directly linked to one or more of the RFP research questions.
- **III. Methods – Data Collection:** Contain a **robust and scientifically defensible methods section**, including
  - A narrative describing the experimental design and justification of sample size to be used given existing spatial/temporal variability (power analysis highly encouraged for relevant studies).
  - A tabular or graphical depiction of the experimental design
- **IV. Methods – Data Analysis.** Describe your data analysis methodology, including identification of statistical tests to be used. Note that statisticians are included on the review panel.
- **V. Work Products:** Conclude with a section describing the products of the work, at a minimum to include:
  - A talk at a restoration conference for the practitioner audience;
  - Annual presentations to the regulatory community at regulatory training events for the duration of the study period; and
  - At least one scientific paper in the peer-reviewed scientific literature.

Reviewers will carefully consider how clearly the hypothesis, methods, and analysis approaches were crafted.

**Criteria**

All projects will be evaluated by a Technical Review Committee composed of external peer reviewers on the following criteria:

- Ability to successfully and objectively answer one or more of or a component of one or more of the key restoration questions described earlier;
- Use of scientifically robust methods, including sampling regimes and parameters, and statistical analysis appropriate to address the proposed hypothesis;
- Demonstration that project sites selected for study will be available and accessible as proposed;
- Organization and lead staff qualifications;
• Transferability of the results to key audiences, such as regulators, restoration implementers (e.g., local governments), and restoration practitioners; and
• Stated willingness and plan to submit data to the Trust and partners no later than one year from when the data were compiled.

Funding partners reserve the right to fund projects and budget items that advance their mission and meet their specific priorities and criteria.

Eligible Applicants

Both not-for-profit entities (academic institutions, non-profit organizations) and for-profit entities are permitted to apply. The strongest proposals will show committed partnerships with various types of organizations. Organizations need not be based in Maryland, but the work conducted with these funds must occur in Maryland or be relevant to a Maryland application.

Funding Available and Timeline

Funding partners have allocated approximately $800,000 for this research program. Literature reviews will be funded at a level of less than $50,000 and must be concluded within 6 months of execution of award. Project timeframe for research projects should correspond with the goals of the project. However, the upper end of the project time limit is 3 years.

Eligible Budget Items

Budget and Match

• Cash and in-kind match is not required but is one criterion against which the project will be judged. Preference will be given to projects with the most robust research plan. Therefore, leveraging funds and indicating matching resources can result in higher scores.
• Appropriateness and scale of budget, including research personnel time and indirect costs, will be evaluated.

The following cannot be funded:

• Endowments, deficit financing, building programs, or venture capital.
• Mitigation activities.
• Political lobbying.
• Reimbursement for a project that has been completed or materials that have been purchased.

Application, Review, Decision, and Award Processes

Application Process: Applicants must submit proposals using our Online Application System, found at http://www.cbtrust.org/restorationresearch by 4:00 pm on February 21, 2018. Late applications will not be accepted and the online funding opportunity closes promptly at 4:00 pm. Applicants are strongly encouraged to submit at least a few days prior to the deadline given potential for high website traffic on the deadline date. The Trust cannot guarantee availability of technical assistance for your online application on the deadline date.
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Review Process: Applications will be disseminated for peer review between February 22, 2018, and March 20, 2018. By March 20, 2018, applicants may be provided with a set of questions from a first round of proposal review. Applicants must make a representative available to answer reviewer questions on April 16, 2018, (12 pm to 1 pm) either in person at the Chesapeake Bay Trust office (60 West Street, Suite 405, Annapolis, Maryland) or by phone. The date and time are subject to change.

Decision Process: Awards will be announced in May 2018. All applicants will receive a letter stating the funding partnership’s decision. An application may be declined, partially awarded, or fully awarded. The Trust and funding partners may request that applicants include additional collaboration with other applicants prior to receiving the award.

Award Process: If approved, the Trust will send an agreement letter with award conditions and due dates of status and final reports. In the agreement, awardees will agree to:

- Disseminate research results in annual training sessions for regulators/policy makers (one per year during the award period as well as the year immediately following the award period upon conclusion of the work);
- Provide the Trust with the research data produced as part of this award. Agreements shall specify the data to be delivered and delivery schedules for the data. The timeframe for data delivery may be up to one year from the completion of the work and may be made publically available for use; and
- Commit to submit one or more publications as a result of the work to a peer reviewed scientific journal.

In cases in which the awardee fails to submit a status report or final report by the due date, the Trust reserves the right to terminate the agreement and require a refund of funds already transferred to the awardee. When the project is complete, awardees are required to complete final reports, including submission of all invoices, receipts, and timesheets, if staff time is used. Organizations with outstanding final reports will not receive additional awards.

Contact

For technical assistance with projects, please contact: Sadie Drescher at 410-974-2941 ext. 105 or sdrescher@cbtrust.org

Proposal Instructions

When completing the online application, you will be asked for the following information:

Project Title: List the title of your project

Organization Information
  1) Organization Name
  2) Address and Phone Number
  3) Mission of Organization
  4) Organization Type
  5) Employer Identification Number (EIN) and DUNS number if for-profit entity
An Executive Officer and Project Lead must be identified for all proposals and must be different individuals. Both individuals must be staff or board members of the applicant organization.

**Executive Officer of Requesting Organization:** Name, Title, Address, Phone, and E-mail

**Project Lead:** Name, Title, Address, Phone, and E-mail

**Award Information:**
1) Amount of funding requested
2) Award Period: enter project start and end dates
3) In which county will the project be located?
4) In which stream, river or watershed will the project be located?
5) Latitude and longitude (in decimal degrees) representative of project site(s)

**Project Abstract**
In a text box, you will be asked to provide a brief (3 to 4 sentences) summary of the project, including details such as type of project and main objectives, including hypothesis to be tested.

**Project Timeline**
You will be asked to complete a table listing major project tasks, with start and end dates.

**Project Deliverables**
You will be asked to fill in estimated deliverables for a variety of metrics. Disregard any deliverables that do not apply to your project.

**Project Partnerships and Qualifications**
You will be asked to complete a table listing all project partner organizations, individuals, their areas of expertise, and their role in your project. Applicants are encouraged to upload a letter of support for the project from each partner outlining the partner’s project role. Letters may be added to the Project Narrative File or uploaded as an attachment.

**Project Narrative Upload**
Answer the project narrative questions and upload the MS Word or PDF file. The project narrative should not exceed ten (10) pages of text. We recommend that you copy and paste the questions to use as an outline in the project narrative to demonstrate that the narrative addresses all questions. You may add photos, letters of support, and other materials to support your project proposal as additional file attachments.

Project Narrative Organize your proposal as follows:

1. **Key Restoration Question(s):** Articulate the key restoration question(s) your project will address. Reference the question number listed in the Request for Proposals (1-7).

2. **Introduction and Literature Review:** Begin with a short review of the literature to support the research direction and methodology chosen. Discuss the background of the hypothesis you will be testing, including other relevant studies (peer-reviewed and gray literature) and their findings. How does your work build on previous activities? How does your proposed project advance the knowledge to the next level?
3. **Hypothesis Section**: Clearly identify the specific hypothesis to be tested. Hypotheses proposed must be directly linked to one or more of the RFP research questions.

4. **Methods – Data Collection**: Provide **robust and scientifically defensible methods section**, including:
   a) a narrative describing the experimental design and justification of sample size to be used given existing spatial/temporal variability (power analysis highly encouraged for relevant studies). Identify sampling sites (if applicable), sampling regime (if applicable), parameters measured. Your methods must be clear and justified to answer the research question(s).
   b) A tabular or graphical depiction of the experimental design

5. **Methods – Data Analysis**: Describe your data analysis methodology, including identification of statistical tests to be used. Note that statisticians are included on the review panel.

6. **Work Products**: Conclude with a section describing the products of the work, at a minimum to include:
   a) At least one scientific paper in the peer-reviewed scientific literature;
   b) A talk at a restoration conference for the practitioner audience; and
   c) Annual presentations to the regulatory community at regulatory training events for the duration of the study period.

7. **Requesting Organization and Qualifications**: Briefly describe your organization. Describe the experience of your organization, the staff selected in your organization to perform this work, and the contractors selected to perform this work.

8. **Transferability**: Explain how you plan to disseminate the information (above and beyond the required participation in regulatory/policy-maker workshops described earlier).

9. **Regulatory Support**: Describe the regulatory support for your project plan, project site(s), and proposal, as appropriate.

10. **Conflict of Interest**: Projects in which there is independence between the lead investigator(s) and other phases of the project (e.g., design, build, monitor, maintain, etc.) will be ranked highest. Independence is defined as lack of involvement of the investigator(s) proposed here and the design or construction of the project(s) to be used to answer the questions in this study. Please describe any connections your project team has with the design, construction, and/or funding of the restoration project(s) that could impact or be perceived to impact the results and their use.

**Budget Upload**

You will be asked to upload your budget using the “Application Budget” worksheet of the Chesapeake Bay Trust’s Financial Management Spreadsheet, an excel file template. The template is available in the online application and can be found by visiting [www.cbtrust.org/forms](http://www.cbtrust.org/forms).

- Please be as detailed as possible.
- For any staff cost requests, list the percentage of overall time devoted to the project by each staff member in the budget item column. It is expected that all personnel included in budgets will be
directly involved in the research conducted under this program. Requests that do not include full justification for personnel involved may not be fully funded.

- Matching/leveraged resources are encouraged. Please indicate whether each match entry is applied for, pledged, or in-hand. Indicate in the narrative whether your organization has requested financial support from any other sources for the project not listed as match in the budget submitted.

**Budget Category Information**
This final online award program component will ask applicants to enter budget category totals. These totals will be automatically calculated in the Application Budget. Finally, check that the project’s total requested amount you entered earlier in the application is correct.

Use the “Additional Budget Justification” section in the online application to justify and explain costs. Budgets that are detailed, justified, and itemized are ideal.

The body of work described in your proposal should be able to be accomplished with the resources requested in your budget. If the success of the work is contingent upon award of other funds, please make this clear in your budget justification section.