



DEPARTMENT OF
ECOLOGY
State of Washington

IAA No. C1600135

INTERAGENCY AGREEMENT (IAA)

BETWEEN

THE STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY

AND

UNITED STATES FISH AND WILDLIFE SERVICE

THIS INTERAGENCY AGREEMENT (“Agreement” or “IAA”) is made and entered into by and between the state of Washington, Department of Ecology, hereinafter referred to as "ECOLOGY," and the United States Fish and Wildlife Service hereinafter referred to as the "USFWS," pursuant to the authority granted by Chapter 39.34 RCW.

THE PURPOSE OF THIS AGREEMENT to test the effectiveness of plants and fungi to improve bioretention soil mix performance to remove pollutants carried by stormwater.

THEREFORE, IT IS MUTUALLY AGREED THAT:

1) STATEMENT OF WORK

USFWS shall furnish the necessary personnel, equipment, material and/or service(s) and otherwise do all things necessary for or incidental to the performance of the work set forth in Appendix A, attached hereto and incorporated herein.

2) PERIOD OF PERFORMANCE

Subject to its other provisions, the period of performance of this IAA shall commence on **March 15, 2016**, or date of final signature, whichever comes later, and be completed by **June 15, 2019**, unless terminated sooner as provided herein. Amendments extending the period of performance, if any, shall be at the sole discretion of ECOLOGY.

3) COMPENSATION

The source of funds for this IAA is **General Fund – Private/Local (RSMP)**. Compensation for the work provided in accordance with this IAA has been established under the terms of RCW 39.34.130 and RCW 39.26.180(3). This is a performance-based contract, in which payment is based on the successful completion of expected deliverables.

The parties have determined that the cost of accomplishing the work identified herein will not exceed \$424,920.00. Payment for satisfactory performance of the work shall not exceed this amount unless the parties

mutually agree via an amendment to a higher amount. Compensation for services shall be based on the terms and tasks set forth in Appendix A, Statement of Work and Budget. ECOLOGY will not make payment until it has reviewed and accepted the completed work.

4) BILLING AND PAYMENT PROCEDURE

Payment requests shall be submitted on state form, Invoice Voucher A19-1A with supporting documentation. Invoices shall describe and document to ECOLOGY's satisfaction a description of the work performed, the progress of the work, and related fees. Each invoice voucher shall reference the Agreement (IAA) number and clearly identify those items that relate to performance under this Agreement. Payment will be made within thirty (30) days of a properly completed invoice (form A19-1A) with supportive documentation. All expenses invoiced shall be supported with copies of invoices paid.

Invoices are to be sent to:

State of Washington Department of Ecology Attn: Brandi Lubliner, RSMP Coordinator P.O. Box 47600 Olympia, WA 98504-7600

Payment requests may be submitted as deliverables are completed, on completion of the project or annually. Upon expiration of this Agreement, any claim for payment not already made shall be submitted to ECOLOGY within 30 days after the expiration date or the end of the fiscal year, whichever is earlier.

Payment for approved and completed work will be issued through Washington State's Department of Enterprise Services Statewide Payee Desk. To receive payment you must be registered as a state-wide vendor. To register submit a state-wide vendor registration form and an IRS W-9 form at website, <http://www.des.wa.gov/services/ContractingPurchasing/Business/VendorPay/Pages/default.aspx>. If you have questions about the vendor registration process you can contact DES at the Payee Help Desk at (360) 407-8180 or email payeehelpdesk@des.wa.gov.

5) ALTERATIONS AND AMENDMENTS

This Agreement may be amended by mutual agreement of the parties. Such amendments shall not be binding unless they are in writing and signed by personnel authorized to bind each of the parties.

6) ASSIGNMENT

The work to be provided under this Agreement, and any claim arising thereunder, is not assignable or delegable by either party in whole or in part, without the express prior written consent of the other party, which consent shall not be unreasonably withheld.

7) ASSURANCES

Parties to this Agreement agree that all activity pursuant to this contract will be in accordance with all the applicable current federal, state and local laws, rules, and regulations.

8) CONFORMANCE

If any provision of this contract violates any statute or rule of law of the state of Washington, it is considered modified to conform to that statute or rule of law.

9) DISPUTES

Parties to this Agreement shall employ every effort to resolve a dispute themselves without resorting to litigation. In the event that a dispute arises under this Agreement that cannot be resolved among the parties, it shall be determined by a Dispute Board in the following manner. Each party to this Agreement shall appoint one member to the Dispute Board. The members so appointed shall jointly appoint an additional member to the Dispute Board. The Dispute Board shall review the facts, agreement terms, and applicable statutes and rules, and then make a determination of the dispute. The determination of the Dispute Board shall be final and binding on the parties hereto, unless restricted by law. The cost of resolution will be borne by each party paying its own cost. As an alternative to this process, if state agencies, either of the parties may request intervention by the Governor, as provided by RCW 43.17.330, in which event the Governor's process will control. The parties may mutually agree to a different dispute resolution process.

10) FUNDING AVAILABILITY

ECOLOGY's ability to make payments is contingent on availability of funding. In the event funding from state, federal, or other sources is withdrawn, reduced, or limited in any way after the effective date and prior to completion or expiration date of this Agreement, ECOLOGY, at its sole discretion, may elect to terminate the agreement, in whole or part, for convenience or to renegotiate the agreement subject to new funding limitations and conditions. ECOLOGY may also elect to suspend performance of the agreement until ECOLOGY determines the funding insufficiency is resolved. ECOLOGY may exercise any of these options with no notification restrictions.

11) GOVERNING LAW AND VENUE

This Agreement is entered into pursuant to and under the authority granted by the laws of the state of Washington and any applicable federal laws. The provisions of this Agreement shall be construed to conform to those laws. This Agreement shall be construed and interpreted in accordance with the laws of the state of Washington, and the venue of any action brought hereunder shall be in the Superior Court for Thurston County.

12) INDEPENDENT CAPACITY

The employees or agents of each party who are engaged in the performance of this Agreement shall continue to be employees or agents of that party and shall not be considered for any purpose to be employees or agents of the other party.

13) ORDER OF PRECEDENCE

In the event of an inconsistency in the terms of this Agreement, or between its terms and any applicable statute or rule, the inconsistency shall be resolved by giving precedence in the following order:

- a. Applicable federal and state of Washington statutes, regulations, and rules.
- b. Mutually agreed upon written amendments to this Agreement.
- c. This Agreement.
- d. Statement of Work and Budget.
- e. Any other provisions of this Agreement, including materials incorporated by reference.

14) RECORDS MAINTENANCE

The parties to this Agreement shall each maintain books, records, documents and other evidence that sufficiently and properly reflect all direct and indirect costs expended by either party in the performance of the service(s) described herein. These records shall be subject to inspection, review or audit by personnel of both parties, other personnel duly authorized by either party, the Office of the State Auditor, and federal officials so authorized by law. All books, records, documents, and other material relevant to this Agreement will be retained for six years after expiration of this Agreement and the Office of the State Auditor, federal auditors,

and any persons duly authorized by the parties shall have full access and the right to examine any of these materials during this period.

Records and other documents, in any medium, furnished by one party to this Agreement to the other party, will remain the property of the furnishing party, unless otherwise agreed. The receiving party will not disclose or make available this material to any third parties without first giving notice to the furnishing party and giving it a reasonable opportunity to respond. Each party will utilize reasonable security procedures and protections to assure that records and documents provided by the other party are not erroneously disclosed to third parties subject to state public disclosure laws.

15) RESPONSIBILITIES OF THE PARTIES

Each party of this Agreement hereby assumes responsibility for claims and/or damages to persons and/or property resulting from any act or omissions on the part of itself, its employees, its officers, and its agents. Neither party will be considered the agent of the other party to this agreement.

16) RIGHTS IN DATA

Unless otherwise provided, data which originates from this Agreement shall be "works for hire" as defined by the U.S. Copyright Act of 1976 and shall be owned by state of Washington, ECOLOGY (*if otherwise, need AAG approval*). Data shall include, but not be limited to, reports, documents, pamphlets, advertisements, books magazines, surveys, studies, computer programs, films, tapes, and/or sound reproductions. Ownership includes the right to copyright, patent, register, and the ability to transfer these rights.

17) SEVERABILITY

If any provision of this Agreement or any provision of any document incorporated by reference shall be held invalid, such invalidity shall not affect the other provisions of this Agreement which can be given effect without the invalid provision, if such remainder conforms to the requirements of applicable law and the fundamental purpose of this agreement, and to this end the provisions of this Agreement are declared to be severable.

18) SUBCONTRACTORS

USFWS agrees to take complete responsibility for all actions of any Subcontractor used under this Agreement for the performance. When federal funding is involved there will be additional subcontractor requirements and reporting.

Prior to performance, all subcontractor who will be performing services under this Agreement must be identified, including their name, the nature of services to be performed, address, telephone, WA State Department of Revenue Registration Tax number (UBI), federal tax identification number (TIN), and anticipated dollar value of each subcontract. Provide such information to ECOLOGY's agreement manager.

19) TERMINATION FOR CAUSE

If for any cause, either party does not fulfill in a timely and proper manner its obligations under this Agreement, or if either party violates any of these terms and conditions, the aggrieved party will give the other party written notice of such failure or violation. The responsible party will be given the opportunity to correct the violation or failure within 15 working days. If failure or violation is not corrected, this Agreement may be terminated immediately by written notice of the aggrieved party to the other.

20) TERMINATION FOR CONVENIENCE

Either party may terminate this Agreement upon thirty (30) days' prior written notification to the other party. If this Agreement is so terminated, the parties shall be liable only for performance rendered or costs incurred in accordance with the terms of this Agreement prior to the effective date of termination.

21) WAIVER

A failure by either party to exercise its rights under this Agreement shall not preclude that party from subsequent exercise of such rights and shall not constitute a waiver of any other rights under this Agreement unless stated to be such in a written amendment to this Agreement signed by an authorized representative of the parties.

22) AGREEMENT MANAGEMENT

The representative for each of the parties shall be responsible for and shall be the contact person for all communications and billings regarding the performance of this Agreement.

The ECOLOGY Representative is:	The USFWS Representative is:
Name: Brandi Lubliner Address: 300 Desmond Dr. SE (USPS) PO Box 47600 (FedEx) Olympia, WA 98504-7600 Phone: 360.407.7140 Email: brwa461@ecy.wa.gov	Name: Jay Davis Address: 510 Desmond Dr. SE, Suite 102 Lacey, WA 98503 Phone: 360.753.9568 Email: jay_davis@fws.gov

APPENDIX A STATEMENT OF WORK AND BUDGET

Effectiveness study on whether plants and fungi enhance bioretention performance
to reduce pollutants in stormwater over time

for

Washington State Department of Ecology,
Regional Stormwater Monitoring Program

Introduction

This scope of work is to implement an effectiveness study as part of the Regional Stormwater Monitoring Program (RSMP) designed to address the study question: “What soil amendments and bioretention soil mixes combined with plant selection combines optimum removal of nutrients, bacteria and metals?”

The background, activities, deliverables and schedule associated with this study are provided below. Work on these tasks will be performed by USFWS with assistance from Washington State University (WSU). USFWS and WSU are hereafter referred to as the “Project Team”.

Background

Recent bench and field scale bioretention studies have indicated a significant potential for pollutant exports from bioretention installations that meet the SMMWW specifications. Replicated mesocosm studies indicate that the role of plants in bioretention systems needs further research to evaluate whether adding plants as an installation amendment provides additional pollution control benefits. Recent studies have also indicated that wood-decomposing fungi can be used in bioretention mulch to achieve unique environmental services. This project will evaluate the effects of plants and fungi on toxicity, water quality, and hydraulic properties of bioretention cells under field conditions. Four treatments (no plants / no fungi; plants / no fungi; no plants / fungi; plants / fungi) will be evaluated in triplicate. The study will use a soil mix recommended by the WA Department of Ecology and a plant community informed by the ongoing WSU Puyallup mesocosm study. The results will critically inform the Regional Stormwater Management Program’s goal to optimize bioretention systems and evaluate the risk of nutrient and metal exports from bioretention soil and will help to understand the interplay of soils, plants, and fungi and their role in stormwater remediation.

For the proposed work, stormwater will be treated in real time at a downspout from a busy roadway. We are currently working with WSDOT to identify potential sites. The runoff will be treated on-site using four different types of bioretention columns (bioretention soil media (BSM) only; BSM + plants, BSM + fungi, BSM + plants + fungi), evaluated in triplicate. The objective will be to evaluate the effects of plants and fungi on toxicity, water quality, and hydraulic properties of bioretention cells under field conditions. Through this project we will better understand the interplay of soils, plants, and fungi. We will know if plants and fungi as soil amendments will improve the water quality of effluent from bioretention cells. Furthermore, this project will increase the understanding of the fate of pollutants like heavy metals and PAH in bioretention soil and in plant tissue. This knowledge helps to determine the lifetime of a bioretention cell and whether this lifetime can be extended by plant or fungi soil amendments.

The time series of hydraulic properties contributes to our understanding of water movement in the bioretention cells. This data will allow us to design and dimension bioretention cells and maintenance intervals in greater detail as well as to better predict and avoid hydraulic failure.

Schedule

Timeline for task completion on a quarterly basis

Task Descriptions	2016				2017				2018			
	1	2	3	4	1	2	3	4	1	2	3	4
1. Develop QAPP												
2. Bioretention soil preparation												
3. Bioretention cell preparation and installation												
4. Baseline soil and hydraulic testing												
5. Monitoring												
6. Post experiment tests												
7. Final report and presentation												

Task 1: Quality Assurance Project Plan (QAPP) (Total Cost \$47,868)

Deliverable 1 = Quality Assurance Project Plan (QAPP)

We will prepare a Quality Assurance Project Plan (QAPP) that follows Ecology’s *Guidelines and Specifications for Preparing Quality Assurance Project Plans for Environmental Studies*, February 2001 (Ecology Publication No. 01-03-003) prior to water quality testing. We will submit this QAPP to the Department of Ecology with time for revision, comment and approval. \$47,868 Due Date: March 31, 2016

Task 2: Bioretention soil preparation (Total Cost \$12,939)

We will prepare a bioretention soil mix based on the recommendation of WA Department of Ecology. Compost conforming to appropriate test parameters will be purchased and incorporated into a bioretention soil mix at a ratio informed by the above-mentioned studies. Bioretention materials (e.g., sand, compost) will be tested separately for concentration of metals (Table 1).

Deliverable 2.1 = 2 m³ of well characterized bioretention soil media

\$6,469 Due Date: June 30, 2016

Deliverable 2.2 = Report on chemistry of bioretention soil materials

\$6,470 Due Date: June 30, 2016

Task 3: Bioretention cell preparation and installation (Total Cost \$51,849)

We will develop water retention curves from the gravel and the soil mix before they are installed in the bioretention cells. We will build 12 bioretention cells with a volume of 200 L (55-gallon drums, 60 cm diameter, 86 cm height), each containing a 5 cm diameter underdrain within a 30 cm gravel drainage layer (Western WA Stormwater Manual). Bioretention soil media (BSM; 60 cm) will be tamped down on top of the drainage layer and covered with bark mulch (Figure 1). Each layer of the bioretention cell (drainage, BSM, mulch) will be tested for microbial communities, nutrients, and metals. BSM will be tested at three depths during construction (15 cm, 30 cm, 46 cm). Six of the 12 bioretention cells will be planted and 6 of the 12 bioretention cells will be inoculated with a fungus. Every bioretention cell will be equipped with probes to measure the soil water content, the matric potential, and the soil temperature continuously over the duration of the experiment. Finally, we will install these cells to receive real-time runoff from a busy roadway.

Deliverable 3.1 = Report on water retention curves of bioretention soil mix

\$17,283 Due Date: June 30, 2016

Deliverable 3.2 = Report on chemistry of bioretention soil layers

\$17,283 Due Date: June 30, 2016

Deliverable 3.3 = Design drawings and photographs of completed bioretention test cell array

\$17,283 Due Date: June 30, 2016

Task 4: Baseline testing of bioretention cells (Total Cost \$19,291)

The bioretention cells will be conditioned with clean water prior to receiving runoff. Microbiology and chemistry will be assessed in effluent from the clean water infiltration (Table 2 and 3). Toxicity testing of effluent from clean water infiltration of the bioretention soil media and drainage layer will qualify baseline toxicity (or lack thereof) of the materials to aquatic biota (Table 4).

Deliverable 4.1 = Report on microbiology and chemistry of effluent from clean water conditioning

\$4800 Due Date: June 30, 2016

Deliverable 4.2 = Report on toxicity testing of effluent from clean water conditioning

\$14,491 Due Date: June 30, 2016

Task 5: 24-month performance monitoring (Total Cost \$234,128)

Hydraulic performance, as well as the chemistry and toxicology of effluent water from bioretention cells will be collected on a quarterly basis. The saturated hydraulic conductivity will be determined with the falling head method (SMMWW). Collected effluent (plus influent sample) will be submitted to certified laboratories for chemical analysis (Tables 2 and 3) and also stored for toxicity testing. Toxicity testing will be conducted according to standard EPA protocols for effluent testing using *Ceriodaphnia dubia* or per protocols previously published by McIntyre et al. (2014) for zebrafish (Table 4).

Deliverable 5.1 = Year 1 report on hydraulic, water quality, and toxicity monitoring (0-6 mo)

\$58,532 Due Date: March 31, 2017

Deliverable 5.2 = Year 1 report on hydraulic, water quality, and toxicity monitoring (6-12 mo)

\$58,532 Due Date: September 30, 2017

Deliverable 5.3 = Year 2 report on hydraulic, water quality, and toxicity monitoring (13-18 mo)

\$58,532 Due Date: March 31, 2018

Deliverable 5.4 = Year 2 report on hydraulic, water quality, and toxicity monitoring (18-24 mo)

\$58,532 Due Date: September 30, 2018

Task 6: Post-experimental testing (Total Cost \$15,740)

We will collect soil samples in each bioretention cell from three depths (15 cm, 30 cm, and 45 cm) to assess accumulation and mobilization of metals over the experimental period (Table 1) and to develop post experiment water retention curves and hydraulic conductivity. We will also determine the plant mass (root and shoot) and perform plant tissue analysis to check for accumulated pollutants in plant roots or shoots. We will also assess the microbial communities in the post experiment bioretention soil.

Deliverable 6 = Report on pollutant accumulation and mobilization, hydraulic conductivity, and microbial communities

\$15,740 Due Date: December 1, 2018

Task 7: Final report (Total Cost \$43,105)

Data from the hydraulic properties, water quality, and toxicity monitoring will be analysed with respect to treatment effects (presence/absence of plants, fungi) as well as potential seasonal or antecedent dry period effects. Results of this project will be presented at a minimum of two public meetings; including a SWG meeting and perhaps a WSU LID Annual Review in Puyallup, WA. The final report will describe the entire study and will include all prior deliverables. Following Ecology approval, the report will be available on the Washington Stormwater Center website.

Deliverable 7 = Presentations (2) and final, cumulative report, fact sheet

\$43,105 Due Date: December 31, 2018

Budget Detail by Task

	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Total by Object
Salaries & Benefits	\$24,032	\$6,008	\$10,300	\$6,077	\$98,702	\$6,008	\$34,332	\$185,459
Grad Tuition	\$14,204		\$15,198		\$16,262			\$45,664
Supplies		\$1,000	\$4,696	\$500	\$1,000	\$500		\$7,696
Equipment		\$2,000	\$4,467					\$6,467
Travel & Publication	\$1,000		\$1,000		\$2,000		\$1,000	\$5,000
Subcontracts		\$1,598	\$6,838	\$9,235	\$73,944	\$6,394		\$98,009
Indirect Costs	\$8,632	\$2,333	\$9,350	\$3,479	\$42,220	\$2,838	\$7,773	\$76,625
Total Task	\$47,868	\$12,939	\$51,849	\$19,291	\$234,128	\$15,740	\$43,105	\$424,920

Tables and Figures

Table 1: Analytes for soil samples

Metals (As, Cd, Cr, Cu, Ni, Pb, Zn)
 Total N
 Total C
 Moisture Content

Table 2: Metals, conventionals and bacteria to be analyzed in water samples

Total and dissolved Cu, Zn
 Total suspended solids (TSS)
 Suspended sediment concentration (SSC)
 Dissolved organic carbon (DOC)
 Total organic carbon (TOC)
 Chemical oxygen demand (COD)
 Hardness
 Alkalinity
 pH
 Ammonia
 Total nitrogen and nitrates
 Total Phosphorous and ortho-Phosphorous
E. coli, fecal coliform

Table 3: PAHs to be analyzed in water samples

Abbreviation	Rings	PAH Name
NPH	2	Naphthalene
C1-C3NPH	3	Alkylated naphthalenes
ACY	3	Acenaphthylene
ACE	3	Acenaphthene
FLU	3	Fluorene
C1-C4FLU	3	Alkylated fluorenes
DBT	3	Dibenzothiophene
C1-C4DBT	3	Alkylated dibenzothiophenes
PHN	3	Phenanthrene
C1-C4PHN	3	Alkylated phenanthrenes
ANT	3	Anthracene
PYR	4	Pyrene
FLA	4	Fluoranthene
C1-C4FLA	4	Alkylated fluoranthenes
CHR	4	Chrysene
C1-C4CHR	4	Alkylated chrysenes
BAA	4	Benzo[<i>a</i>]anthracene
BBF	5	Benzo[<i>b</i>]fluoranthene
BKF	5	Benzo[<i>k</i>]fluoranthene
BEP	5	Benzo[<i>e</i>]pyrene
BAP	5	Benzo[<i>a</i>]pyrene
PER	5	Perylene
IDP	5	Indeno[1,2,3- <i>cd</i>]pyrene
DBA	5	Dibenz[<i>a,h</i>]anthracene (and [a,c])
BZP	6	Benzo[<i>ghi</i>]perylene

Table 4: Summary of toxicity testing for water samples

Organism	Endpoint	Time
<i>Ceriodaphnia dubia</i>	Survival	48 h
<i>Danio rerio</i>	Survival, morphometrics, developmental abnormalities cardiac function & abnormalities	48 h

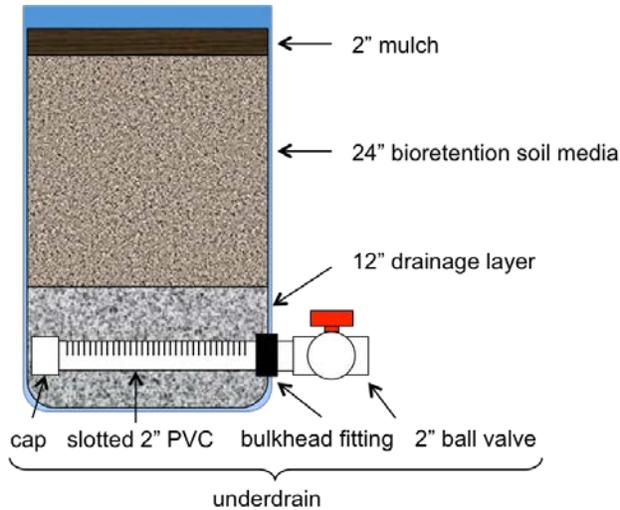


Figure 1: Schematic of the bioretention cell