

MEMORANDUM

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Subject: Summary of Findings – New Stormwater Rule Evaluation of Nine (9) Project Development and Environment (PD&E) Studies.

Executive Summary

The Florida Department of Transportation (FDOT) conducted a comprehensive review of nine Pond Siting Reports (PSRs) from Project Development and Environment (PD&E) studies across six FDOT districts. These projects, shown in **Figure 1** and summarized in **Table 1**, represent a broad array of Florida's transportation infrastructure, ranging from flush shoulder and curb and gutter corridors to major interstate improvements located within the regulatory jurisdictions of several Water Management Districts (WMDs): Northwest Florida, Southwest Florida, South Florida, and St. Johns River.

Figure 1: Location Map of Nine Total Projects



Table 1: Nine Projects Evaluated for the New Stormwater Rule

Project	FDOT District	Description	Typical Section	FPID	Additional ROW ¹ (Y/N)
I-10	D3	From SR 281 to Log Lake Road (NFWWMD)	Flush Shoulder	413062-5	No
SR 544	D1	From MLK Jr. Blvd. to SR 17 (SWFWMD)	Curb & Gutter	440273-1	No
SR 45	D7	From Kracker Ave. to South of SR 676 (SWFWMD)	Flush Shoulder/Curb & Gutter	430056-1	No
SR 45 at SR 54	D7	From South of SR 54 Intersection to North of SR 54 Intersection (SWFWMD)	Curb & Gutter	419182-1	No
Cove Road	D4	From SR 76 to SR 5 (SFWMD)	Curb & Gutter	441700-1	No
SR 16	D2	From IGP to I-95 (SJRWMD)	Curb & Gutter	210447-5	No
US 98	D3	From CR 30A to West Phillips Inlet Bridge (NFWWMD)	Flush Shoulder/Curb & Gutter	437179-1	Yes
I-95	D6	From S. Miami Garden's Drive to Broward CL (SFWMD)	Curb & Gutter	414964-1	Yes
SR 20	D3	From SR 263 to Appleyard Dr. (NFWWMD)	Curb & Gutter	219820-2	No

1. Indicates if additional right-of-way (ROW) compared to the original PSR was needed to meet the new stormwater rule criteria.

The goal was to assess the implications of Florida's newly adopted nutrient reduction stormwater regulations – specifically, Chapter 62-330, Florida Administrative Code (F.A.C), and the incorporated Environmental Resource Permit (ERP) Applicant's Handbook Volume I (A.H. Vol. 1). This assessment evaluated how these regulations may impact future stormwater facility planning, design, and FDOT's work program (e.g. ROW and Maintenance).

The new stormwater rule fundamentally shifts Florida's regulatory approach from the volume-based treatment requirement (commonly known as the "first-flush" method) to a focus on nutrient reduction efficiency. Under the new rule, stormwater management systems must achieve defined minimum nutrient reduction standards for total nitrogen (TN) and total phosphorus (TP), with heightened requirements in impaired watersheds and in those discharging to Outstanding Florida Waters (OFWs). This shift places greater emphasis on modeling nutrient load reductions and optimizing Best Management Practices (BMP) performance, which leverage project-specific characteristics.

FDOT's evaluation focused on how the new criteria affect BMP selection, sizing, and optimization, along with right-of-way (ROW) requirements. A recurring finding is that the roadway typical section

(flush shoulder vs. curb and gutter) and the downstream ambient water quality conditions are the key determinants of the ability to meet the new nutrient reduction standards. An example of how the typical section and ambient water quality in downstream receiving water bodies can affect outcomes is seen in the US 98 project, which was unable to meet the nutrient reduction required by the new criteria for outfalls classified as impaired and OFWs. This project will require additional ROW and/or reliance on vegetated natural buffer zones associated with historic flow paths onto forest lands abutting the state highway system to accommodate additional BMPs. A global finding in this evaluation is that flush shoulder typical sections benefit from natural vegetative treatment along the corridor and available ROW, often allowing them to meet nutrient reduction targets without requiring substantial new infrastructure or additional ROW. In contrast, curb and gutter typical sections, constrained by limited space and the absence of vegetated surfaces, require more advanced or engineered BMP solutions if downstream water bodies are classified as impaired and/or OFWs. Projects with curb and gutter typical sections and no downstream impairments and/or OFW classifications were able to meet the nutrient reduction standards of the new rule with minor modifications to traditional BMPs in series, such as the addition of the side bank filter BMP.

Notably, the evaluation found that applying the calculations needed for the new stormwater rule (A.H. Vol. 1 Section 9) does not inherently demand more land for every project. While multiple factors contribute to this outcome and it is not a universally clear-cut finding, the key takeaway is that the ability to meet nutrient reduction standards hinges on optimizing available space through reconfigured ponds, integrated treatment trains, and innovative BMPs such as side bank filters and the split BMP system, which are discussed in the narrative of this report. These approaches leverage infiltration processes to supplement conventional detention systems and are critical for projects with a curb and gutter typical section. However, this increased complexity introduces higher global demands on analysis, nutrient reduction modeling, and potential intra-agency coordination. Construction costs are only expected to increase for BMP solutions on projects with a curb and gutter typical section.

Only two of nine projects (I-95 and US 98) required ROW in addition to the original PSRs ROW estimates. Both projects included at least partial curb and gutter typical sections that discharge to downstream OFWs or impaired OFWs, thus requiring the most stringent nutrient reduction standards. I-95 lacked feasible retention or infiltration BMP opportunities within its dense urban corridor, while US 98's modified swales could not meet nutrient reduction requirements. In contrast, the I-10 (SR 8) project in District 3 was the only other project to also discharge to downstream OFWs, some of which were also impaired. The nutrient reduction provided by Vegetated Filter Strips (VFS), swales (flush shoulder typical section), and the originally sited ponds was sufficient to meet the new rule's nutrient reduction standards. Although US 98 also includes a flush shoulder typical section along portions of the project limits, the corridor must also account for nutrient loading from curb and gutter typical section segments. The nutrient loading from these curb and gutter segments, combined with the narrower VFS width of the modified swales, is the primary reason US 98 was unable to meet the new rule's nutrient reduction standards compared to the I-10 project. Across all nine projects, post-condition nutrient reductions were achieved to below pre-condition levels.

This evaluation highlights the importance of incorporating available geotechnical data during the PD&E phase when assessing BMP feasibility. Retention BMPs are sensitive to groundwater depth and soil

infiltration characteristics, making early consideration of these factors critical. As with the previous stormwater rule, how designers use this information can significantly influence project outcomes. By drawing on available data and applying engineering judgment, designers can better provide reasonable assurance of BMP feasibility and reduce the likelihood of rework in the design phase.

Ultimately, this transition marks a critical evolution in Florida's stormwater planning philosophy, requiring a more integrated and multidisciplinary coordination between roadway, environmental, geotechnical, and drainage designers to meet the nutrient reduction standards of the new rule. Key findings and considerations for future FDOT projects include:

- **Typical Section and Adequate ROW Drives Ability to Meet Nutrient Reduction Standards:** The roadway typical section is the most influential factor in determining available BMPs in series.
- **Early Use of Geotechnical Information in PD&E Phase:** Early consideration of available groundwater and soil data is essential to assess BMP feasibility, especially for infiltration-based systems like dry retention ponds.
- **Innovative BMPs Are Essential:** New systems, such as side bank filters, split BMPs, routing open and closed flume inlets to swales, and implementing previous unrealized BMP opportunities like the VFS, are key to meeting standards within limited footprints and should be prioritized.
- **Optimize Before Expanding:** Nutrient reduction targets may be met through strategic layout and optimized treatment trains without requiring additional ROW.
- **Increased Engineering Complexity:** The new rule requires holistic project pre-post nutrient loading analysis and nutrient reduction modeling, some at the HUC 12 sub-watershed or distinct water body outfall scale, replacing net new impervious volume-based checks.
- **Early Coordination:** For certain projects, early coordination with the corresponding FDOT District during the PD&E phase may be needed to review impairment classifications and align appropriate treatment strategies. While designers remain responsible for identifying impairment classifications and selecting BMP strategies, coordination with FDOT is recommended prior to discussions with the Water Management District for projects with unique circumstances or highly stringent nutrient reduction requirements.
- **Cost Implications Vary by BMP:** While some commonly used BMPs remain to be the most cost-effective, proprietary structures and newer systems (e.g., Split BMPs, side bank filters) may raise both capital and maintenance costs due to added components, complexity, and inspection frequency. VFS and swales, though new to ERP applications, offer cost-effective alternatives that help illustrate the tradeoffs between simpler and more complex BMPs.
- **FDOT Documents Should be Reviewed and Updated:** Key documents such as the FDOT Drainage Manual, Drainage Design Guide, PD&E Manual, Permit Handbook, and WATERSS Process Guidebook to address the potential overlap with the "regional treatment" approach in new rule, ETDM Manual, and associated design guides should be reviewed and updated to reflect the nutrient reduction stormwater framework.
- **Maintenance Frequency & Costs:** Maintenance needs and costs for stormwater management systems will depend on the selected BMPs. Existing BMP systems will maintain current



inspection and maintenance schedules and activities under FDOT's Statewide Stormwater Management Plan (SSWMP).

Based on the list of findings above, the following actionable items are recommended.

Actionable Items:

1. Include drainage and ROW accommodations in roadway typical section packages.
2. Expand available resources for geotechnical data to be used in the PD&E phase.
3. Promote and educate consultants on BMP options, optimization concepts, and philosophy to prevent defaulting to BMP footprint expansions to meet the new stormwater rule standards.
4. Research new BMP systems focused on efficiency over volume to target the new nutrient reduction standards.
5. Update and improve BMP modeling system for FDOT projects in accordance with FDEP's criteria.
6. Review and update FDOT manuals and guidance documents to align efforts with the new rule.

Please refer to **Appendix A** for a comprehensive impact matrix.

Introduction & Objective

FDOT conducted a comprehensive review of nine (9) PSRs as part of ongoing PD&E studies across six (6) FDOT districts, and four (4) WMDs. A list of these projects can be found in **Table 1** in the Executive Summary.

The purpose of the review was to assess the implications of the newly adopted stormwater regulatory framework established in Chapter 62-330, F.A.C, and incorporated ERP Applicant Handbooks Volumes I and II. The primary objective was to evaluate how the revised stormwater rule would affect the identification, analysis, and selection of stormwater management alternatives within future roadway projects. The analysis of this report focused on potential impacts on the design approach, planning strategies, and maximized value associated with the preparation of PSRs.

A key component of the review involved evaluating the stormwater treatment facilities proposed in each PSR as treatment BMPs under the criteria set forth in the new rule. Each facility's performance was assessed for its ability to meet the updated nutrient reduction standards. Where new performance standards could not be achieved, recommendations were made to modify or supplement the existing BMP configurations – such as incorporating additional dry retention areas, exfiltration trenches, or innovative treatment strategies.

In addition, the review aimed to identify how the ability to meet the nutrient reduction standards of the new rule could influence project development parameters. The findings from this effort are intended to inform the reader of the adoption of the new rule using these nine PSRs, potentially shaping future pond siting strategies and to support FDOT in aligning its project delivery process with evolving regulatory requirements.

New Stormwater Rule

The new stormwater rule criteria is quantified differently, focusing on the reduction of TN and TP in surface water discharges. Criteria is determined by BMP efficiency rates based on the existing ambient water quality conditions of the downstream Water of the State, outlined in Sections 8.3.2 through 8.3.5 of the Applicant's Handbook Volume I (A.H. Vol 1). This technical memorandum presents the findings and verification calculations for the proposed stormwater management facilities to provide reasonable assurance with the nutrient reduction performance standards established under the new stormwater rule. No changes in volumetric attenuation are expected, so attenuation volumes were not evaluated.

For this evaluation, the Florida Department of Environmental Protection (FDEP) Division of Environmental Assessment and Restoration's (DEAR) Waters Not Attaining Standards (WNAS) from the adopted 2022-2024 Biennial Assessment dataset was used to identify impaired waterbodies (WBIDs) within the HUC 12 sub-watersheds. Impaired WBIDs are defined as those that are not meeting their applicable water quality standards under Chapter 62-302, F.A.C., and have been verified as impaired under Chapter 62-303, F.A.C., which are associated with assessment categories 4a, 4b, and 5. This definition of impaired waterbodies for administration of the ERP program was confirmed with FDEP's DEAR and Division of Water Resource Management administrators. This memorandum is focused on the A.H. Vol. 1 of the stormwater rule. Applicant's Handbook Volume II (A.H. Vol. 2) will vary by WMD. Although the new rule establishes nutrient reduction standards for TN and TP, the rule

does not specify if the impairment classification is to be used for nutrient and nutrient response variable impairments, or all water quality parameters (e.g. bacteria, mercury and metals). Thus, two ambient water quality scenarios were evaluated:

- Scenario 1: focused on nutrient-specific impairments.
- Scenario 2: considered additional risks of using impaired WBIDs with any water quality parameters, including but not limited to nutrients, bacteria, mercury, and metals.

This memorandum presents the results of applying the new stormwater rule, as outlined in the A.H. Vol. 1. This assessment assumes full implementation without grandfathering to evaluate future impacts on the Department's Work Program. **Table 2** summarizes the applicable performance standards from Section 8.3 of the new stormwater rule.

Table 2: New Stormwater Management Performance Standard Requirements

Ambient Water Quality Classification	BMP Nutrient Reduction Rate % (TP)	BMP Nutrient Reduction Rate % (TN)	Nutrient Loading Analysis	Presumptive TSS Reduction Rate %	A.H. Section
All Sites	80	55	Post ≤ Pre	80	8.3.2
Impaired Waters	80	80	Post ≤ Pre	80	8.3.4
OFW	90	80	Post ≤ Pre	95	8.3.3
Impaired + OFW	95	95	Post ≤ Pre	95	8.3.4

It should be noted that impaired waters not meeting their designated use at the time of application must follow the impaired performance standards. For example, during the PD&E phase, a WBID may be listed as assessment category 4a (impaired with a TMDL); however, by the time the project advances to design and the ERP application is submitted, the WBID could be reclassified as assessment category 2t (meeting its designated use). Then the WBID would no longer be considered impaired and the impaired performance standards would not need to be met. As the impaired list is updated every two years, the opposite may be true as well. A waterbody that is not classified as impaired during the PD&E phase could change to classified as impaired by the biennial assessment when the project advances to design and the ERP application is submitted. Then, because the WBID would be considered impaired, the impaired performance standards would apply. The impairment status of a WBID at the time of ERP application will ultimately determine the water quality performance standard requirements.

Under the old stormwater management rule, applicants were required to demonstrate that proposed stormwater treatment facilities provided a predefined treatment volume. This volume was calculated based on the greater of either 1-inch of runoff over the entire basin/project area or 2.5 inches of runoff over the impervious area, which is typically the net new impervious depending on specific WMD criteria. The treatment volume was increased or reduced depending on proximity to an OFW and the proposed BMP type to be used. To meet these volumetric criteria, the design typically included a weir or other

control structure set at an elevation corresponding to the required treatment volume. This configuration allowed for the capture and detention of stormwater, during which time sediment-bound nutrients could settle to the bottom of the treatment pond or facility by gravity.

The new rule, however, represents a paradigm shift in regulatory approach by eliminating the standard first-flush treatment volume, where the treatment volume was known upfront in design. Instead, it focuses on the nutrient reduction *efficiency* of stormwater BMP systems. Under this nutrient reduction-based framework, the design objective is no longer to provide a specific treatment volume, but rather to demonstrate, through modeling or calculation, that the selected BMPs can achieve the required nutrient reduction set forth in the new rule language. The removal of the static first-flush treatment volume is a benefit of the new rule, by reducing the required overall volume needed for each facility, potentially reflecting a proportional decrease in the required pond footprint on a case-by-case basis.

Summary of Findings

The evaluation of nine PSRs has identified key insights that challenge prevailing assumptions about stormwater facility planning within the first-flush treatment volume regulatory framework (old rule). While the updated regulations impose stricter nutrient reduction efficiency standards, the evaluation indicates that substantial additional ROW is not universally required. The necessity for expanded space is contingent upon the specific project typical section and condition of receiving waters. Furthermore, critical factors influencing feasibility and type of offsite stormwater management facilities include seasonal high-water elevations, the availability of undeveloped land or optimization of available space, and the integration of drainage considerations into the typical section planning process. These key factors emerged from the new stormwater rule evaluation and will directly influence ROW needs, stormwater treatment design, project feasibility, and project schedules when drainage becomes a part of the critical path:

1. **Typical Section:** The roadway typical section is the primary driver in determining whether additional ROW will be necessary for stormwater BMPs. Flush shoulder typical sections tend to benefit from the new rule due to the availability of vegetated treatment pathways. Curb and gutter typical sections, with limited vegetated surface interaction, face greater challenges in meeting nutrient reduction criteria.
2. **Geotechnical Data:** Subsurface data controls stormwater BMP type and opportunities. Subsurface data is essential to assess in-situ soil infiltration rates and groundwater constraints, which are critical to BMP nutrient reduction performance. Online datasets, such as those provided by the NRCS Web Soil Survey, FDOT's geotechnical GIS database, canal or lake regulation schedules, USGS data, NOAA Tide and Current Stations, USFWS National Wetland Inventory, aerial imagery (FDOT), and permit research may still be applied as they were under the previous water quality rule.
3. **Area Optimization:** Evaluation of findings indicate that additional ROW is not universally required. In most cases for the projects evaluated, nutrient reduction standards were met without the need of additional ROW. Strategically optimizing existing areas, such as reconfiguring pond geometry or integrating treatment into linear infrastructure, can achieve the nutrient reduction standards of the new rule without expanding project footprints.

4. **Development of New BMPs:** The transition to a nutrient reduction regulatory framework underscores the need for innovative BMP systems. New or modified designs – such as side bank filters and split BMP treatment trains – are essential to address site-specific constraints while achieving the nutrient reduction standards of the new rule. This includes roadside BMPs (VFS and swales) and development of BMPs that can be added into FDOT's Standard Plans and Specifications like the recently updated Type V underdrain Standard Plan for side bank filters.
5. **Engineering Analysis for Future Pond Siting Reports:** For this evaluation under the new stormwater rule, drainage systems relied on a nutrient reduction modeling approach rather than the previous first-flush volumetric methodology. Some BMPs may include additional features that increase capital and construction costs. It should be noted that the nine PSRs evaluated for this study were closer to a 45% conceptual design level; therefore, the level of engineering analysis effort may not be fully representative of all future PD&E PSR projects.

The following narrative provides more details of each key finding introduced in the list above.

Typical Section

A clear distinction in the development of future PSRs is driven by the intended roadway typical section. For corridors with flush shoulder typical sections, stormwater treatment begins once sheet flow leaves the pavement surface. This is initiated by the VFS, which are essentially the standard unpaved shoulder and front slope of the roadway embankment. The treatment train for these typical sections generally consists of a combination of VFS, conveyance swales (vegetated ditches), and detention or retention ponds. One of the key findings from this evaluation is the high nutrient reduction efficiency of the VFS and swales prior to stormwater reaching the pond. In many scenarios, modeling results demonstrated that these upstream features provided sufficient treatment to meet the standards of the new rule, indicating that the primary function of the downstream pond in flush shoulder typical sections may shift from providing both treatment and attenuation to only sizing for attenuation. This insight reinforces the importance of considering the full treatment train and typical section context when designing stormwater management systems. For corridors with flush shoulder typical sections, it may be more beneficial to adhere to the new stormwater rule rather than maximizing grandfathering provisions. BMP modeling supports this approach, indicating that flush shoulder typical sections may perform better under the new rule than under the previous volumetric-based standards. This applies especially to projects in tidally influenced basins, where ponds may only be needed for nutrient reduction and do not have to adhere to pre-post discharge criteria. The key takeaway is that roadway configurations allowing for vegetated surface treatment generally provide larger nutrient reductions. Please note that while the benefits of pretreatment in flush shoulder typical sections is a consistent finding in this evaluation, the need for ponds strictly for nutrient reduction is not universal, and each project warrants a detailed, project-specific evaluation.

In contrast, this treatment dynamic does not hold true for curb and gutter roadway typical sections. Unlike their flush shoulder counterparts, curb and gutter typical sections draining to stormwater pipes do not benefit from nutrient reduction through vegetated surface interactions, as stormwater runoff is collected almost immediately via inlets and conveyed through underground storm drain systems. As a result, stormwater loses the opportunity for pre-treatment provided by the VFS or conveyance ditches. Instead, treatment begins at downstream facilities, typically dry or wet ponds. These ponds therefore

serve as the primary, and often sole, means of nutrient reduction. This places a higher treatment burden on the pond system and significantly influences how facilities are sized, sited, and integrated within dense, space-constrained curb and gutter corridors. Consequently, curb and gutter typical sections demand a different BMP strategy, often requiring more advanced or engineered treatment solutions to meet the minimum nutrient reduction rates of the new rule. For example, the Cove Road project in District 4 used curb flumes to direct runoff into linear treatment systems prior to discharging into the closed conveyance network and downstream ponds. Incorporating these linear systems as pretreatment measures enhanced nutrient reduction at the HUC 12 sub-watershed scale, thereby eliminating the need to upsize ponds to satisfy the nutrient reduction standards for impaired water outfalls (80% for TN & TP).

Geotechnical Data

Geotechnical data, such as seasonal high-water levels (SHWL) and percolation properties are critical determinants in the efficiency of BMPs designed to meet the nutrient reduction standards of the new rule. Dry retention BMPs have the highest nutrient reduction efficiency by storing and infiltrating stormwater runoff so it does not discharge to downstream waterbodies; however, their feasibility diminishes in areas with elevated groundwater levels, or poor percolation soil properties. To maximize the effectiveness of stormwater strategies under the new rule, stormwater considerations in the PD&E phase necessitate reliance on available geotechnical data, and engineering judgment. Because BMP performance is highly sensitive to subsurface conditions, incorporating geotechnical considerations during PD&E is beneficial for developing a sound conceptual drainage strategy that minimizes redesign and delays in permitting. Online datasets such as the NRCS Web Soil Survey, FDOT's geotechnical GIS database, canal regulation schedules, USGS data, NOAA Tide and Current Stations, USFWS National Wetland Inventory, aerial imagery (FDOT), and permit research may still be applied as they were under the previous stormwater criteria. Site-specific geotechnical investigations should be coordinated with FDOT on a case-by-case basis.

Area Optimization

For many projects, particularly those in less constrained or suburban contexts, meeting the new nutrient reduction standards can be achieved through a strategic reconfiguration of space in similar footprints as ponds sized for the old rule – optimizing the location, function, and integration of BMPs to meet nutrient reduction standards for each individual roadway sub basin or at the HUC 12 sub-watershed or direct outfall level (compensatory treatment). The focus shifts from expanding the footprint to maximizing the nutrient reduction efficiency within it. This is particularly true for wet detention ponds, as Appendix O in the A.H. Vol. I. establishes maximum allowable nutrient reduction efficiencies for these systems. As a result, increasing the size of a wet pond does not translate to higher credited treatment performance. Regardless of volume, the nutrient reduction efficiency is capped at 43% for TN, and 80% TP for a maximum residence time of 200 days. This means compliance with FDEP and WMDs' regulations is based on those defined limits rather than pond size. This presents an opportunity to optimize space, by eliminating excess wet pond's permanent pool volume (PPV) that does not contribute to additional treatment credit and instead reallocating that space for more effective BMPs such as dry retention systems, which can offer higher nutrient reduction efficiencies, if seasonal high groundwater table elevations allow for it. Moreover, compensatory treatment can be applied at the HUC 12 sub-watershed level, allowing all available BMPs within the sub-watershed to contribute to overall

nutrient reduction. Under this approach, nutrient loadings from individual roadway sub-basins are combined, and their proportional reductions are aggregated to determine the total nutrient reduction efficiency for the HUC 12 sub-watershed. This method was used in evaluating the nine projects, as it provides greater flexibility and enhances the ability to meet the nutrient reduction standards of the new rule.

Optimization of space was successful for projects with minimum nutrient reduction requirements for regular sites (55% TN/ 80% TP) and impaired waters (80% TN and TP); however, this finding does not extend to all nutrient reduction requirements such as projects with downstream impaired waterbodies that are also OFWs and are located in heavily urbanized areas like the I-95 project in District 6. For projects where ROW is limited, Directly Connected Impervious Area (DCIA) is extensive, and available space is virtually nonexistent, meeting these standards poses a far greater challenge. In such contexts, the lack of spatial flexibility necessitates alternative approaches – such as maintenance intensive BMPs, regional stormwater treatment systems, or other advanced treatment technologies. Ultimately, the new rule demands not more space in general, but well thought out, context-sensitive use of the space that is available, an approach that varies dramatically between low-density developments and space-constrained urban infrastructure.

New Best Management Practices (BMPs)

Under the new stormwater rule, it is essential to consider innovative BMP configurations that leverage available site conditions and optimize the use of space. Emphasis should be placed on systems that utilize native soils as filtration media and can be integrated into typical pond footprints.

Side Bank Filters - One such approach is the side bank filter system, which retrofits the sloped banks of wet detention ponds with an underdrain per updated FDOT Standard Plans, which specify the use of fine aggregates to provide nutrient reduction through filtration. Treated stormwater percolates through side bank soils before discharging to the downstream outfall location. To maintain performance, the system includes an underdrain that manages the wet pond's normal water level and promotes consistent recovery of the treatment volume. This BMP functions as a detention-with-filtration system per the A.H. Vol. I language. Unlike standard wet ponds, where water quality treatment occurs primarily through sedimentation, side bank filters provide additional nutrient reduction through media filtration. Preliminary results from FDOT's research project BDV24-977-25 indicates that the filter media (FDOT A-3 fine aggregate soils) can achieve reduction efficiencies of 34% for TN and 81% for TP. However, these values only represent media-specific performance. The total nutrient reduction efficiency of the system is determined by multiplying the filter media efficiency by the annual volume of stormwater that is effectively retained and treated through infiltration.

For example, if a pond retains 60% of the annual runoff volume, the overall reduction efficiency for TN would be approximately 20.4% (0.34×0.60), and for TP, approximately 48.6% (0.81×0.60). When applied as an alternative solution to some of the nine PSRs, BMP models show that side bank filters can yield average added efficiencies of 30% for TN and 76% for TP when properly designed and paired with traditional wet detention ponds. This system is particularly effective for projects that are not located in impaired watersheds or do not discharge to OFWs, as the wet detention PPV and side bank filters treatment train overall efficiency exceeds the 55% TN and 80% TP nutrient reduction standards. Side

bank filters in series with the PPV of a wet pond cannot achieve the 80% or more TN nutrient reduction required for impaired and/or OFW downstream waterbodies.

To meet the 55%TN/ 80%TP performance standards, side bank filters must provide at least 21.3% of nutrient reduction efficiency when used in conjunction with treatment limits of a wet pond per Appendix O. Given their average modeled performance, they offer a valuable degree of flexibility and can help reduce the required pond footprints, supporting FDOT's goal of optimizing space while meeting new water quality standards, but are limited to projects that do not have downstream impairments or OFWs. This BMP was added to the FDOT 2026 Drainage Manual, and FDOT Standard Plan Index 440-001 was modified to include a Type V underdrain to supplement side bank filters in wet ponds.

Vegetated Filter Strips – Vegetated Filter Strips (VFS), have been adopted by reference in the A.H. Vol. I. Appendix O under the Traditional Stormwater BMP list. These systems are particularly beneficial in flush shoulder corridors where overland flow allows for natural infiltration of stormwater runoff, functionally reducing the overall discharge to downstream BMPs or outfalls. Nutrient reduction varies based on the amount of cross-sectional width that drains to the VFS, the width of the actual VFS, and the depth, slope and storage capacity of the VFS.

The Split BMP – proposed in several of the reviewed PSRs, this system is another example of innovative BMP integration. While composed of familiar elements – a dry pond paired with a wet detention system – it is designed to function as a single, cohesive stormwater management facility that provides both attenuation and treatment. This hybrid system addresses spatial constraints by combining treatment stages and optimizing the use of available ROW, making it well-suited for the nutrient reduction framework of the new stormwater rule.

Lastly, prioritize vegetation opportunities for conveyance systems with closed or curb flumes draining to linear swales prior to discharging to closed conveyance systems and downstream ponds. The pretreatment provided by swales enhances nutrient reduction prior to discharging to ponds and is particularly valuable in sub-watersheds subject to the more stringent nutrient reduction requirements of the new rule.

Engineering Analysis for Future Pond Siting Reports

This section discusses the anticipated impacts on the traditional PSR process and outlines how future reports may evolve under the new stormwater rule.

Data Collection – The data collection process for evaluating projects under the new stormwater regulations largely mirrors the previous methodology employed under the old rule. The new rule requires HUC 12 sub-watershed level assessments of ambient water quality, which will require additional data. This information is available through FDEP's online resources.

Analysis Process – The nutrient reduction analysis under the new stormwater rule is more involved than the previous criteria. Previously, stormwater facilities' performance standards were assessed using volumetric calculations based on first-flush flow depths to determine treatment volumes. In contrast, the framework used to evaluate these projects for the new rule requires modeling to evaluate the nutrient reduction efficiency of BMPs. Unlike the static volumetric method, this modeling process

necessitates detailed input data and iterative simulation techniques, reflecting the shift towards nutrient reduction modeling in stormwater management. This enhanced analytical process is expected to increase drainage analysis. Designers are encouraged to utilize FDOT recently added ambient water quality tools to facilitate analyses required for the new stormwater rule.

Right-of-way – Drainage ROW acquisition estimates for roadway projects are influenced by project-specific factors, including typical section type, geotechnical characteristics such as soil properties, groundwater table levels, and environmental considerations like ambient water quality, impairments or proximity to OFWs, which may necessitate additional ROW to meet stringent nutrient reduction requirements.

Agency Coordination – Under the new stormwater rule, agency coordination for roadway projects will closely mirror the process established under the previous rule beginning with initial comments and identification of permitting considerations through the Efficient Transportation Decision Making (ETDM) process.

Designers should understand the criteria of each project and coordinate closely with the District Drainage Engineer and District Environmental Permit Coordinator to determine any additional preparation needed before scheduling a pre-application meeting with the regulatory agency, if needed. If regional treatment measures are considered for a project, early coordination with stake holders is strongly encouraged. Designers should coordinate with corresponding FDOT Districts and local agencies prior to coordination with the regulatory agency.

For accelerated projects, BMP feasibility coordination with corresponding FDOT Districts is encouraged. The efficiency of BMPs at the HUC 12 sub-watershed scale is sensitive to each BMP applied. Therefore, it's crucial for designers to have a reasonable level of confidence in the feasibility of proposed BMPs at the PD&E phase. Delaying BMP selection can lead to challenges in meeting nutrient reduction criteria and may result in costly redesigns. By addressing BMP effectiveness early on, project teams can be reasonably confident that the chosen measures are both practical and effective, leading to more successful project outcomes.

Construction Costs – Construction costs will vary based on the selected BMPs. Traditional BMPs, such as wet ponds, swales, ditches and vegetated filters are expected to remain similar in cost to those designed under the previous stormwater rule. The split BMP concept introduced in this report typically requires less excavation than a full wet pond, offering potential cost savings. However, to function effectively as a system, the split BMP requires a flow diversion structure. These structures are usually custom-designed and can be more expensive than a standard manhole, the current average cost of a flow diversion structure is \$34,100. Non-traditional BMPs, like proprietary baffle boxes, are significantly more costly while offering relatively low nutrient reduction efficiencies, as outlined in Appendix O. The current average cost of a proprietary baffle box is about \$224,500 and requires FDOT to perform quarterly inspection and maintenance under the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) program. Moreover, if side bank filters are incorporated as a BMP, the overall cost of the stormwater management system will increase due to the underdrain construction, compared to a traditional wet pond designed under the old rule.

In general, construction costs for stormwater systems that comply with the new rule will be project-specific, based on selected BMPs (traditional vs. nontraditional). For example, if swales with ditch blocks are proposed, designers must now consider base clearance measures – such as adding black base to roadway typical sections, if necessary to achieve nutrient reduction standards in roadside swales. To optimize both cost and performance, stormwater management systems should be integrated into the overall roadway design, not treated as a separate system. Coordinating drainage and roadway design early in the PD&E process can lead to more efficient, cost-effective outcomes.

Environmental Impacts - The evaluation of the nine PSRs found no additional environmental impacts for eight projects under the new stormwater rule compared to the previous rule. Two projects (I-95, and US 98) required consideration of additional ROW, for which potential additional environmental impacts were evaluated. For US 98, no new impacts to species, wetlands, or floodplains are anticipated beyond those previously documented in the original PSR. For I-95, the additional proposed pond (Retention Area 15) is located within a depression identified as a potential wetland in the FWS National Wetland Inventory. If field verification confirms these wetlands, the I-95 project would result in additional wetland impacts. These findings apply only to the projects reviewed and should not be assumed to represent outcomes for all future projects.

Maintenance Frequency & Costs – The maintenance frequency and cost for stormwater management systems will vary based on the selected BMPs. Traditional BMPs, such as ditches, wet and dry ponds, will generally maintain their current maintenance costs and schedules. These systems are well understood, and no significant changes are anticipated for their maintenance frequency or cost. However, BMPs like the proposed split BMP may require additional maintenance such as desilting the flow diversion structure and potentially fixing any erosion along the inside berm. The inspection frequency for this system is to match FDOT's Statewide Stormwater Management Plan (SSWMP) of once every 3 years, which matches both dry retention and wet detention SMF inspection frequencies. This is critical because excessive silting would reduce the retention volume, which must be preserved for proper nutrient reduction. Maintenance is further complicated by space limitations on both the bottom and top of the pond:

- **Bottom Limitation:** Silt buildup at the bottom of the pond reduces retention volume, but deeper excavation is not feasible due to the need to maintain a proper separation from Seasonal High-Water Level (SHWL) for infiltration to occur.
- **Top Limitation:** The 1-foot freeboard for design storms must be maintained to ensure FDOT design compliance. Raising the pond bottom would compromise the hydraulic feasibility of the design and alter the system's flow characteristics.

As such, the dry portion of the split BMP requires a balanced profile to optimize retention capacity while maintaining structural integrity. The split BMP facility and flow diversion structures will follow FDOT's SSWMP inspection and maintenance schedule.

The inspection and maintenance of side bank filters is covered under dry retention with filtration BMPs within the FDOT's SSWMP.

For traditional infrastructure such as trunklines, inlets, and other common BMPs, no changes to maintenance frequencies are expected. These systems will continue to follow the established SSWMP guidelines for maintenance.

Other Key Findings with Potential Influence on Future Pond Siting Reports – The evaluation of the nine PSRs indicates that the new stormwater rule does not require additional ROW in all cases; rather, it emphasizes the optimization of space. Among the nine projects assessed, only two necessitated expanded ROW beyond the originally sited areas – specifically, the US 98 and I-95 projects. Both projects discharge into OFWs and are located within impaired WBIDs, which mandate higher nutrient reduction efficiencies (95% for TN and TP), thereby influencing the need for additional space for BMPs. Notably, the I-10 (SR 8) project achieved the 95% nutrient reduction requirement for both TN and TP due to the flush shoulder typical section treatment train composed of VFS and swales pretreatment, and treatment in the pond's PPV already sited in the original PSR. In contrast, the US 98 project did not include additional ponds in its original PSR, as stormwater was intended to discharge to roadside retention swales (i.e. linear ponds). While US 98 benefited from VFS pretreatment, these ditches did not provide sufficient retention volume to achieve a 95% combined nutrient reduction when modeled as BMPs. Although US 98 also includes a flush shoulder typical section along portions of the project limits, the corridor must also account for nutrient loading from curb and gutter typical section segments. The nutrient loading from these curb and gutter segments, combined with the narrower VFS width of the modified swales, is the primary reason US 98 was unable to meet the new rule's nutrient reduction standards compared to the I-10 project. Similarly, while the I-95 project included ponds and proprietary, maintenance intensive baffle boxes in its original PSR, it lacked pretreatment from systems such as VFS or swales and therefore could not meet the 95% nutrient reduction requirement for TN and TP without additional ROW for more BMPs. This highlights the importance of pretreatment BMPs upstream of ponds for projects discharging to impaired water bodies that are also OFWs.

Conversely, the new stormwater rule's approach to nutrient reduction, has the potential to reduce pond sizes in several evaluated projects. The elimination of the fixed first-flush treatment volume translates to smaller pond footprints, where roadway basins may achieve the required nutrient reduction with alternative systems like the VFS and swale conveyance. In such cases, smaller ROW footprints would be required. Moreover, projects with flush shoulder typical sections discharging to tidally influenced waters have the potential to eliminate pond sites overall in most WMDs' jurisdiction.

While certain projects – particularly those discharging to OFWs and located within impaired WBIDs – may require additional ROW to meet stringent nutrient reduction standards, the overall trend suggests that optimizing existing space and adopting treatment train methods, including new BMPs like the VFS, side bank filters and split BMP can reduce the need for expanded ROW in many roadway projects. Findings suggest future PSRs will not always require larger pond footprints compared to those sized under the old stormwater regulation for most nutrient reduction standards in the new rule. The primary exceptions are projects that discharge downstream to impaired water bodies that are also OFWs within a HUC 12 sub-watershed boundary, particularly in dense urban areas such as the I-95 project in District 6. However, if pretreatment measures like VFS or swales are incorporated to the roadway typical section, even these projects can achieve the nutrient reduction needed to meet the new rule without expanding pond footprints beyond what would typically be proposed under the old rule. Although this

assessment primarily focuses on nutrient reduction, ICPR.4 models were performed where optimization of originally sited ponds (split BMPs) was proposed to enhance nutrient reduction. These hydraulic models indicate no adverse effects on attenuation volumes.

New Analysis & Procedures

The new stormwater rule presents both opportunities and challenges. It encourages engineers to rethink strategies, utilizing existing spaces more efficiently and exploring innovative solutions that align with the updated nutrient reduction standards. This approach fosters a more integrated system promoting consideration of drainage features early in roadway planning and design. By fostering collaboration across disciplines, FDOT can create cohesive stormwater management systems that meet both transportation and environmental permitting objectives. These evaluations demonstrated that with thoughtful design and planning, it is possible to meet the nutrient reduction standards of the new stormwater rule without needing more ROW comparable to what is common for the old rule, in most cases. The new rule allows for smaller pond sizes for attenuation purposes when nutrient reduction requirements are achieved through pretreatment measures. Additionally, for projects in tidally influenced basins, ponds may only need to be sized to meet nutrient reduction goals, potentially reducing the total number of ponds required. With exceptions to projects upstream of impaired water bodies also classified as OFWs. For such cases, it depends on available pretreatment BMPs like the VFS within ROW upstream of ponds. The following narrative expands on proposed recommendations to the analysis and procedures process of future roadway projects from patterns that emerged through this evaluation.

Ambient Water Quality and Typical Section Package

The primary factors influencing the area required for drainage systems are the roadway typical section, the natural environment available to support stormwater treatment, and the quality of receiving waters. Adopting a balanced, drainage-inclusive approach to optimize FDOT roadway projects involves integrating considerations of drainage design elements into the roadway typical section submittal. Early integration can provide reasonable assurance that drainage systems are designed to meet the nutrient reduction requirements of the new stormwater rule, in coordination with roadway plans and roadway geometry. Such an approach may include the incorporation of optimized swales or ditches, strategic planning of corridor ROW, or the selection of a flush shoulder typical section over a curb and gutter one, as long as safety criteria are also met. By aligning drainage design with roadway planning from the outset, projects are better suited to meet nutrient reduction standards of the new rule while maintaining efficient use of space and resources.

Promote Educational Tools

To support FDOT staff and consultants in evaluating projects under the new stormwater rule, the following educational tools, reference materials, and practices are recommended for FDOT guidance documents, websites, and training materials:

- Ambient Water Quality Assessment resources, including guidance on identifying nutrient impairments and Waters Not Attaining Standards (WNAS).
- Hydrologic Unit Code (HUC) 12 Basin mapping and evaluation methodologies.

- ERP Applicant's Handbooks, with emphasis on Event Mean Concentrations (EMCs) and Appendix O nutrient reduction efficiencies.
- Best Management Practice (BMP) strategies, including treatment trains, space optimization techniques, and other innovative or nontraditional approaches including recently added BMPs such as the VFS.
- Guidance on Compensatory and Regional Treatment approaches for meeting nutrient reduction standards at the watershed scale.
- Drainage design examples demonstrate practical applications under the new rule.
- Typical Section Packages that integrate drainage considerations in roadway planning and contribute to the typical section selection.

These tools are intended to build technical understanding, promote consistency in project development, ensure alignment with the nutrient reduction requirements of the new stormwater rule, and should be promoted Statewide for usage.

Update Impacted Documents

The following FDOT documents are anticipated to be impacted by the new stormwater rule and will require updates to ensure consistency with the revised regulatory framework:

- Drainage Manual (Manual has been revised for new rule).
- Drainage Design Guide (Updates for the new rule are underway).
- Project Development & Environment (PD&E) Manual.
- Standard Plans and Specifications (for new standard BMPs).
- WATERSS Process Guidebook.
- FDOT Design Manual (FDM).
- ETDM Manual.
- FDOT's Permitting Handbook.
- The Florida Greenbook.

These updates will help align internal procedures, design standards, and documentation with the nutrient reduction requirements introduced by Chapter 62-330, F.A.C., and the ERP A.H. Vol. I.

Conclusion

The adoption of Florida's updated stormwater criteria under Chapter 62-330, F.A.C., represents a fundamental shift from the previous first-flush volumetric focus, toward achieving the nutrient reduction standards required by the new stormwater rule. The evaluation of nine PSRs demonstrates that while the new rule introduces more stringent nutrient reduction requirements, particularly for projects discharging to impaired waters or OFWs, it does not universally necessitate expanded pond footprints. Instead, success under the new framework hinges on project specific integration of BMPs, supported by early coordination, early usage of available geotechnical data, and multidisciplinary planning. Strategies like the split BMP offer promising solutions, combining increased nutrient reduction effectiveness with potential cost and space savings relative to traditional ponds sized for the old rule. Projects like the I-95 project in District 6 could not meet the required nutrient reduction without the implementation of costly, non-transportation friendly and maintenance intensive BMPs. This provides insight into the limitations of traditional BMPs in heavily urbanized areas where outfalls are impaired water bodies and OFWs. Refer to **Appendix A** for a comparison impact matrix comparing the old first-flush rule and the new nutrient reduction rule.

Appendix A

New Stormwater Rule Impact Matrix																	
Analysis			Data Collection			Coordination			Right-of-Way			Construction Cost			Enviromental Impacts		
Item	Old Criteria	New Rule	Item	2020 Rule	2024 rule	Item	2020 Rule	2024 rule	Item	2020 Rule	2024 rule	Item	2020 Rule	2024 rule	Item	2020 Rule	2024 rule
Permit Research	No Change.		Soils	NRCS Web Soil Survey, FDOT's geotechnical GIS database, canal regulation schedules, USGS gage data, NOAA Tide and Current Stations, USFWS National Wetland Inventory, Aerial imagery (FDOT) and permit research. Geotech testing to occur on a case-by-case basis.	NRCS Web Soil Survey, FDOT's geotechnical GIS database, canal regulation schedules, USGS gage data, NOAA Tide and Current Stations, US FWS National Wetland Inventory, Aerial imagery (FDOT) and permit research. Geotech testing to occur on a case-by-case basis.	Pre-App Meeting w/ WMD	No Change.		Cost Estimates	Based on runoff volume and first flush treatment volume.	Typical dependent - Flush shoulder typical section benefits from new rule: Curb and gutter typical sections could optimize space to minimize added ROW. Additional R/W in urbanized, high Ground Water Table (GWT) areas like D6 I-95. No global significant change for ROW needed for ponds under new rule. This does not translate for projects needing to meet the 95% reductions for TN and TP.	Earthwork	Based on Pond Sizing for treatment and attenuation volumes.	Based on Atten. Vol + BMP grading needs, if applicable (Split BMP). Not projected to increase, unless for BMPs requiring select soils.	Wetlands	Based on impact footprints.	Based on impact footprint. No significant environmental impacts outside of heavy urban, low-space available projects like I-95; no significant increase than old rule; Curb and gutter typical sections are likely to have more impacts than flush shoulder typical sections due to larger ponds needed. This is not a global finding, each project should be evaluated in detail.
Basin Delineation	No Change.		Infiltration Data (Geotech)	Estimated Values based on best available data at PD&E. Geotech testing to occur on a case-by-case basis.	Estimated Values based on best available data at PD&E. Geotech testing to occur on a case-by-case basis.	Permitting	Comments; RAIs.	Potential coordination issues to use BMPs not listed in AH Volume II.	Parcel Selection	Where available for wet or dry systems: BMP feasibility independent.	May require multiple/separate parcels for nutrient reduction based on BMPs needed. More complexity for projects with curb and gutter typical sections, with impaired and or OFW water bodies downstream.	Miscellaneous Construction Costs	No change expected.	No change expected.	Species	Based on impact footprints.	Based on impact footprint. No significant environmental impacts compared to the old rule outside of heavy urban, low-space available projects like I-95.
CN Calculations	No Change.		SHW	Estimate for PD&E. Geotech testing to occur on a case-by-case basis.	Estimate for PD&E. Geotech testing to occur on a case-by-case basis.				Width	For roadway.	May require increased width for pretreatment BMPs like swales and VFS, specially for project draining to downstream impaired and or OFW water bodies.	Outfall	No change expected.	No change expected.	Cultural Resources	Based on impact footprints.	Based on impact footprint. No significant environmental impacts compared to the old rule outside of heavy urban, low-space available projects like I-95.
BMP Models	Projects in Impaired WBIDs only.	All Projects.	FEMA Floodplains	No Change.		District NPDES Coordinaiton	Case by base. Typically ELA/WATERSS Projects.	Documentation of reduction of nutrient loads from Pre-Development Condition; Coordination on using non-standard or high maintenance BMPs.	Typical Section	For roadway.	Typical section type is the most important separator of treatment success. Recommend incorporate drainage consderations into Typical Section Package; BMPs to be planned along roadway needs to minimize excessive ROW needs; Ambient water quality assesment should be considered in the typical section selection when possible.	Special Infrastructure	In case by case; not typical. Commonly uses manholes as junction structures, and curb inlets to collect stormwater. These are all standards structures. Underdrains for side bank filters are also standard.	Curb inlets, underdrains and manholes will still be used. If Split BMPs are employed, this will require flow diversion structures. Which may require special design.	Hazardous Materials	Based on impact footprints.	Based on impact footprint. No significant environmental impacts compared to the old rule outside of heavy urban, low-space available projects like I-95.
Compensatory	WMD Dependent.	HUC 12 Sub-basins.	Wetlands	No Change.											Utilities	Based on impact footprints.	
Ponds	Treatment + Attenu.	Treatment + Attenu.	Parcels	No Change.													
Time of Concentration	No Change.		Ambient Water Quality	Projects that had to demonstrate net improvement.	All projects.												
Impaired Waters	Post=Pre.	Greater of Post=Pre or 80% TN/TP reduction efficiency.	HUC 12 Basins	No.	Yes.												Maximizing BMPs within roadway ROW can have more impacts, such as swales. Flow diversion structures could result in more impacts. Underground BMPs could result in more impacts.