2009 Student Technology Fee Proposal Form

Title of Project: Huxley Lab Class Water Purification System

Department/Organization: **Department of Environmental Sciences/Huxley College**

Name(s) of Project Applicant(s)

Name **Ruth Sofield (Harper)** MS **9181**		Phone **2181**
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Name MS		Phone

Principal Contact person:

Name **Ruth Sofield (Harper)**		Phone **2181**
Amount Requested for project:	**$7,390.98**	
Contribution by Requesting Organization:	**$500**	

Important note: Before completing this form, please read the Proposal Form Instructions located on the STF website: http://www.wwu.edu/stf/

I. Project Abstract

Give an overview of existing environment, and summarize the items being requested. Include a brief explanation as to how the requested technology will improve student *access* to technological resources and/or enhance the *quality* of the student academic experiences through the use of technology and/or increase the *integration* of technology into the curriculum.

The undergraduate students enrolled in our Department of Environmental Sciences laboratory classes or conducting research as part of their senior project use deionized distilled water (ddH2O) to prepare solutions, culture media, buffers, and calibration standards for analytical instruments. The use of ddH2O is required to ensure that trace metals and organic compounds found in general tap water or in distilled water do not interfere or contaminate samples being tested or analyzed. Currently, the students are provided ddH2O in 5 gallon plastic carboys because there is no water purification system in the laboratory classes. Teaching assistants or faculty instructors must obtain the ddH2O from systems located in two Huxley College faculty research laboratories, one in the Institute for Watershed Studies (IWS) and one in the Institute of Environmental Toxicology (IET). A third option is to obtain ddH2O from the system in Scientific Technical Services (SciTech). The system in IWS' faculty research laboratory is a relatively new Barnstead Nanopure Diamond UV model. It was acquired using external grant funds. The system in IET's faculty research laboratory is an older (13 years old) Barnstead Nanopure Infinity system that was purchased with external grant funds as part of a grant-funded research project. The system in SciTech's analytical laboratory is identical to the one in IWS and is a relatively new Barnstead Nanopure Diamond UV model. They purchased the system through the Chemistry Department's operating funds for their GC-MS, IC, HPLC, etc analyses they conduct in support of most of the university's laboratory classes.

Scheduling access to any of the systems and getting the ddH2O can be problematic since the first priority is for the faculty, IWS, and IET grant-funded research projects or for the technical (analytical) support services provided by SciTech. The high demand on these systems also results in the need to make more frequent replacements of the water treatment cartridges and UV lamps, which in turn places the financial burden on the faculty, institutes, or SciTech. Laboratory class fees cannot be used to reimburse the faculty or institutes for the cost of the cartridges. Moreover, because the systems are used for both classes and research there is no clear delineation between what costs should be covered by the faculty and institutes, and what could be covered by department funds.

In addition to access issues there is also the issue of transporting the ddH2O. The water is collected in 5 gallon carboys and transported on carts to our laboratory class where they have to be lifted onto countertops for use. This can pose a safety issue since 5 gallons weighs almost 42 lbs (1 gallon = 8.35 lbs). Moreover, the fact that the water has to be collected, transported, stored, and dispensed in plastic carboys also increases the potential for the water to become contaminated. Since there is no testing or monitoring of the water once it is collected in the carboys, the actual quality of the water is unknown by the time it is used in the laboratory classes.

This proposal, therefore, is to request a Barnstead Nanopure Diamond UV Model water purification system (Barnstead # D11911) specifically for use in the Department of Environmental Sciences laboratory classes. Included in the request is a remote dispenser (Barnstead # D11981) that allows the user to dispense the water at bench level without having to hold containers up to the dispenser mounted on the front of the system, one cartridge pack (Barnstead # D50280) for immediate use in the system and one additional pack for reserve, as well as an additional UV lamp in the event the lamp that comes with the system burns out prematurely. This model was selected for several reasons. The Diamond series of water purification systems are the current line of models offered by Barnstead and as such possess the latest in technological improvements. The UV model was specifically selected because of the high purity of water it can produce that is specifically needed for our laboratory classes experimental applications, as well as its price compared to the higher end Bioresearch and Life Sciences Diamond models. It was also selected due to its already proven reliability and performance on campus as evidenced by testimonials from SciTech staff and Dr. Robin Matthews, the IWS faculty member who have this system.

Barnstead Diamond UV system w/ remote dispenser

II. Relationship to STF Objectives and Impact upon existing Academic Programs

Describe your proposed project in detail. Tell us how it will provide positive benefits to specific courses or instructional programs.

1. From a **student perspective**:

    a. How would this project provide additional student access to technological resources?

    Currently students in the department's laboratory classes are directed to the 5 gallon plastic carboys containing the ddH2O and told to use that water for preparing any dilutions, solutions, standards, etc. They are informed that it is ultra pure water and the importance of using it as part of Good Laboratory Practices (GLPs), Quality Assurance (QA), and Quality Control (QC) principles. They have no reference, however, of where or how the water is produced, nor data verifying its purity at the time it is actually used. By having the water purification system in the actual laboratory class in which they are setting up and conducting their experiments, the students have direct access to this water purification technology. They will learn how the system works, how to operate the system, and the technological features it is equipped with to inform the user as to the quality of the water at any given time. This is a standard technology in many scientific laboratories and one that our students would learn to use if it were available in the classroom lab.

    b. How would this project broaden or enhance the quality of the student's academic experience through the proposed technology?

    Having a water purification system in the laboratory classroom is a learning experience for the students to see for themselves the technology used to create ultra pure water. Water purification employs the use of a variety of processes including filters that physically remove particles, specially formulated resins and activated charcoal that chemically and physically bind metals and organics to them, and radiation (ultraviolet) to destroy pathogens and organic matter in the feed water. The Barnstead Diamond UV system utilizes all of these methods through specialized cartridge system, a final 0.2µm final filter, and a dual wavelength UV lamp.

    Students will learn how to operate the system, how the feed water is processed within the system to make it ultra pure, what the LCD digital display is indicating about the quality of the final water being produced, and the relevance of that information in relation to complying with GLPs, QA, and QC principles.

    Students have a general knowledge of the importance of ultra pure water in conducting toxicity tests, water quality analyses, or in doing any chemical analyses. The water is specifically used for making dilutions, solutions, calibration standards, and other media for laboratory tests, wet chemistry applications, and analytical uses. As such the water must not contribute any organic, particulate, or metal contaminants to ensure that the data obtained are accurate, precise, and reliable (repeatable). Yet when students are not informed about how the water is produced, there is sometimes a

disconnect between what they know and what they understand. For example the students know to always use the "cleaner" water from the carboys, but do not necessarily know why it is "cleaner". It wasn't until students in the ESCI 457 Toxicology Laboratory I class saw SciTech's Barnstead Diamond UV system in operation during a visit to their facilities and were told how it worked that students made that connection. Comments such as "I've never seen one of those before and never even heard about it until this class." and "Wow, that's really neat!" conveyed the clear message that students learn best by seeing and doing, rather than by just being told about something.

c. How would this project integrate technology into coursework?

Water purification systems are a fundamental component of all laboratory facilities throughout the world. The technology that makes these systems work so effectively and efficiently is based on basic physical, chemical, and biological principles the students learn through coursework in the classroom. For example technological advances have enabled the creation of filter media with very precise porosity that optimizes the removal of particles and bacteria without compromising flow-through. Specially formulated resins and processed carbon substrates provide ionically charged surfaces with high surface to volume ratios. These substrates can selectively absorb and adsorb metals and organics, thereby efficiently and effectively de-ionizing, de-mineralizing, and purifying any aqueous medium. The disinfection and sterilization qualities of ultraviolet radiation have also been utilized. Under controlled conditions light can be generated at precise wavelengths and intensities to selectively destroy any type of organic matter without leaving any residual radiation. Combined together into one unit these technological advances have created water purification systems that produce consistently high quality, ultra low organic water for laboratory applications that meets or exceeds established Type I water requirements.

The technology of these systems is a fundamental component of GLPs, QA, and QC principles and as such integrates completely with the student's coursework. GLPs are concerned with the conditions under which laboratory and field studies are planned, performed, monitored, recorded, and reported. As part of compliance with GLP guidelines students conduct tests and analyze samples using standardized, peer-reviewed procedures or Standard Operating Procedures (SOPs). These ensure the quality and integrity of the data generated. The students quickly learn that any laboratory test, wet chemistry, or instrument analysis conducted without using ultra pure water will compromise the accuracy and precision of the data results. By having a water purification system in the laboratory, the technology provides the student with a reliable, high quality source of water and a means to monitor, as well as verify that quality at any stage of their laboratory coursework. Conversely, ultra pure water collected elsewhere and transported in carboys to the laboratory, which is the current practice, has the potential to become contaminated. Moreover, students must assume that the water purification system that produced the water was properly operating

when the water was collected. If their lab experiment data results are questionable and fail data quality objectives or test acceptability criteria it is much more difficult for the student or the instructor to identify the source of the error(s) when the water source is not fully controlled and regularly monitored.

2. From a **faculty perspective**, explain how this project will enhance your ability to help students meet their educational goals.
   The purpose of all academic programs is to provide the student with the educational knowledge, training, and skills necessary to succeed in the career path s/he has selected. As an upper-division college, students in the Department of Environmental Sciences are at the stage in their educational development of selecting courses that specialize in those subjects that directly link their educational goals to their selected career paths. The courses we offer (ESCI 457/557 Toxicology Laboratory I, ESCI 458/558 Toxicology Laboratory II, ESCI 428 Freshwater Algae Bioindicators, ESCI 444 Biogeochemistry of Marine Sediments, ESCI 322 Oceanography Lab, and ESCI 362 Water Quality Lab) therefore strive to provide the knowledge, skills, and hands-on practical training which will ultimately assist them in their careers.

   As faculty members (Ruth Sofield and Robin Matthews) and instructor (April Markiewicz), this project will support our ability to ensure that the students meet their educational goals, as well as our expectations for them to be fully prepared when they pursue jobs in their selected career paths. As professionals, studies conducted by them may be used in regulatory settings and/or scrutinized during litigious proceedings, It is critical that tests be designed and conducted so that the results are accurate and precise. Being aware of and adhering to the principles and procedures associated with GLPs, QA, and QC practices they learn in laboratory class will enable them to produce accurate and precise test results in their professional capacities. A key component to ensure this is to understand how laboratory equipment operates and the technological features they have to verify the quality and integrity of data generated in the laboratory.

   The purchase of a Barnstead Nanopure Diamond UV model water purification system will enable us to provide them hands-on training in the use of what is standard equipment in any laboratory throughout the world. Their ability to understand how it works, how to operate the system and its features, what the LCD digital display is indicating about the quality of the final water being produced, and the relevance of that information will be invaluable to them in their professions. Especially in verifying the quality of the Type I laboratory water they will be using for so many crucial laboratory operations, tests, and analyses as part of their job duties. Our students deserve access to, and use of, equipment that has current technological capabilities. This will provide them with the knowledge and tools they need to obtain the best job they can in a highly competitive job market.

3. Will other departments be involved with this project? If so, please describe.
   No

4. Has any part of this project previously been funded by STF?

   No ☒ Yes ☐ (Please describe):

III. Utilization

1. Please list the anticipated number of times and duration per each use, per quarter, that the proposed technology will be used by students.
   The system would be used by the students enrolled in the laboratory classes that is held in the classroom in which the technology is installed. Currently, this is 3-4 classes/year. Students in other ESCI lab classes may also access the system as needed. Finally, students conducting internship or senior research projects under the direction of a department faculty member throughout the year may gain access to the system. On average the water purification system would be used approximately 25 times a week for approximatly 20 minutes per use for a total of about 83 hours per quarter.

IV. Project Budget

This section of the proposal details the estimated cost of the project. Please include costs that will be covered by your department or another source, for ongoing costs such as personnel or operating expenses.

To assist you in preparing your budget, please consult with relevant campus support departments ATUS, Purchasing, Space Administration, etc.) For more information, see this page on our website: http://www.wwu.edu/stf/instructions.shtml

ATUS has developed standard configurations for desktop and laptop PCs and Macs. Your project is not limited by these standards, but these figures may be helpful. Standard configurations can be found on the Student Technology Fee website: http://www.wwu.edu/stf/instructions.shtml

Please complete all of the following sections (attach Excel spreadsheet for any additional details).

Item	Quantity	Item Cost	Total
Barnstead Nanopure Diamond UV Water Purification System (D11911)	**1**	**$4,532.69**	**$4,532.69**
Barnstead Nanopure Diamond Organic Free RO/ Distilled Water Feed Cartridge Pack (D50280)	**2**	**$470.70**	**$941.40**
Barnstead Diamond Remote Dispenser (D11981)	**1**	**$588**	**$588**
Replacement UV Lamp for Barnstead Nanopure Diamond UV system (LMX13)	**1**	**$180.29**	**$180.29**
SUBTOTAL			**$6,242.38**
Shipping (taxable) estimated at 10% rate			**$624.24**
Tax (8.4%)			**$524.36**
TOTAL			**$7,390.98**

We recognize your proposed budget as an estimate. Final funding for successful projects will be established after through technical review; some costs may need adjusting due to price changes. The STF Committee may impose special conditions may upon a project. *See Sections B.7 & B.9 of the STF Mission Statement* http://www.wwu.edu/cms/WWU.STF/mission.html

1. What funding is available from your department or other sources?
   A total of $500, with $200 coming from the Huxley College of the Environment, $200 from the Department of Environmental Sciences, and $100 from the Institute of Environmental Toxicology.
2. Could this project be divided into discrete elements that could be funded separately?

   No ☒ **Yes** ☐ Please summarize and prioritize project segments with cost estimate for each segment.

3. Are lab fees charged for any of the courses that will use this equipment?

   No ☒ **Yes** ☐ If yes, please note: the total funding requested from the STF must reflect the amount collected from course fees for equipment replacement and/or equipment acquisition. All proposals asking for course fees will be reviewed by the Academic Budget Office.

V. Impact on Existing Resources

The proposal should address your project's potential impact on existing resources. Special attention should be given to impact on data transmission networks (e.g. sources accessed, networking equipment, etc.), and personnel (e.g. staffing, administrative support, faculty support, etc.).

Any proposal that includes the replacement of computers should specifically address the feasibility and cost effectiveness of upgrading the computers rather than replacing the computers.

1. Describe how existing equipment is used. Contrast this to projected use if your project was funded.
   In the laboratory classes (ESCI 362 Water Quality Lab, ESCI 322 Oceanography Lab, ESCI 428 Freshwater Algae Bioindicators, ESCI 444 Biogeochemistry of Marine Sediments, ESCI 457/557 Environmental Toxicology Lab I, and ESCI 458/558 Environmental Toxicology Lab II) the Teaching Assistant or faculty instructor arranges to get ddH2O from one of the Institutes' research laboratories or SciTech water purification systems. Five gallon carboys are filled with the ddH2O by the TA and then transported by cart and elevator to the respective lab classes for use by the students. The carboys are set up at the sinks and students open the carboy stopcocks to dispense the ddH2O into flasks or beakers which they use to transport the water back to their lab stations. At their stations they will then measure specific volumes of the ddH2O needed to prepare dilutions, reagents, solutions, standards or other media for the laboratory tests or analyses. The fact that the water has to be collected, transported, stored, and dispensed in carboys increases the potential for the water to become contaminated. Moreover, since there is no testing or monitoring of the water once it is collected in the carboys, the actual quality of the water is unknown by the time it is used in the laboratory class.

Having a dedicated water purification system for the department's laboratory class needs will eliminate most of the access, transport, safety, potential contamination, and data QA/QC issues that currently exist. Moreover, the existing systems will no longer have to support both class and research needs with the burden of the costs being carried by the faculty who have the systems in their research laboratories. By having the system in the actual laboratory class in which students are setting up and conducting their experiments, the students also have direct access to this water purification technology. They will work with the system as a matter of routine, and therefore, will learn how the system works, how to operate the system, and the technological features it is equipped with to inform the user as to the quality of the water at any given time.

2. Is similar equipment or technology available elsewhere on campus—such as the Student Technology Center, Classroom Services, Video Services, Western Libraries, a college lab? If so, please describe why the existing equipment doesn't meet the needs outlined in this proposal.
   Scientific Technical Services (SciTech) and the Institute for Watershed Studies (IWS) both have the Barnstead Nanopure Diamond UV water purification systems in their labs ES 505 and ES 325, respectively. The Institute of Environmental Toxicology has an older model Barnstead Nanopure Infinity system in ES 328 that is not capable of providing ultra low organic ddH2O that SciTech's and IWS' systems can. These water purification systems are for highly sensitive analytical procedures and grant-funded research projects. For many years SciTech and the institutes have been generous in providing access to and use of their systems for the department's laboratory class needs, however the access, transport, safety, potential contamination, and data QA/QC issues that currently exist out-weigh the benefits of continuing to use their systems for free. The students also miss out in knowing how water purifications work, how to operate them, and the technological features they have. The only appropriate option is for the department's laboratory classes to have their own water purification system, which is standard equipment in most, if not all the other science laboratory classes at Western.

3. If this project involves the replacement of equipment:

   a. Describe the 'before and after' configuration changes. A spreadsheet reflecting these changes can be attached.

   b. Describe the costs and benefits of replacing vs. upgrading (if applicable).

4. Will this equipment be available to students outside your department?
   No ☐ **Yes** ☒

5. If the proposed technology will be used by students outside your department, please describe how they would gain access, how the availability of the equipment will be publicized, the hours/week when the equipment will be available, and any costs that would apply.
   Students outside of Huxley College's Department of Environmental Sciences are able to take its laboratory classes if they have fulfilled the required prerequisites or obtained permission from the instructor. As a student enrolled in the laboratory class, s/he will gain access to use the

water purification system as part of her/his assigned lab experiments. Students outside of the College not taking these classes may also gain access to the systems when not in use for laboratory classes on a case-by-case basis with permission from the faculty. Students may contact the Department of Environmental Sciences for referral to the appropriate faculty or directly contact the faculty to find out how to go about scheduling access to, and training on, using the water purification system.

Since the Biology and Chemistry departments have been allocated new buildings in the last 10 years, most, if not all of their lab classrooms, have water purification systems in them. Students in those programs therefore have greater options to access those local systems than seeking access to the one system we are requesting for our department's six laboratory classes. So, though any students attending Western can gain access to our system, it is anticipated that realistically only the Department of Environmental Sciences students will be requesting access to ours.

6. Does this project involve the check-out of equipment to students?

   No ☒ **Yes** ☐ If yes, please discuss whether or not the Student Technology Center could be assigned this task.

6. Does the department have adequate operating funds to provide on-going maintenance and support?

   No ☐ **Yes** ☒ Please describe.
   Funds are available from the Department of Environmental Sciences, from Huxley College, and from the Institute of Environmental Toxicology to cover the costs of ongoing maintenance and support for the system.

7. Does the department have adequate personnel funds to provide on-going staff support for this project?

   No ☐ **Yes** ☒ Please describe,
   Huxley College's full-time scientific instructional technician is reponsible for ensuring that all laboratory classroom instruments and equipment are regularly maintained and repaired when needed. In addition, Scientific Technical Services (SciTech) is located in ES 508, across the hall from the Department of Environmental Sciences office in ES 522 and provides technical repair services for our laboratory classes, as well as faculty research laboratory equipment and instruments when needed as part of their service to the university.

VI. Space and Site Information

This section addresses any space alteration or site preparation necessary for the proposed project. Site alterations include painting, holes in walls, security systems, carpeting, construction, lighting changes, or conversion of a lab or office

Special Note: If this project requires any site preparation, or if this project uses any space not currently under control of the department, a draft proposal must be submitted to Space Administration by **Friday, November 14, 2008**. Space Administration and Facilities Management will conduct a site survey and respond back to you with information concerning project feasibility, cost, and schedule. This information must be included in the final project proposal.

Proposals for projects that involve any site preparation will be considered only after the required site survey by Space Administration and Facilities Management has been completed.

1. Location for installation of equipment or technology.
   In ES 405

2. Is site modification required?

   No ☒ **Yes** ☐ Please describe. (Electrical, air, painting, lighting, security, network access, etc.)

3. Will this project use space not currently assigned to your department or area?

   No ☒ **Yes** ☐ Please describe.

VII. Project Schedule

This section describes your overall implementation schedule. Project awards will be announced by the end of spring quarter. It is anticipated that projects would be substantially completed by the end of the calendar year. If there is any site preparation involved, please align your project schedule with the schedule provided by Space Administration and Facilities Management.
Once informed that the project has been awarded funds the vendors will be contacted shortly thereafter to obtain an updated quote for the water purification system, cartridge packs, remote dispenser, and additional UV lamp, including tax and shipping. During early summer we will work with the Purchasing Department to finalize criteria for the bid proposal to go out to the vendors, as well as evaluate valid bids that are received. Once the bid is awarded to the vendor we will work with them on delivery of the system to the Environmental Studies building, with the goal of having it installed in ES 405 by the beginning of Fall 2009 Quarter.

VIII. Constraints

This section should list any external or internal factors that could affect your project schedule, project objectives, or the project budget (e.g. if external approval is required for curricular changes, or if funding must be received by a certain date).

1. Please describe any constraints to this project.
   Price quotes for the water purification system, cartridge packs, remote dispenser, and additional UV lamp expire after 30 days so there is the potential for prices to increase somewhat by the time the project is funded.

IX. External Funding

This section must be completed for any **projects over $100,000**. For project budgets of this scale, the applicant should investigate opportunities for obtaining external funding for all or part of the proposed project.

1. Describe the external organization(s) able to provide funding in support of this project.

Not applicable. This section does not apply since the project is well below the $100,000 limit.

2. Describe the funding cycle for these requests (submission dates, projected award dates).

   Not applicable

3. Indicate the amount of external funding that would be requested.

   Not applicable

4. In cases where joint funding is requested, what will happen if the STF award is made and the external grant is not awarded?

   Not applicable

5. Has a grant proposal already been submitted for all or part of the proposed STF project?

   Not applicable