UNIVERSITY OF MARYLAND EASTERN SHORE
Office of the President

April 15, 2026

Dr. Elena Quiroz-Livanis
Acting Secretary of Education
Maryland Higher Education Commission
217 E. Redwood Street, Suite 2100
Baltimore, MD 21202

RE: Substantial Change Proposal New Academic Program (Standalone Upper Division Certificate in Green Infrastructure)

Dear Dr. Quiroz-Livanis:

The University of Maryland Eastern Shore (UMES) hereby submits a proposal to begin offering a **standalone Upper Division Certificate in Green Infrastructure**.

In keeping with its land-grant mission and commitment to addressing critical environmental and societal challenges, UMES has developed this program to prepare students and working professionals for careers in sustainable infrastructure, environmental planning, and climate resilience. This new certificate program is uniquely positioned to support Maryland's strategic goals in environmental justice, climate adaptation, and workforce development in emerging green industries.

The Upper Division Certificate in Green Infrastructure is designed as a standalone academic credential and will provide students with technical knowledge and applied training in the planning, design, and implementation of coastal and urban stormwater-oriented nature-based solutions and low-impact development (LID) strategies. The program integrates environmental science, engineering, economics, and urban planning with real-world field experiences, leveraging UMES's partnerships with regional agencies and community stakeholders.

This new certificate complements UMES's academic offerings in Environmental Science, Agriculture, and Engineering Technology and builds on the university's existing collaborations with

agencies such as the Maryland Department of the Environment, NOAA, and USDA. It will serve both traditional undergraduates and non-traditional learners—including municipal employees and environmental professionals—seeking specialized training in green infrastructure to meet regulatory, sustainability, and climate resilience goals across Maryland, particularly in underserved rural and coastal communities on the Eastern Shore.

The proposed certificate will also strengthen UMES's role in advancing applied research and public engagement related to stormwater management, coastal zone and near-shore enhancement and protection, flood mitigation, and ecological restoration—key concerns for Maryland's future. As a standalone program, it will contribute to our strategic vision of increasing access to high-impact, career-aligned training programs that support community resilience and environmental sustainability.

The attached proposal has undergone the university's established curriculum approval process, and I fully support its implementation.

Thank you for your consideration.

Sincerely,

Heidi M. Anderson, Ph.D., FAPhA
President

Copy: Dr. Rondall Allen, Provost and Vice President for Academic Affairs
Dr. Moses Kairo, Dean, School Agriculture and Natural Sciences

Office Use Only: PP#

Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	University of Maryland Eastern Shore

Each action below requires a separate proposal and cover sheet.

- (○) New Academic Program
- (○) New Area of Concentration
- (○) New Degree Level Approval
- (●) New Stand-Alone Certificate
- (○) Off Campus Program
- (○) Substantial Change to a Degree Program
- (○) Substantial Change to an Area of Concentration
- (○) Substantial Change to a Certificate Program
- (○) Cooperative Degree Program
- (○) Offer Program at Regional Higher Education Center

Payment Submitted: (●) Yes (○) No Payment Type: (●) R*STARS # (○) Check # JJ611335 Payment Amount: 850 Date Submitted: 11/25

Department Proposing Program	Department of Natural Sciences
Degree Level and Degree Type	Upper Division Certificate
Title of Proposed Program	Green Infrastructure
Total Number of Credits	12
Suggested Codes	HEGIS: 042000 CIP: 03.0104
Program Modality	(○) On-campus (●) Distance Education (fully online) (○) Both
Program Resources	(●) Using Existing Resources (○) Requiring New Resources
Projected Implementation Date (must be 60 days from proposal submisison as per COMAR 13B.02.03.03)	(●) Fall (○) Spring (○) Summer Year: 2026
Provide Link to Most Recent Academic Catalog	URL: https://wwwcp.umes.edu/schedule/academic-catalogs/
Preferred Contact for this Proposal	Name: Leesa Thomas Banks Title: Interim Vice Provost for Academic Affairs Phone: 410-651-7591 Email: lpthomasbanks@umes.edu
President/Chief Executive	Type Name: Heidi M Anderson Signature: Heidi M Anderson Date: 4/15/26
	Date of Approval/Endorsement by Governing Board: 12/24

Revised 4/2025

University of Maryland Eastern Shore (UMES)

Upper Division Certificate in Green Infrastructure Proposal

A. Centrality to Institutional Mission and Planning Priorities

1. Program Description and Relationship to Institutional Mission

The University of Maryland Eastern Shore (UMES), Maryland's Historically Black 1890 Land-Grant Institution, is a Professions-focused Undergraduate/Graduate-Doctorate Small University committed to delivering high-quality, student-centered education in an ethnically diverse environment. UMES prepares graduates to meet regional and national workforce needs through integrated education, research, and service.

UMES proposes the **Green Infrastructure (GI) Certificate Program** to address growing demand for professionals trained in sustainable stormwater management, climate resilience, and environmental infrastructure. Green Infrastructure reduces stormwater runoff and water-driven pollution through natural systems while providing additional benefits such as improved air quality, reduced urban heat, economic revitalization, and enhanced community well-being.

The GI Certificate Program is multidisciplinary, integrating environmental science, STEM, and business principles. It directly supports UMES's mission by preparing students—particularly underrepresented minorities—for employment in a rapidly expanding environmental management workforce serving the Eastern Shore of Maryland and the broader region.

2. Alignment with Strategic Goals and Institutional Priority

The proposed program aligns with Goal II of the UMES Strategic Plan, by supporting workforce development, applied research, and environmental problem-solving relevant to the Eastern Shore and the State.

Demands for Green Infrastructure expertise is increasing due to expanded stormwater regulations, infrastructure modernization efforts, climate adaptation initiatives, and public and private investment in sustainable development. Municipalities, state agencies, utilities, engineering firms, and environmental organizations increasingly require professionals with applied skills in green stormwater design, implementation, and maintenance.

The GI Certificate Program addresses these workforce needs by providing applied, experiential training aligned with employer expectations. The program builds on existing institutional capacity and reflects UMES's ongoing commitment to environmental workforce development, confirming it as an institutional priority.

3. Funding and Five-Year Sustainability

The Green Infrastructure Certificate Program will be funded for at least the first five years through existing resources within the Department of Natural Sciences (DNS) in the School of Agricultural and Natural Sciences.

- DNS has hired an adjunct faculty member at $4,000 per semester ($8,000 annually) to teach *DNSC 402: Concepts in Green Infrastructure* and *DNSC 403: Applications in Green Infrastructure*, which have been offered as electives since 2017.
- Program oversight will be provided by Dr. Ali Ishaque through his faculty appointment in Environmental Sciences.
- Existing UMES faculty will continue to deliver supporting courses within Environmental Sciences, Agriculture, Business, and accounting programs at no additional cost.

This structure ensures long-term sustainability without reliance on external or temporary funding.

4. Institutional Commitment to Program Support and Continuation

a. Ongoing Administrative, Financial, and Technical Support

The Green Infrastructure Certificate Program is affiliated with the Environmental Sciences program within the Department of Natural Sciences (DNS). As such, DNS and the School of Agricultural and Natural Sciences will provide all necessary administrative, financial, and technical support, including:

- Program coordination and oversight
- Course scheduling and advising
- Access to laboratory and instructional resources
- Faculty support and assessment oversight

The administrative and instructional infrastructure required for the program is already in place and will continue throughout the program's duration.

b. Continuation of the Program

UMES is fully committed to offering the Green Infrastructure Certificate Program for a period sufficient to allow all enrolled students to complete the program. Because the certificate relies on existing courses, faculty, and administrative structures, there are no anticipated barriers to program continuation. The program is designed to be fully embedded within existing academic operations, ensuring long-term viability and continuity.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan

Labor Market Demand Narrative

Demand for Green Infrastructure professionals continues to grow due to regulatory requirements, climate-driven flooding risks, and infrastructure investments.

According to the U.S. Bureau of Labor Statistics, employment of environmental scientists and specialists is projected to grow by approximately 6% from 2022 to 2032. Employers increasingly require skills in:

- Stormwater management
- Low-impact development (LID)
- GIS and environmental monitoring
- Regulatory compliance

1. Demonstrated Regional and Statewide Need

Stormwater runoff is a leading cause of water quality impairment in the Chesapeake Bay and Maryland Coastal Bays. Excess nutrients and sediment contribute to algal blooms, hypoxia, and habitat loss. The Chesapeake Bay Total Maximum Daily Load, established by the U.S. Environmental Protection Agency in 2010, mandates significant reductions in nitrogen, phosphorus, and sediment across the watershed. While the original 2025 targets have not been fully achieved, the program has transitioned to an extended implementation phase emphasizing adaptive management, climate resilience, and strengthened accountability. These evolving priorities have increased the demand for green infrastructure and nature-based solutions as cost-effective strategies for nutrient and stormwater management, highlighting the need for a trained workforce equipped with skills in design, implementation, and maintenance of such systems.

Maryland's Phase III Watershed Implementation Plan (2019), updated through a 2022 climate-focused addendum and subsequent milestone cycles, identifies workforce development as essential to meeting these goals. Increasing investment in clean water and green infrastructure projects, including more than $400 million in state funding for Chesapeake Bay restoration and local water infrastructure, has created substantial demand for a skilled workforce capable of designing, implementing, and maintaining stormwater and nature-based solutions (Maryland Department of the Environment- Clean Water Infrastructure).

In parallel, regional initiatives such as the Green Streets, Green Jobs, Green Towns (G3) program has invested over $17 million in more than 300 green infrastructure projects across the watershed, explicitly linking environmental restoration with job creation and workforce development (Chesapeake Bay G3 Green Infrastructure Projects).

Despite these investments, workforce gaps persist. Programs led by organizations such as the Alliance for the Chesapeake Bay highlight a growing shortage of trained professionals in green infrastructure design, installation, and maintenance, noting that expanding implementation efforts have outpaced the availability of qualified workers (Green Workforce Development).

Collectively, these trends demonstrate a sustained and growing demand for Green Infrastructure professionals in Maryland and the Chesapeake Bay region, underscoring the critical need for targeted workforce training programs such as the proposed certificate.

a. Advancement and Evolution of Knowledge

The proposed program supports the advancement of applied knowledge in green infrastructure by integrating principles from environmental science, engineering, urban planning, and ecological design. As regulatory requirements evolve and climate-driven precipitation extremes increase, there is a critical need for professionals who possess current, interdisciplinary expertise in GI systems. The certificate program contributes to the development and dissemination of this knowledge through a structured curriculum and experiential learning opportunities.

b. Societal Needs and Expanded Educational Access

The Green Infrastructure Certificate Program addresses societal needs by expanding access to high-demand STEM-related educational pathways for minority and educationally disadvantaged students. As an 1890 Land Grant Historically Black Institution, UMES plays a critical role in diversifying Maryland's environmental workforce. The certificate provides students with marketable skills aligned with regulatory compliance and community resilience efforts, thereby enhancing employment opportunities and supporting equitable participation in environmental and infrastructure-related professions.

c. Strengthening the Capacity of a Historically Black Institution

UMES has established leadership in coastal environmental research through partnerships with federal and state agencies, positioning the institution as a regional leader in applied environmental education and workforce development.

2. Consistency with the Maryland State Plan for Postsecondary Education

The proposed Green Infrastructure (GI) Certificate Program is consistent with the Maryland State Plan for Postsecondary Education, which emphasizes collaborative workforce development in STEM fields and highlights environmental sciences as an area of national and international strength. The program aligns with the 2022–2026 State Plan developed by the Maryland Higher Education Commission, advancing priorities in **Student Access, Student Success, and Innovation**, while supporting Maryland's environmental and economic goals.

Workforce Need

Maryland faces sustained demand for professionals trained in green infrastructure, driven by regulatory and environmental priorities such as the Chesapeake Bay Total Maximum Daily Load. Statewide investments—including county stormwater programs, urban sustainability initiatives, and restoration efforts in the Maryland Coastal Bays—require a workforce with specialized, applied skills. However, Maryland currently lacks a dedicated academic credential focused on GI workforce preparation. This program addresses that gap by creating a direct pathway to employment in high-demand environmental sectors.

Student Access (Priorities 1–4)

The GI Certificate expands access to affordable, high-quality education through a **12-credit, stackable credential** embedded within existing degree programs. Its flexible structure (6 credits online and 6 credits within the student's field of study) accommodates traditional and non-traditional learners. As an HBCU, UMES is well positioned to serve **underrepresented and economically disadvantaged students**, directly supporting the State Plan's goal of reducing disparities in access and completion.

Student Success (Priorities 5–7)

The program promotes student success through **career-aligned instruction and experiential learning**. Designed for completion within existing degree timelines, it supports **timely graduation** and reduces barriers to completion. The curriculum emphasizes applied competencies in sustainability and infrastructure, ensuring graduates are workforce-ready. As a stackable credential, it also supports **lifelong learning and continued professional development**.

Innovation (Priority 8)

The GI Certificate advances innovation by integrating **hybrid delivery, interdisciplinary instruction, and hands-on learning**. Students engage in real-world problem-solving related to stormwater management, climate resilience, and sustainable design. The program leverages modern instructional tools and reflects a forward-looking approach to workforce preparation in emerging environmental sectors.

Quality, Impact, and Partnerships

The State Plan also emphasizes high-quality education and a culture of innovation. The GI Certificate delivers **cutting-edge content on nature-based solutions** for urban stormwater and coastal infrastructure, areas not widely offered in comparable programs. The curriculum incorporates innovative implementation models such as the Community-Based Public-Private Partnership (CBP3) approach used in Prince George's County, where over **$340 million in investment** has supported restoration of **3,800 impervious acres** and generated significant workforce opportunities.

Strategic partnerships with agencies including the U.S. Environmental Protection Agency, the Maryland Coastal Bays Program, and the National Oceanic and Atmospheric Administration (LMRCSC) enhance experiential learning, applied research, and workforce placement.

Conclusion

The proposed GI Certificate Program represents a strategic response to Maryland's workforce and environmental needs. By expanding access, supporting student success, and fostering innovation, the program aligns directly with the MHEC State Plan and contributes to the state's goals of economic competitiveness, environmental sustainability, and equitable educational outcomes.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State

1. Potential Industries, Employment Opportunities, and Expected Entry Level

Graduates of the GI Certificate Program will be prepared for positions such as:

- Environmental Technician
- Stormwater Technician
- Sustainability Analyst
- Field Coordinator

Entry-level salaries typically range from $48,000 to $55,000, with opportunities for advancement.

Graduates of the Green Infrastructure (GI) Certificate Program will be prepared for positions such as Environmental Technician, Stormwater Technician, Sustainability Analyst, and Field Coordinator. These roles are aligned with regional workforce needs in environmental monitoring, stormwater management, and infrastructure implementation.

Salary data from multiple sources indicate that entry-level compensation for these positions is competitive. For example, environmental technicians in Maryland earn an average of approximately $56,000–$57,000 annually, with entry-level salaries starting around $43,000–$52,000 (Career Explore- Environmental Technician).

Stormwater technicians in the United States earn an average of $43,000–$49,000, with early-career salaries around $42,000–$45,000 and higher earnings as experience increases (Salary.com- Stormwater Technician).

Collectively, these data support a typical entry-level salary range of approximately $48,000 to $55,000, with clear pathways for advancement into higher-paying roles (e.g., environmental specialists, project managers, and sustainability professionals), where salaries commonly exceed $60,000–$70,000 with experience (Salary.com).

2. Market Demand and Projected Job Openings

Quantitative evidence demonstrates sustained and growing demand for trained GI professionals:

- The Water Environment Federation has identified significant workforce gaps in the water sector, particularly in stormwater management and green infrastructure (GI), where implementation requires interdisciplinary skills spanning engineering, ecology, and construction (Water Environment Federation, 2019). National initiatives such as the National Green Infrastructure Certification Program further underscore the need for standardized workforce training to meet industry demand.
- National and regional assessments by the U.S. Environmental Protection Agency estimate that hundreds of thousands of water sector workers will be needed in the coming decades, with nearly one-third of the current workforce eligible for retirement. Additionally, only about 50–60% of utilities report being fully prepared to meet future workforce needs, highlighting a significant skills gap in areas such as GI implementation, stormwater compliance, and infrastructure resilience (EPA- Interagency Water Workforce)
- The Prince George's County Clean Water Partnership—a ~$100 million public-private partnership—provides clear, real-world evidence of workforce demand tied to GI implementation. The program has committed to retrofitting thousands of impervious acres with green infrastructure practices over a multi-year period, while also creating local job opportunities and workforce development pipelines, including training programs targeting underrepresented communities. Implementation activities such as bioretention installation, urban tree planting, and long-term maintenance contracts demonstrate sustained demand for a skilled GI workforce (Prince George's County Clean Water Program).
- Similar regulatory obligations exist across Maryland, including jurisdictions with high population density and significant runoff challenges such as the City of Baltimore. As local governments expand GI implementation to meet TMDL and Municipal Separate Storm

Sewer System (MS4) permit requirements, demand for trained GI professionals is expected to continue increasing statewide (Maryland Department of the Environment- Maryland's Municipal Separate Storm Sewer System (MS4) Permit Program).

Collectively, these data demonstrate a clear and growing workforce gap in green infrastructure, supporting the need for targeted educational and training programs to prepare the next generation of professionals in sustainable stormwater management.

3. Market Surveys and Evidence of Educational and Training Needs

The demand for GI-trained professionals is further supported by documented regulatory requirements and large-scale green infrastructure initiatives. For example, Prince George's County, Maryland, has implemented a $100 million GI program that requires substantial local and minority workforce participation to meet stormwater compliance goals. Similar initiatives in Baltimore City and other Maryland jurisdictions indicate a consistent and measurable need for trained personnel (Prince George's County Clean Water Partnership).

These county-level workforce requirements, combined with national data from the U.S. Environmental Protection Agency and the Water Environment Federation, provide reliable and quantifiable evidence of sustained educational and training needs over the next five years. Large-scale GI programs increasingly include workforce development components and local hiring mandates, demonstrating a direct demand for a skilled workforce.

Graduates of this program will have a competitive edge, as they will possess the specialized qualifications and hands-on training required to meet workforce demands in green infrastructure design, implementation, and maintenance.

4. Current and Projected Supply for Graduates

Currently, Maryland lacks a specialized certificate or degree program focused on green infrastructure (GI) workforce preparation. While existing environmental science and civil engineering programs produce graduates with general environmental and engineering skills, there is a limited supply of professionals with applied GI expertise.

The proposed program will help fill this gap by leveraging UMES's existing student population in STEM and business disciplines, with a particular focus on minority and educationally disadvantaged students. STEM disciplines at UMES represent approximately 30% of the undergraduate population, translating to an estimated 600-700– students annually across programs such as Environmental Science, Engineering, Agriculture, and Natural Resources. Of these, approximately 200–250 upper-division (junior and senior) students constitute the primary target population for the proposed Green Infrastructure Certificate.

This provides a strong and sustainable pipeline to support the projected enrollment of 10–15 students annually, increasing from the current baseline of zero graduates. The program builds on existing STEM competencies while providing specialized, workforce-oriented training in green infrastructure, stormwater management, and environmental sustainability.

The table below provides the STEM Student Population at UMES (2021–2025)

Year	Total Undergraduate	Estimated STEM (%)	Estimated STEM Students
2021	~1,800	~35%	~630
2022	~2,000	~30%	~600
2023	~ 2,240	~31%	~695
2024	~ 2,470	~30%	~740
2025	~2,700	~29%	~780

D. Reasonableness of Program Duplication

No equivalent program exists in Maryland. Unlike general sustainability programs, this certificate focuses specifically on applied stormwater management and green infrastructure systems.

1. Identification of Similar Programs

To date, there are no programs in Maryland, the region, or nationally that are directly equivalent to the proposed Green Infrastructure (GI) Certificate Program. The closest analogous program within the University System of Maryland (USM) is the Sustainability Minor, offered through the Schools of Agriculture and Public Policy at the University of Maryland, College Park. This minor requires 15 credit hours selected from a broad array of courses spanning science, technology, policy, institutional frameworks, and social and human dimensions.

2. Similarities, Differences, and Justification

While both programs address environmental sustainability, the GI Certificate is distinct in scope and focus. Unlike the Sustainability Minor, which provides a general interdisciplinary overview, the GI Certificate concentrates specifically on coastal and urban stormwater management and the design, implementation, and maintenance of green infrastructure systems. The curriculum emphasizes applied knowledge in stormwater reduction, environmental compliance, and

infrastructure resilience, including experiential learning opportunities such as internships and field projects.

The program is justified on the basis that it fills a unique workforce and educational niche. Maryland and regional jurisdictions are increasingly implementing GI initiatives to comply with stormwater regulations and TMDL requirements, creating an urgent demand for professionals trained in practical GI skills. No other program in the State currently provides a credential that integrates both theoretical and applied GI competencies in this focused area. The GI Certificate therefore represents a first-of-its-kind program, meeting a documented workforce need while complementing, rather than duplicating, existing environmental and sustainability programs. Another unique quality of this certification program is that it is applicable for STEM and non-STEM students and careers. As GI becomes increasingly integrated into municipal programs and more common across the landscape, there will be an ongoing and growing need for professionals of many and varied backgrounds to have familiarity with these practices. Fields such as psychology, sociology, and economics have already been focusing on the impacts and benefits of GI in the academic context. It is expected that professional applications in GI in these types of fields will become more prevalent in the future, which further reinforces the value of the UMES GI Certification program.

E. Relevance to High-Demand Programs at Historically Black Institutions (HBIs)

The program represents a unique credential at Maryland HBIs and strengthens existing Environmental Sciences programs by adding workforce-ready skills.

The proposed Green Infrastructure (GI) Certificate Program represents a first-of-its-kind credential at Maryland's HBIs. No other HBI in the state offers specialized training in coastal and urban stormwater management or applied green infrastructure.

The program will support and enhance existing high-demand programs at UMES, including the B.S. and B.S./M.S. programs in Environmental Sciences, by providing targeted, workforce-ready skills in a growing sector. Students completing the GI Certificate will be prepared for immediate employment in environmental management, urban planning, water resources engineering, and related fields, thereby strengthening UMES's high-demand offerings and its ability to meet regional workforce needs.

F. Relevance to the Identity of Historically Black Institutions (HBIs)

The program expands access to environmental careers for minority students and supports workforce diversity in underrepresented sectors.

The GI Certificate Program aligns with UMES's mission as a Historically Black Institution by expanding access to environmental careers for minority students and supporting equitable workforce development. By building upon the existing Environmental Sciences B.S. program,

which enrolls over 70% minority students, the program reinforces UMES's unique role in preparing underrepresented students for STEM careers. Graduates will acquire marketable skills in water resources management, enhancing the university's identity as a leader in applied environmental education while supporting the state's commitment to HBI development and minority student success.

National workforce reports indicate that minority representation in environmental and infrastructure-related professions remains disproportionately low. As a Historically Black Institution, UMES is uniquely positioned to address this gap by preparing underrepresented students for high-demand careers in environmental management and green infrastructure, thereby contributing to a more diverse and inclusive workforce.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes

The curriculum was developed by faculty with expertise in environmental science and aligned with workforce and regulatory standards.

1. Program Establishment and Faculty Oversight

The GI curriculum was developed by DNS faculty and EPA-funded consultants through the U.S. Environmental Protection Agency and the Maryland Coastal Bays Program (**Linking Environmental and Academic Programs; LEAP, MOU**), to ensure rigor, relevance, and alignment with workforce requirements.

- Faculty oversight includes:
    - Dr. Ali Ishaque, Program Director, Professor of Environmental Sciences and Director of the Graduate Toxicology Program
    - Dr. Jonathan Cumming, Chair of Natural Sciences
    - Dr. Paulinus Chigbu, Associate Dean, School of Agricultural and Natural Sciences (SANS)
    - Dr. Moses Kairo, Dean, SANS
- The National Municipal Stormwater Alliance (NMSA) where the EPA- funded consultants were from supports curriculum and experiential learning alignment with technical standards.

2. Educational Objectives and Learning Outcomes

Program Modality and Curriculum Structure

The Green Infrastructure (GI) Certificate Program will be delivered in a hybrid format consistent with University System of Maryland (USM) expectations for accessibility, flexibility, and workforce alignment. The program integrates online instruction, in-person experiential learning, and applied training within students' academic disciplines to ensure both academic rigor and practical skill development.

The certificate requires 12 total credits, structured as follows:

a. Online Core (6 Credits): Two courses delivered in a fully online format (asynchronous) to provide foundational knowledge:
    - DNSC 402 – General Concepts in Green Infrastructure (3 credits, online)
    - DNSC 403 – Practical Applications in Green Infrastructure (3 credits, online)
    - These courses emphasize:
        - Regulatory frameworks (e.g., Chesapeake Bay TMDL, Maryland WIP)
        - Design principles and planning approaches
        - Climate resilience and sustainability concepts

b. Field of Study / Applied Courses (6 Credits)
    - Students will complete 6 credits within their major or field of study, incorporating green infrastructure applications relevant to their discipline (e.g., Environmental Science, Engineering, Agriculture, Business).
    - These courses will include in-person laboratory and field components.

c. Experiential Learning Integration
    - Consistent with USM's emphasis on high-impact practices, the program embeds:
        - Field-based instruction
        - Project-based learning
        - Optional internships or practicum experiences
    - This structure ensures that students gain workforce-relevant competencies aligned with regional employer needs.

d. Flexibility and Accessibility
    - The hybrid modality supports:
        - Traditional and non-traditional students
        - Working professionals seeking upskills

- Seamless integration with existing undergraduate degree programs

The proposed 12-credit Green Infrastructure Certificate is designed as a hybrid program that combines 6 credits of online foundational coursework with 6 credits of applied, discipline-specific training within the student's field of study. This structure aligns with USM priorities by promoting flexibility, interdisciplinary learning, and workforce readiness, while integrating experiential and applied learning opportunities that prepare graduates for careers in green infrastructure and stormwater management.

Learning Outcomes

Objectives: Prepare students for careers in environmental management, urban planning, water resources engineering, and related fields, emphasizing applied GI practices, water quality improvement, and sustainable infrastructure management.

General Learning Outcomes:

a. Understand applications of green and grey infrastructure.

b. Understand relationships between the built environment and water management.

c. Evaluate social, economic, policy, and financial drivers for GI.

d. Engage with current research and sector trends to advance GI knowledge.

Specific Learning Outcomes:

a. Identify GI practices and implementation drivers.

b. Understand water resources, urban planning, and economic interconnections.

c. Apply basic hydrology and watershed management concepts.

d. Analyze existing water infrastructure and GI integration.

e. Identify relevant federal, state, and local regulations.

f. Evaluate social and economic factors influencing GI adoption.

g. Identify stakeholders for communication and public engagement.

h. Integrate emerging concepts such as smart infrastructure and sustainability into GI applications.

3. Assessment of Student Learning Outcomes

a. The Program Director, in collaboration with the UMES Office of Institutional Research, will implement the Student Learning Outcomes Assessment Process (SLOAP) to systematically evaluate course-level and program-level goals and learning outcomes. This process will include the collection and analysis of assessment data, documentation of student performance and outcome

attainment, and the use of results to inform continuous improvement of curriculum, instruction, and student support activities.

b. Student achievement of learning outcomes in the Green Infrastructure (GI) program will be systematically documented through the Student Learning Outcomes Assessment Process (SLOAP) in coordination with the UMES Office of Institutional Research. Documentation will include course-embedded assessment artifacts, rubric-based evaluation results, and aggregated assessment data demonstrating student attainment of program and course learning outcomes.

Assessment findings will be recorded in institutional assessment management systems and compiled into annual assessment reports that summarize performance trends, identify areas for improvement, and document actions taken to enhance curriculum, instruction, and student support. These records will provide verifiable evidence of student learning, support continuous program improvement, and ensure accountability to institutional leadership, accreditation bodies, and external funding agencies.

4. Courses and Program Requirements

- **Academic component:** Mandatory to take two courses (DNSC courses listed below) and 6 credit hours of additional coursework for those listed below.

- **Mandatory courses**:
- DNSC 402 – General Concepts in Green Infrastructure (3 credits, online)
- DNSC 403 – Practical Applications in Green Infrastructure (3 credits, online)

- **Additional optional courses**:
- 6 credit hours of foundational Core Knowledge Area (CKA) coursework at the 300–400 level from UMES catalog courses (ACCT, AGME, AGNR, BIOL, BUAD, CMTE, ECON, ENVS, FINA, HORT, MKTG, NRES, PLSC, SOIL).
- **Experiential component:** Minimum 40 hours of internships, volunteer activities, employment with local government, NGOs, or engineering/landscape firms; letters of completion required.

COURSE DESCRIPTIONS

- **DNSC 402ONLINE - General Concepts in Green Infrastructure**
  Credit 3
  This course is designed as an introduction to the general concepts related to green infrastructure in the context of urban stormwater runoff management as well as coastal area dynamics. Topics covered include the differences and commonalities in green and grey infrastructure, integrated water management, basic hydrology and hydraulics, water quality concerns, and advances in water resources management systems and technologies. The regulatory landscape, economic, social and equity considerations and communications and public engagement needs will also be covered. Prerequisites: ENGL 102. Enrollment Requirements: PREREQUISITE: ENGL 102.

- **DNSC 403ONLINE - Practical Applications in Green Infrastructure**
  Credit 3
  This course builds on the general concepts of green infrastructure by investigating critical factors for the planning, design, analysis, and implementation of green infrastructure practices. GI practices used for urban stormwater and coastal environments will be covered. Operations and maintenance needs, project management, and sustainability (environmental, social, and financial) aspects of successful GI implementation will be covered. Prerequisites: DNSC 402.

- **ACCT 301 Cost & Budgetary Control**
  Credit 3
  This course is a study of the basic principles of managerial accounting and the environment in which cost accounting information is developed and used for decision-making. Basic cost accounting concepts under job order and process costing systems and budgeting techniques are emphasized. Prerequisite(s): ACCT 202 with a grade of "C" or better

- **ACCT 302 Intermediate Accounting I**
  Credit 3 Honors
  The course involves an in-depth study of modern financial accounting, concepts, principles, practices, and the conceptual framework on which accounting is developed. The accounting cycle, adjusting entries, corporate transactions and the preparation of financial statements are emphasized. Prerequisite(s): ACCT 202 with a grade of "C" or better

- **ACCT 303 Intermediate Accounting II**
  Credit 3 Honors
  The course is a continued in-depth study of modern financial accounting as it relates to income determination, asset valuation, and stockholders' equity. International and ethical implications are considered. Prerequisite(s): ACCT 302.

- **ACCT 304 Managerial Accounting**
  Credit 3
  The course consists of a study of the usefulness of financial data and financial analysis in the management functions of planning, control, and decision-making. The course surveys the elements of cost, as well as the main aspects of the accounting structure. Prerequisite(s): ACCT 301 with a grade of "C" or better

- **ACCT 308 Accounting Information Systems**
  Credit 3 Hybrid
  The course provides a basis for understanding, using, and controlling accounting information systems (AIS) as found in business organizations. The principal contents areas include documentation of accounting information systems; security, privacy and ethics; internal control systems, AIS and business processes. Prerequisites: ACCT 202 with a grade of "C" or above. Prerequisite(s): ACCT 202 with a grade of 'C' or better.

- **ACCT 400 Intermediate Accounting III**
  Credit 3 Honors
  A continued in-depth study of modern financial accounting covering such troublesome topics as pensions, leases, deferred taxes, and foreign currency transactions. Prerequisite. ACCT 302 with "C" grade or above. Prerequisite(s): ACCT 302 with "C" grade or better.

- **ACCT 402 Federal Income Tax Accounting Individual**
  Credit 3
  The course is an in-depth study of tax provisions and planning for individuals. The basic procedures involved in the determination of income tax liability of individuals are performed. Prerequisite(s): ACCT 302.

- **ACCT 407 Auditing**
  Credit 3
  This is a capstone course for accounting majors. Financial auditing principles, concepts and practices including professional ethics, statistical sampling techniques, and audit

liability are covered. Work paper preparation and audit reports are an important part of the course. This capstone course in accounting is taken during the final semester of study. Prerequisite(s): Senior Standing, ACCT 303, ACCT 400 with grades of "C" or better. The use of audit software is required. A thorough understanding of financial accounting is required.

- **AGRN 423 Plant Nutrition and Soil Fertility**
  Credit 3
  Honors
  This course provides an advanced study of the interrelationships between soil type, mineralogy, pH, soil nutrients, and other nutritional aspects related to plant growth, development and production. The availability and supply of micro and macro nutrients in soil, as affected by the environment, and the use of organic and inorganic fertilizers on plant growth and nutrition will be a major focus. Prerequisite(s): PLSC 184, PLSC 185 and SOIL 203 or permission of instructor. This course is cross listed with AGRN 653.

- **BIOL 301 Microbiology**
  Credit 3
  This course examines the basic life processes of various microscopic organisms and their relevance to humans, focusing on pathogenicity. Discussion also encompasses chemotherapy and the immune response to infection. The course introduces the study of microorganisms and their diversity, growth, life cycle, physiology and control. The role of microorganisms in diseases, the environment and industry, as well as other economic considerations. Prerequisite(s): BIOL 112 or equivalent (grade of C or better); one year of Chemistry, or permission of the instructor. This course is comprised of three hours of lecture per week.

- **BIOL 303 Microbiology Laboratory**
  Credit 1
  This course is designed to expose students to laboratory activities that will acquaint them with procedures for the proper and safe handling of microorganisms to facilitate investigations using microorganisms. Corequisite(s): BIOL 301. This course is comprised of two two-hour laboratory sessions per week. Laboratory fee required.

- **BIOL 402 Ecology**
  Credit 4
  This course is designed to provide the student with a study of the basic interrelations of plants and animals with physical and biotic factors of the environment.

Prerequisite(s): BIOL 111 (grade of C or higher), and BIOL 112 (grade of C or higher). BIOL 211/BIOL 213 is recommended. This course is comprised of two hours of lecture, one hour of discussion, and three hours of laboratory per week. Laboratory fee required

- **BUAD 302 Management and Organizational Behavior**
  Credit 3
  This course is designed to develop a full understanding of the role of business organizations and their effective management. It deals with principles and practices of management and theory and analysis of organizations. Course content includes historical background of management theory and analysis of organizations, principles and processes of management functions, leadership, communication, and morale. Prerequisite(s): Junior standing and ECON 201, ECON 202, ACCT 201 and ACCT 202, with grades of 'C' or better. Fashion Merchandising majors only: ECON 201, ACCT 200 and permission of the respective Department Chairs.

- **BUAD 311 Justice and Diversity in Organizations**
  Credit 3
  This course covers the vitally important and complicated work of managing diversity in contemporary workforces. The reasons diversity enhances all professional environments will be discussed as well as the conceptual frameworks and strategies for approaching Justice, Equity, Diversity, and Inclusion. External factors that influence identity and the intersection of multiple identities will be addressed, and students will learn to recognize the difference between interpersonal bias and systematic and structural injustice and how they impact historically marginalized populations. The impact of implicit and explicit bias, microaggressions, dominant culture narrative, ableism, internalized dominance, structural inequality, and systematic oppression on organizations will be explored. Finally, we will investigate how to work across differences to create personal and organizational transformation. Prerequisite(s): ENGL 102 with a C or better

- **BUAD 354 Business Statistics II**
  Credit 3
  Advanced inferential statistics are emphasized. The topics covered include time series, regression analysis, chi-square test, and analysis of variance as these relate to solutions to business and economic problems. Prerequisite(s): BUAD 253 with a grade of 'C' or better.

- **BUAD 364 Managerial Economics**
  Credit 3
  This course is the application of economic theory and methodology to managerial decision-making and policy formulation organizations settings such as business firm or government agency in local or global context. Emphasis will be on demand analysis, production and cost analysis under different market conditions, and decision-making under uncertainty. This course requires some exposure to economics, and fair knowledge of basic algebra and calculus. Managerial Economics is basically an applied quantitative course in which managerial problems are studied, analyzed and solved using economic models including graphs, diagrams, mathematical expressions, and equations. Prerequisite(s): BUAD 252, ECON 201 , BUAD 302 with grades of 'C' or better.

- **BUAD 495 Strategic Management**
  Credit 3
  The course is designed to integrate the knowledge and analytical skills acquired in the functional subject areas in Business Administration and related areas. The scope of the subject matter includes responsibilities of top management together with the organizational processes for formulating and implementing organizational strategy. The course includes the integration of the functional areas of Economics, Accounting, Management, Marketing, Finance and Law. This course uses case study methods and pedagogical techniques to deal with business problems and to formulate business problems and to formulate business policies and strategies. Prerequisite(s): Senior standing; to be taken in the final year. Prerequisite(s): Senior standing; to be taken in the final year

- **CMTE 319 Statics and Strength of Materials**
  Credit 3
  This course is an introduction to structural behavior and structural theory. The course covers the development and application of the basic principles of statics and strength of materials as they relate to the analysis of building structures. Illustrations and examples of building structural components, i.e. foundations, columns, beams, etc., will enable construction students to visualize the connection between concepts and real buildings and materials. Prerequisite(s): MATH 112 and PHYS 121

- **CMTE 320 Building Structures**
  Credit 3
  This course will cover common building structural systems including wood, steel, concrete and masonry. Construction Management students will gain a conceptual understanding of the basic principles of structural systems and how these systems perform, as well as a familiarity with the components, sizes, connections, methods of assembly, resistance, building codes and other factors affecting their application in buildings. Prerequisite(s): CMTE 319

- **CMTE 328 Building Construction and Operation 3-Credits**
  Credit 3
  This course is intended to broaden and deepen the student's understanding of building systems, material science, important to students of construction management, architecture and engineering. Emphasis is placed on exploring the impact of design decisions with construction scenarios on the final product. Topics include sitework, foundation and structural framing systems of concrete, reinforced concrete, site cast and pre-cast concrete, brick and concrete masonry, reinforced masonry, constructability analysis, roofing, cladding systems and interior and exterior finishes. Prerequisite(s): CMTE 201, CMTE 205, CMTE 230, CMTE 325 OPEN TO CMT Students

- **CMTE 350 Soil Mechanics and Foundation**
  Credit 3
  This course is an introduction to soil mechanics, including an investigation of the mechanical and physical properties of soils and the relation to soil action in problems of engineering such as soil composition, index properties, classification, exploration, compaction, permeability, stress distribution, consolidation, settlement, shear strength, bearing capacity, and lateral earth pressure. The course contains lectures and lab. Prerequisite(s): CMTE 201, CMTE 214, CMTE 230, MATH 112, PHYS 123, PHYS 124. Open to Juniors and Seniors

- **CMTE 395 Construction Management Internship II**
  Credit 2
  This course is designed to provide students with work experience as interns under supervision of construction professionals. Students become familiar with many phases of construction under actual job conditions, which may include estimating, field engineering, inspecting, scheduling, and supervision. Students must register for the course during summer school and work a minimum of 40 hours per week for six (6) weeks to receive credit for the course. Students with verifiable construction experience

of three (3) years or more may receive credit under this course listing. Verification will be through letters of recommendation from employer(s) on company letterhead and documented payroll receipts. Junior college transfer students who have completed an Associate Degree Program are required to complete one internship course.

- **CMTE 425 Construction Project Management**
  Credit 3
  This course covers the principles, theories, methods and quantitative tools for the effective management of construction projects. Major topic areas of study include project management principles and ethics; project life cycle phases and organizational structuring; project estimates, network-based systems, constructability and value engineering; project procurement management; cost engineering, accounting and cost control; and risk management and safety issues. Prerequisite(s): CMTE 286, CMTE 325, and CMTE 342. Lecture three hours.

- **CMTE 426 Construction Law, Contracts and Specifications**
  Credit 3
  This course covers construction law and the legal implications of contracts and common and regulatory law. Construction contracts & specifications, their relationships, meanings and significance in construction will also be covered. The course also covers project life cycle and methods of project delivery, roles and responsibilities, contract formation and breach, professional liability, claims, disputes and resolution methods, procurement, preconstruction, construction activities, QA/QC and documentation. Prerequisite(s): CMTE 425 or permission of instructor Lecture three hours.

- **CMTE 427 Land Development and Planning**
  Credit 3
  This course deals with analysis of land development practices and landforms for implementation of practical engineering solutions based on social economics, and environmental factors. The topics include topography and soil, storm drainage, sanitary sewer, roadway design, and project cost feasibility for residential and commercial land development sites. Prerequisite(s): CMTE 201 , CMTE 214 and CMTE 327

- **CMTE 445 Construction Cost Estimating**
  Credit 3
  This course covers the creation of construction project cost estimates. Topics that will be covered in the course include bid proposals for public & private sector projects,

professional ethics, types of project cost estimates and their uses, life cycle costing, analysis and determination of material, labor & equipment costs, subcontracting, direct & indirect overhead costs and profit, and spreadsheet and cost estimating software applications. Prerequisite(s): CMTE 205 and CMTE 342. Lecture three hours.

- **CMTE 450 Sustainable Design and Construction**
  Credit 3
  This course is the study of sustainable construction techniques and best practices. It provides an understanding of the interdependence between planning, design, building, operation, and demolishing the built environment and their impact on the natural environment. Course topics will include: 1) issues of resource efficiency, economics ethics, waste, human health, environmental justice, and industrial ecology; 2) alternative practices that significantly reduce adverse environmental impacts of built infrastructure; and 3) exploration of past and present thinking of engineering practitioners in the newly emerging discipline. Prerequisite(s): Junior or senior standing.

- **CMTE 458 Construction Contract Administration**
  Credit 3
  This course covers all administrative activities necessary to effect and determine fulfillment of the contract requirements by the parties to the construction contract. Topics discussed include project initiation, submittals, meetings, interpretations and modifications, project execution, measurements and payments, project closeout and documentation requirements. This course requires the submission of a senior project. A senior project is a capstone experience. It should integrate theory and application across the student's undergraduate education. Prerequisite(s): CMTE 425,senior standing in Construction Management Technology and permission of the instructor.

- **ECON 300 Intermediate Micro Economic Theory**
  Credit 3
  Students learn the general principles and analytical tools of price theory. Topics include an analysis of consumer behavior, business firms, and industry and factor markets. Prerequisite(s): ECON 201 and ECON 202.

- **ENVS 403 Marine Ecotoxicology**
  Credit 3
  This course cuts across traditional subject boundaries by integrating different disciplines, such as chemistry and biochemistry, through ecology and statistics. It

provides students with a distinct approach to solving marine environmental pollution issues stemming from stable pollutants how they interact with biotic and abiotic components of the marine ecosystem. Prerequisite(s): CHEM 112/CHEM 112, CHEM 211/CHEM 211, BIOL 112/BIOL 112 and MATH 210.

- **ENVS 405 Marine Ecotoxicology Laboratory**
  Credit 1
  This course is comprised of two hours of laboratory per week and is designed to accompany ENVS 403/601. The course will provide hands-on research training to students in Marine Ecotoxicology. Students will learn, among other things, including wet chemistry, instrumental analysis, environmental data analysis and environmental modeling. Prerequisite(s): CHEM 112 , CHEM 211 , BIOL 112 , MATH 210 Corequisite(s): ENVS 403/601. Laboratory fee required.

- **ENVS 460 Earth Science**
  Credit 3
  This course is an interdisciplinary examination of the grand challenges confronting the environmental sciences in the 21st Century. Topics examined include biogeochemical cycles, biodiversity and ecosystem functioning, climate variability, hydrologic forecasting, infectious disease and the environment, legal control of resource use, land-use dynamics, and the re-use of materials. The practical and scientific importance of each topic is discussed as well as the readiness of the scientific establishment to meet important areas for future research. Students are expected to research and answer a series of practical hypothetical environmental problems in each area discussed. Prerequisite(s): ENVS 221, ENVS 222, or consent of the instructor.

- **ENVS 499 Undergraduate Research**
  Credit 1-4
  In this course, students conduct independent research projects under the supervision of a faculty member. Apart from the research, students are also expected to present oral and written reports. The course is designed for juniors or seniors who have an interest in pursuing a special problem as a research project. The hours and credits for this course are by arrangement with the individual instructor. Students may register for 1, 2, 3 or 4 cr. but should repeat the course to accumulate the number of credits required in the core program.

- **FINA 340 Financial Management**
  Credit 3
  The course is designed to provide a basic understanding of principles and practices in the area of business finance as an integral part of the business enterprise. It deals with

sources and allocation of funds, channels and procedures of financing in the capital market, internal and external financing and inter-firm relations, corporate finance and international capital markets, and public regulations by government and non-government agencies. Prerequisite(s): ACCT 202, ECON 201, and ECON 202 with grades of 'C' or better.

- **HORT 423 Horticultural Crops**
  Credit 3
  This course presents the scientific aspects of commercial fruit and vegetable production. Principles of economics and practices in the global marketing of vegetables, fruits and nuts are discussed in relation to the maintenance of a safe food supply. General aspects of regional vegetables and fruits are given special emphasis for the Delmarva Peninsula. Prerequisite(s): HORT 203 or permission of instructor. Two hours of lecture and two hours laboratory per week.

- **MKTG 308 Principles of Marketing**
  Credit 3
  The focus is on introducing the nature and fundamentals of marketing activities in the modern industrial economy. This course deals with the analysis of socio-economic and psychological factors, influencing consumer behavior, market measurement and forecasting methods, development of marketing programs in the areas of product-line, price, promotion and channels of distribution, procedures for planning and controlling marketing operations and the legal aspects of marketing. Prerequisite(s): ECON 201, ECON 202, ACCT 202 and junior standing. (Fashion Merchandising Majors only: ECON 201, ACCT 200 and permission of the respective Department Chairs).

- **PLSC 321 Integrated Pest Management**
  Credit 3
  This course is designed as an introduction to insect pests, disease causing organisms, weeds, and their management in crop plants using integrated practices. Topics will include classification, identification, biology, ecology, sampling methods, IPM development, management tactics, use of conventional pesticides, biological control, host plant resistance and legislative methods. It will also include biology and management of important insects, diseases and weeds in selected crops. Prerequisite(s): PLSC 184 and PLSC 185. The course meets for two lectures and a two-hour laboratory per week.

- **PLSC 484 Internship in Agriculture and Natural Resources**
  Credit 3-6
  This course involves supervised work experience in an approved setting that is planned with a business, university, or government agency. A faculty advisor must pre-approve the internship opportunity. Prerequisite(s): Permission of instructor.

- **SOIL 203 Introduction to Soil Science**
  Credit 3
  This course engages students in a study of soil forming factors, soil forming processes and minerals involved in soil development, weathering, soil physical and chemical properties, organic matter mineralization, and the impact of these factors on soil fertility, soil moisture holding ability, and pH. Prerequisite(s): CHEM 111 and CHEM 113 or permission of instructor. Three hours lecture per week.

- **SOIL 204 Introduction to Soil Science Laboratory**
  Credit 1
  This course will provide students with individual and group dynamic approaches to laboratory exercises that will be designed for students to acquire knowledge, comprehend, apply, analyze, synthesize, and evaluate aspect of soil profile development, soil forming factors, minerals, weathering, soil physical properties, chemical properties, organic matter mineralization, soil chemistry, and the impact of these factors on soil fertility, soil moisture content, and soil hydrogen ion concentration. Prerequisite(s): CHEM 111 and CHEM 113 or permission of instructor. Corequisite(s): SOIL 203.

- **Experiential Knowledge (40 HOURS)**
  Purpose: Understanding of application of concepts related to green infrastructure in a real-world setting.
  Delivery: Volunteer or paid work totaling a minimum of 40 hours
  Opportunities may include:
  Construction work for land development (e.g., erosion control)
  Stream/watershed clean up
  Rain barrel workshops
  Academic labs or field studies
  Engineering or Landscape Architect Intern

- **Total program requirement: 12 credit hours**

5. General Education

- The certificate is earned by students concurrently completing a B.S. degree in STEM or business disciplines.

6. Accreditation / Certification

- No specialized accreditation is required.

7. Collaboration

- No contracts with other institutions; however, UMES collaborates with EPA, Maryland Coastal Bays Program, MDNR, MDA, and MDE through existing MOUs.

8. Student Support

- UMES support services: advising, retention, tutoring, IT support, research resources, library access, and course planning.

9. Marketing and Admissions

- Targeted at junior-level B.S. students in STEM or business. Transfer students meeting prerequisites may be accepted. Program information will be disseminated via departmental brochures, catalog, recruitment office, and online channels.

H. Adequacy of Articulation

1. Not applicable; no articulation agreements required.

I. Adequacy of Faculty Resources

1. Faculty resources are sufficient and include interdisciplinary expertise. Existing teaching capacity supports program delivery without impacting other programs.

a. One **adjunct faculty** teaches DNSC 402 and 403; Seth Brown has **a Ph.D. in Civil Engineering** and has over 25 years of professional experience.
b. Additional faculty from STEM and business departments teach CKA courses. Most faculty are full time with terminal degrees.

The proposed Green Infrastructure (GI) program will be delivered by a highly qualified, interdisciplinary faculty team with expertise spanning environmental science, ecology, chemistry, biology and agriculture. Faculty members possess strong academic credentials, relevant terminal degrees, and demonstrated experience in teaching, applied research, workforce training, and community-engaged scholarships aligned with GI principles. Program faculty include full-time

tenure-track and professional-track faculty, supplemented as needed by qualified adjunct instructors with specialized industry or agency experience. Collectively, faculty bring extensive experience in curriculum development, experiential learning, grant-funded research, and mentoring students from diverse and historically underrepresented backgrounds. Faculty routinely integrates real-world case studies, applied projects, and regulatory and policy frameworks into instruction, ensuring that students acquire both theoretical knowledge and practical, workforce-relevant skills. Faculty qualifications, instructional assignments, and professional roles ensure appropriate coverage of all core and elective courses within the GI program and support academic rigor, instructional continuity, and student success.

Summary list of faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, adjunct) and the course(s) each faculty member will teach in the proposed program.

Course Number	Course Title	Course Credit	Instructor Name	Instructor Title	Instructor Degree Field	Instructor Academic Rank	Instructor Status
DNS 402ONLINE	General Concepts in GI	3	Seth Brown	Ph.D.	Civil Engineering	Adjunct Faculty	Part Time
DNS 403ONLINE	Practical Applications in GI	3	Seth Brown	Ph.D.	Civil Engineering	Adjunct Faculty	Part Time
ACCT 301	Cost & Budgetary Control	3	Kyung Joo Lee	Ph.D.	Business Administration (Accounting)	Professor	Full-Time, Tenured
ACCT 302	Intermediate Accounting I	3	Kyung Joo Lee	Ph.D.	Business Administration (Accounting)	Professor	Full-Time, Tenured
ACCT 303	Intermediate Accounting II	3	Kyung Joo Lee	Ph.D.	Business Administration (Accounting)	Professor	Full-Time, Tenured
ACCT 304	Managerial Accounting	3	Kyung Joo Lee	Ph.D.	Business Administration (Accounting)	Professor	Full-Time, Tenured
ACCT 308	Accounting Info Systems	3	Hwei Wang	DBA, C.P.A	Accounting	Professor	Full-Time
ACCT 400	Intermediate Accounting III	3	Kyung Joo Lee	Ph.D.	Business Administration (Accounting)	Professor	Full-Time, Tenured
ACCT 400	Intermediate Accounting III	3	Leslie West	Ph.D.	Accounting	Assistant Professor	Full-Time
ACCT 402	Fed Income Tax Accounting Ind	3	Anajali Chatelle	JD, C.P.A	Accounting/Law	Adjunct Faculty	Part Time
ACCT 407	Auditing	3	Leslie West	Ph.D.	Accounting	Assistant Professor	Full-Time
AGRN 423	Plant Nutrition and Soil Fertility	3	Mozhgan Sepehri	Ph.D.	Biology and Biotechnology	Assistant Professor	Full-Time
BIOL 301	Microbiology	3	Mobolaji Okulate	Ph.D.	Microbiology	Professor	Full-Time
BIOL 303	Microbiology Laboratory	1	Mobolaji Okulate	Ph.D.	Microbiology	Professor	Full-Time
BIOL 402	Ecology	4	Gordon Custer	Ph.D.	Ecology	Assistant Professor	Full-Time

BUAD 302	Manag and Org Behavior	3	Vichet Sum	Ph.D.	Finance	Professor	Full-Time
BUAD 311	Justice and Div in Organizations	3	Nicole Hollywood	Ed.D.	Management and Marketing	Professor	Full-Time, Tenured
BUAD 354	Business Statistics II	3	Rexford Abaidoo	Ph.D.	Business Administration	Professor	Full-Time
BUAD 364	Managerial Economics	3	Mohammad Ali	Ph.D.	Food and Resource Economics	Professor	Full-Time, Tenured
BUAD 495	Strategic Management	3	Byrant Mitchell	Ph.D.	Industrial Management	Associate Professor	Full-Time, Tenured
CMTE 319	Statics and Strength of Materials	3	Joseph Arumala	Ph.D.	Civil/Structural Engineering	Professor	Full-Time
CMTE 320	Building Structures	3	Joseph Arumala	Ph.D.	Civil/Structural Engineering	Professor	Full-Time
CMTE 328	BIM Technology for Construction Management II	3	Jeffrey Molavi	Ph.D.	Civil/Construction Engineering and Management	Professor	Full-Time
CMTE 350	Green Building Fundamentals	3	Joseph Arumala	Ph.D.	Civil/Structural Engineering	Professor	Full-Time
CMTE 395	Const Manag Internship II	2	Carlos Salgado	Ph.D.	Construction Engineering & Management	Associate Professor	Full-Time
CMTE 426	Construction Management II	3	Carlos Salgado	Ph.D.	Construction Engineering & Management	Associate Professor	Full-Time
CMTE 427	Soils and Site Development	4	Joseph Arumala	Ph.D.	Civil/Structural Engineering	Professor	Full-Time
CMTE 445	Construction Cost Estimating	3	Carlos Salgado	Ph.D.	Construction Engineering & Management	Associate Professor	Full-Time
CMTE 450	Green Building II	3	Joseph Arumala	Ph.D.	Civil/Structural Engineering	Professor	Full-Time
CMTE 458	BIM Technology for Construction Management II	2	Jeffrey Molavi	Ph.D.	Civil/Construction Engineering and Management	Professor	Full-Time
ECON 300	Intermediate Micro Economic Theory	3	Mohammad Ali	Ph.D.	Food and Resource Economics	Professor	Full-Time, Tenured
ENVS 403	Marine Ecotoxicology	3	Ali Ishaque	Ph.D.	Ecotoxicology	Professor,	Full-Time, Tenured
ENVS 405	Marine Ecotoxicology Laboratory	1	Ali Ishaque	Ph.D.	Ecotoxicology	Professor,	Full-Time, Tenured
ENVS 460	Earth Science	3	Stephanie Stotts	Ph.D.	Geography	Associate Professor	Full-Time
ENVS 499	Undergraduate Research	1-4	Jonathan Cumming	Ph.D.	Natural Resources	Professor	Full-Time
ENVS 499	Undergraduate Research	1-4	Eric May	Ph.D.	Fish Biology & Pathology	Professor	Full-Time
ENVS 499	Undergraduate Research	1-4	Ali Ishaque	Ph.D.	Ecotoxicology	Professor	Full-Time, Tenured
ENVS 499	Undergraduate Research	1-4	Justine Whitaker	Ph.D.	Wildlife & Fisheries	Assistant Professor	Full-Time
ENVS 499	Undergraduate Research	1-4	Stephen Tomasetti	Ph.D.	Marine and Atmospheric Sciences	Assistant Professor	Full-Time

FINA 340	Financial Management	3	Rexford Abaidoo	Ph.D.	Business Administration	Professor	Full-Time
HORT 423	Horticultural Crops	3	Naveen Dixit	Ph.D.	Plant Physiology	Assistant Professor	Full-Time
MKTG 308	Principles of Marketing	3	Monisha Das	Ph.D., MBA	Marketing	Associate Professor	Full-Time, Tenured
PLSC 321	Integrated Pest Management	3	Simon Zebelo	Ph.D.	Plant and Environmental Bio-sensory Chemical Ecology	Professor	Full-Time
PLSC 484	Internship in Agriculture and Natural Resources	3-6	Corrie Cotton	M.L.A	Landscape Architecture	Research Assistant Professor	Full-Time
SOIL 203	Introduction to Soil Science	3	Mozhgan Sepehri	Ph.D.	Biology and Biotechnology	Assistant Professor	Full-Time
SOIL 204	Introduction to Soil Science Laboratory	1	Stephan Tubene	Ph.D.	Agricultural Economics	Professor	Full-Time

2. Ongoing Pedagogy Training and Faculty Development

The institution is committed to continuous professional development to ensure that faculty employ effective, inclusive, and evidence-based teaching practices. Faculty will receive ongoing professional development in pedagogy, learning management systems, and evidence-based teaching practices, including online instruction.

a. Faculty Development and Professional Engagement

Faculty participating in the Green Infrastructure Certificate Program will be supported through ongoing professional development to maintain currency in research, teaching, and applied practice. The UMES Center for Teaching Excellence (CTE) provides structured support for faculty development, including workshops on pedagogy, online/hybrid instruction, assessment, and active learning, ensuring effective delivery of both theoretical and applied content in the program.

In addition to institutional support, faculty are encouraged to attend national, regional, and local conferences and workshops aligned with their specific areas of expertise, including:

- Stormwater and Green Infrastructure Design
    - *Water Environment Federation (WEF) Stormwater Institute* – Technical workshops on BMP design, GI planning, and stormwater compliance.
    - *National Green Infrastructure Conference (NGIC)* – Policy, design, and implementation of GI practices.
- Environmental Science and Monitoring
    - *Chesapeake Stormwater Network Workshops* – Regional updates on best practices, regulatory compliance, and monitoring of stormwater BMPs.

- *Society of Wetland Scientists (SWS) Annual Meetings* – Ecosystem-based stormwater and wetland management strategies.

- Policy, Planning, and Sustainability
  - *EPA Green Infrastructure Webinars and Trainings* – Guidance on GI planning, monitoring, and regulatory frameworks.
  - *American Society of Civil Engineers (ASCE) Environmental & Water Resources Conferences* – Sessions on sustainable infrastructure, stormwater modeling, and resilience planning.

Participation in these events ensures that faculty remain current in their research and professional practice, while allowing them to integrate emerging science, regulatory updates, and workforce-relevant skills into the curriculum. Attendance also facilitates networking with practitioners, municipal agencies, and industry partners, creating direct opportunities for student internships, applied projects, and experiential learning.

b. Pedagogy that meets the needs of the students

Faculty will engage in professional development focused on student-centered and inclusive teaching practices, including:

- Active learning strategies and problem-based learning.
- Culturally responsive and inclusive pedagogy to support diverse learners.
- Universal Design for Learning (UDL) principles to enhance accessibility.
- Assessment strategies aligned with measurable student learning outcomes.

Training opportunities will be offered through faculty development activities, teaching and learning workshops, and peer mentoring initiatives, with an emphasis on improving student engagement, retention, and achievement.

c. Learning Management System (LMS) training

The institution provides Canvas as its Learning Management System (LMS). This platform will support structured and ongoing training in course delivery, ensuring consistency, accessibility, and effective instruction across the program.

. Training will include:

- Course design and organization.
- Use of LMS (Canvas) tools for assessments, grading, and feedback.
- Integration of multimedia, interactive content, and analytics to monitor student progress.

- Compliance with accessibility and data privacy standards.

Faculty will have access to instructional designers and technical support staff to assist with course development and continuous improvement.

d. Evidence-based best practices for distance education (if applicable)

For the two courses offered online, the faculty will receive targeted training in evidence-based online teaching practices, including:

- Online student engagement and communication strategies.
- Best practices for asynchronous and synchronous instruction.
- Assessment of integrity and authentic assessment in online environments.
- Techniques to promote interaction, collaboration, and community in virtual learning spaces.

These training activities ensure instructional quality, consistency, and alignment with institutional standards and accreditation expectations for distance education.

J. Adequacy of Library Resources

UMES provides access to major scientific databases and journals, supporting all instructional and research needs.

Library Resources and Online Support for Green Infrastructure Students

1. Academic Journals (Online Access)

Students have access through UMES's library and inter-institutional subscriptions to major peer-reviewed journals relevant to green infrastructure, stormwater management, and sustainability:

- Journal of Environmental Management
- Water Research
- Journal of Hydrology
- Landscape and Urban Planning
- Ecological Engineering
- Sustainability
- Journal of Soil and Water Conservation

- Environmental Science & Technology
- Urban Water Journal
- Stormwater (professional magazine with research and practice content)

These journals include research on best practices, case studies, design, and policy—critical for student assignments, literature reviews, and applied projects.

2. Key Textbooks and e-Books

UMES students have online and print access to foundational texts that support GI coursework:

- Urban Stormwater Management in the United States (Wiley)
- Green Infrastructure: Linking Landscapes and Communities (Island Press)
- Low Impact Development and Green Infrastructure: Case Studies in Practice (Springer)
- Stormwater Management for Sustainable Communities (CRC Press)
- Designing Urban Agriculture (Wiley) – for context on multifunctional green spaces
- Principles of Water Resources: History, Development, Management, and Policy (Wiley)

Students can access many of these through UMES's e-book collections and interlibrary loan services.

3. Database and Online Research Platforms

Students can conduct literature research, access technical reports, and retrieve full-text articles using institutional subscriptions to:

- Web of Science
- Scopus
- ScienceDirect
- ProQuest Environmental Science Collection
- JSTOR
- IEEE Xplore (for infrastructure sensors/tech)
- ERIC (for education and workforce training literature)

These platforms support student research, capstone projects, and evidence-based design assignments.

4. Online Professional Resources

UMES students can access high-quality professional materials, technical guidance, and case studies, including:

- EPA Green Infrastructure Resources
    - Design guides, fact sheets, implementation tools
- Water Environment Federation (WEF)
    - Green infrastructure manuals and professional training modules
- Chesapeake Stormwater Network
    - BMP guides and regional case studies
- American Society of Civil Engineers (ASCE) Library
    - GI design standards and proceedings
- American Planning Association (APA)
    - Urban sustainability and GI planning resources

These are available through library links or publicly and are integrated into course assignments.

5. GIS and Modeling Software

Students enrolled in the GI program will have access (through institutional licenses) to key analytical tools:

- ArcGIS Online / ArcGIS Pro — for spatial analysis and watershed modeling
- EPA SWMM (Storm Water Management Model) for hydrologic and hydraulic simulations
- HEC-RAS / HEC-HMS — for flood and watershed analysis
- QGIS — open-source GIS support
- Inundation and climate visualization tools

Training modules and tutorials for these tools are available through library guides and linked in course syllabi.

6. Institutional Support

UMES Library offers:

- Subject guides curated for environmental science and infrastructure topics
- Research consultations with librarians
- Workshops on literature search, citation management, and data tools

- 24/7 online help via chat and email

Students in the Green Infrastructure Certificate Program will have access to a comprehensive suite of online and print resources, including leading environmental and engineering journals, key textbooks, specialized databases, professional guidance from EPA and WEF, and GIS/modeling software. Institutional support through the UMES Library ensures students can conduct high-quality research, complete applied projects, and stay current with best practices in green infrastructure planning, design, and implementation.

K. Adequacy of Physical Facilities, Infrastructure, and Instructional Equipment

Existing laboratories support:

- Water quality analysis
- Soil testing
- Environmental monitoring

1. Adequacy of physical facilities and instructional resources

The University of Maryland Eastern Shore (UMES) affirms that existing classrooms, faculty and staff offices, and instructional laboratories are sufficient to initiate and sustain the proposed Green Infrastructure (GI) Certificate Program. Classrooms are technology-enabled, and laboratories are equipped to support hands-on, applied, and technology-focused instruction aligned with GI workforce competencies. UMES maintains established processes for the maintenance, upgrading, and replacement of equipment, and the existing infrastructure can accommodate anticipated enrollment growth.

The 6 credits delivered in-person will utilize current facilities already supporting similar courses, while the 6 online credits do not require dedicated physical space. Students enrolled in online courses will have access to computer labs and other campus resources as needed. Overall, UMES's existing physical and technological facilities are fully adequate to support program delivery and growth.

2. Adequacy of infrastructure for distance education

UMES assures that students and faculty in distance education have full access to institutional communication and instructional technologies.

a. Institutional electronic mailing system
All students, faculty and staff have secure UMES email accounts, serving as the official channel for academic and administrative communication.

b. Learning management system (LMS)

The institution provides Canvas as a centrally supported Learning Management System (LMS) for content delivery, communication, assessment, grading, and engagement tracking. Faculty and students receive ongoing technical support and training to ensure effective, accessible, and high-quality hybrid and online instruction. Canvas will facilitate structured course delivery, promoting consistency, engagement, and effective learning across the program.

L. Adequacy of Financial Resources

The program is cost-neutral:

- Uses existing courses and faculty
- Annual cost: ~$8,000 (adjunct support)
- No new funding required

TABLE 1: RESOURCES					
Resources Categories	**FY 25**	**FY 26**	**FY 27**	**FY28**	**FY 29**
1. Reallocated Funds	0	0	0	0	0
2. Tuition/Fee Revenue (c + g below)	0	4392	8784	8784	8784

a. # FT Students
R = Residents
NR = Non-residents
	0	3	6	6	6

b. Annual Tuition/Fee Rate	0	4392	8784	8784	8784
c. Annual Full Time	0	4392	8784	8784	8784
d. # PT Students	0	0	0	0	0
e. Credit Hour Rate	0	244	244	244	244
f. Annual Credit Hours	0	6	6	6	6
g. Total Part Time	0	0	0	0	0

3. Grants, Contracts	0	0	0	0	0
4. Other Sources	0	0	0	0	0
Total (Add 1-4)	0	4392	8784	8784	8784

Notes to tables: Revenues are not new. Students in the GI Certificate Program are expected to be enrolled at UMES already and their tuition will not change because they will be receiving a Certificate in addition to their BS degree. Students will incur no additional charges.
The adjunct faculty member has been working for the DNS since 2017 and therefore the budget for the DNS will not change once the Certificate is approved

TABLE 2: EXPENDITURES					
Expenditure Categories	**FY 26**	**FY 27**	**FY 26**	**FY28**	**FY 29**
1. Total Faculty Expenses (b +c)	$8000	$8000	$8000	$8000	$8000
a. # FTE	0.5	0.5	0.5	0.5	0.5
b. Total Salary	$8000	$8000	$8000	$8000	$8000
c. Total Benefits @ 35%	0	0	0	0	0
2. Total Administrative Staff Expense (b + c)	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
3. Total Support Staff Expenses (b + c)	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
4. Equipment	0	0	0	0	0
5. Library	0	0	0	0	0

6. New or Renovated Space	0	0	0	0	0
7. Other Expenses	0	0	0	0	0
Total (Add1-7)	$8,000	$8,000	$8,000	$8,000	$8,000

- The program is designed for current UMES students; no additional revenue streams are required.
- Annual expenditure: adjunct faculty ($4,000/semester, $8,000/year).
- Program oversight by Dr. Ishaque included in current faculty appointment.
- Existing faculty and infrastructure provide additional support; experiential learning positions funded by Maryland Coastal Bays Program are supplementary.

M. Adequacy of Provisions for Program Evaluation

Program effectiveness will be assessed through:

- Student learning outcomes
- Retention and completion rates
- Employer feedback
- Continuous improvement processes

1. Evaluation of courses, faculty and student learning outcomes: Courses, faculty, and student learning outcomes will be assessed using student evaluations, peer review, and alignment with defined learning outcomes. Student achievement will be measured through exams, projects, laboratory exercises, applied assignments, and experiential learning (capstone experiences), all aligned with Green Infrastructure (GI) workforce competencies. Faculty annual/post-tenure review will also be considered.

2. Program evaluation and Assessment of effectiveness: Program effectiveness will be monitored using aggregated student learning outcomes, retention and progression data, student and faculty satisfaction surveys, and analyses of cost-effectiveness. Results will inform curriculum adjustments, instructional improvements, and resource allocation to ensure high-quality instruction, workforce readiness, and compliance with institutional and regulatory standards.

N. Consistency with Minority Student Achievement Goals

The program supports UMES's mission by increasing minority participation in environmental and STEM careers.

1. UMES, an HBCU, advances minority student access, success, and career readiness in STEM fields. This program supports UMES's mission to increase minority representation in environmental careers and Supports University System of Maryland (USM) Vision 2030 Goals:

- **Goal I:** Academic Excellence & Innovation
- **Goal III:** Workforce and Economic Development

O. Relationship to Low-Productivity Programs

1. N/A

P. Adequacy of Distance Education Programs

The program is primarily in-person with two online courses supported by institutional LMS and IT infrastructure.

1. Compliance with C-RAC guidelines and full LMS support assured; faculty are trained and certified for online instruction.