An Ecological Framework for Compensatory Mitigation

Online Training Series Framework Document

Jointly Developed by the
Association of State Wetland Managers
and U.S. Army Corps of Engineers

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Association of State Wetland Managers and US Army Corps of Engineers

An Ecological Framework for Compensatory Mitigation Online Training Series

Background & Goals

The Association of State Wetland Managers (ASWM) and the U.S. Army Corps of Engineers (Corps) jointly developed a webinar training series to develop and provide advanced training materials that address all forms of compensatory mitigation, i.e., banks, in-lieu fee and permittee responsible mitigation. Each module builds on information from the proceeding webinars. The series focuses on topics that go beyond what is currently available at the National Interagency Review Team course or in Corps Regulatory Mitigation Workshops.

Over the past three decades compensatory mitigation has become an important strategy for addressing the unavoidable environmental impacts that result from dredge and fill activities. Compensatory mitigation projects should be designed to provide self-sustaining, long-term replacement of lost ecological functions and services. Federal and State regulatory staff routinely review these proposals to ensure that projects will achieve the desired outcomes. But what exactly should compensatory mitigation project reviewers consider in evaluating a proposal?

Target Audience

The target audience for this training series is current and future Corps regulatory staff engaged in reviewing, approving and monitoring compensatory mitigation. These include project reviewers, regulators, practitioners, state and tribal wetland program staff. Additional audiences that may benefit include other people who are working with or running compensatory mitigation programs such as state agency staff, etc.

Delivery and Recording of Live Training Webinars

To develop the compensatory mitigation training series content, ASWM worked with a national workgroup to develop webinar content, deliver and record the following training webinars:

- Webinar 1: An Ecological Framework for Reviewing Compensatory Mitigation: An Introduction – June 19, 2018
- Webinar 2: An Ecological Framework for Reviewing Compensatory Mitigation: Abiotic Processes – July 16, 2018
- Webinar 3: An Ecological Framework for Reviewing Compensatory Mitigation: Biotic Processes – August 29, 2018
- Webinar 4: An Ecological Framework for Reviewing Compensatory Mitigation: Plan Review – March 21, 2019
- Webinar 5: An Ecological Framework for Reviewing Compensatory Mitigation: Coherent Plans – Goals, Objectives, Performance Standards', Outcomes and Monitoring – April 18, 2019
- Webinar 6: An Ecological Framework for Reviewing Compensatory Mitigation: From Conceptual to Final Design – May 15, 2019

- Webinar 7: An Ecological Framework for Reviewing Compensatory Mitigation: Anticipating the Unexpected - June 27, 2019
- Webinar 8: An Ecological Framework for Reviewing Compensatory Mitigation: Oversight and Compliance - October 24, 2019
- Webinar 9: Webinar 9: An Ecological Framework for Reviewing Compensatory Mitigation: How interests in property may affect mitigation projects - February 20, 2020

Development of Compensatory Mitigation Online Training Modules

This training series consists of 28 individual modules. Content for the modules was developed through the planning, delivery, recording and post-processing of nine webinars. Using recordings from each webinar, ASWM then developed complete modules, including learning objectives and test questions for each module. Each webinar and its associated modules are listed below:

An Ecological Framework for Reviewing Compensatory Mitigation: An Introduction

The purpose of this webinar was to provide an overall framework for review of proposed compensatory mitigation projects. Presenters focused on the processes that shape wetlands across diverse landscapes including the critical components of wetlands and wetland restoration project: hydrology, soils and vegetation. Landscape context, wetland classification, the use of reference wetlands, function and values, and temporal considerations will be discussed.

Module 1: An Ecological Framework for Reviewing Compensatory Mitigation

Module 2: Introduction to Wetland Hydrology

Module 3: Ensuring Soil Quality and Function in Wetland Creation and Restoration Efforts

Module 4: An Ecological Framework for Reviewing Compensatory Mitigation – Biology (Mostly Plants)

An Ecological Framework for Reviewing Compensatory Mitigation: Abiotic Processes

The purpose of this second of four webinars was to assist compensatory mitigation project reviewers by providing information about how to evaluate abiotic processes--soils and hydrology--critical to designing wetland restoration projects that will achieve project objectives and meet performance standards. Presenters focused on both abiotic and biotic characteristics of soils and their functions, review specific considerations with respect to hydrology and soils in tidal restoration projects, and describe a process for developing hydrology-based performance standards in freshwater systems. The webinar presentations ran around 100 minutes and was followed by a questions and answer session.

Module 5: Soil, Landscape, Hydrology Relationships

Module 6: Factors Governing Successful Tidal Wetland Mitigation

Module 7: Concepts and Components of Performance Standards for Target Hydrology

An Ecological Framework for Reviewing Compensatory Mitigation: Biotic Processes

The purpose of this third of four webinars was to assist compensatory mitigation project reviewers by providing information about how to evaluate biotic processes—plants, animals, etc. and explore 1) how they are linked to hydrology, soils and other biotic characteristics, 2) how biotic elements provide indicators of wetland health and function and 3) how to measure progress using performance standards and monitoring plans. During the webinar the use of and selection of reference wetlands to determine appropriate biological communities to restore (e.g., planting palettes) was also explored. By linking all these elements together presenters provided insights into how to manage abiotic and biotic elements to restore high quality, high functioning wetlands. These topics were explored using examples of freshwater wetlands including vernal pools, floodplains, riverine and coastal projects

Module 8: Biotic Processes – Vernal Pool Case Study

Module 9: Biological Components of Compensatory Mitigation Wetlands

Module 10: Biotic Processes in Riverine Wetlands

An Ecological Framework for Reviewing Compensatory Mitigation: Plan Review

The purpose of this webinar was to help plan reviewers evaluate whether a project as proposed is likely to achieve its objectives by examining some of the most important aspects of a project. Examples (including both successful and less than successful projects) from riverine, palustrine freshwater and coastal projects was provided to highlight the importance of site selection, water budgets, soils, monitoring, adaptation, and resiliency in evaluating a restoration plan.

Module 11: Mitigation Plan Review: Site Selection, Riverine Systems

Module 12: 'Red Flag' Review for Hydrology and Soils in Palustrine Systems

Module 13: Monitoring Plans and Adaptive Management for Coastal Mitigation Projects

An Ecological Framework for Reviewing Compensatory Mitigation: Coherent Plans – Goals, Objectives, Performance Standards, Outcomes and Monitoring

The purpose of this webinar is threefold: First, the webinar shares that performance standards are the roadmap to successful wetland restoration and mitigation. The likelihood of success increases dramatically when well-designed, ecologically relevant performance standards are used. This talk outlined key considerations for constructing effective performance standards that account for a broad set of physical, hydrological, and biological functions. We also covered practical considerations such alternative ways to approach "reference", timing of when different standards should be met, and ways to develop standards that are resilient to changing conditions over time. Finally, we considered critical data management approaches that can improve accessibility of monitoring data necessary to evaluate standards over time.

Second, the webinar covers a condition-based approach to assessing functional replacement for wetland mitigation. An approach of this type was developed using a reference wetland data set of natural wetlands that includes data from the major Ohio wetland types that span a gradient of human disturbance. From this data set wetland program tools were developed. Fundamentally, this approach is strongly data-driven, and it follows then that meaningful and adequate mitigation monitoring is absolutely necessary to determine whether the mitigation

wetland has "succeeded" or "failed." This process and considerations are covered in the first portion of the webinar.

Third, tiering may be an often overlooked but very useful approach to mitigation design and implementation. There are lots of information to be gained from the biology of early successional and volunteer species. Too often in the past, too much focus has been on getting plants in the ground and the subsequent survivorship metric of the planted specimens. Poor survivorship may be a result of poor microhabitat selection, poor choice of plants for site-specific conditions, or a result of overlooking other ecological factors and processes. Anthony provided an overview of some case studies of how some restoration sites here in the east have failed and why, and how tiering, more attention to site-specific attributes, and the consideration of other ecological factors in the mitigation planning process may help to improve success of a mitigation site.

Module 14: Linking Monitoring Indicators to Performance Standards

Module 15: Performance Standards and Monitoring Protocols for Ohio Compensatory Mitigation Wetlands

Module 16: Ecological Considerations in Wetland Mitigation Planning and Monitoring

An Ecological Framework for Reviewing Compensatory Mitigation: From Conceptual to Final Design

The purpose of this webinar is threefold: First, the value of good data on both biotic and abiotic elements was emphasized in earlier webinars in this series. Good biotic and abiotic data also forms the foundation of the mitigation conceptual design; however, all the data necessary to finalize the design is often not yet available when a conceptual mitigation plan is first presented to regulatory agency staff. Using selected case studies, this webinar identified general best practices for evaluating conceptual designs, illustrate how designs become more refined as new information comes to light and how to best remain engaged in the design process while working towards a final, implementable design.

Second, mitigation projects generally follow a three-phased approach to design prior to construction and implementation on the ground. These phases consist of Conceptual, Preliminary, and Final Design efforts. The Conceptual phase focuses on developing a series of Concepts / Options and then determining the feasibility of developing a mitigation project. These initial conceptual phases are important in provides an opportunity for cooperative agency review and input towards the selection of an approved "Preferred" concept. However, that "Preferred" concept may or may not move forward into more detailed design based upon cost/benefit analysis. Preliminary Design phase is where the details of a "Preferred" concept selected evolves thru a design process towards the development of construction plans. It involves agency review that may involve revisions to the details of the "Preferred" design as it moves forward towards construction. This webinar outlined this process and discuss the Final Design, which finalizes the construction plans and specifications of a mitigation project for construction efforts. This presentation provided some examples of the different phases for different types of projects that may be undertaken.

Third, the webinar outlined the U.S. Army Corps of Engineers Norfolk District review and approval process for Mitigation Work Plans submitted by providers of wetland and stream

compensatory mitigation projects from conceptual to final design. This presentation focused on the District regulators perspective of what information is necessary, when is that information necessary, and the level of detail required at each submittal milestone for review and approval. The presenter walked through some specific examples that will serve to demonstrate some lessons learned and how the District's requirements have changed over the years.

Module 17: Wetland Mitigation Concept to Final Design – Where Dreams and Reality Collide

Module 18: Three Phases of Design in Compensatory Mitigation Projects

Module 19: Mitigation Work Plans: A Regulator's Perspective

An Ecological Framework for Reviewing Compensatory Mitigation: Anticipating the Unexpected

The purpose of this webinar was threefold: First, compaction of created wetland subsoils is often required for stability and to limit groundwater losses, but failure to provide a suitably loosened surface soil rooting media is a common problem, particularly for deeper rooted forested wetlands. This webinar discussed these problems and several remedies include managing soil placement and tillage operations in concert with seasonal/moisture constraints. Near-surface compaction can also drastically alter hydroperiod regimes away from intended target references. Deeper excavations of creation sites in the mid-Atlantic USA also commonly encounter potential acid-sulfate materials, which if allowed to oxidize, generate very low soil+water pH and phytotoxic conditions. Preconstruction testing, recognition and avoidance are critical; remedial measures include heavy liming and organic amendments and/or keeping these materials saturated year-round.

Second, wetland and fluvial restoration projects commonly include post-construction plans which detail actions to address issues related to routine maintenance, adaptive management and remediation. These three direct actions have one common goal: set the constructed project on a trajectory to realize the restoration objectives. This webinar reviewed these three direct actions, with an emphasis on (1) how the direct actions are typically differentiated during the pre-construction planning and design phase, (2) post-construction conditions that are difficult to anticipate and therefore plan around, and (3) strategies that can be used to address significant uncertainties involving future landscape conditions. They reviewed the San Clemente Dam Removal project to help illustrate routine maintenance, adaptive management and remediation, within the context of an action that will reset the Carmel River corridor to a new physical state.

Third, this presentation provided an understanding of the Corps' perspective in review, approval, and oversight of mitigation projects where adaptive management has been used as an important tool for planning and response to challenges and unforeseen changes to those projects.

Module 20: Soil Compaction and Acid-S Conditions

Module 21: Anticipating the Unexpected in the Context of Dam Removal

Module 22: Adaptive Management: A Regulator's Perspective

An Ecological Framework for Reviewing Compensatory Mitigation: Oversight and Compliance

This webinar has a three-fold purpose around the topic of oversight and compliance: First, oversight and compliance is an important component of compensatory mitigation. This presentation discussed oversight and compliance from the perspective of a Corps Regulator as well as important "touch points" in mitigation plan review, approval, implementation, monitoring and long term management. Examples of effective adjustment of anticipated outcomes will be given and along with flexibility in the regulatory oversight of the compensatory mitigation process.

Second, oversight and compliance are essential components of any functional regulatory program. This presentation discusses oversight tools that are used in Virginia in the regulation of mitigation banks and in-lieu fee programs. In addition, through several case studies, the presentation will provide a state perspective of the communication and resolutions that developed when non-compliance or other issues were identified.

Third, oversight and compliance challenges in compensatory mitigation are different for project sponsors and consultants than for regulators. This presentation will explore challenges faced by project sponsors and consultants during the development, implementation, monitoring, and long-term management stages of mitigation projects and offer potential solutions and best management practices. Such challenges include implementing complex performance standards for multiple agencies, finding appropriate easement and endowment holders, disparity in endowment requirements across projects, coordinating decisions with multiple parties during implementation, and lack of collaboration between agencies and project proponents during project development.

Module 23: Mitigation Oversight and Compliance: USACE Regulatory Perspective

Module 24: An Ecological Framework for Reviewing Compensatory Mitigation: Oversight and Compliance

Module 25: Challenges and Potential Solutions for Mitigation Compliance: Project Sponsor and Consultant Perspective

An Ecological Framework for Reviewing Compensatory Mitigation: How interests in property may affect mitigation projects

This webinar has a three-fold purpose: First, the webinar seeks to help participants understand and address real property interests for successful site protection and financial assurances. To ensure that mitigation projects are provided long-term protection through real estate or other available mechanisms it is necessary to understand basic concepts of property law, including title concepts, encumbrances of property, priority of interests, and potentially severed interests or estates. The goal of this presentation was to understand real estate legal concepts within the framework of planning for successful site protection for mitigation sites, and to address issues arising from prior and severed interests in property pledged to protect mitigation projects.

Secondly, the webinar explored how water rights drive aquatic resource mitigation in the West. Water is a finite resource in the arid west and as demands on water supply increase, implementing legal protection for the hydrology of aquatic resource mitigation is as essential for long term success as site selection and mitigation design. The goal of the presentation was to shed light on questions regarding self-sustaining aquatic resource mitigation and restoration projects, methods to protect aquatic resources from future water demands in perpetuity, and

federal and state regulatory requirements. This discussion will provide examples of how water rights have governed mitigation success and failures within arid regions.

Third, the webinar address factors affecting cost and feasibility of mitigation projects. There are many property interests that can affect mitigation projects, with the most common affects being negative impacts to cost and schedule. Impacts to cost and schedule ultimately translate to challenges to the overall feasibility of the projects. This presentation looks at some of these property interests and how they can affect mitigation projects; and will also address the numerous other associated interests that can compound the effects on a project's costs and overall feasibility. Examples will be provided of mitigation projects that were able to successfully overcome these challenges and another project that was unable to overcome the challenges.

Module 26: Understanding and Addressing Real Property Interests for Successful Site Protection & Financial Assurances

Module 27: How Water Rights Drive Aquatic Resource Mitigation in the West

Module 28: Factors Affecting Cost and Feasibility of Mitigation Projects

Module #1: An Ecological Framework for Reviewing Compensatory Mitigation

Trainer: **Eric D. Stein, D.Env.** is a Principal Scientist at the Southern California Coastal Water Research Project (SCCWRP), where he is head of the Biology Department. Dr. Stein oversees a variety of projects related to in-stream and coastal water quality, bioassessment, hydromodification, watershed modeling, and assessment of wetlands and other aquatic resources. His research focuses on effects of human activities on the condition of aquatic ecosystems, and on developing tools to better assess and manage those effects. Dr. Stein has authored over 100 journal articles and technical reports and participates on numerous technical workgroups and committees related to water quality and wetland assessment and management. Prior to joining SCCWRP in 2002, Dr. Stein spent six years as a Senior Project Manager with the Regulatory Branch of the Los Angeles District Corps of Engineers, and four years with a private consulting firm.

Module Objectives:

- Objective #1 - This presentation will provide an overview of the onsite and offsite ecological processes that create and sustain wetlands on the landscape. Participants will learn how a compensatory mitigation plan that supports key ecological processes is essential to meeting project goals and objectives. Specifically, participants will learn that compensatory mitigation plans must appropriately identify the proper landscape setting, and demonstrate an understanding for past, present and anticipated future landscape characteristics and connections with respect to the proposed compensatory action.
- Objective #2 - Participants will gain an understanding of how the presence or absence of hydrology – both surface and subsurface - healthy hydric soils, landscape connectivity and other current landscape elements provide both opportunities and constraints for compensatory mitigation plan to meet its intended goals and objectives. The role of appropriate reference conditions (i.e. information about a similar wetland that represents the intended endpoint for the compensatory mitigation plan) can assist in designing a project and evaluating it through a monitoring plan whether it will/has met its goals and objectives. The importance of an appropriate monitoring plan to measure progress will be discussed.
- Objective #3 - This presentation will cover specific information that should be available to a compensatory mitigation plan reviewer in order to evaluate whether a compensatory mitigation plan is likely to meet the project's goals, objectives and performance standards. This includes, but is not limited to, information on key hydrologic processes, soil conditions, biological connections and the potential impacts of anticipated future conditions including drought, flooding and sea level rise.

Test Questions

1. Which are the most important determinants of successful restoration? (select all that apply)

A. Position in the landscape
B. Aquatic resource type

C. Physical connections
D. Biological connections
Answer: A, C and D

2. Which of the following is NOT a hydrogeomorphic (HGM) classification?
A. Slope
B. Depression
C. Flat
D. Marginal
E. Riverine
Answer: D

3. Which of the following are considerations for selecting a good reference site?

A. If the reference site is located in a comparable landscape setting
B. If the reference site contains comparable and appropriate biology
C. If the reference site has comparable hydrology and soil conditions
D. If the reference site is less than 10 miles from the mitigation site
Answer: A and C

4. Why are landscape connections important? (select all that apply)

A. Provide pathways for surface and subsurface water flows which are important for wetland type and function
B. Promote materials processing functions for soils structure and associated microbial communities
C. Ensures easy access for practitioners and construction equipment
D. Provide critical refugia, migration corridors and connectivity to adjacent uplands
Answer: A, B and D

5. Which of the following describe information that should be part of a compensatory mitigation plan and/or available on request? (select all that apply)

A. Current and historical information for the site (e.g., aerial photos, maps, etc.)
B. Information including diagrams and data representing key hydrological processes
C. Current (and historic if possible) soil conditions
D. Adjacent land uses and location of nearby wetlands
E. Narrative description or summary data plots of anticipated future site conditions related to precipitation and air temperature
F. Potential sources of invasive species—both plants and animals
Answer: All of the above (A, B, C, D, E and F)

Module #2: Introduction to Wetland Hydrology

Trainer:

Jeremy Sueltenfuss is a Wetland Ecologist at Colorado State University, Department of Forest and Rangeland Stewardship. His research focuses on wetland hydrology, and the hydrologic drivers of wetland form and function. Jeremy's research has focused primarily on mountain systems, ranging from the wetlands of Juneau Alaska down to the Peruvian Andes. By understanding how water flows through and across the landscape, Jeremy tries to apply his research on degraded and hydrologically altered wetlands to restore these vital ecosystems. His dissertation research focused on the use of hydrologic performance standards for wetland mitigation.

Module Objectives:

- Objective #1 - This presentation will provide an overview of how water flows across and through the landscape.
- Objective #2 - Participants will learn about diverse wetland types, how wetlands connect to the broader landscape and how hydrographs vary by wetland type.
- Objective #3 – Participants will learn about what hydrology factors to consider in reviewing wetland restoration designs and proposals.

Five test questions

1. Wetland water levels are the primary driver of: (select all that apply)

A. Soil formation.
B. Vegetation composition.
C. Air quality.
D. Animal use.
E. Potable well water availability
Answer: A, B and D

2. Which of the statements below is NOT true?

A. Wetland types are highly variable.
B. Wetland types differ in their hydrologic regimes.
C. If you meet the technical standard for wetland hydrology you do not need to worry about wetland type.
D. Wetland type indicates depth to the water table.
Answer: C and D

3. What are some ways in which water moves across and through the landscape? (select all that apply)
A. Snow and rain seep into the landscape.
B. Groundwater moves slowly through the wetland and discharges into a stream. Rivers and streams move water through floodplains.
D. Water can move through the ground parallel to the river channel.
Answer: All of the above

4. Understanding the hydrogeomorphic classification of your wetland provides insights into:

A. How the wetland functions.
B. How to restore the wetland.
C. The mineral content of the wetland.
D. What its hydrograph will likely be.
Answer: A, B and D

5. What are some of the questions that a good restoration plan should allow you to answer?

A. What was the historical wetland type, water source and landscape connection before the wetland was altered?
B. What does the wetland site look like now?
C. What impacts occurred to bring the wetland to the condition it is in today?
D. How do the proposed actions restore the altered hydrology?
Answer: All of the above.

Module #3: Ensuring Soil Quality and Function in Wetland Creation and Restoration Efforts

Trainer: **W. Lee Daniels** is the Thomas B. Hutcheson Professor of Environmental Soil Science at Virginia Tech in Blacksburg, Virginia. He received his Ph.D. in Soil Science from VPI & SU in 1985. Dr. Daniels areas of specialization include stabilization and restoration of disturbed lands including areas disturbed by mining, road building, waste disposal, urbanization and erosion. In particular, he has focused his research and consulting experience in wetland impact mitigation, mine reclamation, and soil-waste management systems. His teaching programs at Virginia Tech focus on soil geomorphology and landscape analysis with particular emphasis on the relationships among surficial geology, hydrology, soil patterns and long term landscape evolution processes. Major awards include the *Reclamation Researcher of the Year* by the American Society for Surface Mining and Reclamation (ASMR) in 1993, USEPA's *National Biosolids Utilization Research Award* in 2000 and the *Lifetime Achievement in Research Award* by ASMR in 2012.

Module objectives:

- Objective #1 - This presentation will provide an overview of the characteristics and functions of hydric soils in wetland creation and restoration projects.
- Objective #2 - Participants will also learn about common limitations in created and/or restored wetland soils.
- Objective #3 – Participants will learn about what factors to consider in determining the likelihood of establishing hydric soil function.

<u>Test Questions</u>

1. Which is the correct NRCS definition of a hydric soil?

A. A soil that is formed under conditions of continual surface saturation all year round.
B. A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.
C. A soil that is sustained by groundwater during the drier months of the year sufficiently enough to develop anaerobic conditions in the lower part.
D. A soil that is found only in natural tidal wetlands in the southeastern region of the United States.
Answer: B

2. Which of the following is NOT a function of hydric soils?

A. Nitrogen removal.
B. Phosphorus removal.
C. Carbon sequestration.
D. Habitat provision for wetland flora, fauna, microbes, etc.

E. Storm surge protection.
Answer: E

3. Which are some common problems with created and/or restored wetlands soils? (select all that apply)

A. Compaction.
B. Lower soil organic material levels than natural sites/soils.
C. Lack of microtopography.
D. Degraded soil structure/permeability/rooting.
E. Higher soil temps when young, leading to higher carbon loss rates.
Answer: All of the above

4. Which of the following statements is false?

A. Sulfidic materials are good for hydric soil health.
B. Hydric soils take time to develop.
C. It is important to understand hydric soils within the context of the landscape in which they are located.
D. It is valuable to have other scientific disciplines involved with site assessments.
Answer: A

5. Which of the following are ways to determine the presence of a hydric soil? (select all that apply)

A. Learn how to accurately and completely describe soil morphology, particularly redox features.
B. Carefully describe soil morphology before any site disturbance and then immediately after final creation/restoration, being sure to quantify redox feature abundance.
C. Monitor and record the success of hydric plant growth on soil surfaces.
D. At a pre-determined interval (e.g., 1, 3 and 5 years), conduct follow-up soil descriptions in "mini-pits" excavated to 30+ cm and carefully quantify color, redox feature abundance, etc.
E. Detect and quantify development of lower overall chroma and increased redox concentrations, pore linings, or other features.
Answer: A, B, D and E

Module #4: An Ecological Framework for Reviewing Compensatory Mitigation – Biology (Mostly Plants)

Trainer: **Matt Schweisberg** is the Principal of Wetland Strategies and Solutions, LLC (www.wetlandsns.com), where he provides policy, regulatory and technical advice and assistance for clients seeking to navigate a wide range of regulatory and non-regulatory issues related to wetlands and other aquatic resources. He works throughout the U.S. Matt is a Professional Wetland Scientist under the Professional Certification Program of the Society of Wetland Scientists. He is a retired federal wetlands ecologist and wildlife biologist who spent over 32 years with the U. S. Environmental Protection Agency at its HQ office in Washington, D.C. and New England Region office in Boston. Matt served as Chief of the New England Region's Wetlands Protection Program and Senior Wetland Ecologist, and on national work groups developing guidance and regulations on Clean Water Act jurisdiction. He has testified before federal grand juries and served several times as an expert witness in federal, state, and private litigation. He co-instructs a week-long intensive course on wetland identification and delineation at the Eagle Hill Institute in Maine, and has taught courses in wetland regulation, restoration and creation, wetland ecology, and wetland identification and delineation for federal and state agencies, academic organizations, and environmental consultants. He received his degree in Wildlife Management from the University of Maine.

Module Objectives:

- Objective #1 - This presentation will provide an overview of how biotic structure is affected/influenced by abiotic factors, primarily ecological processes. Participants will learn how a compensatory mitigation plan that addresses the key ecological processes is essential to ensuring the project meets its stated goals and objectives.
- Objective #2 - Participants will understand the role of appropriate ecological reference and data requirements to understand the trajectory of the development of targeted vegetative communities.
- Objective #3 - This presentation will cover specific information and resources recommended to support the project's goals, objectives, monitoring program, and performance standards. This includes, but is not limited to, available data sources, hydrologic and biological connections, temporal considerations, changing conditions, and stressors that will drive the trajectory of development of vegetation contributing to the success of a mitigation project.

Test Questions

1. Which of the following are factors that will affect targeted plant communities/species? (check all that apply)

A. Watershed conditions
B. Landscape position
C. Hydrologic Regime and Connections
D. Air Quality

E. Soils
Answer: A, B, C, and E

2. What should you be identifying when reviewing a mitigation site and its ecological reference when designing your compensatory mitigation project? (check all that apply)

A. Vertical and horizontal structure
B. Dominant and non-dominant species
C. Natives and non-native invasive species
D. Patch types
E. Stressors
Answer: All

3. The following are on-line information sources that can be used when evaluating proposed vegetation plans (check all that apply):
A. National Wetland Plant List
B. USDA Natural Resources Conservation Service Plant Materials Program
C. Local, experienced botanists
D. Regional Invasive/Noxious Plant Lists
E. Herbarium data, manuals and/or handbooks
Answer: All

4. Select the factors to be considered when designing a vegetation monitoring program (check all that apply):

A. Predatory animal species
B. Invasive species management
C. Vegetative succession timing
D. Hydrologic regime
E. Survival rates
F. Cost
G. Climate Variability
Answer: B – G

5. What information should be included in Mitigation Plans to support the proposed goals and objectives of a mitigation project (check all that apply)?

A. Biological Connections – adjacent land uses and sources of invasive species
B. Soil Conditions – compaction, salinity, organic matter, hydric soil rating,
C. Key hydrologic processes – diagrams supporting data, hydrologic impacts (e.g. drain tiles, discharges, physical barriers, etc.), frequency of flood events
D. Proximity to other aquatic resources
E. Stressors and other reasonably foreseeable land uses
Answer: All

Module #5: Soil, Landscape, Hydrology Relationships

Trainer: **Lenore Vasilas** is a USDA Natural Resources Conservation Service (NRCS) Soil Scientist on the Soil Science Division Technical Soil Services Staff. She has been a soil scientist for NRCS for 28 years working for the first 7 years on soil survey and the rest of her career in various positions concentrating on hydric soils issues. She has been a member of the National Technical Committee for Hydric Soils for 20 years and is the current chair of the committee.

Module Objectives:

- Objective #1 – Understand how soil, landscape and hydrology relate to your mitigation design.
- Objective #2 - Understand how soil, landscape and hydrology affect the functions of your mitigation site.
- Objective #3 – Understand how to assess if you have achieved soil hydrology targets.

Test Questions

1. Which of the following statements is false?

A. Water held by suction forces has a pressure less than atmospheric pressure.
B. Saturated soil has a pressure greater than atmospheric pressure.
C. A horizon is saturated when the soil water pressure is zero or positive.
D. The strength of suction force is related to soil pore diameter.
E. Unsaturated soils have suction forces that allow water to move freely.
Answer: E

2. Which of the following is NOT a soil characteristic that affects hydrologic function?
A. Slope.
B. Drainage class/hydroperiod.
C. Permeability.
D. Conductivity.
E. Microtopography.
Answer: D

3. What are some tools for assessing whether you have achieved wetland hydrology?

A. Piezometer.
B. Shallow well.
C. Soil temperature gauge.
D. IRIS tube.
E. Physical evidence.
Answer: A, B, D and E

4. Which of the following statements is false?

A. Wetlands that have a high hydraulic gradient have fast moving water flows.
B. Soil color should not be used an indicator of soil type.
C. Different types of wetlands provide different wetland functions.
D. Perched water tables with small hydraulic gradients often lead to gleyed colors.
E. Different hydroperiods produce different soils that provide different functions.
Answer: B**5. Which of the following statements are true? (select all that apply)**

A. Wetlands remove 70-90% of nitrogen from water.
B. Uplands do not remove nitrogen from water.
C. Wetlands retain about 45% of phosphorous from water.
D. If soils were hydric before restoration, then they will be hydric after restoration.
E. Wetland functions are the biological, chemical and physical processes that occur in wetlands.
Answer: A, C and E

Module #6: Factors Governing Successful Tidal Wetland Mitigation

Trainer: **Walter I. Priest, III** after over 40 years in the public sector working for the Virginia Division of Shellfish Sanitation, U.S. Army Corps of Engineers, the Virginia Institute of Marine Science and the NOAA Restoration Center, Walter, currently works with his consulting firm, Wetland Design and Restoration. He is a Professional Wetland Scientist. His work experience at VIMS included: permit review and environment impact assessment, tidal wetlands inventories, beneficial use of dredged material and wetland restoration. While with the NOAA Restoration Center, he provided project management for a wide range of fisheries habitat restoration projects including: large and small scale tidal wetland restorations, oyster reefs, Living Shorelines, seagrass restoration and dam removal projects. He also designed and helped implement a number of tidal wetland restorations at remediated Super Fund sites. He has also developed Prospectus' and design for two tidal wetland mitigation banks as well as conducted long-term monitoring of two other tidal wetland mitigation banks. During his career he has been involved with over 70 habitat restoration projects involving over 100 acres providing: design, detailed critical review, project management, construction oversight, volunteer plantings and/or long-term monitoring. He recently authored a chapter in the book, Living Shorelines: The Science and Management of Nature-based Shoreline Protection, entitled, Practical Living Shorelines: Tailored to Fit in Chesapeake Bay.

Module Objectives

- Objective #1 – Understand the five primary functions of tidal wetlands and how to determine if proposed design is realistic for the site.
- Objective #2 - Understand how to evaluate plan for appropriate tidal hydrology, elevation, soil composition, plant selection and biological benchmarks.
- Objective #3 –Understand how to monitor and review monitoring reports to ensure performance targets have been met.

Test Questions

1. Which of the following are important criteria for tidal mitigation site selection?

A. No contamination on site.
B. Site has diminished ecological value.
C. Site has access to tidal hydrology.
D. Site is connected to the larger watershed.
E. Site has adjacent habitat for wildlife.
Answer: All of the above.

2. Which of the following is NOT a tidal wetland function?

A. Fish, shellfish and wildlife habitat.
B. Water quality enhancement.
C. Heat abatement.
D. Shoreline erosion protection.
E. Flood buffering.
Answer: C

3. Which of the following should be included in a monitoring report?

A. History of the watershed.
B. Project description.
C. Sampling design.
D. Presentation of summary and raw data.
E. Analysis and recommendations.
Answer: B, C, D and E

4. Which of the following should be monitored?

A. Sediment accumulation.
B. Macrobenthic invertebrates and wildlife.
C. Signs of excessive erosion or deposition.
D. Number, size and diversity of fishes.
E. Plant survival and invasive species.
Answer: All of the above.

5. Which of the following statements are true? (select all that apply)

A. Sand is best for planting and growth.
B. Organic matter will increase over time.
C. Perimeter ditches can help with invasive species management.
D. Elevation is not critical to success.
E. Vegetation success is an indicator of appropriate hydrology.
Answer: A, B, C and E

Module #7: Concepts and Components of Performance Standards for Target Hydrology

Trainer: **Steve Eggers** is a Senior Ecologist for the U.S. Army Corps of Engineers, St. Paul District Regulatory Branch. He has worked with the Corps of Engineers for more than 40 years. Steve is widely recognized as a regional and national expert in wetlands, serving as a member of a national team responsible for updating the Corps wetland delineation manual, as well as participating in the update of the national wetland plant list and co-authoring the book Wetland Plants and Plant Communities of Minnesota and Wisconsin. Steve provides training and technical assistance with wetland delineations and restoration projects. He has helped further understanding of wetland science and connecting it with public policy.

Module Objectives:

- Objective #1 – Understand the components of and how to develop appropriate performance standards for hydrology.
- Objective #2 - Understand how performance standards can be used to achieve the correct trajectory for meeting goals/objectives.
- Objective #3 – Understand how to identify and use reference wetlands for development of performance standards.

Test Questions

1. Which of the following statements is false?

A. Performance standards must be based on the best available science that can be measured or assess in a practicable manner.
B. A compensation site that meets performance standards for both target hydrology and target vegetation is typically on the correct trajectory for meeting goals/objectives.
C. The technical wetland hydrologic standard is adequate for any wetland type.
D. The goal is not to establish the minimum wetland hydrology, but rather to establish the optimum hydrology for targeted wetland types and associated functions and services.
E. Unsaturated soils have suction forces that allow water to move freely.
Answer: C

2. It is not important for data loggers to collect data at the same time of day – true or false?

A. True.
B. False.
Answer: False

3. True or False: Reference wetlands should be within the same watershed as the compensation site?

A. True.
B. False.
Answer: A

4. What should you do if there are no suitable reference wetlands available? (select all that apply)

A. Consult scientific literature.
B. Consult regional wetland experts.
C. Incorporate site-specific data and analysis.
D. Develop performance standards based on best available science.
E. Develop performance standards based on preferred wetland functions.
Answer: A, B, C and D

5. Which of the following statements are true? (select all that apply)

A. Performance standards must require water levels to be less than 12 inches below the soil surface.
B. Hydrology performance standards are targets, not absolutes.
C. Performance standard descriptions must be assigned metrics.
D. If a site should develop a different hydrological regime than specified in the performance standards, then the site is considered a failure.
E. You should use site specific data to tailor performance standards to achieve goals/objectives.
Answer: B and E

Module #8: Biotic Processes – Vernal Pool Case Study

Trainer: **Matt Gause** is the Ecological Resources & Land Stewardship Director at Westervelt Ecological Services and oversees Westervelt's land stewardship and ecological resources on over 8,000 acres of restored wetlands and endangered species habitat on 18,000 acres of preserved properties in California, the Rocky Mountain region and southeastern United States. Mr Gause has over 25 years of experience with wetland restoration including the restoration of vernal pools, riparian forest, tidal marsh, and floodplain wetlands. He has also managed conserved lands for more than 15 threatenend or endangered species on preserves throughout California. In addition, Mr. Gause provides site suitability analyses during the land acquisition process, including restoration suitability, threatened and endangered species, easement restriction analysis, and future land management cost estimation. Mr. Gause also develops and implements both baseline and long-term land management and monitoring strategies for mitigation and conservation landscapes. Mr. Gause is a Certified Ecological Restoration Practitioner (CERP) and received a Bachelor of Science in Botany from the University of California at Davis

Module Objectives:

- Objective #1 – Learn the definition of a vernal pool.
- Objective #2 - Understand the abiotic and biotic elements of a vernal pool.
- Objective #3 – Understand vernal pool monitoring and performance standards.

Test Questions

1. Which is the most accurate definition of a vernal pool?

A. Vernal pools are seasonally flooded landscape depressions where water ponds because of limitations to surface and subsurface drainage.
B. Vernal pools are depressional wetlands that are flooded during the summer and fall.
C. Vernal pools are wetlands formed by glaciated depressions on the landscape and are wet all year round.
D. Vernal pools are wetlands that are fed by groundwater that seeps to the surface.
E. Vernal pools are tidal wetlands that have water levels responsive to tidal fluctuations.
Answer: A

2. Which of the following are characteristics of vernal pools? (select all that apply)

A. The soil surface horizon is often composed of clay loam or clay.
B. Vernal pools go through three hydrologic phases: initial inundation, undulating inundation and drying.
C. Soil chemistry can have a broad range from acidic to alkaline.
D. They have highly specialized endemic flora.
E. The provide critical habitat for generalistic fauna.
Answer: A, B, C and D

3. Which of the following statements is true?

A. All vernal pools are alike.
B. Vernal pools are only found in California.
C. Agriculture has been the biggest cause of vernal pool loss in California over the past twenty years.
D. Floral rings around vernal pools in California are caused by nutrient overloads from surrounding agricultural practices.
E. Vernal pool soils are rich in nutrients.
Answer: C

4. In California, vernal pool wetted acreage cannot exceed 15% density across the landscape because: (select all that apply)

A. Federal regulations require it.
B. Vernal pools exist within a matrix of grassland.
C. Dietary requirements of fairy shrimp.
D. Otherwise they remain wet all year round.
E. It makes it easier to avoid impacts.
Answer: B

5. Which of the following statements is false? (select all that apply)

A. Vernal pool performance standards are universally applicable.
B. Total vernal pool acreage across California has increased dramatically in the past 100 years.
C. During construction, excavation should be managed to control the thickness of soil over restrictive layers.
D. Invasive species cannot survive in vernal pools because of the hardpan soil layers.
E. Numerous vernal pool classification schemes have been developed.
Answer: A, B and D

Module #9: Biological Components of Compensatory Mitigation Wetlands

Trainer: **Mick Micacchion** is a Professional Wetland Scientist and works as a restoration ecologist with The Nature Conservancy for the Ohio In-Lieu-Fee Compensatory Mitigation Program. He has a BS and MS in Wildlife Management, both from Ohio State University. Mick retired in 2011 from the Ohio Environmental Protection Agency (Ohio EPA) with 32 years of state service including 10 years with the Ohio Department of Natural Resources. While working for 20 years at Ohio EPA he was instrumental in the development of Ohio's Wetland Water Quality Standards rules, wetland assessment tools, including the Ohio Rapid Assessment Method for Wetlands (ORAM), Vegetation Index of Biotic Integrity (VIBI), Amphibian Index of Biotic Integrity (AmphIBI), "Standardized Monitoring Protocols and Performance Standards for Ohio Mitigation Wetlands" and their integration into Ohio's wetland program, which has worked as a model for the country.

Mick also works for the non-profit Midwest Biodiversity Institute (MBI) where he has served as a wetland ecologist for the past seven years. Currently he instructs courses in Wetland Botany, Wetland Delineation, Ohio Amphibians, Ohio Wetland Assessment Methods, including ORAM, VIBI/VIBI-FQ, and AmphIBI, as well as several other courses at MBI. He has monitored the physical, chemical and biological features, including the soils, hydrology, chemistry, plant, amphibian and macroinvertebrate communities of hundreds of Ohio's natural wetlands and trained hundreds of wetland professionals in the development and use of wetland monitoring and assessment methods, including ORAM, VIBI and AmphIBI. He has also monitored, assessed, and reported on the condition of hundreds of Ohio compensatory wetland mitigation projects and spent more than a decade on Ohio's Interagency Review Team, where he was a major contributor to the "Guidelines on Wetland Mitigation Banking in Ohio." Mick was a member of the Technical Advisory Group, which developed the methods used in the National Wetland Condition Assessment (NWCA), and lead crews and managed others for both the 2011 and 2016 NWCAs sampling wetlands in Ohio, Michigan, Wisconsin, Minnesota, Kentucky, Tennessee, and 10 other states. He is the Vice President of the Ohio Wetlands Association and was a founder and has been active with the Ohio Vernal Pool Network since 2004.

Module Objectives:

- Objective #1 – Understand how the abiotic components impact the biotic components of a mitigation wetland.
- Objective #2 - Understand how to characterize reference condition.
- Objective #3 – Understand how to develop IBIs and set quantitative ecological performance standards that are achievable and reasonable.

Test Questions

1. What components are important for site selection? (select all that apply)

A. Correct texture and compactness of soils.
B. Correct type of hydrologic regime for wetland type.
C. Correct water chemistry.
D. Correct slopes, depths and microtopography.

E. Adequately wide buffers and low intensity surrounding land uses.
Answer: All of the above

2. Which of the following statements is false?
A. Ecological understanding gained from defining reference condition leads to development of reasonably achievable and quantifiable performance standards.
B. Expectations for performance standards change with differing classes of wetlands, ecoregions, plant community classes and watershed of a project.
C. Undisturbed reference wetlands may not exist in your state in which case you should select the least disturbed wetlands for reference.
D. A reference network of wetlands should be selected that represent the diversity of all wetland types.
E. Reference wetlands should be sampled to verify the level of performance desired on a trajectory to reaching reference condition.
Answer: D

3. Which statement below is true?
A. Your IBI score is unrelated to the gradient of human disturbance.
B. IBI scores should only be developed for wetland vegetation.
C. Native flora is genetically stronger and therefore better suited to thrive in disturbed wetlands than non-natives.
D. You should use the same IBI metrics for all taxa.
E. The biological species of wetlands and how they respond to stressors can be used to develop IBIs.
Answer: E

4. Monitoring of compensatory mitigation wetlands is needed to: (select all that apply)

A. Take any necessary adaptive management actions.
B. Confirm that the mitigation site is on a trajectory to reach performance targets.
C. Compare reference wetlands to compensatory mitigation wetlands.
D. Watch for and manage invasive species infestations.
E. Track abnormal wildlife behavior.
Answer: A, B, C and D

5. Habitat needs for biotic elements on mitigation sites include: (select all that apply)

A. Appropriate microtopography.
B. High level intensity surrounding land uses that incentivize migration of species onto the mitigation site.
C. Soils that hold water during the summer months.
D. Supply of plants and animals that make up targeted animal species diets.
E. Poor water quality.
Answer: A and D

Module #10: Biotic Processes in Riverine Wetlands

Trainer: **Gretchen Coffman** is an Associate Professor at the University of San Francisco. Dr. Coffman is a restoration ecologist and Associate Professor at the University of San Francisco (USF) who has worked on wetland and riparian restoration projects throughout the U.S. and internationally for more than 28 years. Since 1991, she has conducted jurisdictional wetland delineations throughout California, the east coast, the southeast, Midwest, and Puerto Rico. In addition, she has applied ecological experience in vegetation and invasive plant species mapping, watershed assessment studies, historical ecology studies, rare plant surveys, and compensatory wetland mitigation projects.

Dr. Coffman's current research focuses on scientific questions with high relevance to management problems, mainly related to riparian plant ecology, restoration, and invasive plant biology in wetlands and river systems of Mediterranean-type and tropical climates. Her research focuses on experimental wetland revegetation and restoration strategies, invasive plant ecology, and restoration monitoring to improve performance standards. She has on-going research projects along rivers and watersheds in coastal southern California, the San Francisco Bay Area, the Central Valley of California, and Southeast Asia. In 2015, she led a National Geographic Expedition in the Annamite Mountains of Laos to document and begin restoration of the Critically Endangered Asian swamp cypress trees she discovered. Since then, her team has successfully propagated almost 2,000 seedlings and started restoration efforts in 2018. In 2016, she was the recipient of the Arthur Furst Faculty Research Award that honors USF Faculty or Alumnus whose work exemplifies research for the betterment of humanity.

Since 2010, she has taught field ecology courses in the Environmental Science Department, Masters of Science in Environmental Management graduate program, and Environmental Studies program at the USF. Courses include Basic and Advanced Wetland Delineation, Field Botany, California Ecosystems, Tropical Restoration Ecology in Borneo, Ecology and Human Impacts, and Introduction to Environmental Science. She developed a Wetland Delineation Certificate Program at USF in 2013 in which more than 70 students have completed. From 1996 – 2011, Dr. Coffman taught wetland ecology, delineation, and restoration courses in the Wetland Science Series at SFSU's Romberg Tiburon Center for Environmental Studies in Tiburon, California. She holds a Ph.D. from UCLA, 2007, Environmental Science; a M.A. from SFSU, 1998, Ecology and Systematic Biology; and a B.A. from Colgate University, 1991, Biology.

Module Objectives:

- Objective #1 – Understand the biotic characteristics, elements and functions of riverine wetlands
- Objective #2 – Understand the structure of the riparian zone
- Objective #3 – Learn best practices for measuring and monitoring riverine wetland mitigation performance

Test Questions

1. Which of the following statements about riparian zones are true? (select all that apply)

A. The riparian zone includes the transitional zone between the terrestrial and aquatic ecosystems.
B. Hydrology in the riparian zone is driven by the flood-pulse concept.
C. Vegetation is adapted to flood-pulse events and subsequent dry down.
D. Biotic characteristics are closely linked to hydrology and soils.
E. Roots of trees growing in the riparian zone often draw water from groundwater.
Answer: All of the above

2. Riverine wetlands along dynamic Mediterranean-type climate rivers are affected by: (select all that apply)

A. Floods.
B. Fires.
C. Drought.
D. Invasive species.
E. Air pollution.
Answer: A, B, C and D

3. Which of the following statements is false? (select all that apply)

A. Riverine wetlands can always be restored to their pristine historical condition.
B. Restoration potential is sometimes impacted by trade-offs due to socio-economic constraints and policy choices.
C. When reviewing compensatory mitigation and monitoring plans, linking revegetation to hydrology and soils is essential.
D. Performance standards should be easily measurable, robust and linked to ecosystem services.
E. Interim standards for monitoring can ensure restoration is on the right trajectory.
Answer: A

4. Which of the following is not a standard biotic measuring metric for flora? (select all that apply)
A. Survivorship.
B. Hydrologic regime.
C. Percent cover.
D. Native vs invasive.
E. Soil type.
Answer: B and E

5. Which of the following statements is false? (select all that apply)

A. Historical maps, photos and records can be used to understand reference conditions.

B. Reference sites can be used to develop a plant palette and compare to recovery of the restoration site over time.
C. You should only use one reference site to compare to your restoration site.
D. You should choose reference sites that are most similar in hydrology, gradient and geomorphology as your restoration site.
E. If it is difficult to obtain data for your own restoration site due to lack of access, budget or timing, data sharing can be a useful tool.
Answer: C

Module #11: Mitigation Plan Review: Site Selection, Riverine Systems

Trainer: **Michelle Mattson** is a stream and wetland ecologist with over 20 years of professional experience as a consultant and regulator. Michelle is a compensatory mitigation subject matter expert (SME) and the IWR Regulatory Team budget manager. She supports national and regional training courses in compensatory mitigation and has spent her career in the field working with restoration teams to design, install and monitor restoration projects and programs. At the USACE, Michelle worked across agencies to develop the Advanced Permittee-Responsible Mitigation (APRM) Program for San Diego Association of Governments (SANDAG) and managed multiple banks and ILFs. As a consultant, she worked on two Special Area Managements Plans (SAMPs), the Otay River Watershed Management Plan, and several Mitigation Banks and ILF sites and multiple large-scale stream restoration projects in alignment with existing and planned USFWS habitat conservation plans (HCPs) and new SDRWQCB water quality requirements. She was a member of the California Wetland Monitoring Workgroup Level 2 (rapid assessment) Committee and was the first to use CRAM in evaluating impacts, alternatives analysis, and monitoring compensatory mitigation to improve decision making in LA District for several large alternative energy projects. Michelle remains a huge supporter of using functional and conditional assessments in regulatory and restoration practices including in informing the location and design of sites to short- and long-term monitoring performance and condition of sites.

Module Objectives:

- Objective #1 – Understand the important characteristics to look for in site selection and evaluating a proposed site.
- Objective #2 – Understand the important baseline information needed for site selection.
- Objective #3 – Understand how to assess if a proposed site will meet watershed needs.

Test Questions:

1. What factors according to the 2008 Mitigation Rule must be considered during site selection? (select all that apply)

A. Watershed needs.
B. Onsite alternatives where applicable.
C. Local land use needs.
D. Practicality of accomplishing ecological self-sustaining aquatic resource restoration.
E. Availability of native seed banks.
Answer: A, B and D

2. The following statements about the Watershed Approach are true: (select all the apply)

A. Allows for use of preservation.
B. Information and analysis must be commensurate with the scope of the mitigation site.
C. The watershed must be at least a HUC 12.
D. Must be used to the extent appropriate and practicable.
E. Allows for inclusion of riparian areas and upland buffers that may not be within Corps jurisdiction.
Answer: A, B, D and E

3. Mitigation should: (select all that apply)

A. Replace lost functions.
B. Occur within the same watershed as the impact.
C. Consider habitat diversity.
D. Consider connectivity and adjacent land uses.
E. Consider risks to aviation.
Answer: All of the above

4. Which of the following are important site selection considerations? (select all that apply)

A. Is there a significant presence of invasive species present on the site or adjacent to the site?
B. Could the post-restoration condition be self-sustainable?
C. Can the site naturally support the type of system proposed?
D. What is the current condition of the watershed and what are potential future impacts?
E. What is attainable?
Answer: All of the above

5. Other informational needs for mitigation site selection include: (select all that apply)

A. Soils and geology.
B. Cause of original impact.
C. Topography.
D. Aquatic resource boundaries.
E. Existing easements and property rights.
Answer: A, C, D and E

Module #12: 'Red Flag' Review for Hydrology and Soils in Palustrine Systems

Trainer: **Michael (Mike) S. Rolband** is the founder of Wetland Studies and Solutions, Inc. (WSSI), a 175+ person natural and cultural resources consulting firm headquartered in Gainesville, Virginia, and a subsidiary of The Davey Tree Expert Company. Mike founded WSSI in 1991 and pioneered its growth and expansion from the one-person wetlands consulting firm, to the multi-discipline natural and cultural resource consulting firm that today operates from four offices focused on permitting and regulatory requirements for the Clean Water Act, Chesapeake Bay Preservation Act, and Stormwater.

Mike is responsible for development of the first wetlands bank in Virginia in 1994 and the first mitigation bank to provide stream credits in Virginia in 2001. He also formed a non-profit to manage the Wetland Research Initiative, a research program that has funded $3.6 million in grants to several universities since 2007 – dedicated to advancing the state of the science of Mitigation. Between mitigation banks and permittee-responsible mitigation, WSSI has designed over 1,000 acres of wetland mitigation and over 280,000 linear feet of stream restoration projects.

Mike has served on the Chesapeake Bay Local Assistance Board and many state and local committees dealing with the Chesapeake Bay Preservation Act, stormwater regulations, and wetlands/stream regulations. In 2017 he accepted an appointment as a part-time Professor of Practice in the School of Civil and Environmental Engineering at Cornell University, and now invests his time and expertise teaching graduate students about the design and challenges of wetlands and stream restoration projects. Mike is an alumnus of Cornell, where he obtained his BS in Civil and Environmental Engineering, Master of Engineering (Civil), and MBA.

Module Objectives:

- Objective #1 – Learn important questions a plan reviewer should ask the plan designer.
- Objective #2 – Understand the key information to look for in a hydrograph.
- Objective #3 – Understand water budget modeling approaches and limitations.

Test Questions

1. What is the major determinate of the kind of wetland you restore or create? (select all that apply)

A. Soil type.
B. Presence of invasive species.
C. Adjacent land uses.
D. Hydrology.
E. Evapotranspiration rates.
Answer: D

2. What information should you find or provide in a hydrograph? (select all the apply)

A. Minimum water level.

B. Maximum water level.
C. Duration.
D. Timing/seasonality.
E. Salinity.
Answer: A, B, C and D

3. Which of the following are considered water budget inputs? (select all that apply)

A. Net potential storage.
B. Precipitation.
C. Surface-water input.
D. Overflow bank.
E. Groundwater input.
Answer: B, C, D and E

4. Which of the following are considered water budget outputs? (select all that apply)

A. Evapotranspiration.
B. Surface-water output.
C. Overflow bank.
D. Ground-water output.
E. Net potential storage.
Answer: A, B, D and E

5. What are some tools available in support of estimating groundwater output? (select all that apply)

A. The NRCS soil texture/bulk density triangles.
B. Large, sealed, double ring infiltrometer.
C. Best professional judgement.
D. Single ring infiltrometer.
E. Precision permeameter.
Answer: All of the above.

Module #13: Monitoring Plans and Adaptive Management for Coastal Mitigation Projects

Trainer: **Karen Greene** is the Mid-Atlantic Field Offices Supervisor for NOAA Fisheries Greater Atlantic Regional Fisheries Office's (GARFO) Habitat Conservation Division and is also the GARFO Essential Fish Habitat Coordinator. She has been with NOAA Fisheries for more than 25 years, working primarily in the Mid-Atlantic region, especially in New York, New Jersey, Delaware and Pennsylvania. Her primary focus has been to provide advice and guidance to federal agencies on avoiding, minimizing and offsetting adverse impacts to coastal fish habitats through a number of consultation authorities such as the Magnuson Stevens Fishery Conservation and Management Act and the Fish and Wildlife Coordination Act. Karen has been involved in the evaluation of compensatory mitigation plans for more than two decades and participated on many interagency review teams (IRTs) for wetland mitigation banks, including the Meadowlands Interagency Mitigation Advisory Committee originally convened in 1998, as well as the IRTs for the first federally approved mitigation banks in NJ and NY. Karen is co-located at the NOAA Fisheries Northeast Fisheries Science Center at their James J. Howard Marine Science Laboratory at Sandy Hook, NJ. She has a BS and MS in Environmental Science, both from Rutgers University.

Module Objectives:

- Objective #1 – Learn about why monitoring is important and how it is used.
- Objective #2 – Understand what the key elements are that should be included in a monitoring plan.
- Objective #3 – Understand how to assess monitoring parameters and performance standards.

Test Questions

1. What are the required elements for a monitoring plan? (select all that apply)

A. Parameters to be monitored.
B. Frequency for submitting monitoring reports.
C. Length of monitoring period.
D. Parties responsible for conducting the monitoring.
E. Party responsible for report submission.
Answer: All of the above.

2. What is the correct length of time for a monitoring period? (select all the apply)

A. Not less than 5 years.
B. From 1-5 years.
C. 5-10 years.

D. Until performance standards are met.
E. Until the site meets the reference site level of performance.
Answer: A and D

3. Which of the following are biotic parameters to monitor? (select all that apply)

A. Benthic organisms.
B. Vegetation.
C. Fish.
D. Wildlife.
E. Thickness of the B Horizon.
Answer: A, B, C and D

4. Which of the following are abiotic parameters to monitor? (select all that apply)

A. Hydrology.
B. Soils.
C. Encroachment.
D. Contaminants.
E. Physiography.
Answer: A, B, D and E

5. What are some key points to consider when creating or reviewing performance standards? (select all that apply)
A. Measure completion of action.
B. Measure outcomes not actions.
C. Identify the attribute of the indicator that will be monitored.
D. Write standards based upon minimum thresholds.
E. Use precise and unambiguous language to define compliance.
Answer: B, C, D and E

Module #14: Linking Monitoring Indicators to Performance Standards

Trainer: **Eric D. Stein, D.Env.** is a Principal Scientist at the Southern California Coastal Water Research Project (SCCWRP), where he is head of the Biology Department. Dr. Stein oversees a variety of projects related to in-stream and coastal water quality, bioassessment, hydromodification, watershed modeling, and assessment of wetlands and other aquatic resources. His research focuses on effects of human activities on the condition of aquatic ecosystems, and on developing tools to better assess and manage those effects. Dr. Stein has authored over 100 journal articles and technical reports and participates on numerous technical workgroups and committees related to water quality and wetland assessment and management. Prior to joining SCCWRP in 2002, Dr. Stein spent six years as a Senior Project Manager with the Regulatory Branch of the Los Angeles District Corps of Engineers, and four years with a private consulting firm.

Module Objectives:

- Objective #1 – Learn key attributes for good performance standards.
- Objective #2 – Understand the ecological considerations that are key for mitigation monitoring and selection of performance metrics.
- Objective #3 – Learn about factors that influence wetland plant communities.

Test Questions

1. What are some key characteristics of good performance standards? (select all that apply)

A. Measurable in an objective and repeatable manner.
B. Tied to clear targets, benchmarks or reference standards.
C. Resilient to changing conditions over time.
D. Remain constant over time.
E. Clear, concise and unambiguous.
Answer: A, B, C and E

2. What are some different ways to establish performance targets? (select all that apply)

A. Comparison to ambient.
B. Comparison to reference.
C. Comparison to peer reviewed studies.
D. Improvement from reference.
E. Improvement from baseline.
Answer: A, B and E

3. Which of the below are types of performance indicators? (select all that apply)

A. Ecological indices.

B. Condition or functional assessment.
C. Wetland establishment approach (vegetation, hydrology, soils).
D. Level 3 intensive measure (plant community composition, geomorphic condition, sensitive species).
E. Geospatial analysis.
Answer: A, B, C and D

4. Which of the following are hydrologic considerations/best practices for performance standards? (select all that apply)

A. Issues of seasonality/perenniality relative to water source.
B. Avoids reliance on artificial sources of hydrology.
C. Appropriate hydrologic regime relative to landscape position and desired wetland/stream type.
D. Allows for aquatic species.
E. Allows for necessary dynamism (e.g. flood-scour cycles).
Answer: A, B, C and E

5. Which of the following are biotic considerations/best practices for performance standards? (select all that apply)

A. Consider using standard bioassessment tools (e.g. FQAI, IBI).
B. Adjust standards over time relative to sentinel locations.
C. Allow for habitat needs of sensitive, threatened and endangered species.
D. Allow for short and long-term succession cycles and response to natural disturbances.
E. Focus on structural and functional elements (e.g. recruitment).
Answer: A, B, D and E.

Module #15: Performance Standards and Monitoring Protocols for Ohio Compensatory Mitigation Wetlands

Trainer: **Mick Micacchion** is a Professional Wetland Scientist and works as a restoration ecologist with The Nature Conservancy for the Ohio In-Lieu-Fee Compensatory Mitigation Program. He has a BS and MS in Wildlife Management, both from Ohio State University. Mick retired in 2011 from the Ohio Environmental Protection Agency (Ohio EPA) with 32 years of state service including 10 years with the Ohio Department of Natural Resources. While working for 20 years at Ohio EPA he was instrumental in the development of Ohio's Wetland Water Quality Standards rules, wetland assessment tools, including the Ohio Rapid Assessment Method for Wetlands (ORAM), Vegetation Index of Biotic Integrity (VIBI), Amphibian Index of Biotic Integrity (AmphIBI), "Standardized Monitoring Protocols and Performance Standards for Ohio Mitigation Wetlands" and their integration into Ohio's wetland program, which has worked as a model for the country.

Mick also works for the non-profit Midwest Biodiversity Institute (MBI) where he has served as a wetland ecologist for the past seven years. Currently he instructs courses in Wetland Botany, Wetland Delineation, Ohio Amphibians, Ohio Wetland Assessment Methods, including ORAM, VIBI/VIBI-FQ, and AmphIBI, as well as several other courses at MBI. He has monitored the physical, chemical and biological features, including the soils, hydrology, chemistry, plant, amphibian and macroinvertebrate communities of hundreds of Ohio's natural wetlands and trained hundreds of wetland professionals in the development and use of wetland monitoring and assessment methods, including ORAM, VIBI and AmphIBI. He has also monitored, assessed, and reported on the condition of hundreds of Ohio compensatory wetland mitigation projects and spent more than a decade on Ohio's Interagency Review Team, where he was a major contributor to the "Guidelines on Wetland Mitigation Banking in Ohio." Mick was a member of the Technical Advisory Group, which developed the methods used in the National Wetland Condition Assessment (NWCA), and lead crews and managed others for both the 2011 and 2016 NWCAs sampling wetlands in Ohio, Michigan, Wisconsin, Minnesota, Kentucky, Tennessee, and 10 other states. He is the Vice President of the Ohio Wetlands Association and was a founder and has been active with the Ohio Vernal Pool Network since 2004.

Module Objectives:

- Objective #1 – Understand how a condition-based approach to assessing functional replacement can be developed and used.
- Objective #2 – Learn how to utilize multi-metric biological indices and hydrological and biogeochemical indicators to measure condition.
- Objective #3 – Understand how a rapid assessment methodology can be used to measure functional capacity.

Test Questions

1. Which of the categories below are required for Ohio wetland mitigation bank performance standards? (select all that apply)

A. Wetland area.
B. Water quality.
C. Ecological condition.
D. Relative cover of native perennial hydrophytes.
E. Relative cover of invasive plant species.
Answer: A, C, D and E

2. How do you ensure adequate replacement of functions occur? (select all the apply)

A. Ensure that the site is protected by a long-term easement agreement.
B. Ensure replacement is based on the appropriate mitigation ratios.
C. Ensure replacement includes the same wetland type.
D. Ensure performance standards meet equal or higher levels of ecological condition.
E. Ensure monitoring is conducted using quantitative condition-based wetland assessment tools.
Answer: B, C, D and E

3. In Ohio, in order to provide forested habitat with an adequate diversity of species, the following planting guidelines must be followed: (select all that apply)

A. A minimum of 200 native, free standing live and healthy (disease and pest free) trees per acre.
B. A minimum of 200 native, free standing live and healthy (disease and pest free) shrubs/sub-canopy tree species per acre.
C. A minimum of 8 native tree species are planted within the forested areas, and each of these 8 species represents at least 5% of the overall tree count.
D. A minimum of 8 native shrub/sub-canopy species are planted within the forested areas, and each of these 8 species represents at least 5% of the overall shrub/subcanopy tree count.
E. A minimum of 25% of all live trees planted consist of at least 4 species having coefficient of conservatism values from 5 to 10.
Answer: All of the above

4. Which of the following are included in Ohio's rehabilitation performance standards? (select all that apply)

A. Must meet VIBI scores equivalent to or higher than the threshold for wetland habitat.
B. Must increase VIBI score 10 points from baseline score.
C. Less than 5% relative cover of invasive species.
D. Greater than 75% relative cover of native perennial hydrophytes.
E. Less than 10% turbidity due to erosion.
Answer: A, B, C and D

5. What are some beneficial outcomes of quantitative wetland performance standards? (select all that apply)

A. Based on conditions specific to Ohio's wetlands.
B. Expectations are clear and measurable from the beginning.
C. No debate as to whether or not a performance standard has been met.
D. Puts appropriate weight on the permittee or sponsor to develop high quality wetlands to compensate for losses.
E. High performing mitigation projects can receive advanced credit releases in Ohio if they outperform or meet required standards sooner than the 10-year standard time frame.
Answer: All of the above

Module #16: Ecological Considerations in Wetland Mitigation Planning and Monitoring

Trainer: **Anthony Zemba** is a certified ecologist, certified soil scientist, and certified hazardous materials manager. He has over 30 years of experience in natural resource management that includes aquatic toxicology, analytical chemistry, wetland assessment and delineation, ecological risk assessment, habitat assessments, conservation biology and ecological restoration. Mr. Zemba also serves as an adjunct professor at the University of New Haven Graduate Program in Environmental Science where he teaches a course in Environmental Impact Reports and Assessment. His love of nature blurs the line between work and play and on any given day, he may be found half-submerged in a swamp, scampering over boulder talus, or striding through forest and field alike with binoculars, insect net, hand lens, camera, or all of the above in tow searching for the next subject of study.

Module Objectives:

- Objective #1 – Understand what some of the key issues and challenges are for wetland mitigation depending on your approach.
- Objective #2 – Understand the ecological considerations that are key for mitigation monitoring and selection of performance metrics.
- Objective #3 – Learn about factors that influence wetland plant communities.

Test Questions

1. What are some key issues and challenges for compensatory mitigation when using wetland creation? (select all that apply)

A. Starting from scratch ecologically.
B. High risk of failure/poor performance.
C. Selection of suitable sites.
D. Long-term liability.
E. Costs/financial assurances.
Answer: All of the above

2. What are some key issues and challenges for compensatory mitigation when using wetland enhancement? (select all that apply)

A. Need to manipulate physical, chemical, or biological characteristics.
B. Can be challenging to heighten, intensify, or improve a specific aquatic resource function.
C. Credits are not available for enhancement so need to secure outside funding sources.
D. May gain a selected aquatic resource function but may also lead to a decline in another function(s) / value(s).
E. Need to restore natural processes.
Answer: A, B and D

3. Which of the below may be mitigation planning and monitoring pitfalls? (select all that apply)

A. Planting mortality.
B. Changing hydrologic conditions.
C. Inappropriate design for site conditions.
D. Incorrect depth, duration, timing for sustaining hydrology.
E. Sedimentation & erosion control.
Answer: All of the above

4. Which of the following are ecological considerations for mitigation monitoring and selection of performance standards? (select all that apply)

A. Role/importance of special habitat attributes.
B. Role of abiotic v. biotic factors.
C. Use of non-native vs. native genotypes.
D. Role of wetland methane release during construction.
E. Role of symbiosis in community development.
Answer: A, B, C and E

5. Which of the below were listed as empirical factors that influence wetland plant communities? (select all that apply)

A. Hydrology.
B. Seasonality.
C. Soil texture.
D. Salinity.
E. Distribution.
Answer: A, C and D

Module #17: Wetland Mitigation Concept to Final Design – Where Dreams and Reality Collide

Trainer: **Matt Gause** is the Ecological Resources & Land Stewardship Director at Westervelt Ecological Services and oversees Westervelt's land stewardship and ecological resources on over 8,000 acres of restored wetlands and endangered species habitat on 18,000 acres of preserved properties in California, the Rocky Mountain region and southeastern United States. Mr Gause has over 25 years of experience with wetland restoration including the restoration of vernal pools, riparian forest, tidal marsh, and floodplain wetlands. He has also managed conserved lands for more than 15 threatened or endangered species on preserves throughout California.

In addition, Mr. Gause provides site suitability analyses during the land acquisition process, including restoration suitability, threatened and endangered species, easement restriction analysis, and future land management cost estimation. Mr. Gause also develops and implements both baseline and long-term land management and monitoring strategies for mitigation and conservation landscapes. Mr. Gause is a Certified Ecological Restoration Practitioner (CERP) and received a Bachelor of Science in Botany from the University of California at Davis.

Module Objectives:

- Objective #1 – Learn general best practices for evaluating conceptual designs.
- Objective #2 – Understand how designs become more refined as new information comes to light.
- Objective #3 – Learn how to best remain engaged in the design process while working towards a final, implementable design.

Test Questions

1. What are some basic elements for a basis of wetland design? (select all that apply)

A. Biotic and abiotic baseline data.
B. Wetland functional goals and references.
C. Anticipated outcomes.
D. External influences.
E. Cost-benefit analysis.
Answer: All of the above

2. What are some common sources of biotic and abiotic uncertainty in floodplain restoration? (select all that apply)

A. Hydrologic and hydraulic data.
B. Manning's n.
C. Topographic data.
D. Soils and geologic data.
E. Ambient air quality data.

Answer: A, C and D

3. What are some common sources of new or refined biotic and abiotic data? (select all that apply)

A. Site specific hydrologic or hydraulic data, observations or models.
B. Site specific seed bank data.
C. On the ground topographic data.
D. Site specific soil data.
E. More complete understanding of adjacent land uses/effects.
Answer: A, C, D and E

4. What are some external elements that can impact/influence your design? (select all that apply)

A. Utilities.
B. Mineral rights.
C. Local agencies and "experts".
D. Permitting issues.
E. Water rights.
Answer: All of the above.

5. Which of the following are typically included in a final conceptual design? (select all that apply)

A. Identification of access and ESA areas.
B. Identification of cut and fill locations.
C. Finalized cross sections.
D. Watershed analysis.
E. Specifications and technical elements.
Answer: A, B, C and E

Module #18: Three Phases of Design in Compensatory Mitigation Projects

Trainer: **Lawrence J. "Larry" Urban i**s the wetland mitigation specialist for the Montana Department of Transportation with state-wide responsibilities based out of Helena, Montana. He has over 30 years of experience in wetland delineations, functional assessments, monitoring and mitigation site development for both the New Jersey and Montana Department of Transportations. He has been involved in the development of a comprehensive aquatic resource mitigation program to meet wetland and stream mitigation needs for transportation projects throughout the state of Montana that has created over 55 mitigation areas ranging in size from ½ to 300 acres in size. He developed MDT's annual mitigation monitoring programs for the purposes of managing MDT aquatic resource mitigation sites on private, state and tribal lands to comply with federal, state and tribal permitting requirements.

He has presented at National and Regional wetland mitigation conferences, and participates in annual continuing education, undergraduate and graduate courses as an instructor in wetland regulations, endangered plant species, functional assessments, mitigation monitoring, and aquatic resource restoration here in the state of Montana. He was the recipient of the 2017 Montana Wetland Stewardship Award for his untiring efforts to protect, preserve and restore Montana's wetland ecosystems. In his spare time, he is a fly-fishing guru working part-time at CrossCurrents Fly shop in Helena, Montana for his addiction to fly-fishing and fly-tying. He is also an avid birder that loves his day job at MDT as it affords him opportunities to see all kinds of birds and travel across the vast expanses of Montana.

Module Objectives:

- Objective #1 – Learn about the three phases of design.
- Objective #2 – Understand how designs become more refined as new information comes to light.
- Objective #3 – Learn how to best remain engaged in the design process while working towards a final, implementable design.

Test Questions

1. Which of the following are true about conceptual designs? (select all that apply)

A. They include an invasive species management plan.
B. They provide a decision point for a "preferred", "hybrid", or "no build" concept design.
C. They include potential credits yields for the various types of mitigation.
D. They include initial ideas and concepts toward development of a mitigation plan.
E. They provide an opportunity for early interagency review.
Answer: B, C, D and E

2. What parameters are needed for conceptual design? (select all that apply)
A. Geomorphic/topographic position of site.
B. Migratory bird data.
C. Type of mitigation to be undertaken.
D. Sources of water and seasonality.
E. Estimated costs of project.
Answer: A, C, D and E

3. What should be included in a preliminary design? (select all that apply)
A. Topographic information.
B. Hydraulic design analysis.
C. Location of any water control structures or berms.
D. Estimated construction costs.
E. Initial seeding/planting plans.
Answer: All of the above

4. What should be included in a final design? (select all that apply)
A. Project plan details.
B. Cross-sections.
C. Earthwork and material quantities.
D. Anticipated number and type of credits (final crediting plan).
E. Indicators of biological integrity.
Answer: A, B, C and D

5. Which of the following statements is false? (select all that apply)

A. Final designs should be ready to build.
B. Conceptual designs should be reviewed by the interagency review team (IRT) early in the process.
C. Separate design plans must be created for each type of mitigation proposed on a site.
D. Site visits by the IRT are important.
E. Sometimes a hybrid conceptual design is created from components of the original conceptual designs.
Answer: C

Module #19: Mitigation Work Plans: A Regulator's Perspective

Trainer: **Jeanne C. Richardson** is the Mitigation Subject Matter Expert for the U.S. Army Corps of Engineers, Norfolk District Regulatory Branch. She has worked for the Corps of Engineers for over 15 years. Jeanne oversees the District's compensatory mitigation program where she develops and implements District level policy, standard operating procedures, templates, and technical guidance related to compensatory mitigation. Jeanne organizes training and provides assistance for District staff, 3rd party mitigation providers, and others specific to those policies, procedures, templates, and guidance. Jeanne manages the Virginia Aquatic Resources Trust Fund (VARTF) for the District. VARTF currently has currently has approximately 109 approved and pending projects. Jeanne provides the primary oversight of the District's Interagency Review Team.

Module Objectives:

- Objective #1 – Understand what information is necessary.
- Objective #2 – Understand when the information is necessary.
- Objective #3 – Understand the level of detail required at each submittal milestone for review and approval.

Test Questions

1. A Mitigation Work Plan should include (but is not limited to) which of the following? (select all that apply)

A. Construction methods.
B. Sources of water.
C. Financial assurances.
D. Methods for establishing the desired plant community.
E. Erosion control.
Answer: A, B, D and E

2. Which of the following is not identified as a mitigation plan requirement in the 2008 Mitigation Rule but should be considered early? (select all that apply)

A. Property interests.
B. FEMA floodplain requirements.
C. Threatened and endangered species.
D. Historic/cultural resources.
E. Demographic data for adjacent properties.
Answer: A, B, C and D

3. Which of the following (among others) should be included in a conceptual mitigation work plan? (select all that apply)

A. Description of existing baseline conditions.

B. Site descriptions.
C. Objectives for the site and how the plan will meet those objectives.
D. Water budget information.
E. Reference data.
Answer: All of the above

4. Which of the following (among others) should be included in a final mitigation work plan? (select all that apply)
A. Erosion and sediment control plans.
B. Grading plans.
C. Credit analysis.
D. Letters of support.
E. Anticipated project constraints.
Answer: A, B, C and E

5. As-Built Plans should include which of the following? (select all that apply)

A. Boundaries and topography.
B. 3D modeling of proposed mitigation.
C. Photographs.
D. Planting composition, density and locations.
E. Any proposed revisions in credit totals with an explanation for any changes made.
Answer: A, C, D and E

Module #20: Soil Compaction and Acid-S Conditions

Trainer: **W. Lee Daniels** is the Thomas B. Hutcheson Professor of Environmental Soil Science at Virginia Tech in Blacksburg, Virginia. He received his Ph.D. in Soil Science from VPI & SU in 1985. Dr. Daniels areas of specialization include stabilization and restoration of disturbed lands including areas disturbed by mining, road building, waste disposal, urbanization and erosion. In particular, he has focused his research and consulting experience in wetland impact mitigation, mine reclamation, and soil-waste management systems. His teaching programs at Virginia Tech focus on soil geomorphology and landscape analysis with particular emphasis on the relationships among surficial geology, hydrology, soil patterns and long term landscape evolution processes. Major awards include the Reclamation Researcher of the Year by the American Society for Surface Mining and Reclamation (ASMR) in 1993, USEPA's National Biosolids Utilization Research Award in 2000 and the Lifetime Achievement in Research Award by ASMR in 2012.

Module Objectives:

- Objective #1 – Understand the causes of soil compaction and how it impacts wetland hydrology.
- Objective #2 – Understand how acid-sulfate impacts wetland hydrology.
- Objective #3 – Learn how to mitigate high bulk density.

Test Questions

1. What are some of the reasons why created wetland soils are compacted? (select all that apply)

A. To limit losses to local groundwater seepage and/or perch the saturated zone.
B. To limit spread of invasive species.
C. Routine construction and grading operations.
D. Soil materials are moved and placed in a moist to wet condition.
E. Lack of fencing in sensitive areas.
Answer: A, C and D

2. Which of the following statements is true? (select all that apply)

A. We are routinely at or above theoretical root limiting bulk density at many created/mitigation sites.
B. Poorly drained soils can support upland vegetation and not show any redox features.
C. A "traffic pan" can lead to very wet winter conditions yet very dry extended summer droughts.
D. Active growing root tips can and do move soil particles out of the way.
E. Macropore development associated with soil structure does not impact bulk density.
Answer: A, B and C

3. What mitigates high bulk density? (select all that apply)

A. Air temperature.
B. Appropriate moisture content.
C. Tillage/ripping.
D. Macropore development.
E. Planting high density cover crops.
Answer: B, C, and D

4. Which of the following statements are true about acid sulfate soils? (select all that apply)

A. With few exceptions, any soil pH <3.8 is indicative of acid sulfate soils and needs attention.
B. They are formed from the weathering of sulfide-bearing parent materials, which results in extremely low pH and precipitation of sulfate salts.
C. Active acid sulfate soils are commonly pH 2.0 to 3.5 and very high in sulfates salts and soluble metals.
D. Post-active acid sulfate soils will slowly decrease in pH.
E. Minimal applications of lime will generate significant acidity.
Answer: A, B, and C

5. Which of the following are false? (select all that apply)

A. Adding compost or other organic amendments does not work well will lime amendment.
B. All "risky materials" should be analyzed for total sulfate.
C. Near-surface brown to red materials (e.g. weathered soils) are usually much lower risk since the sulfate probably oxidized long ago.
D. Liming rates commonly range from 50 tons per acre 6" deep to 100+ and the lime needs to be mixed and incorporated.
E. Agricultural lime additions can eliminate pyrite oxidation.
Answer: B, C, and D

Module #21: Anticipating the Unexpected in the Context of Dam Removal

Trainer: **Shawn Chartrand** completed his PhD at the University of British Columbia, and he is presently a postdoctoral research fellow at Vanderbilt University. Shawn is interested in how mountain streams form and evolve due to changes in local to watershed scale conditions. He uses laboratory experiments, develops theory, numerical models as well as field-based programs to pursue his interests, and develop strategies to assist practitioners working on applied problems. He has worked professionally for Balance Hydrologics since 2000, during which time he built and continues to lead a river and wetland restoration program. His notable applied experience includes 8 years of work on the San Clemente Dam Removal project, Carmel River, CA, and 15 years of work using climate change projections to plan water supply and instream flows for salmonids with the City of Santa Cruz and other regional Cities.

Module Objectives:

- Objective #1 – Understand ways in which the design process can reduce risk.
- Objective #2 – Learn about some proactive strategies to use for adaptive management.
- Objective #3 – Understand the differences between routine maintenance, adaptive management and remediation.

Test Questions

1. What are the critical components of a transparent design process? (select all that apply)

A. Context (goals and objectives).
B. Feasibility (field-based site characterization).
C. Alternatives (concept alternatives).
D. Analysis (design alternatives).
E. Refinement (design package).
Answer: All of the above.

2. Which of the following statements is true? (select all that apply)

A. Routine maintenance is anticipated and planned post-construction work.
B. Routine maintenance is anticipated but not planned post-construction work.
C. Routine maintenance is not anticipated and not planned post-construction work.
D. Routine maintenance is not anticipated but planned for anyway.
E. Routine maintenance should not be part of a mitigation plan.
Answer: A

3. Which of the following statements about adaptive management are true? (select all that apply)

A. Actions are the result of adjusting the constructed site condition to adapt to on the ground changes that diverge from expectation.
B. Actions are not typically covered by an Operations and Maintenance Manual (OMM) developed within the design and permitting phase.
C. On the ground adaptive management actions are often radically different from expectation.
D. Adaptive management is an iterative exercise that typically occurs within a planned management cycle to allow for necessary adjustments in order to reach project goals.
E. Adaptive management is only necessary post-construction.
Answer: A, B, C and D

4. Which of the following circumstances could result in the need for remediation? (select all that apply)

A. The design is not approved by the regulator.
B. Inadequate planning.
C. Inadequate construction.
D. Natural disaster.
E. Lack of land available for mitigation.
Answer: B, C, and D

5. Which of the following statements about remediation are false? (select all that apply)

A. Remediation does not always mean new direct actions - unanticipated change can offer a path to achieve project goals and objectives.
B. Remediation only occurs when contaminants are found on the site.
C. Remediation actions [or inaction] are the result of evolving site conditions that were not anticipated or expected by the design documentation or the regulatory permits.
D. Remediation must result in the mitigation site meeting all proposed original design criteria.
E. Remediation only occurs if the site is a total failure.
Answer: B, D and E

Module #22: Adaptive Management: A Regulator's Perspective

Trainer: **Krystel Bell** recently became Regulatory Program Manager for the U.S. Army Corps of Engineers in Washington, D.C. Prior to this, she served as Mitigation Banking Specialist for the Sacramento District of the U.S. Army Corps of Engineers where she chaired the Interagency Review Team for multiple mitigation banks and in-lieu fee programs and worked on several of the District's most complex regulatory actions. Prior to working for the Sacramento District, Ms. Bell worked as an environmental consultant and acted as a local representative for a County- level environmental program. Ms. Bell has extensive knowledge of how Regulatory decisions can affect developers, conservationists, and the general public. Her ability to communicate effectively with applicants, the public, federal, state and local agencies, and peers in the regulatory community has led to productive collaborative approaches in resolution of complex regulatory issues.

Module Objectives:

- Objective #1 – Learn about the Corps' regulatory context for adaptive management.
- Objective #2 – Understand some project planning considerations.
- Objective #3 – Understand some post-project implementation considerations.

Test Questions

1. Which are the following statements is included in the Corps' definition of adaptive management? (select all that apply)

A. Adaptive management means the development of a management strategy that anticipates the likely challenges associated with compensatory mitigation projects.
B. Adaptive management provides for the implementation of actions to address anticipated challenges as well as unforeseen changes.
C. Adaptive management requires consideration of risk, uncertainly, and dynamic nature of compensatory mitigation projects.
D. Adaptive management includes the selection of appropriate measures that will ensure that the aquatic resource functions are provided.
E. Adaptive management guides modification of compensatory mitigation projects to optimize performance.
Answer: All of the above

2. Which of the following statements is true? (select all that apply)

A. Adaptive management plans need to account for the universe of all potential circumstances or potential management actions needed.
B. Performance standards should never be revised in order to address deficiencies in the project.
C. Monitoring requirements may be revised to account for measures taken to address project deficiencies.

D. The permittee or sponsor must notify the Corps about any changes in management strategies.
E. Performance standards may be revised to reflect changes in management strategies and objectives only if the new standards provide for ecological benefits that are comparable or superior to the approved project.
Answer: C, D and E

3. Which of the following are project planning considerations? (select all that apply)

A. Avoid overly restrictive design and management requirements to allow sites to change as environmental conditions change at various scales.
B. Anticipate potential for modifications to site design based upon conditions during earth disturbance.
C. The plan should consider conditions/stressors present in the watershed.
D. Financial assurances may be needed and/or required.
E. The plan should account for climate variability.
Answer: All of the above

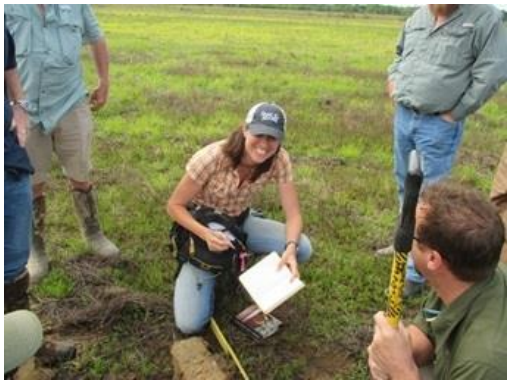
4. Post-project implementation considerations include:

A. If monitoring results indicate the project is not/will not meet its approved ecological performance standards, the project sponsor/permittee should propose the actions that require notification to the Corps.
B. If there are no adaptive management measures available, it may be appropriate to consider modifying the ecological performance standards.
C. In the case of natural disasters, the rule does not allow revisions to performance standards.
D. As a last resort, alternative compensatory mitigation may be required to offset a shortfall in aquatic resource functions.
E. Alternative compensatory mitigation should be included by default in every adaptive management plan.
Answer: A, B and D

5. Which of the following statements is true? (select all that apply)

A. Remedial actions are synonymous with adaptive management.
B. Remedial actions are performed on a project to best meet the approved goals and objectives.
C. Remedial actions are used to address changes to a plan to reflect changing site conditions.
D. Remedial action could include additional construction activities to alter the hydrologic regime.
E. Adaptive management addresses changes to a plan based upon changing site conditions.
Answer: B, D and E

Module #23: Mitigation Oversight and Compliance: USACE Regulatory Perspective



Trainer: **Kristi Hall,** Professional Wetland Scientist, is currently the USACE Regulatory Headquarters Science Detailee. When not on detail assignment, she is a Senior Environmental Scientist with the Vicksburg District Regulatory Branch, Evaluation Section. At the District, Kristi primarily focuses on mitigation banking and standard permitting. Kristi has worked in the Regulatory field since 2003 and has been with the Vicksburg District since 2015. She obtained her bachelor's degree in biochemistry from Virginia Tech and her master's degree in fisheries and wildlife biology from Colorado State University. Kristi has worked in both the public and private sectors with the Mississippi Department of Transportation, USACE ERDC Environmental Lab, as well as several private consulting firms prior to working with USACE Regulatory. Kristi served as Acting Technical Services Branch Chief in the Nashville District in 2017 and was named the 2018 Vicksburg District Regulator of the Year. In her "free time" she can be found shuttling her two kids to their numerous athletic endeavors, and working with her husband to build their own home in Vicksburg.

Module Objectives:

- Objective #1 – Learn the basics of oversight and compliance.
- Objective #2 – Understand the Corps' process for oversight and compliance.
- Objective #3 – Learn about some ways in which oversight and compliance issues may be resolved.

Test Questions

1. Which of the following are areas that regulators need to track for oversight for mitigation banks? (select all that apply)

A. Construction.
B. Credit releases.
C. Adaptive management.
D. Modifications to instrument.
E. Bank or In-Lieu Fee Program site closure.
Answer: All of the above

2. Which of the following elements of mitigation projects are subject to compliance? (select all that apply)

A. Funding long-term management of the project (endowment).
B. Furnishing short-term financial assurances.
C. Submittal of timely and complete monitoring reports.
D. Maintaining/managing the mitigation project in accordance with the management plan.
E. Evaluating whether the project is in conformance with its permit and/or instrument
Answer: All of the above

3. What is the Corps' process for oversight and compliance?

A. Identify the issue, perform a site visit, notify the Office of the Chief, provide 30-days to rectify issues or lose credits.
B. Identify the issue, the project manager reaches out to the mitigation provider, discuss solutions, request and receive a modified "get right" plan, receive approval for new plan, and execute the plan.
C. Identify the issue, the project manager reaches out to the permittee, the Corps' issues a cease and desist order, project is terminated, and credits rescinded.
D. Identify the issue, perform a site visit, record all deficiencies, report to headquarters.
E. Identify the issue, alert the IRT, create a remediation plan for the sponsor, adjust financial assurances.
Answer: B

4. What are some enforcement options for non-performing sites? (select all that apply)

A. Issue a cease and desist order and turn over to the Corps' enforcement attorneys.
B. Adjust/remove the appropriate amount of total credit generating areas.
C. Look for other alternative compensation to meet the obligations in a permit or instrument.
D. Remediate the site.
E. Terminate the instrument and/or suspend the mitigation bank.
Answer: B, C, D and E

5. Which of the following best practices were shared for regulators performing oversight and compliance? (select all that apply)
A. Don't panic.
B. Communicate.
C. Keep it simple.
D. Command and control.
E. Document your decisions.
Answer: A, B, C and E

Module #24: An Ecological Framework for Reviewing Compensatory Mitigation: Oversight and Compliance

Trainer: **Sarah Woodford** is the Compensatory Mitigation Specialist for the Virginia Department of Environmental Quality. She is the state chair of the Interagency Review Team for all non-tidal wetland and stream mitigation banks and in-lieu fee programs in the U.S. Army Corps of Engineers Norfolk District, and ensures that mitigation sponsors adhere to State Water Control Law and Virginia Water Protection Permit Program regulations. Sarah works closely with the Corps and the Virginia Marine Resources Commission IRT chairs, along with other member agencies of the IRT, to reach consensus on complex issues in compensatory mitigation. She also assists permit managers, mitigation sponsors, consultants, and the regulated public in understanding the mitigation process. Prior to DEQ, Sarah worked as an environmental consultant, where she focused on water quality monitoring and stream mitigation assessment, restoration design, and post-construction performance monitoring.

Module Objectives:

- Objective #1 – Learn about Virginia's oversight and compliance program.
- Objective #2 – Learn about some oversight and compliance tools at the state of Virginia level.
- Objective #3 – Learn how Virginia works with sponsors, permittees and other agencies to provide oversight and compliance.

Test Questions

1. Which of the following statements are true? (select all that apply)

A. Virginia does not have any independent regulatory authority for stand-alone wetlands or streams.
B. Virginia's state laws and regulations include the Virginia Water Protection Permit Program and the Virginia Tidal Wetland Banking Guidelines.
C. Virginia's laws and regulations provide the bulk of mitigation requirements are very complimentary to the Army Corps and EPA Final Mitigation Rule.
D. Virginia's laws and regulations are very unique to the Army Corps and EPA Final Mitigation Rule.
E. Virginia has only been regulating impacts to stand-alone wetlands and streams since they developed the 2018 Mitigation Banking Instrument template.
Answer: B and C

2. The most decisive tool is an approved and signed _____. (Fill in the blank)

A. Mitigation Banking Instrument.
B. Site protection agreement.
C. Financial assurance.
D. Long-term management plan.

E. As-built report.
Answer: A

3. If the Virginia IRT determines that the Sponsor is in noncompliance with any provision of the Mitigation Banking Instrument or the mitigation site is otherwise not meeting Performance Standards, the IRT Chairs may do what? (select all that apply)

A. Suspend credit sales.
B. Initiate adaptive management.
C. Decrease available credits.
D. Utilize financial assurances.
E. Terminate the instrument.
Answer: All of the above.

4. The Virginia DEQ uses spreadsheets to track which of the activities below? (select all that apply)

A. Financial assurances.
B. Credit releases.
C. Monitoring and maintenance reports.
D. Mitigation type.
E. Long-term management activities.
Answer: A, B, C and D

5. Which of the following are other tools that Virginia DEQ uses to track/ensure compliance? (select all that apply)

A. Internal audits with credit sales statements in RIBITS.
B. Hidden wildlife video cameras.
C. IRT meetings to discuss time sensitive compliance issues.
D. Third party agencies.
E. Site visits.
Answer: A, C and E

Module #25: Challenges and Potential Solutions for Mitigation Compliance: Project Sponsor and Consultant Perspective

Trainer: **Ashley Zavagno** is a Restoration Ecologist and Project Manager at WRA, Inc., a private environmental consulting firm based in the San Francisco Bay Area. She received her Bachelor of Science in Ecology and Evolution from U.C. Santa Barbara and her Master of Environmental Science and Management with a specialization in conservation planning from the Bren School of Environmental Science & Management. She is also a Certified Ecological Restoration Practitioner through the Society of Ecological Restoration and a Certified Ecologist through the Ecological Society of America. For the past several years, she has been overseeing the entitlement, permitting, implementation, monitoring, and long-term management of various mitigation banks and large-scale permittee-responsible mitigation projects throughout California. She has worked in various western landscapes including tidal wetlands, vernal pools, chaparral, coniferous forests, and oak woodlands, but her passion is rivers and salmonids.

Module Objectives:

- Objective #1 – Learn about ways to improve coordination and communication between project sponsors and regulators.
- Objective #2 – Learn about some of the challenges that project sponsor teams face and potential solutions.
- Objective #3 – Learn about some ways to improve performance standards, adaptive management plans and outcomes.

Test Questions

1. Which of the following are some solutions for improving collaboration between project sponsors and regulators? (select all that apply)

A. Frequent working group meetings.
B. Team building exercises.
C. Increase engagement with project sponsors, consultants and regulatory experts on relevant topics.
D. Sponsors should initiate discussions with regulators about any changes before resubmitting a document.
E. Request regularly scheduled weekly check-in meetings.
Answer: A, C and D

2. When deciding between focusing on either form or function, what are some suggestions to consider? (select all that apply)

A. Replicating a natural looking wetland is critical for performance success.
B. Consider the long-term development of the site – the trajectory.
C. Utilize a process-based restoration approach that allows for dynamism.

D. Some approaches (e.g., defined water outlet point for depressional wetlands) may be necessary to increase likelihood of performance.
E. Functions can be modified to fit the form.
Answer: B, C and D

3. What are some suggestions for handling conflicting objectives (e.g., restoration vs stormwater)? (select all that apply)

A. Always default to local ordinances.
B. Better coordination and communication among various agencies.
C. Elevate the conflict to the District Commander.
D. Increased consideration of regional ecology and historical conditions.
E. Distribute a community survey to find which objective is more important to the local community.
Answer: B and D

4. What are some ways to improve performance standards? (select all that apply)

A. Use reference sites to capture climatic variation.
B. Set interim performance targets to avoid issues with slow growing resources.
C. Focus performance standards on completion of actions.
D. Coordinate performance standard selection and timing of monitoring across agencies.
E. Be explicit in how monitoring is to be performed and how to interpret data.
Answer: A, B, D and E

5. What are some best practices for developing an effective adaptive management plan? (select all that apply)

A. Don't be overly prescriptive.
B. Build in allowances for some changes over time.
C. Develop a 25-year plan for dealing with any unexpected setbacks.
D. Monitor the site for the first year and base the adaptive management plan on those findings.
E. Establish thresholds where adaptive management actions should be considered.
Answer: A, B and E

Module #26: Understanding and Addressing Real Property Interests for Successful Site Protection & Financial Assurances

Trainer: **Paul Loftus** is the District Counsel for the U.S. Army Corps of Engineers, Huntington District. Mr. Loftus serves as the Chief Legal advisor for the District with responsibility for all legal activities and functions of the District. Prior to joining the Corps of Engineers in 2016, Mr. Loftus was a litigation partner at Huddleston Bolen LLP and Dinsmore & Shohl LLP in Huntington, WV. In private practice Mr. Loftus represented transportation companies in litigation and was active in industry groups, including the Inland River Ports and Terminals Association, the American Short Line & Regional Railroad Association, and the National Association of Railroad Trial Counsel.

Mr. Loftus is a graduate of the University of Dallas (BA), The University of Maryland College Park, (MA), and the West Virginia University College of Law (JD). He is licensed to practice law in Kentucky, Maryland, and West Virginia and is admitted before various state and federal courts.

Module Objectives:

- Objective #1 – Learn about some of the legal site protections that may exist on your mitigation site.
- Objective #2 – Understand some of the differences between the available legal instruments for property interest holders.
- Objective #3 – Learn about some approaches available to address interests in property.

Test Questions

1. Site protection may be provided through which of the following? (select all that apply)

A. Federal legislation.
B. Bill of sale.
C. Conservation land use agreements.
D. Title transfer.
E. Conservation easements.
Answer: A, C, D and E

2. The difference between a conservation easement and a deed restriction is: (select all that apply)

A. Conservation easements do not permanently limit uses of the land whereas deed restrictions do.
B. Deed restrictions are binding agreements between the landowner and another entity whereas conservation easements are agreements made by the landowner only.
C. Deed restrictions are binding agreements by the landowner only whereas conservation easements are agreements made between the landowner and another entity.
D. Conservation easements can only be made on public lands whereas deed restrictions can only be made on private lands.

E. There is no substantive difference.
Answer: C

3. Which are following statements are true about conservation easements? (select all that apply)

A. No requirement for a third-party holder.
B. Easement remains even though property owner changes.
C. Allows owner to retain many rights.
D. It is the best tool for protecting mitigation projects on federal land.
E. Holder may assume responsibility for managing resources.
Answer: B, C and E

4. Which of the following are forms of interest in land? (select all that apply)
A. Ownership.
B. Easements.
C. Rights-of-way.
D. Lien holders.
E. Leases.
Answer: All of the above.

5. What are some potential approaches to handle other interests? (select all that apply)

A. Subordination.
B. Remoteness determination.
C. No surface occupancy agreement.
D. Alternate mitigation.
E. No long-term monitoring agreement.
Answer: A, B, C and D

Module #27: How Water Rights Drive Aquatic Resource Mitigation in the West

Trainer: **Kara Hellige** is the Senior Project Manager for the US Army Corps of Engineers, Durango Colorado Regulatory Office for the Sacramento District. She covers regulatory actions under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Kara has been working for the Corps of Engineers within Regulatory since 1999 and has been in the Durango Office since 2003. She is currently the lead on several interagency review teams for mitigation banks and an in-lieu fee program, along with the review lead for countless permittee-responsible mitigation and voluntary restoration/creation projects.

Module Objectives:

- Objective #1 – Understand the basics about water rights in the arid West.
- Objective #2 – Learn about how water rights may affect a compensatory mitigation project.
- Objective #3 – Learn some important questions to ask prior to mitigation site selection and design.

<u>Test Questions</u>

1. Which of the following statements are correct in regard to the concept of "prior appropriation"? (select all that apply)

A. The prior user is entitled to divert the full amount of water to meet his or her entire water right before the next junior user may legally divert any water.
B. If you do not use your water allocation, you lose it.
C. The first user to divert and put water to beneficial use has a prior right.
D. Water right may not be appropriated unless the water is put to a beneficial use.
E. Senior water rights are established by the user's location in the watershed.
Answer: A, B, C and D

2. Which of the following are types of water rights? (select all that apply)

A. Precipitation.
B. Direct flow.
C. Storage.
D. Over bank flooding.
E. In-stream flow.
Answer: B, C and E

3. These are the types of questions an entity should consider in states that operate under a prior appropriation doctrine: (select all that apply)

A. Is all the water historically used for the property necessary for the mitigation?
B. What type of water is required (surface or groundwater)?
C. What was the historic use?

D. Does the project proponent have a water right for the quantity of water needed to sustain and protect the mitigation work?
E. Is the watershed/river over appropriated?
Answer: All of the above

4. What are some reasons to obtain a water right for a compensatory mitigation project?

A. To ensure that the project complies with state water law and that the mitigation project won't injure senior rights.
B. To ensure that the site is protected from future water depletions and that a call on water from a senior user won't cause injury to the mitigation project.
C. To ensure that the site is compliant with the 2008 Mitigation Rule.
D. To ensure that the site is compliant with Clean Water Act Section 404 regulations.
E. To ensure that the Army Corps can exercise its authority over senior water right holders.
Answer: A, B and C

5. What ways can you determine if a project proponent has the water right for the quantity of water needed to sustain a mitigation site? (select all that apply)

A. Determine the water rights involved through interviewing landowners, water commissioner, and neighboring water users.
B. Determine the water rights involved by reviewing the water decree and the State's database to ensure that there are no restrictions.
C. Determine that the water right has not been abandoned.
D. Determine the ownership of the water right.
E. Determine the actual historical use.
Answer: B, C, D and E

Module #28: Factors Affecting Cost and Feasibility of Mitigation Projects

Trainer: **Robin Bedenbaugh** is a wetland restoration ecologist and senior project manager with RES. He holds a BS and MS in Biology from Old Dominion University. He has worked as an environmental scientist in Virginia for over 38 years, with much of his career focused on wetlands delineation, permitting and mitigation for DOT and DOD clients. His areas of expertise include both tidal and non-tidal wetland restoration and he has designed and overseen the development of successful wetland mitigation projects in a number of states. His special area of interest is in non-tidal forested wetland mitigation, and he has devoted much of his professional career towards the advancement of design, construction, and monitoring of these systems.

Module Objectives:

- Objective #1 – Learn about some of the factors regarding property interests that may affect the cost of a mitigation project.
- Objective #2 – Learn about some of the factors regarding property interests that may affect the feasibility of a mitigation project.
- Objective #3 – Learn some best practices in regard to identifying and managing various interests in property.

Test Questions

1. Which of the following are factors that may affect the cost and feasibility of mitigation projects? (select all that apply)

A. Regulatory drivers (federal, state and local).
B. Presence of hazardous materials.
C. Mineral rights.
D. Cultural resources.
E. Utility conflicts.
Answer: All of the above.

2. What are some best practices you could employ to avoid conflicting property interests? (select all that apply)

A. Obtain a copy of the deed as it will ensure all existing property rights are represented.
B. Be sure to identify all potential utility conflicts and begin coordination with affected utility companies as early as possible.
C. Utilize information from GIS or provided by others with an understanding that it may be insufficient to support design of your mitigation project.
D. Be sure to do the most complete due diligence studies that the project schedule and cost can support.
E. Check local zoning laws and be sure to coordinate early with the locality to ensure that the site can be rezoned for conservation purposes.

Answer: B, C, D and E

3. What were some of the reasons why the Newton Creek site was not feasible? (select all that apply)

A. There was a bald eagle nest on the site.
B. Chesapeake Bay Protection Act buffers.
C. Historic property on the site.
D. Incompatible zoning.
E. Recognized environmental conditions.
Answer: A, B and C

4. What were some of the reasons why the Phillips Creek site was not feasible? (select all that apply)

A. Anticipated costs of material disposal.
B. Recognized environmental conditions.
C. Objections by neighbors.
D. Incomplete hydrologic analysis.
E. Government to government coordination.
Answer: A, B and D

5. These are the items that project proponents should look into prior to selecting a site? (select all that apply)

A. Coordinate early and often with regulatory agencies to identify potentially conflicting regulatory policies or regulations that could negatively affect your project.
B. Know your federal, state and local regulatory environment associated with wetland, stream, or habitat mitigation.
C. Fully investigate property rights, especially water rights and mineral rights
D. Perform a cost-benefit analysis based on future land value.
E. Perform a study on impact of construction noise on neighbors.
Answer: A, B and C