Maryland
Department of
the Environment

Triennial Reviews for Stormwater Management Programs:

A Status of the Stormwater Management and Small Pond Approval Process

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MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230 | mde.maryland.gov
410-537-3442 | 800-633-6101 x3442 | TTY Users: 7-1-1

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Executive Summary

In late 2020, the Maryland Department of the Environment (Department) held a series of virtual training workshops for more than 100 attendees. These workshops provided outreach and training to the communities in Maryland that manage stormwater and approve small ponds, i.e., MD-378 ponds, as defined by Environment Article, §5-503(b), Annotated Code of Maryland. Approximately 15,000 small ponds exist in Maryland that manage stormwater or are used for water supply, recreation and agriculture, and their function is crucial in protecting State water resources. An open discussion was initiated through three sessions and an accompanying survey. The information gathered has been summarized in this document and provides a status of Maryland's stormwater and small pond approval programs.

The workshops were developed for representatives from local municipalities, counties, and the local Soil Conservation Districts (SCDs). Additional participants represented the Department's Office of the Attorney General, the Maryland Department of Natural Resources, the Maryland Department of Agriculture, the Maryland Department of Transportation State Highway Administration (MDOT SHA). Also in attendance was the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS).

The sessions focused on the current legal and regulatory requirements for the design, construction, and maintenance of small ponds and stormwater best management practices. Participants discussed the review approval process, inspections procedures for construction and long-term maintenance, and enforcement measures. Through this dialogue, current Department guidance and requirements were reviewed, as well as local approval processes. Participants discussed planning for downstream impacts, flooding, hazard creep, and climate change. They also described their program concerns and needs.

Local jurisdictions face many challenges with ensuring that stormwater infrastructure, and small ponds in particular, remain safe and resilient to the effects of climate change. The Department continues its work to support these efforts through providing consistent oversight in the form of technical guidance and training. The results of this series will be utilized to support local programs through updated guidance, enhanced future outreach, improved Department communication, and the development of further training topics.

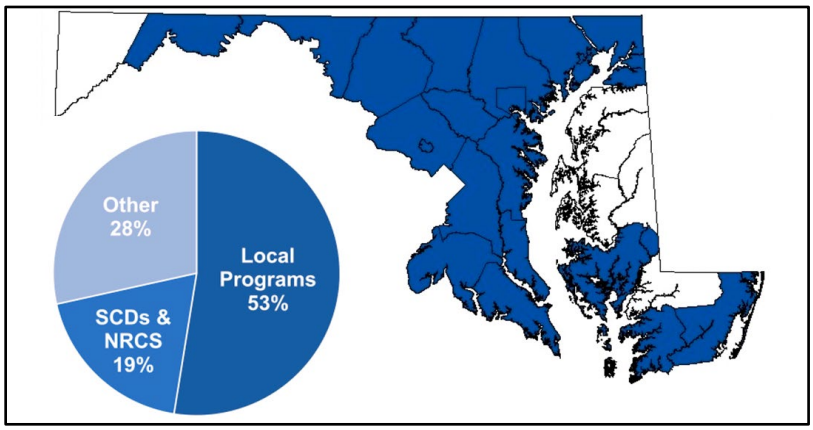
Introduction

The Maryland Department of the Environment (Department) is taking action to ensure that stormwater infrastructure in Maryland remains resilient to the effects of climate change. Increasing precipitation and runoff have focused the State's attention on the structural integrity of stormwater ponds and dams for public safety and water quality. In late 2020, the Department held a series of virtual training workshops for more than 100 attendees to discuss the importance of ensuring the resiliency of this critical infrastructure. The sessions reviewed the current requirements for stormwater management and small ponds, including design criteria, the approval process, common maintenance concerns, and hazard classification. The Department further communicated policy updates and began a group dialogue to foster collaboration with the goal of enhancing resiliency, safety, and compliance. The presentations from each session may be accessed on the Department's website at mde.maryland.gov/programs/Water/DamSafety/Pages/WiYP2020.aspx.

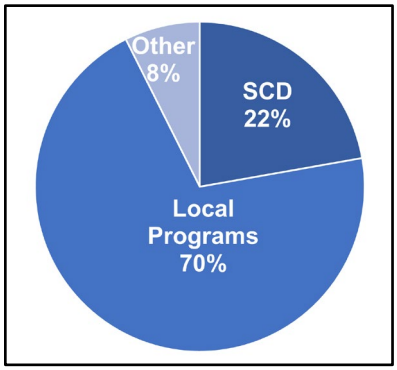
The purpose of these sessions was to provide outreach and training to the communities in Maryland that manage stormwater and approve small ponds about the current legal and regulatory requirements for their design, construction, and maintenance. This effort also supports the Department's regulatory obligations to review the State's stormwater management program as well as the programs of the 117 jurisdictions, including counties, cities, towns, and State and federal agencies that maintain a stormwater management program on a triennial basis. These training sessions along with the data gathered from the associated survey of local programs serve as the Department's 2021 Statewide assessment as required in Environment Article, §4-206, Annotated Code of Maryland, and COMAR 26.17.02.03.C.(3).

Attendees represented local municipalities, counties, State, and other stormwater management agencies, including the local Soil Conservation Districts (SCDs). Specifically, sixteen counties, three municipalities, and eleven SCDs participated in the training sessions. Other State and federal agencies that participated included MDE and its Office of the Attorney General, the Maryland Department of Natural Resources, the Maryland Department of Agriculture, the Maryland Department of Transportation State Highway Administration (MDOT SHA), and the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS). The figure below provides a breakdown of the attendees.

Participants Across the State



Survey Respondents



Out of the 136 individuals that were sent a survey (with some jurisdictions receiving surveys directed to multiple agencies that perform work related to stormwater and dam safety), 26 (19%) provided feedback on the surveys. The responses came from 19 local programs, six SCDs, and the NRCS. For some jurisdictions, attendees from more than one agency provided responses (for example, answers were received from a jurisdiction's separate agencies for Plan Review; Inspections; and Stormwater Management). Not all attendees answered the survey questions. The feedback was gathered for informational purposes and is not statistically representative, as not all jurisdictions responded.

A focus of the State's stormwater program review was on small ponds, and survey questions asked about pond embankments; stormwater best management practices; plan review policies; and technical knowledge. Respondents were asked to describe an overview of the local review process for stormwater best management practices and small ponds. The survey asked about small pond design requirements to determine if local criteria are consistent with the latest State guidance. The survey also asked about existing local rules on materials, components, and other design details; and how design requirements enable their programs to plan for downstream impacts, flooding, hazard creep, and climate change. Respondents were asked to provide an overview of how inspections are conducted during construction and for long-term maintenance, and how as-builts are reviewed, tracked, and enforced; and what enforcement tools are used to ensure maintenance of public and private facilities. Finally, the survey requested information on jurisdictions' concerns, challenges, and needs, such as for training.

The information obtained from the survey and the live discussions held during the training sessions has been summarized in this document and provides a status of Maryland's stormwater and small pond approval programs. This valuable feedback will be used to update guidance, enhance future outreach, develop topics for training, improve Department communications, and gain a better understanding of the needs of local programs.

Stormwater Management and Small Ponds

In Maryland, small ponds (i.e., MD-378 ponds) are defined by Environment Article, §5-503(b), Annotated Code of Maryland as having a:

- Contributory drainage area less than 1 square mile (640 acres);
- Dam that is not greater than 20 feet in height measured vertically from the lowest point on the top of the dam to the lowest point on the upstream toe of the dam; and,
- Dam with a low hazard classification of which the failure is unlikely to cause loss of life or property damage.

The Department estimates about 15,000 small ponds exist in Maryland. The number of small ponds constructed each year in the State varies significantly by region from fewer than ten in many jurisdictions to more than 30 in some of the more urban areas. The majority are constructed to provide stormwater management for new development projects usually as a means of quantity control. Additional small ponds are constructed for recreational purposes and agriculture use.

The design and construction requirements of small ponds are under the authority of the Department and require a permit from the Dam Safety Program per Environment Article, §5-503, Annotated Code of Maryland. Alternatively, Maryland regulations (COMAR 26.17.04.05.G) authorize SCDs to issue an approval for the construction of small ponds in lieu of the required Dam Safety permit. Local SCDs are required to notify the Department upon approval of a small pond for construction by submitting a USDA-NRCS Pond Summary Sheet (MD-ENG-14), and submitting the sheet again with as-built information within 90 days after construction is complete.

The Department has initiated efforts with SCDs and local jurisdictions to verify the location and condition of all small ponds, and to ensure new pond approvals are properly documented. Providing oversight on the design, construction, and maintenance of these structures, as well as maintaining an accurate inventory of their locations, enhances the quality of stormwater management programs throughout the State, and ensures the facilities adequately manage flooding, improve water quality, and remain resilient in a changing climate.

Plan Review and Approval Authority

Local authorities review stormwater management construction plans to ensure they meet local and State standards before approval. In cases where these controls will be converted to permanent stormwater management practices, they are required to meet the MD-378 design standards. According to Maryland's regulations, a comprehensive process for approving grading and sediment control plans and stormwater management plans is required. This includes integrating strategies for erosion and sediment control and stormwater management into a

comprehensive development plan, and often involves the consideration of small ponds used for sediment control. At each phase of the plan review process (concept, site development, and final), the designer is required to solicit general feedback from review and approval authorities and any other local agencies deemed appropriate, e.g., planning and zoning, public works, so that the developer may incorporate any concerns and recommendations. Involving all review agencies from the beginning of site planning through the final phases fosters a more efficient and thorough review process.

The SCD has approval authority for the construction of ponds that meet the Natural Resources Conservation Service - Maryland (NRCS) Code No. 378 Pond Standards/Specifications (MD-378). The Department asked how reviews and approvals are performed for stormwater management projects and MD-378 facilities; what are each agency's responsibilities and if a memorandum of understanding between the agencies exists; and what is the review process for new development and redevelopment projects. For the majority of respondents, small pond review and approvals are the responsibility of the SCD. However, several jurisdictions require additional approvals from the stormwater approval authority for small ponds used as stormwater management structures. In other jurisdictions there are agreements between the SCD and the stormwater approval authority or with NRCS to perform small pond technical reviews while the small pond approval rests with the SCD. There are 23 counties, 157 municipalities, and 24 SCDs in Maryland, and the variety of organizational structures and agreements surrounding small pond approvals demands close coordination and communication among the Department, SCDs, and jurisdictions.

Design and Construction Standards

Small ponds are required by Maryland regulations to meet the design standards and construction specifications of MD-378. However, SCDs may require more rigorous standards where warranted. The Department periodically publishes updates and technical memoranda on a variety of design topics related to small ponds. Experience has shown that the current version of MD-378 may be challenging to understand and can result in multiple interpretations of the same criteria. Some of the most important and varied interpretations have been on defining a dam; measuring dam height; determining a dam's hazard classification; and assessing whether a pond meets the MD-378 small pond standards.

Various design standards may be referenced by a jurisdiction during plan review. The variety of responses received about the use of MD-378, determining dam height, or applicable dam breach criteria illustrate the importance of the need for the Department to continue to provide training on the application of MD-378 for small pond approvals. Nearly all of the jurisdictions responding to the surveys use the MD-378 standards to determine if a stormwater management structure is considered a small pond, while a few noted they use the Department's Stormwater

Design Manual or information from discussions with the Department to make this determination. When ponds are smaller than those referenced in MD-378, several approval authorities and SCDs utilize the Department's Stormwater Design Manual or discuss with NRCS to determine appropriate design criteria. Three out of four respondents provide supplemental guidance for small pond design.

The Department released a series of small pond policy memoranda in 2019 and 2020, available on the Department's website. These provide updated information and recommendations for small pond design, construction, maintenance, hazard classification, and removal. The memos were written to clarify what are the acceptable design criteria according to current regulation. Slightly more than half of the survey respondents reported that they were familiar with these updated recommendations. The Department will continue to ensure the regulatory community has access to the most updated information.

- Technical Memo 1: clarifies tree removal requirements and provides details on how to remove trees while maintaining the structural integrity of the dam.
- Technical Memo 2: resolves questions about roadway and railroad embankments that have a culvert or may act as an impoundment.
- Technical Memo 3: discusses potential dangers associated with siting dams and ponds on the crest of steep slopes.
- Technical Memo 4: provides a simplified hazard classification system for select low height, low storage volume dams, to supplement the existing "Guidance for Completing a Dam Breach Analysis for Small Ponds and Dams in Maryland".
- Technical Memo 5: is under development and will describe best practices for constructing dams and small ponds, to supplement MD-378 for designers, contractors, and inspectors.
- Technical Memo 6: provides general concepts to consider when planning a dam removal, and criteria for appropriate design of controlled breaches.
- Technical Memo 7: clarifies what information must be included in the impoundment filling plan submitted to the Department, to be considered when first filling a dam.
- Technical Memo 8: is under development and will clarify structural design guidance for risers and trash racks in COMAR 26.17.04.05(A)(3) and MD-378.
- Technical Memo 9: addresses the broad definition of "dam" in State regulations and identifies when the Dam Safety Program's involvement may be necessary for permitting water storage and collection tanks.
- Technical Memo 10: addresses treatment of utilities within and near dam embankments.
- Technical Memo 11: clarifies which activities are considered normal maintenance and therefore do not typically require a permit, versus repairs or modifications.
- Technical Memo 12: is under development and clarifies language in MD-378 regarding excavated ponds.

The Department is updating the MD-378 standards. This will require a change in COMAR to reference the new document that will be created. Updates will increase clarity and address new issues. Criteria will be developed to "grandfather" projects under development and a schedule will be developed for periodic reviews and updates of the new standards document.

Hazard Classification

A dam is classified by the magnitude of potential consequences in the event of its failure. The Department uses three hazard classifications that consider the potential to result in loss of life or property damage. These classifications are: high hazard, significant hazard, and low hazard. Among other things, the hazard classification of a dam determines the appropriate emergency response needed for a dam failure or near failure. Environment Article, §5-503.1, Annotated Code of Maryland, requires the owner of a high or significant hazard dam to prepare an emergency action plan. As noted previously, all small ponds by definition are considered to be low hazard structures. However, as the area downstream of a dam becomes more developed (e.g., by adding homes or other infrastructure), the consequences of failure can become more severe. "Hazard creep" is the term used when development downstream of an existing dam results in a change in the hazard class of the dam. Because the hazard classification is based on what impacts could result when the dam fails, development that occurs within the dam failure inundation area after the dam is constructed can increase the severity of the consequences, and thus change the hazard classification of the dam.

The Department asked whether programs are reviewing for hazard creep. Half of the respondents review plans for hazard creep of existing dams during either a breach analysis, pond repair, or when the embankment may be impacted by a proposed project. Often a change of hazard classification will require a structural upgrade to meet the safety criteria of the new hazard class. However, it was noted that it is not always possible to upgrade older existing facilities to meet current dam safety design standards. Local comprehensive plans should consider dams and inundation areas in land use planning decisions, and establish local development mechanisms that require dam upgrades in instances of hazard creep

Materials

The MD-378 standards specify which materials are allowed for dam and pond construction, including for pipe conduits under or through the dam, based on the height of the dam. The guidance also outlines material properties such as minimum strength, any applicable coatings, or required accompanying components. For example, principal spillways are typically concrete with reinforcing steel per ASTM C361, also known as reinforced concrete pipe with a concrete cradle placed on natural ground. However, weir walls are an increasingly popular spillway alternative to a pipe. Depending on a number of factors including soil type, dam height, cost, and lifespan, the materials used to construct dams and their components have various advantages and disadvantages.

The Department asked what types of principal spillway materials local approval authorities allow, prohibit, and prefer for MD-378 ponds. Approximately half of the survey respondents noted there is a jurisdictional preference for the type of material used in principal spillways, or that a specific material is prohibited. Generally accepted principal spillway conduit (pipe) materials include reinforced concrete pipe (RCP), high-density polyethylene (HDPE), corrugated metal pipe (CMP), or polyvinyl chloride (PVC). One in four also indicated that a reinforced concrete weir wall may be used in lieu of a spillway conduit. The most commonly prohibited material was corrugated metal pipe. In addition to the MD-378 standards, the Department's library of technical resources includes federal guidance on choosing appropriate materials, available on request. Updates to MD-378 or additional Technical Memos on standards and design for spillway weir walls will be forthcoming.

Seepage Control

No dam is completely watertight. Seepage through a dam is not necessarily a problem, but controlling seepage is necessary to prevent internal erosion and loss of embankment material. There are various means to do so. Historically, anti-seep collars were used as the preferred option by directing it away from the pipe spillways. The MD-378 standards continue to authorize the use of anti-seep collars as an acceptable seepage control for small ponds. However, multiple dam failures or near failures have occurred in Maryland due to anti-seep collar issues. The most common failure mechanism is inadequate compaction around the anti-seep collar during construction. The Department now encourages the installation of filter diaphragms in lieu of anti-seep collars.

The Department asked if programs currently allow anti-seep collars to be used on MD-378 facilities. Nearly three quarters of respondents continue to allow anti-seep collars to be used on MD-378 facilities. The Department explained during the workshops that anti-seep collars do not prevent seepage failures. Filter and drainage diaphragms are recommended in all scenarios, but are required by MD-378 when a pond must be designed according to TR-60 or when embankment soils have a high piping potential such as Unified Classes GM (silty gravel), SM (silty sand), or ML (silt). The Department will develop further guidance on anti-seep collars. Until then, any questions should be directed to the Department.

Regional and Local Concerns

In addition to meeting State requirements, there may be geographical or geological concerns at the local level that must be considered in stormwater management and small pond design and construction. Survey respondents noted several unique challenges for MD-378 ponds, including: special designated uses or protected areas for water or land; topographic issues such as steep slopes, flat terrain, and high groundwater tables; issues related to soil type such as poor drainage, unstable clay soils, presence of bedrock, and highly erodible soils; karst areas; and sea level rise causing land subsidence and saltwater intrusion. These issues influence what is the appropriate

design storm and the allowable component materials. For example, salt water corrodes metal pipes; and karst increases the risk of seepage and failures. Many concerns such as these can be addressed by establishing more specific local requirements as needed. The Department continues to solicit feedback to determine areas of concern where State intervention or guidance would help to address these issues.

Outfalls and Downstream Impacts

Maryland's stormwater regulations outline design requirements for outfall protection as well as the mandatory considerations for the downstream impacts of development. The MD-378 standards require all excavated ponds to be designed to ensure a stable outfall for the 10-year, 24-hour frequency storm. As noted in the standards, "...review and design of such class "a" structures shall be based on sound engineering judgment assuring a stable outfall for the ten (10) year, 24-hour storm event." The Department's Stormwater Design Manual also specifies that facilities exempt from MD-378 standards must still be approved by the appropriate authority to ensure they are designed for a stable outfall using the 10-year design storm, or the 2-year design storm if the pond is an off-line structure providing water quality volume storage only.

Furthermore, COMAR 26.17.02.09.D requires the developer to obtain from adjacent property owners any easements or other necessary property interests concerning flowage of water if the plan involves a change in the direction, course, rate, or volume of runoff from the site. Approval authorities and SCDs may specify additional requirements or more rigorous design criteria to address local priorities or concerns. The Department asked about the current design requirements for outfalls; how approval authorities review for downstream stability (i.e., channel protection) and flooding; and if sediment control plans are reviewed for the potential to cause adverse off-site impacts. Based on the responses, there are a wide variety of design requirements for outfalls and downstream impacts implemented throughout Maryland. Considerations include the use of technical guidance from the Department or NRCS to ensure a stable conveyance of the 10-year storm, create positive drainage, and minimize steep slopes.

Session speakers emphasized that regulations prohibit impacts to adjacent properties without their permission. They further explained the importance of approval agencies to design small ponds so that outfalls remain stable during full pipe flow, and noted that a riprap lined ditch or level apron is not an acceptable alternative to a plunge pool, which may be a necessary component. The Department referenced the NRCS Design Guide MD #6 (2003) for complete information.

Survey respondents noted that various methods may be used when reviewing designs for potential impacts to downstream areas, such as evaluating downstream stability and flooding impacts based on the location of the discharge or changes to flow volume and velocity. Hydrologic and hydraulic modeling software such as USDA Technical Release 20, Project

Formulation Hydrology (TR-20), the Hydrologic Engineering Center's River Analysis System (HEC-RAS), geographic information systems (GIS), or floodplain data are used by some jurisdictions to verify that the outfalls and the downstream conveyance system can safely convey design storms such as the 10-year, 25-year, and 100-year storms. One jurisdiction reported that they conduct a site visit during the review process to observe existing conditions and features. Another jurisdiction requires applicants to solicit feedback from downstream property owners during planning. Steps such as these are essential to prevent downstream impacts and ensure resilience to the increasing size and severity of precipitation events.

Climate Change

Planning to minimize the negative impacts of climate change on water quality and urban flooding is a priority for the Department. As the frequency, intensity, and size of storms trend upward, the design storms that are considered in stormwater management criteria and outfall impact evaluations may need to be updated. This is essential to ensure adequate channel protection offsite and prevent erosion of banks downstream caused by inadequately sized structures. Programs must also consider whether existing ponds, dams, and spillways have sufficient capacity. The Department asked if jurisdictions are implementing any special considerations (e.g., increased sizing criteria or storage) to plan for climate change. While there is concern at the local level that current stormwater design standards are outdated, only one out of five jurisdictions is currently implementing special conditions to account for climate change. Examples include examining localized flooding issues and high intensity rainfall, and increasing standards based on updated national rainfall data. Many jurisdictions responded that they are looking to the Department to issue guidance or regulatory updates.

The Department recommended that local programs throughout the State may need to design small ponds and urban stormwater practices for larger storm events. In addition, calculations such as annual exceedance probability and duration may need to change in the future to prevent flooding. The Department further suggested that the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 is in the process of being updated. The Department is conducting a State-specific study of probable maximum precipitation (PMP) focusing on high hazard and significant hazard dams. The study will analyze factors that are applicable to small ponds such as climate change, temporal rainfall distribution, and may include a probabilistic analysis of less frequent storms such as the 100-year 24-hour storm.

Inspecting During Construction and For Long-Term Maintenance

A robust, local inspection program is required during construction and long term to maintain stormwater facilities (including small ponds) by COMAR 26.17.02.10 and 26.17.02.11. Inspections performed at critical stages of construction are necessary to ensure proper materials

and methods are implemented. Per State stormwater regulations (COMAR 26.17.02.10), small ponds should be inspected at a minimum:

- Upon completion of excavation to sub-foundation and, when required, installation of structural supports or reinforcement for structures, including but not limited to:
    - Core trenches for structural embankments,
    - Inlet and outlet structures, anti-seep collars or diaphragms, and watertight connectors on pipes, and
    - Trenches for enclosed storm drainage facilities;
- During placement of structural fill, concrete, and installation of piping and catch basins;
- During backfill of foundations and trenches;
- During embankment construction; and
- Upon completion of final grading and establishment of permanent stabilization.

To help both the builder and the inspector ensure the stormwater infrastructure is resilient, construction standards and specifications are required to be included on the approved small pond plans. The MD-378 standards outline the required construction specifications for small ponds.

The Department asked for information on the construction and maintenance inspection process including whether jurisdictions use written standard procedures or checklists, how often inspections are conducted, what inspections are conducted, and who conducts the inspections. Most survey respondents implement standard operating procedures (SOPs) for construction and maintenance inspections, which may be performed during various steps in the construction process including: installation and maintenance of erosion and sediment control; installation of stormwater management features, major components, or critical structures; and final inspections and for as-builts. Several respondents reported relying on a third party to perform construction inspections, while others use multiple internal agencies. There is a wide range of inspection frequency during construction, from weekly to bi-monthly or monthly, to inspecting as needed or as requested. A standardized inspection process creates efficiency and enables local programs to more effectively ensure facilities are built properly and maintained in working order.

During the workshops, the Department emphasized that an inspector's role is challenging and includes constant communication with the contractors on site. Inspectors must be trained to recognize issues and understand permit requirements, as well as be able to anticipate potential issues as weather changes and work progresses. They must speak up immediately if work is inadequate, unacceptable, or failing; however, it is not the job of the inspector to supervise the contractor. The inspector can only accept or reject the work that is observed.

For small ponds and sediment basins that must be constructed in accordance with MD-378 standards, required construction inspections must occur when the spillway and embankment are initially constructed. Documentation is required for as-built acceptance including: checking

watertight connections, joint separation measurements, filter diaphragm installation, material gradation, confirming compaction, and geotechnical testing for soil classification. The Department recommends that programs require a construction inspection checklist and photographs of the built structure, and that the program inform the developer of all as-built requirements. Programs should use an integrated approach and avoid disjointed inspections. It is further recommended that the local program designate which agency is responsible for inspections, or provide better coordination when numerous agencies are involved.

As-Built Plan Approval

Requiring as-built drawings at the time that construction is completed helps the jurisdiction ensure the structure was built to approved standards, records its actual dimensions and specifications, and documents any revisions that were made to the design. The Department asked stormwater approval authorities and SCDs about the as-built approval and inspection tracking process, including how the jurisdiction ensures as-builts are completed. COMAR requires the SCD to submit a certification to the Department within 90 days after the construction of an SCD-approved small pond. For the majority of respondents, construction inspection reports are required at the time of the as-built plan submittal, and tracking is typically done through a digital file management system. The majority of stormwater approval programs ensure as-builts are completed through a bond, surety, or other financial security process. Several withhold the certificate of occupancy until as-builts are accepted or alternatively rely on civil citations for non-compliance. Others require a public works agreement to be signed. Because SCDs do not have the authority to require financial securities or to hold certificates of occupancy and have no enforcement authority over small pond construction, they must coordinate with the stormwater approval authority or the Department to enforce small pond approvals.

One purpose of as-builts is to identify significant differences between the field conditions and the approved plans and to determine what differences must be remedied. Significant differences between construction and the approved plan must be approved either by a modified plan approval or an approved field modification. Nearly 90% of the respondents review and comment on as-built plans for conformance with the approved design. More than 75% perform field verification of as-built plans. Components that are reviewed in the field to identify a deviation from the approved design include elevations, storage volume, slopes, pool surface area, types of materials, and sizing of components such as pipes. Respondents considered significant differences to include those that affect the hydraulic performance or the stability of the dam structure. Some respondents listed specific criteria while others noted that these are determined on a case by case basis. Allowable tolerances vary across approval authorities for many design elements including elevation difference, changes in spillway diameters, topographic contours, and storage volume.

In the training sessions, the Department emphasized that the plan approval authority must ensure an as-built is prepared for every dam that is constructed per COMAR 26.17.04.05.D. The Department strongly recommended that as-builts are verified in the field. It was also recommended that they are reviewed prior to inspecting an existing dam to familiarize the inspectors with the expected site conditions.

Maintenance Inspections

Maintenance inspections are critical for ensuring long term resiliency of stormwater infrastructure, dams, or ponds. Maryland stormwater regulations (COMAR 26.17.02.11.A) require that all practices are inspected at a minimum of once every three years. However, there is no requirement in Maryland's dam safety regulations for the Department or SCD to perform regular maintenance inspections on small ponds. Therefore, the Department and local SCD rely heavily on the stormwater approval authority to regularly inspect and ensure maintenance of small ponds. Dam owners must inspect and maintain their dam on a regular basis and are required to contact the Maryland Dam Safety Program when a deficiency or potential failure is observed (COMAR 26.17.04.05.E). During inspections, areas may be identified that need maintenance or have evidence of failure or near failure including dam structural integrity problems, evidence of vandalism, trees on the embankment, spalling concrete, erosion of the dam, or lack of access for maintenance or inspection.

Respondents indicated that construction and maintenance enforcement responsibilities are assigned to various agencies to ensure ponds and other stormwater management facilities operate as designed. Several kinds of enforcement tools may be utilized, including issuing violation notices or stop work orders, enforcing maintenance agreements, making approvals conditional on performing the required corrections, requiring a bond, surety, or security, placing a lien on the property, taking legal action, or issuing a fine. The Department reminded participants that additional enforcement tools are available to the Department for small pond construction and maintenance.

In the training sessions, the Department discussed routine maintenance of small ponds and dams, including mowing, tree removal, stabilization, and debris removal. Routine maintenance does not usually require an approval from the authorized approval agency, unless it involves construction, significant repairs, or modifications to a dam or reservoir. The Department discussed the information that must be submitted for the dam permit review process, including watershed use classification, dimensions, materials, design, current conditions, and results of any hazard analysis.

Training

Continual training is essential for all new and long-time professionals to remain current with the latest knowledge and standards. High quality stormwater and pond approval programs must include staff trained in the design standards as well as how to review plans and identify issues during inspections. Training for jurisdictions performing stormwater management and small pond technical reviews is a key part of the Department's regulatory responsibility (Environment Article, §4-203(d), Annotated Code of Maryland).

While small pond designs are required to meet the MD-378 standards, it was reported that most approval programs and SCDs do not regularly provide training for their staff on those standards, and instead rely on another agency, the Department, or NRCS. The Department explained in the workshops that while the MD-378 standards established a simplified design process that allows for practical application and review, it is important to also understand the underlying principles of dam structures to adequately manage any unique circumstances jurisdictions may encounter.

The Department requested information from jurisdictions on what training was needed at the local level. Respondents suggested they would like further training on outfall protection design and materials, regular updates on what design criteria and materials are no longer accepted, how to increase standardization and uniformity in reviews, and how to utilize relevant computer programs such as TR-20. General overview and refresher training were also suggested.

During the sessions, the Department announced plans to continue providing regular technical training and workshops for stormwater managers and SCDs, including the annual Fall/winter Dam Owners Workshop; HEC-RAS training; emergency preparedness tabletop exercises; and "Maryland Dam Safety 101" sessions for jurisdictions. Participants were also reminded of the updated guidance documents and reference library on the Department's website that provide further information on specific topics.

Other Programmatic Challenges

Survey participants were asked to provide information on other challenges and concerns facing them as small pond approval authorities. Operational challenges that were reported include an inadequacy of funding and staffing resources, a lack of training, including how to utilize asset management software, and uncertainty in how to address climate change.

Several suggestions were made for Department assistance and guidance. Additional training was requested for both staff and contractors on topics like small pond review, proper installation of sediment control practices, and pipe placement. Respondents felt that they would benefit from more frequent guidance and communication, as well as policy clarifications where the

Department has updated or plans to update standards including Maryland's hydrology and stormwater management requirements with considerations for climate change.

Jurisdictions also requested a shorter processing time for dam safety permit applications; additional engineering staff to support that effort; increased technical support; funding for local program staff; increased interdepartmental cooperation and communication; and a clear list of program experts whom jurisdictions may contact.

Some further suggested that the Department establish requirements and certifications that are more consistent Statewide to minimize variation in how policies are interpreted at the local level, and suggested that the State directly approve proprietary stormwater products. Another request was for greater consistency across jurisdictions of local modifications to what is required in the *2000 Maryland Stormwater Design Manual*, and clear, written requirements if the Department prefers stricter standards.

Conclusions

Local programs that perform stormwater management approval and inspection face many challenges with ensuring that stormwater infrastructure, and small ponds in particular, remain safe and resilient. A changing climate and our evolving understanding of water science mean that new knowledge must continuously be incorporated into standards and policies. Programs must provide timely and valuable customer service, often while facing limited personnel, funding, and training experience. Coordination must be maintained among the variety of agencies involved in plan reviews and approvals, and for construction and maintenance inspections, including the State, the SCDs, and the municipal and county stormwater approval authorities. To address this multitude of concerns, the Department continues its efforts to provide consistent oversight and updated guidance regarding minimum design standards, construction specifications, and maintenance. Topics for future training and outreach include:

- Designing sediment basins for quantity control
- Roles, relationships, and coordination of small pond approvals between SCDs and plan review agencies
- Seepage control and use of filter diaphragms
- Evaluation of downstream impacts
- Preventing hazard creep
- As-built plans and acceptable construction tolerances
- Strengthening enforcement of small pond construction standards

APPENDIX A

Complete Survey Results for Attendees of the
"What's in Your Pond" Stormwater Training Program
Provided by the Maryland Department of the Environment
January 6, 2022

POLICY REVIEW

Plan Review (Questions 1-11)

1a. Which local agencies are responsible for stormwater management (SWM) approvals for your jurisdiction?

- Permitting and Inspections (6)
- SCD (10)
- Department of Public Works (DPW) (11)
- Department of Planning and Zoning/Land Use and Growth Management (5)
- Other (6)

1b. Describe each agency's responsibilities.

- The jurisdiction's agency reviews and approves SWM and grading plans, while the SCD reviews pond design and erosion and sediment control (ESC) (12)
- A single agency is the review authority for ESC and SWM (2)
- One jurisdiction's agency "reviews most urban pond plans under an [memorandum of understanding (MOU)] with the [SCD]"
- A jurisdiction's department does review and small pond approval for certain ponds (2)
- "NRCS assists only in the review/concurrence of SWM Ponds across the state"
- A smaller jurisdiction's agency conducts its own SWM review, sends out plans to a designated civil engineer for a final review, and then approves the plan
- A jurisdiction's agency does the review for private development while the SCD reviews for ESC. For the jurisdiction's capital projects, the SCD does a full SWM and ESC review (1)

2. Describe the review process for new development/redevelopment projects (e.g., who, design criteria, differences in information required for submissions)

- Plans are submitted to one department (e.g., zoning department, jurisdiction engineer) in the jurisdiction, and are then sent to the other internal departments (e.g., DPW) or the SCD for review (3). Comments are received and submitted back to the developer
- Plans are reviewed "for new and redevelopment projects using the 2000 Design [M]anual, as amended and the current MD-378 specs." Larger developments must meet environmental site design (ESD) using the Design Manual and, if applicable, requirements in supplemental guidance created by the local jurisdiction, while minor developments under 5,000 square feet are exempt. "Smaller agricultural and residential developments are handled using standard stormwater management plans and require basic information"
- Plans are typically reviewed using "the 3 step submittal (Concept, Site Development, and Final) unless the project is under 1 acre of disturbance or is given Fast Track status"
- "The differences in the three phase review include the following: For Concept the reviewer focuses on existing conditions, concept of what is being proposed for impervious cover, what is required for SWM (ESDv, Recharge, CP_V, Q_{10}, and Q_{100}), [w]aiver justification, and Concept treatment method by making sure the design team uses (ESD to the [maximum extent practicable (MEP)], BMP to the MEP, Offsite treatment and fee in lieu as the last treatment option); For Site Development the reviewer focuses on the waiver public notices, design of the SWM facilities, maintenance requirements, sequences, stormdrain connections and outfalls, materials, and landscaping. For Final Development the reviewer focuses construction costs, Performance Surety, Draft Easements, Draft Declaration of Covenants, and finalizing all the civil plans"
- Once plans are approved by the SCD, they go back to the jurisdiction for the issuance of a grading permit

3. Describe how MS4 permit restoration projects are reviewed. (e.g., who, design criteria, differences in information required for submissions)

- The jurisdiction designs and implements projects internally
- The review is done by a separate unit that reviews (or units that review) plans for conformance with ESC and MD-378
- The review is conducted similar to a review for a new development SWM project since the design criteria and required information are the same
- The jurisdiction contracts with an independent consultant
- The project is reviewed "to confirm that the proposed retrofit meets or exceeds the originally approved quantity management (if a BMP is being retrofitted or replaced) or discharges (if a new BMP or stream restoration site is proposed)"
- "Projects are reviewed to make sure required storage volumes, discharges, and forest conservation laws are all followed"

4. Do you have SOPs, checklists, design criteria, etc. for SWM plan approval?

- Yes: 23 (88%) 18 jurisdictions and 5 SCDs
- No: 3 (12%) 1 jurisdiction, 2 SCD/NRCS

5a. Do you allow continuous monitoring adaptive control (CMAC) type systems and how many have been approved locally?

- CMACs are allowed for rainwater harvesting and quantitative control
- For those jurisdictions that participated in the survey, 0-4 CMACs have been approved in each jurisdiction, and a total of 12 CMACs have been implemented. One jurisdiction reported having several more under review

5b. What special criteria are required in reviewing CMAC systems?

- For those jurisdictions that defined criteria, some examples of specified criteria are the requirement for remote monitoring, updated computations and routings for the facility, or minimum quantity volumes that must be provided

6a. Do you have any agreements (e.g., memoranda of understanding or MOU) with other agencies for SWM plan approval responsibilities?

- Yes: 13 (50%): 9 jurisdictions, 4 SCDs/NRCS
- No: 13 (50%): 10 jurisdictions and 3 SCDs

6b. Describe the types of agreements from 6a. above. Type N/A if not applicable

- MOU with a state agency regarding maintenance, review procedures, SWM banking, and fee-in-lieu amounts
- MOU with MDE on red-line revisions
- MOU with the local SCD to review SWM ponds for MD-378
- Agreement with area towns to review and inspect SWM

6c. Do you have agreements with other agencies for technical review? If no, indicate N/A. If yes, explain.

- Administers a Forest Conservation Program for local jurisdictions
- Provides technical assistance to local jurisdictions
- Utilizes third party reviewers trained by another department
- MOU with the SCD to “review small ponds with barrel pipes 48" and smaller”

7a. Who approves MD-378 structures?

- The Department Dam Safety Permits Division (2)
- SCD (20)
- Local Department of Permitting Services, Zoning, or Inspections (6)

7b. What is the local procedure for sending/referring designs to the Maryland Department of the Environment, Dam Safety Permits Division for approval, exemption, notice of construction completion, etc.?

- "Projects requiring the Dam Breach analysis are forwarded to the Department". Specifically, where the "Drainage area of the pond is greater than 640 acres", the "Dam embankment height is greater than 20 feet (top of the dam to lowest point on the upstream toe)", or the "Pond is an intermediate or high hazard structure"
- One jurisdiction refers developers to the Department if it finds that the development project comes close to the requirements that necessitate a review by the Department
- The "SCD contacts [the Department's] Dam [S]afety [Division] if there is a concern on who is to review the pond"
- If a project contains MD-378 pond beyond the jurisdiction's review limits, the jurisdiction reviews and approves "the project for SWM but will not sign off on the grading permit until proof of Department dam safety approval is presented"
- One jurisdiction reported it requires that the design engineer "submits the SWM project…to [the Department] and have [Department] approval before SWM can be approved" locally

7c. Are sediment basins reviewed for compliance with MD-378? If yes, who is conducting these reviews?

- 20 jurisdictions reported that sediment basins are reviewed by the SCD; 4 jurisdictions specified that basins are reviewed if they will be in place long term (more than 3 years) or permanent
- 2 jurisdictions reported that the Department does this review, while some jurisdictions reported that the local permitting services program conducts a review

8a. Are you implementing any special considerations (e.g., sizing criteria, storage) for climate change?

- Yes: 5 (19%): 4 jurisdictions, 1 SCD
- No: 21 (81%): 15 jurisdictions, 6 SCDs/NRCS

8b. Describe climate change measures. If no, type N/A

- Increases have been made based on National Oceanic and Atmospheric Administration (NOAA) rainfall updates or to incorporate "high intensity rainfall into stormwater management requirements and resiliency into developments"
- "[L]ooks at localized flood issues and storm drain capacity issues"
- "[Jurisdiction] staff and residents are concerned that current standards are outdated, however, we do not have the authority or expertise to develop updated standards and are awaiting updates from the State"

9. Describe any procedures for early start, design-build, or mass grading approvals.

- 20 acre maximum grading unit
- "The plans clearly delineate the phases and require stabilization of the previous phase prior to starting the next phase. These projects are strictly enforced by the regional Department Sediment Control Inspector"
- For one jurisdiction, all projects are handled in the same manner. Other jurisdictions allow for grading only plans
- "For design-build projects, mass grading operations may begin when a concept approval is issued for the overall project, and an ESC plan has been approved for the proposed mass grading operations"

10a. Are pond buffers required for maintenance?

- Yes: 15 (58%) including 13 jurisdictions and 3 SCDs
- No: 11 (42%) including 7 jurisdictions, 4 SCDs/NRCS

10b. If yes, how are they enforced, maintained, and upheld?

- Maintenance agreements or contracts: 7
- Design with maintenance access in mind: 4
- Easements: 4
- Listed in Operations & Maintenance: 1
- Triennial inspection: 3
- Regular status updates: 1
- Right of entry: 1
- Bonds: 1
- Property lien: 1

11. How does the review process consider/address the discharge of water onto/off adjacent properties?

- "The design must consider the entire contributory drainage area even if off-site"
- Increases in flow are not allowed. If there is a change in how water discharges to an adjacent property, "the developer has to get written approval from the affected property owner." Five jurisdictions explicitly mentioned that discharge easements are required
- Plans are evaluated for points of discharge, pre- and post-development conditions, and the 2- and 10-year quantity management. Some jurisdictions have special considerations for 100-year management
- "An adequate outfall is required to ensure no erosion downstream"
- "378 SWM criteria requires breach analysis and justification to ensure no unacceptable, hazardous downstream conditions [are] created in a sunny day breach scenario"

Construction and Maintenance Inspection (Questions 12-19)

12. Who conducts construction and maintenance inspections?

- Construction and maintenance inspections are conducted by different departments within the jurisdiction. These departments may include permitting, MS4 program management, and DPWs
- The jurisdiction engineer or plan review and inspection staff conduct the inspections
- Construction inspections are conducted by the design engineer
- One jurisdiction reported that different departments handle inspections for private and public facilities

13. Do you have SOPs (e.g., procedures, checklists, records required) for construction and maintenance inspections?

- Yes: 21 (81%): 16 jurisdictions, 5 SCDs
- No: 5 (19%): 3 jurisdictions, 2 SCD/NRCS

14a. What inspections are conducted during construction?

- ESC: 10
- SWM installation: 3
- MD-378 ponds: 1
- Specifically mentioned pre-construction meeting: 3
- For any major design conflict: 1
- Specifically mentioned inspection by jurisdiction or third party is required for as-builts: 4
- Specifically mentioned final inspection: 2
- Specifically mentioned compactions: 3
- During installation of specifically mentioned major components or critical structures: 4
- Third party inspections only, none conducted by the jurisdiction: 5

14b. How often are inspections conducted during construction?

- Routinely: 3
- Biweekly: 1
- Weekly: 1
- Every 2 weeks: 3
- Every 2-3 weeks: 1
- Every 4 weeks: 1
- As-needed: 4
- As requested: 4
- Rarely: 1
- At critical times in the process: 7

- Minimum 5 times during construction: 1
- Total 2-4 times during construction: 1
- After pre-construction: 2
- At completion: 2
- Performed by third party: 3

15. How do you track as-built inspection reports?
- Recorded along with inspection and/or project information: 2
- Required at time of as-built review: 13
- Spreadsheet tracking: 3
- Digital file management tool: 7
- GIS database: 1
- Required for bonding / surety: 2
- Third-party certification and submittal: 1

16a. How do you ensure that as-builts are completed? (e.g., performance bonds, public works agreements)
- Bond / surety / security: 18
- Certificate of Occupancy: 4
- Agreement such as Inspection and Maintenance or Public Works Agreement: 5
- Civil citation for noncompliance: 1
- Permit renewal with fee: 1
- Third-party certification and submittal: 2
- One respondent noted "For agencies that do not pay permit fees… As-Builts have been more difficult to enforce due to more limited enforcement capabilities"

16b. When as-builts do not exist, how is construction information (e.g., material, construction QA/QC reports, shop drawings) being recorded/recovered?
- Required if new development or retrofit is proposed on a site with existing development: 2
- Verification is required for all retrofit projects even if there is an as-built on file: 1
- As-builts are required: 5
- Photographs, plans, inspection reports, and/or material supplier tickets: 7
- Search in-house files: 2
- Contact the developer: 1
- Not recovered: 1
- Field exploration or post-hoc as-built Inspection required: 2

17. How are critical, safety-oriented repair items enforced for privately owned SWM facilities?
- Notice of violation or citation: 2

- Lien on property for jurisdiction to do the repair: 6
- Regular inspections; punch list: 8
- Maintenance and inspection agreement: 6
- Legal action: 4
- Written notice of repairs needed: 2
- Relies on the Department's Dam Safety Divisions and/or local SCD: 2
- Local ordinance: 2
- Fines: 2
- Recordation to deed: 1
- Performance bond held: 1
- One jurisdiction explained the three-step notification process, including a verbal notice, a written notice with a deadline sent by certified mail, a second certified letter, and then escalating to the jurisdiction attorney for prosecution
- One jurisdiction explained that they have an internal group ensuring preventative maintenance is done on private property

18. How are you working with private landowners to ensure maintenance?
    - Notice of violation or citation: 3
    - Assistance or education outreach (e.g., operations and maintenance plan with notes, maintenance checklists, verbal communication, door hangers, informational sheets): 7
    - Regular inspections: 7
    - Maintenance and inspection agreement: 4
    - Lien on property for jurisdiction to do the repair: 4
    - Legal action: 11
    - Written notice of repairs needed: 6
    - Fines: 1
    - Relies on the Department's Dam Safety Division and/or local SCD: 2
    - One SCD noted they have a "local public relations program to tell landowners how to do proper maintenance on ponds"

19. What enforcement tools do you use for both construction and maintenance?
    - Notice of violation or citation: 8
    - Regular inspections: 2
    - Maintenance and inspection agreement, or construction agreement, or easement: 4
    - Lien on property for jurisdiction to do the repair: 5
    - Withhold approval, such as occupancy permit or as-built: 8
    - Stop work order: 7
    - Legal action: 4
    - Fines: 2
    - Bond / surety / security: 12

- One jurisdiction noted they can apply liquidated damages to projects under construction with ESC violations, calculated as a portion of the contract price that would not be paid to the contractor. Further, all BMPs are inspected and assigned a rating based on their condition and performance, and those not in an acceptable condition lose their WQv credit and require remediation or mitigation

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TECHNICAL REVIEW

1. How are your reviewers trained in MD-378 review? What training do you need?
   - Relies on the local SCD, NRCS, USDA Natural Resources Conservation Service, or Department resources (including the Design Manual) for training or to do reviews: 12
   - Reviewers are State certified engineers: 1
   - In-house training: 2
   - Has not done training, relies on experience of senior staff: 6
   - Other training resources: 1

   Suggestions for training:
   - Webinar training
   - Outfall protection measures are vitally important
   - Interested in training on performing MD-378 reviews in a standardized way
   - Interested in refresher training
   - Any training on the various computer programs (TR-55, TR-20, hydraulics, etc.) and overview of MD-378, including updates on Code sections that are no longer accepted by the Department
   - Training on pond construction practices and specifications
   - Concerned about cost of training

2. Describe training provided to staff for MD-378 reviews.
   - Department training: 3
   - NRCS training: 4
   - Relies on SCD training or reviews: 5
   - Reviewers are State certified engineers: 1
   - Have not done training, relies on experience of senior staff: 1
   - Relies on Department resources as reference: 2
   - Weekly general training sessions that may include staff questions about MD-378: 1
   - None: 6
   - Plans to develop training: 1

- One jurisdiction commented that "Staff attends seminars on SWM design, construction and inspection of SWM facilities when offered and not filled up"
- One jurisdiction commented "MD-378 Pond training was provided by [the Department] at previous SWM conferences and workshops. These conferences and workshops were critically important to the SWM community, but have not occurred recently"
- One jurisdiction noted their training consists of "Seminars, in office trainings, design manuals and online presentations"
- One approval authority commented that they have "provided in-person presentations at [regional] offices/meetings and one-on-one interaction with field/district staff to address questions, concerns. No formal training provided in recent memory"
- One local SCD noted "SCD/NRCS training was made available for individual district/NRCS field offices. Some regional training has been conducted covering dam breach analysis, cut-off trench/filter diaphragms, hydraulics, etc."

3. Are construction specifications required on approved plans?
- Yes: 20 (83%): 15 jurisdictions, 6 SCDs/NRCS
- No: 1 (4%): 1 jurisdiction
- N/A: 3 (13%): 1 jurisdiction, 2 SCDs

If necessary, do you require modifications to the standard construction specifications found in MD-378?
- Yes: 6
- No: 5
- Yes and must be approved by the Department or SCD: 3
- Yes and jurisdiction will consult NRCS: 1
- Yes and is built into a local revised standard: 1
- Rarely happens: 1
- N/A: 1
- Did not answer: 3

4. How do you determine which stormwater management structures should be designed to MD-378 standards?
- By reviewing Code MD-378 standards, including checklist: 18
- Stormwater Design Manual Appendix B, including Small Pond Review Flow Chart: 2
- Asks the Department for final determination in close situations: 1

Specifically:
- Embankment over 3 feet tall
- Depth of water, height of dam, cubic feet (CF) of storage, length of barrel, slopes of embankment

- Height of the embankment and storage volume
- Embankment height, storage volume, excavated facility, class A structure, etc.
- Embankment is over 4 feet
- Based on embankment height or volume for ponds
- One jurisdiction's criteria are:
  1. Ponds or other structures have more than 4 feet of embankment
  2. Storage at emergency spillway design high water elevation exceeds 40,000 CF
  3. Drainage area to the pond must be less than 640 acres
  4. Height of the pond (measured from the upstream toe to the top of dam) must be less than 20 feet
  5. Dam must be a low hazard structure meaning the failure of which is not likely to cause loss of life or property damage
- One jurisdiction's criteria are: Embankment heights greater than 6 feet or greater than 4 feet if the 100-year storage is greater than 40,000 CF as measured from the top of embankment to the lowest point of excavation excluding the cut off trench. We also evaluate roadway culverts against this same criteria if they either have a riser structure, a permanent pool greater than 3 feet deep, or a depth of 100-year headwater greater than 10 feet and greater than twice the diameter of the culvert. A clear policy document from the Department on this would be appreciated, since the applicability of the excavated pond guidance in MD-378 isn't clearly published
- One local SCD Exemption rule: Consultant must determine exemption and provide calculations for confirmation
- One local SCD commented that they determine during the stormwater management review if a MD-378 review is necessary

5. When facilities are smaller than MD-378, what design and construction standards do you use? (e.g., embankment criteria, freeboard requirement, spillway criteria, material requirements, construction specifications)

- MD-378 Specifications: 2
- Department Stormwater Design Manual: 5
- NRCS standards: 2
- MD-378 with discretion: 2
- Engineer's judgement: 1
- Other: 5

Specifically:

- Embankment compaction, suitable material, freeboard requirement, and require construction specifications
- Embankment and freeboard criteria
- Freeboard, material

- Safe handling of the 10-year, 24-hour design storm and stable outlet design become the main criteria
- Best available material. 100-year storm but no freeboard or 10-year with 1 foot. Same spillway criteria
- Follows MD-378 with discretion, e.g., don't require anti-seep collars or a filter diaphragm for a 3 foot high embankment on a bioretention facility but enforces the MD-378 compaction specs even for small dams
- Embankment shall allow for settlement, embankment top elevation shall have minimum freeboard of 1 feet, materials and construction specifications of the principal spillway shall be in accordance with MD-378, principal spillway/riser shall provide anti-floatation, anti-vortex, and trash rack designs

Other:

- One jurisdiction answered "SWM ponds normally have a principal (2- and/or 10-year storm) and emergency spillway (100-year storm). A one foot freeboard is normally used"
- One jurisdiction answered "[The jurisdiction] uses the [Department] Drainage Manual, [Department] ESC Specification and Details, and the [jurisdiction's] ... standards"
- One jurisdiction answered "[jurisdiction] and State standards"
- One jurisdiction answered "Many of the MD-378 specifications that have been merged into the ... [jurisdiction] Stormwater Management Design Manual"

6a. Do you have any supplemental guidance for small pond design?

- Yes: 7 (27%): 3 jurisdictions, 2 SCDs
- No: 19 (73%): 14 jurisdictions, 5 SCDs/NRCS

6b. If yes, describe. If no, type N/A

- Engineering Newsletters
- Published Guidelines following NRCS standards
- Checklists and Inspection Check-off lists
- Jurisdiction SWM Supplement
- Ponds located near steep slopes
- Jurisdiction SWM Design Manual

7. What local standard details (specific to small ponds and practices exempt from MD-378) do you use?

- N/A
- Department SWM Design Manual
- Jurisdiction Standards
- Details of principal and emergency spillways
- NRCS standard details

- Jurisdiction SWM Supplement
- Compaction regulations, soil materials, pipe specifications riser details and profiles
- DPW SGW Details
- Jurisdiction Design Manual for Construction
- Jurisdiction's HHD
- Jurisdiction SWM Design Manual

8a. Are you familiar with the new policy memoranda from the Department's Dam Safety Division?

- Yes: 11 (42%): 6 jurisdictions, 5 SCDs/NRCS
- No: 15 (58%): 12 jurisdictions, 2 SCDs

8b. If so, any comments?

- The same pond retrofit design requirements have been used for years, and there has not been much change
- Unable to recite without the policy memoranda
- Not aware of any recent changes
- These policies are very useful, and more are needed to clarify the expectations of the Department, specifically regarding MD-378 Small Ponds

9. What are your dam breach analysis criteria?

- N/A: 3
- Department Dam Safety Criteria: 5
- MD-378: 4
- NRCS: 2
- Jurisdiction DPW: 1
- Assistance from local SCD: 1
- Breach Model via NRCS shortcut method
- TR-66, HEC RAS, dry day condition, no impact to roadways and structures downstream
- Qmax (3.2*Hw^2.5) be computed and routed through downstream valley, roadways, culverts, structures, etc. to proven, safe ending point. [Qmax = discharge; Hw = depth of water at the time of failure.] Depths of overtopping flows within the breach area must be proven to follow those listed in CPS-378 [MD-378]
- Study to see the effect of dam failure and design with maximum safety in case of a failure (Q(max) = 3.2Hw with exponential of 2.5)
- Does not use the breach equation found in MD-378. One jurisdiction requires designers to adhere to the Department's "Guidance for Completing a Dam Breach Analysis for Small Ponds and Dams in Maryland"

10a. Are you reviewing for hazard creep (e.g., downstream development or zoning changes that may change the hazard classification)?

- Yes: 12 (52%): 7 jurisdictions, 5 SCDs/NRCS
- No: 11 (48%): 9 jurisdictions, 2 SCDs

10b. If yes, describe. If no, type N/A.

- N/A
- Dam Breach Analysis
- Review for hazard, not always possible to upgrade older facilities to meet current safety standards
- Reviewed during concept; no system in place to monitor non-permitted sites
- Responsibility of the review engineer during breach analysis
- Reviewers will require that post-project and ultimate development conditions be considered
- Jurisdiction's Emergency Services handles the coordination of Hazard Plan
- In known cases of downstream developments, extra onsite storage is provided for safe downstream conveyance to account for future downstream development
- Re-evaluates the hazard classification of a BMP if it is impacted by a proposed project; not currently re-assessing existing low hazard BMPs on a regular schedule
- Factored in when looking at a pond repair project; not currently pro-actively going back and looking at every jurisdiction pond for hazard creep

11a. What types of principal spillway materials do you allow for MD-378 facilities?

- Concrete: 22 (29%)
- HDPE: 13 (17%)
- CMP: 12 (16%)
- PVC: 8 (10%)
- Other: 4 (5%)
- Weir wall may be used in lieu of a spillway conduit: 18 (23%)

11b. If "Other" was selected for 11a, describe the material(s) here. If no, type N/A.

- One respondent answered "Slip-lining using HDPE liners or [cured in place pipe (CIPP)] liners are also allowed"
- Three respondents answered they follow Department guidelines and MD-378 standards and specifications

11c. Do you have any material preferences and are there any that are prohibited?

- Prohibit CMPs: 7
- Prohibits wood: 1
- Prefers no CMP: 1

- Prefers concrete: 6
- Discourages concrete within right-of-way (ROW) due to installation difficulty and expense: 1
- Prohibits everything except concrete: 1
- Prefer HDPE: 3 ("due to ease of installation and longevity") (1 "unless criteria requires C-361 concrete pipe")
- Prohibits HDPE in vertical risers: 1
- Prefers RCP: 1 ("due to longevity")
- Discourages metal because of brackish water: 1

12. Do you allow anti-seep collars to be used on MD-378 facilities?
    - Yes: 17 (71%): 13 jurisdictions, 4 SCDs/NRCS
    - No: 7 (29%): 5 jurisdictions, 2 SCDs

13. What criteria do you use for the design and construction of weir walls for MD-378 facilities?
    - N/A
    - MD-378
    - Reviewed and Approved by the Department
    - Standard weir wall standards
    - Sliding and Overturning analysis with appropriate safety factors
    - Height of the weir wall and outfall elevation
    - Jurisdiction's Design Manual specifications
    - Weir must extend into the embankment a minimum of two feet. Flows over the weir must be fully contained within the concrete section up to the 100-year event. Weirs over 48 inches in height require review by the [jurisdiction] engineer
    - Materials required to meet CPS-378 [MD-378] specifications. Engineer of record must provide concrete/steel specifications and provide overturning computations in design report
    - Structural integrity of a weir wall has to be approved by a Structural Engineer. Weir walls are designed to safely convey various storm discharges and the following equations are used:
      Q = CL(H to the exponent of 3/2)
      Q is discharge in CFS
      C is discharge coefficient
      H is depth of flow above elevation of crest in feet
    - Excavated Ponds
    - Standard concrete wall structural design. If something specific is required by the Department's Dam Safety Division or the SCD in its review, then it is added

14. On average, how many MD-378 ponds are being built in a year?
11 responses:

- 0
- 1
- 2
- 3
- 4
- 6
- 8
- 12
- 20
- 30
- 50

Local Concerns (Questions 15-16)

15. Do you have specific requirements for geotechnical investigations, design, and construction QA/QC for MD-378 structures?

- N/A: 4
- No: 7
- Yes: 13
    - Geotechnical investigation/ report required: 7
    - Soil borings: 3

16. What are the geographic and physical challenges (e.g., karst, high groundwater, Use III waters, Tier 2 waters) your jurisdiction is facing?

- None/ N/A
- Use III waters
- Steep outfalls
- Proximity to streams and wetlands
- High groundwater
- Tidal influence
- Poor soils
- Sea level rise
- Subsidence and saltwater intrusion
- Highly erodible soils
- Steep slopes
- Bedrock
- Clayey soils
- Location of Critical area buffers
- Tier 2 waters
- Sandy soils
- Loss of land
- Springs leading to seeps
- Lack of topographic relief
- Karst

Outfalls and Downstream Impacts (Questions 17-19)

17. What are your design requirements for outfalls?

- 2011 Maryland Standards and Specifications for Erosion and Sediment Control
- Stable/Non-erosive Flows
- Require energy dissipation for erosive flows

- NRCS Technical Guide for Design
- 10-year storm discharge
- Slopes less than 10%
- MD-378 specifications
- Post Q ≤ Pre Q
- Positive drainage
- Can't adversely impact anything down stream

18. How do you review for downstream stability (channel protection) and flooding?
- > 10 % Rule, Velocity/Shear comps, HEC-RAS
- Site visit/ Inspection during review process (i.e., existing ditches, slopes, topo, soil, etc.)
- Require CP_V, Q_{10}, and Q_{100}
- Require the applicant to send notices to downstream property owners at the time of stormwater concept review, and ask those owners to provide applicable feedback; review GIS and floodplain data, and require dam breach and floodplain analysis as needed
- H & H analysis; outfall and downstream analysis
- Proposed flow can't exceed existing flow
- Drainage area on coastal plain
- DPW criteria
- State and Federal standards and specifications
- Verify outfall can safely convey design storms (manage onsite larger storms 10-, 25-, and 100-year)
- Energy dissipators
- Minimize concentrated flows; maximize sheet flows
- Department SWM Manual
- Analyze impacts of SWM downstream tributary where drainage area exceeds site contributing drainage area
- Safe compliance and floodplains studies and engineered channel protection

19a. Are sediment control plans reviewed for the potential to cause adverse off-site impacts?
- Yes: 17 (77%): 11 jurisdictions, 6 SCDs
- No: 5 (23%): 4 jurisdictions, 1 NRCS

19b. If so, describe. Type N/A if no.
- Unsure/Unaware/ N/A
- Reviewed by local SCD
- Enforces the Building Code requirements of no increase in flow to adjacent property
- Alert the design professional if something is of concern during review
- 2011 Maryland Standards and Specifications
- Section 7.1.7 for Temporary Stormwater Management requirements, which is required during construction

- Property boundary and downstream impacts to adjoining properties considered during design; Proposed grading may not alter the drainage to adversely impact adjacent properties. Special easements may be pertinent if impact is unavoidable
- Diverted/Increased drainage at points of investigation (POIs), sheet flow turned to point-discharge, existing known hot spot
- Ground erosion/slope failures/suitable outfalls
- Require additional ESC when necessary
- SCD and internal review
- To keep sediment on-site and for safe conveyance
- Outfalls are located so not to adversely affect neighboring properties

Construction (Questions 20-23)

20. Do you review and comment on as-built plans for conformance with the approved designs?
    - Yes: 19 (86%): 15 jurisdictions, 4 SCDs
    - No: 3 (14%): 3 SCDs/NRCS

21. Are as-built plans field verified?
    - Yes: 17 (77%): 15 jurisdictions, 2 SCDs
    - No: 5 (23%): 5 SCDs/NRCS

22. What do you consider to be significant differences between field conditions and the approved plans?
    - As-built elevation difference from approved plans greater than 0.1 feet
    - As-built elevation difference from approved plans greater than 0.2 feet; opening dimensions less than approved; volume (contours) difference greater than 5%
    - Tolerances determined on case by case basis
    - Try to minimize the differences by doing site visits in the design phase and inspection during the construction phase
    - Engineering firm is responsible for the project being constructed to specifications
    - Compliance within 10% for area and volume, and within a tenth of a foot dimensionally
    - Different structures and/or dimensions that affect the hydraulic performance of the SWM facility
    - Change in location and alignment, change in material and size, volume required versus volume provided
    - Elevations differing by 0.2 feet; storage being less than 10% of design storage; slopes exceeding 2:1 and/or combination of upstream and downstream slopes exceeding 5:1

- SWM facilities constructed smaller in volume than what was shown on the approved. Any pipes or structures installed smaller than specified in the approved. Elevation changes that could impact buildings or nearby properties
- Topography busts, geology (i.e., subsurface rocks), and adverse drainage conditions

23. How are locations for future infiltration practices protected during construction?
    - Divert flow; undisturbed until site is permanently stabilized; cover by fabric
    - Limits traffic and staging and stockpile at infiltration practice locations
    - Sediment control practices should not be used over infiltration practices, if possible. If not, a minimum of a foot separation is needed
    - Through the proper use of ESC
    - By avoidance and grading limitation
    - Exclusion of construction activities and sediment laden water
    - Protective fencing around the area
    - Built after the project has been completely stabilized (sequencing or phasing)
    - Through rough-in and proper movement
    - Either construction is not allowed in these areas or a buffer layer of in-situ soil is left in place above the final bottom of the infiltration practice that will not be removed until the contributing drainage area to the infiltration practice is stabilized and the facility is constructed
    - A minimum difference of 2 feet from the bottom of a sediment control practice must be maintained in relation to the infiltration practice

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OTHER CONCERNS

1. What operational challenges (e.g., staff, funds, experience) is your jurisdiction facing?
    - Lack of funding
    - Lack of staff (retention, not enough qualified/experienced staff and/or loss of experienced staff)
    - Training
    - Time for projects (direct result of lack of funding)
    - Department Standards, address climate change and asset management software

2. What do you need from the Department?
    - Shorter processing time/ quicker project turn around
    - Technical support
    - Interdepartmental cooperation and communication
    - Training for reviewers, consulting engineers, inspectors, and contractors (annually, MD-

378 and other specific topics)
- Proprietary stormwater products should be handled specifically via Department approval, rather than offering general guidelines that must be administered and interpreted locally
- Continuous guidance and policy clarifications
- Consistency between jurisdictions on changes allowed in the Design Manual; written requirements if the Department wants stricter items to be used
- Engineering staff for reviews and funds for SCD staff
- Updated standards from the Department to address concerns of climate change
- Less changing design approach when we're at 65% and 95% design
- A greater requirement of quantity control; statewide requirements instead of letting each local jurisdiction decide its own standards
- A Certified Training Program. Every jurisdiction should be held to the same requirements and be required to have the same certifications for review

3. What changes would you recommend to improve the State's sediment, stormwater, and dam safety programs?
- More training
- Develop new guidelines
- Issue regular updates; more communication
- Small pond review and training for new staff
- Reassessment of Maryland Hydrology, SWM requirements
- Staff more inspectors and reviewers
- Continue Department Dam Safety meetings
- Contact experts for each programs to be provided to local jurisdiction
- Provide checklists for all jurisdictions and requiring them to meet the requirements
- Better communication and follow through with changes made on a State level; the Department should be available to interpret what their manuals stipulate to assist local reviewers when confronting a design engineer who wants to deviate from the State standards; provide training to contractors on how to properly install sediment control practices, pipe placement, etc.