Bayway Bridge Stormwater Runoff Treatment

Technical Memorandum

I-10 Mobile River Bridge and Bayway Widening

Mobile and Baldwin Counties, Alabama

Federal-Aid Project DPI-0030(005)

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Alabama Department of Transportation (ALDOT) Environmental Stewardship Commitments

ALDOT has taken a proactive approach to managing stormwater runoff and pollution over recent years with the implementation of several of the approaches mentioned in the subsequent sections of this document. The following activities are ALDOT's Environmental Stewardship Commitments and mitigation measures for stormwater impacts for this project:

Sweeping on Bayway Bridges

The practice of vacuum sweeping the Bayway bridges to remove particulates that have accumulated on the shoulders of the bridges is a Best Management Practice (BMP) that ALDOT has implemented. This is currently being performed on a monthly basis as part of a regularly scheduled maintenance activity and will continue. Documenting the average volumes of collected materials from the sweeping operations will be done to provide a baseline for the monthly maintenance sweeping activities.

Utilizing OGFC pavements

Another BMP that ALDOT has incorporated into portions of the roadway network is the use of open grade friction course (OGFC) pavements on approximately 156 roadway miles within the Southwest Region. In addition to the OGFC pavements that are in place, ALDOT intends to utilize OGFC on all or portions of the I-10 roadway segments of this project.

Vegetated Filter Strips

Vegetated filter strips have been researched for their effectiveness on removing pollutants from stormwater runoff. For this project, the use of vegetated filter strips on the shoulders and slopes will be evaluated and utilized where practicable. Additionally, ALDOT will evaluate other future projects for the use of vegetated filter strips and incorporate them where practicable as an offsite mitigation measure.

Environmental Stewardship Projects

ALDOT participated in the Joe's Branch stream restoration project in the vicinity of the western terminus of this project. Joe's Branch is a 303(d) listed stream that is crossed by this project. ALDOT was a participant in this first-of-its-kind project in Alabama to remediate the effects of erosion and sedimentation and to improve water quality in Joe's Branch and D'Olive Bay. The Joe's Branch Step Pool Storm Conveyance (SPSC) system won an International Green Apple Award for Environmental Best Practice in 2012. In April 2014, the project area withstood a 100-year rainfall event of more than 13 inches with minimal problems.

Spill Containment

ALDOT will commit to providing resources to be mobilized and utilized to contain spills that could occur on the Bayway bridges and other portions of the project. A Spill Containment Plan will be developed which will outline a plan to assist first responders in any containment/cleanup efforts should a spill occur. This plan will be reviewed and updated to incorporate advances in technological developments related to spill containment measures.

1.0 Introduction

The Draft Environmental Impact Statement (DEIS) for the I-10 Mobile River Bridge and Bayway Widening project was signed by the Federal Highway Administration (FHWA) on July 22, 2014. It was presented to the public and was circulated to State and Federal resource agencies and others. Comments on the DEIS were requested and many of the recipients provided comments.

Part of the process of advancing the DEIS to a Final Environmental Impact Statement (FEIS) includes responding to substantive comments on the DEIS. Both the U.S. Environmental Protection Agency (EPA) and Mobile Baykeeper provided comments regarding bridge stormwater runoff and treatment for the project that require a response. These responses will be provided in a Supplemental Draft Environmental Impact Statement (SDEIS).

The intents of this memorandum are to present ALDOT decision-makers with information based on published, peer-reviewed scientific research regarding bridge stormwater runoff and treatment, to present a range of treatment and BMPs for ALDOT's consideration, and to obtain feedback from ALDOT on the BMPs they will commit to implementing to address the concerns regarding environmental impairment associated with bridge runoff for the Mobile River Bridge and I-10 Bayway across Mobile Bay.

2.0 Background

As mentioned in the previous section, comments were received from the Mobile Baykeeper and the EPA that will be addressed in the SDEIS. These comments include:

> *We recommend in depth study of potential stormwater and spill runoff impacts from the Bridge and Bayway to Mobile Bay and Mobile River to be included in project development as well as in the Final Environmental Impact Statement. Management of stormwater runoff on roadways and bridges is of great importance to Mobile Baykeeper. – Mobile Baykeeper*

> *The proposed project will create 105 acres of impervious surfaces, with 95% of the constructed area over water and wetlands. We categorically disagree with the statement, on page 99 of the DEIS, that this constructed impervious surface will not create additional runoff. Additionally, the statements on page 99 of the DEIS, that "with improved traffic flow, it is anticipated that the amount of pollutants deposited on the roadway, which result from normal traffic, should be reduced due to improved engine fuel burning efficiency and a decrease in the potential for oil or other contaminants that leak from vehicles during traffic delays" are overly optimistic, at the very least. Though the bridge and Bayway widening as proposed is intended to cause an end to traffic delays on I-10, the fact remains that contaminants, such as dirt, dust, rubber, antifreeze, engine oil, and litter, from vehicles and roadway construction are generated and washed from all roadways. Additionally, there is the matter of projected increased numbers of vehicles on the roadway which will mean a greater number of potential sources of pollution crossing Mobile River and Mobile Bay. – Mobile Baykeeper*

> *Pollution prevention structures as well as pollution collection and management systems should be evaluated as integral parts of the development of this project. – Mobile Baykeeper*

> *We recommend incorporation of stormwater runoff capture and containment methods into Bridge design, construction, and operation to reduce runoff pollution to Mobile River and Mobile Bay. We support significant study and implementation of stormwater capture and runoff*

containment methods in transportation project design, construction practices, and the final build. – Mobile Baykeeper

As noted on page 98 of the DEIS, the project area contains three water bodies, Mobile River, Joes Branch and D'Olive Creek, that are listed as impaired on the Alabama Department of Environmental Management's 2012 303(d) list. The updated ADEM 2014 303(d) list still contains these waterways. Mobile River has been found to be polluted with metals (specifically mercury from atmospheric deposition), and a pollutant limit (TMDL) determination is due to be completed in 2020. Joes Branch has pollution impacts from siltation due to land development and is scheduled to have a TMDL established in 2018. D'Olive Creek is significantly impacted from siltation from development with a TMDL date of 2018. Two of the three of these waterways' impairments are due to runoff and stormwater pollution. In order to not exacerbate the pollution issues in these waterways, runoff capture and containment from the Mobile River Bridge and Bayway should be an integral part of project evaluation and final construction. – Mobile Baykeeper

Runoff containment infrastructure could also aid in management of major spills from entering the Mobile River and Mobile Bay. – Mobile Baykeeper

Based on a review of the project impacts, EPA provided detailed comments regarding air quality, cultural resource, water resources, noise and community impacts. The selection of B' relative to the other proposed build alternatives assessed in the DEIS minimizes impacts to communities, cultural resources and the environment. Nevertheless, we recommend that the FEIS describe efforts to further avoid, minimize, mitigate and/or clarify noise, water resource, and cultural resources impacts described in the detailed comments. EPA rates this DEIS as EC-2 i.e., EPA has "Environmental Concerns" and "Additional Information" is requested. EPA's rating system can be found online at: http://www.epa.gov/oecaerth/nepa/comments/ratings.html . – EPA

Appropriate best management practices should be implemented and described in the FEIS to ensure that impacts to sensitive aquatic resources or species are minimized and/or appropriately mitigated. EPA should be consulted, when appropriate. – EPA

In section 4.12, Water Quality and Biological Resources, the DEIS indicates that lower congestion rates and reduced low-speed and idled traffic are likely to result in decreased leaks of oil and combustion-related pollutants because inefficient combustion at low speeds would be reduced. However, the DEIS should also consider that a widened Bayway is also likely to result in an increased volume of traffic, increasing the number of emission sources contributing to emission-related products in runoff to Mobile Bay and River. – EPA

The DEIS indicates that construction would occur across impaired waterbodies, the Mobile River, Mobile to Spanish River, Joe's Branch from it[s] source to D' Olive Creek, and D'Olive Creek from its source to D'Olive Bay. Joe's Branch and D'Olive Creek are both listed for siltation. Section 4.17, Construction Impacts, states that, "Best Management Practices will be utilized to control sedimentation and stormwater runoff during construction." EPA requests that additional information be provided for review in the Final EIS. – EPA

3.0 Water Quality Setting and Section 303(d) Status

Portions of the following water bodies are located in the study area: Mobile River, Mobile Bay, Pinto Pass, Polecat Bay, Chacaloochee Bay and the Tensaw, Apalachee, and Blakeley Rivers. The Wallace

Tunnels and the Bayway currently cross all of the aforementioned water bodies, except Pinto Pass. The new crossing of the Mobile River with the Alternative B' alignment will be accomplished by spanning the river with a high level bridge that will tie down to the existing Bayway east of the river. Additional lanes will be added to supplement those on the existing I-10 Bayway. The existing I-10 Bayway Bridge is approximately 7 miles long with twin structures (564 spans on the eastbound structure and 563 spans on the westbound structure). Both bridges vary in width at ramp locations; however, the typical deck width is 42'. The height of the top of deck above mean sea level (MSL) is a maximum of 32' for those spans over the Tensaw River, with the vast majority of the spans at a constant 21' above MSL. Typical spans are 65' long simple-span prestressed AASHTO girders, supported on bent caps with two or three precast concrete cylinder piles. Longer spans (continuous steel plate girders) exist at the Mid-Bay interchange.

Section 303(d) of the Clean Water Act requires that each state identify those waters that do not currently support designated uses, and to establish a priority ranking of these waters by taking into account the severity of the pollution and the designated uses of such waters. For each water body on the 303(d) list, the state is required to establish a total maximum daily load (TMDL) for the pollutant or pollutants of concern at a level necessary to implement the applicable water quality standards. The Mobile River Bridge project crosses one water body (Joe's Branch) and is near another (D'Olive Creek) that is listed on the Final 2016 Alabama 303(d) list of impaired water bodies. The impaired portions of these water bodies are Joe's Branch from its source to D'Olive Creek; and D'Olive Creek from its source to D'Olive Bay. Joe's Branch and D'Olive Creek, located in Baldwin County, are both listed for siltation (habitat alteration) due to land development. Both of these streams are classified for fish and wildlife utilization. The TMDLs for these water bodies have not yet been developed.

The DEIS lists the Mobile River as an impaired water body due to mercury from atmospheric deposition, but the Final 2016 Alabama 303(d) list does not include the stretch of the Mobile River that will be crossed by this project. This information will be updated in the SDEIS.

4.0 NCHRP Stormwater Research

NCHRP Report 778 – Bridge Stormwater Runoff Analysis and Treatment Options (NCHRP 778) is heavily cited and referenced in this report. The following sections provide the information establishing the independence of the researchers and offers information about why the research was undertaken.

a. National Cooperative Highway Research Program (NCHRP) Background

The NCHRP was established in 1962 to promote research on serious problems related to highways as a result of the accelerating growth of the highway transportation system. The highway administrators of the American Association of State Highway and Transportation Officials (AASHTO) recognized the need to study common problems through a coordinated program of cooperative research employing modern scientific techniques. The NCHRP receives the full support and cooperation of the FHWA. It is also supported on a continuing basis by funds from participating member states of the Association.

The NCHRP research program is administered through the Transportation Research Board (TRB), a division of the National Research Council (NRC). The TRB is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine. The NRC administration of the NCHRP is an insurance of objectivity. The NRC maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

b. NCHRP Report 778 – Bridge Stormwater Runoff Analysis and Treatment Options

NCHRP 778 of NCHRP Project 25-42 has been reviewed and is incorporated by reference to this report. It is a comprehensive report and guide that results from NCHRP Project 25-42 for managing bridge runoff to protect environmental quality and meet regulatory requirements. NCHRP 778 addresses "such critical issues as characterization of bridge runoff and its effects on quality of receiving waters; current and emerging runoff management strategies that may be beneficial and cost-effective for application to bridges; criteria for identifying appropriate runoff management strategies for particular bridges; how bridge owners may establish appropriate levels of effort to address bridge runoff issues at a particular location; and how bridge owners may identify BMPs for bridge runoff and select or develop BMPs for a particular location."

Studies have been conducted regarding the design, operation, construction and effectiveness of best management practices (BMPs) for the control of highway runoff water quality, but few have investigated BMPs specifically for bridge deck runoff. While pollutant loads from highways are similar to those from bridge decks, highway pollutant loads can be more easily treated or sequestered, whereas loads from bridge decks are transported directly to receiving waters via dry deposition or stormwater runoff. Studies reviewed on the impact of bridge deck runoff on receiving waters found little evidence of either water quality or ecosystem degradation, leaving open the question of what stormwater controls, if any, are appropriate for the practitioner to apply for new and reconstruction bridge projects in the event that stormwater mitigation must be included.

NCHRP 778 was developed to provide the practitioner with a stepwise approach to select the best combination of source control and operational and treatment control BMPs for a bridge crossing a perennial, intermittent or ephemeral stream, river, lake or estuary, for virtually any span length. Runoff from a bridge deck may contribute to receiving water quality impairment in areas where the pollutants in the receiving water are elevated due to urbanization or a non-point source. Solutions to managing this contribution to pollution have a range of costs. The practitioner must be the steward of public funding and the environment, balancing the objectives of each to ensure sustainability.

5.0 Maximum Extent Practicable (MEP)

The term Maximum Extent Practicable (MEP) is necessary to understand. The definition of MEP is embodied as the basic performance standard in state and federal regulations, including the Federal Endangered Species Act and Sections 402 and 404 of the Federal Clean Water Act. The MEP standard does not necessarily involve the same criteria in each application, and it is intended to address projects or actions on an individual basis considering each of their specific circumstances and purpose. The MEP standard for treatment of runoff from bridge decks is necessarily different from treating a standard highway section on land. This is because the cost of conveying bridge deck runoff to be treated at the abutment area is relatively high when compared to a standard non-bridged highway section at-grade; right-of-way at the abutment may be limited, and the benefit of the BMP may be substantially less.

The MEP standard must be considered when weighing the costs of treating bridge deck runoff and its effectiveness compared to providing more beneficial treatments elsewhere in the drainage basin for much less cost and potentially providing more safety to the road user.

6.0 Evaluation of Receiving Waters Impacts

Section 2.3 of NCHRP 778 summarizes the published information on bridge runoff quality and its impacts on receiving waters. This is important for DOTs to discern whether contamination of water bodies from roads and bridges is significant, and if so, what mitigation is appropriate. The following paragraphs provide excerpts and information from Section 2.3 of NCHRP 778 about some of the published studies on bridge runoff and its effects on the environment.

Several studies have been conducted to evaluate whether bridge deck and roadway runoff quality were significantly different. The most comprehensive study to date was conducted by URS Corp. for the North Carolina Department of Transportation (NCDOT). The URS study (2010) found "no compelling evidence that bridge deck runoff in North Carolina is higher in pollutants typically associated with stormwater runoff as compared to runoff from other roadways."

A study funded by the Texas Department of Transportation (TxDOT), Malina, et al. (2005) also showed bridge deck runoff is not statistically different from highway runoff. Malina, et al. concluded highway runoff data could be used as a conservative approximation of bridge deck runoff quality. Malina, et al. also found that loading of all measured water quality constituents was minimal, with "no substantial adverse impact to the receiving streams . . . observed or indicated by bridge deck runoff from the three monitored sites." Loadings from upstream sources were several orders of magnitude greater compared to the loading from the bridge deck.

As Nwaneshiudu (2004) and others have pointed out, "Most of the pollution found in highway runoff is both directly and indirectly contributed by vehicles. The constituents that contribute the majority of the pollution, such as metals, chemical oxygen demand, oil and grease, are generally deposited on the highways." Consequently, roadway runoff water quality data should be used as an approximation for the pollutant profile of bridge deck runoff (Dupuis et al., 2002).

Table 2-1. Median concentrations of typical highway runoff constituents.

Constituent	Annual Average Daily Traffic				
	0 – 25K	25K – 50K	50K – 100K	100K +	All Data
TSS (mg/L)	43	56	94	108	79
NO_2+NO_3 (mg/L)	0.385	0.61	0.62	0.805	0.64
NO_3 (mg/L)	0.2	0.83	0.6	1.1	0.6
TN (mg/L)	1.44	4.69	2.57	2.725	2.64
TKN (mg/L)	0.84	1.794	1.7	2.1	1.6
DP (mg/L)	0.072	0.105	0.0745	0.17	0.09
TP (mg/L)	0.12	0.16	0.2	0.237	0.2
T Cu (µg/L)	9.3	20	32	50	24
T Pb (µg/L)	6.6	12.7	74	46	32
T Zn (µg/L)	60	93	180	270	130
Fecal Coliform (#/100 ml)	5000	NA	4150	1700	50
E. Coli (#/100 ml)	NA	NA	NA	NA	1900

As part of the NCHRP project, the National Stormwater Quality Database (NSQD, version 1.1) and the FHWA database were analyzed to determine typical constituent concentrations in highway runoff. The results of this analysis are presented in Table 2-1 with the column titled "All Data" showing the median for all available data regardless of traffic volume. It is clear from looking at the data that the concentrations of pollutants associated with vehicles, such as TSS, total copper, and total zinc, are correlated with Annual Average Daily Traffic (AADT).

NCHRP Report 474 reviewed scientific and technical literature addressing bridge deck runoff and highway runoff performed by FHWA, USGS, state DOTs, and universities, focusing on the identification and quantification of pollutants in bridge deck runoff and how to identify the impacts of bridge deck runoff pollutants to receiving waters using a weight-of-evidence approach. Although undiluted highway runoff can exceed federal and state ambient water quality criteria, this alone does not automatically result in negative effects to receiving waters. Dupuis, et al. found no clear link between bridge deck runoff and biological impairment in the receiving water, but noted that salt from deicing could be a concern.

Bartelt-Hunt, et al. (2012) investigated the impacts of bridge runoff and receiving water quality at four bridges in Nebraska for Nebraska Department of Roads (NDOR). The objectives of this research were to evaluate the quality of bridge deck runoff; to determine the effects of bridge deck runoff on surface water bodies in Nebraska by evaluating water and sediment chemistry; and to evaluate the effects of bridge deck runoff on aquatic life. Statistical analysis of in-stream samples upstream and downstream of bridges showed that bridges did not impact the quality of the receiving water body. Sediment sampling did not show an increase in streambed sediment concentrations from downstream to upstream. Two runoff events were also used in a 48-hour 5 dilution series toxicity test with fathead minnows, and no negative effects were found. These results show that there were no observable effects of bridges on water quality and aquatic life.

7.0 Receiving Water Studies

In the meta-analysis of existing studies, Dupuis et al. showed that while several studies had shown direct drainage to some types of receiving waters (e.g., small lakes) could cause localized increases in certain pollutant concentrations, most studies did not consider whether such increases adversely affected the biota or other receiving water uses. The only comprehensive study of bridge runoff at that time, FHWA's I-94/Lower Nemahbin Lake site, found that although direct scupper drainage increased metals concentrations in near scupper surficial sediments, biosurveys and in situ bioassays found no significant adverse effects on aquatic biota near the scuppers. FHWA concluded that for lower traffic volume bridges at least, runoff had a negligible impact on receiving waters (Dupuis, et al. 1985a).

In the study for NCDOT, URS Corp. (2010) found no statistically significant differences in sediment pollutant concentrations upstream and downstream of the bridge, for either bridges that do not directly discharge to receiving water or direct discharge bridges. Overall, the URS analysis of streambed sediment did not indicate any impacts of bridge deck runoff on sediment quality. Ecoregional differences were observed for some analytes, but these differences appeared to be associated with naturally occurring conditions or upstream anthropogenic influences. Furthermore, where sediment quality benchmarks were exceeded, except for lead and mercury, the exceedances were found to be independent of the discharge drainage design from the bridge (i.e., direct versus indirect) and also were found to occur either upstream of the bridge deck, or at similar levels upstream and downstream, indicating sources other than bridge deck runoff.

8.0 State of the Practice for Bridge Stormwater Management

It is helpful to review the current practices utilized by DOTs to establish what is considered the current standard of care and to also determine what is considered practicable by other DOTs.

Standard practices utilized to convey bridge deck runoff into receiving waters include:

- Discharging runoff through multiple open scuppers directly into the receiving water.

- Discharging runoff through piping down from the bridge deck along or through the columns or piers directly into the receiving water without treatment.
- Conveying the stormwater runoff over the surface of the bridge to one or both abutments for discharge or treatment by a BMP.
- Detaining and treating the stormwater under the bridge deck where overbank areas are available.
- Conveying the stormwater runoff via piping or open gutters to one or both abutments for BMP treatment or discharge.

Conveying bridge deck runoff on long bridges (over 400') is not usually considered practicable. Bridge deck conveyance systems, when utilized, are generally an expensive practice. There are also technical design issues that increase design, construction and O&M costs for the bridge (several of which would pertain to the Bayway bridges). These include:

- Longitudinal slope on bridges can be very low, requiring increased pipe size or increased deck area in the shoulder to convey runoff;
- Deck drain and pipe systems are prone to clogging and/or freezing due to relatively small conveyance areas;
- Pipe joints must have sufficient flexibility to move consistently with the allowable expansion of the bridge joint;
- Pipe systems may not be compatible with the aesthetics of the bridge;
- The additional weight of the pipe system may require a larger bridge cross section;
- Deck drain or scupper maintenance is hazardous and may interrupt traffic flow due to limited shoulder area to work; and
- Pipe materials can corrode and leak.

In a follow up survey of 9 DOTs to *NCHRP Report 474, Volume 2*, the general preference by DOTs is not to install bridge deck treatment and conveyance systems due to their high capital and operation and maintenance cost compared to the apparent limited benefit.

Most DOTs surveyed discharge deck runoff through scuppers (horizontal openings in the railing wall) to the receiving waters. Alternatives are used to the approach when the bridge crosses sensitive receiving waters, and the environmental document or resource agency permit requires some form of deck runoff treatment.

FDOT uses a simple four-step progressive process for evaluation of options:

- Drain on the deck shoulder to a storm drain system at the abutment.
- Direct discharge to receiving water.
- Compensatory treatment at an offsite location.
- Closed conduit collection system.

States emphasized that design approaches were developed on a site-by-site basis because of requirements in the environmental documentation process, and what was considered MEP treatment for the site. In one case, the Maryland State Highway Administration (MDSHA) raised the lip height of scuppers to avoid direct discharge of the first flush. MDSHA also generally treats an equal amount of impervious highway surface at an offsite location in lieu of treating deck runoff if a bridge crosses environmentally sensitive waters.

Getting deck runoff to a treatment site can be a significant technical problem. Force mains or pumping off of bridges was not considered MEP or sustainable solutions.

9.0 Source Control Practices (BMPs) to Consider for All Bridges

Source control approaches were all cited by DOTs as options to improve deck runoff water quality. These practices include: street sweeping, catch basin and scupper cleaning, deck drain cleaning, de-icing controls or changes to de-icing methods, snow management, traffic management, and management of maintenance activities.

Street sweeping is one of the most common source control approaches in MS4s, and some states are considering applying this measure to bridges. The benefits are difficult to discern in outfall water quality. The direct benefit to stormwater quality or effect on receiving waters of this sediment removal has not been conclusively defined. NCDOT (2010) states,

> *Additional investigation is needed to establish the effectiveness of bridge sweeping as a BMP (BMP for stormwater) and to provide potential improvements to existing sweeping practices to benefit stormwater quality…*
>
> *. . . (however), because of the potential to remove sediment, bridge sweeping should continue to be considered as a potential water quality treatment BMP for bridge decks. Other DOTs are reviewing bridge sweeping as a viable alternative for stormwater treatment of deck runoff, particularly when other methods of treatment are not feasible or are cost-prohibitive. In addition, potential improvements to existing sweeping practices should be considered, including equipment upgrades and training for sweeper speed and maintenance. Additional study is recommended to further evaluate sweeping as a BMP and to shape sweeping practices (including frequency, type of equipment, and disposal practices) to maximize the benefit for stormwater quality (NCDOT and URS 2010).*

High efficiency catch basin cleaning is being considered along with high efficiency sweeping in some states.

Porous Friction Course (PFC) and/or open graded friction course (OGFC) pavement has been identified as a BMP. TxDOT and NCDOT have invested in research on the water quality benefits of PFC and/or OGFC pavement. Data from North Carolina indicated that the water quality benefits last as long as the structural life of the pavement, even though no maintenance was performed. NCDOT confirmed that as long as the road has speeds over 45 mph, pavement maintenance for PFC could be avoided without a loss of permeability in the overlay. NCDOT has a current PFC research project underway. Washington State Department of Transportation (WSDOT) indicated they would consider OGFC as a wearing course, but OGFC "gets damaged with studded tires." Massachusetts Department of Transportation (MassDOT) indicated they are pursuing BMP credit for the considerable quantity of OGFC the state is using.

Bio-sorption activated media are being explored by Florida researchers for filtration in deck drains. This technology is already in use, in greater quantities, in roadside BMPs.

10.0 Vegetated Filter Strips

An ALDOT research grant project through the University of South Alabama and performed by Kevin D. White, Ph.D., P.E. and Cecil Bernhard, titled "Vegetated Filter Strip Performance Evaluation for Cost-Effective Runoff Treatment in Alabama" evaluated the use of vegetated filter strips as a post construction BMP. The project concluded that the use of these strips contributes to improved water quality by the reduction of non-point source pollution from a variety of sources, including highways.

This project was performed under ALDOT Research Project 930-811R. The final report is dated June 2014.

Four in-ground samplers were placed at each sampled highway location: edge of pavement (0m), 2m, 4m, and 6m downslope from the edged of pavement, within the vegetated filter strip. After sampler installation, 17 rain events were sampled in the 18-month period from January 2013 to May 2014. The most effective removal of constituents was observed at a distance of both 4 and 6 meters down the vegetative filter strip from the edge of pavement.

11.0 Offsite Mitigation

Offsite mitigation is the preferred BMP in most cases for the following reasons:

- The cost and technical feasibility of retrofitting existing or constructing treatment controls for planned bridges;
- The fact that a significant portion of the contribution of pollutants from bridges to receiving waters actually occurs during dry weather through re-suspension and may not be contained by on-bridge BMPs;
- The lack of available space at the bridge abutment areas to construct treatment facilities; and
- The difficulty of providing routine maintenance for facilities installed on or near the bridge structure.

The site for mitigation could include the treatment of runoff from an adjacent terrestrial section of highway or at another site preferably within the same drainage basin or watershed.

Offsite mitigation has the following benefits:

- It should result in higher pollutant load reduction as compared to treatment of the bridge deck runoff;
- It should be more economical; and
- It is safer when considering the maintenance activities for both the workers and for the road user.

Consequently, if treatment BMPs are required for bridge deck runoff, NCHRP 778 recommends constructing the treatment device on a comparable section of untreated highway as the most effective and economical option.

Selection of offsite mitigation options can be complicated by a number of factors. It is important to prioritize the potential offsite opportunities to reduce the project cost and speed project delivery.

The following ranking of offsite mitigation options is suggested:

1. Untreated runoff from DOT facilities in the watershed that discharge to the same receiving water.
2. Small highly impervious catchments within the watershed of concern outside of the highway system.

3. Larger watersheds with less impervious cover outside the highway system within the same watershed.
4. DOT facilities outside the watershed.

More detailed discussion of these options is included in Section 5.3.5 of NCHRP 778.

12.0 Spill Controls

Section 5.4.1 of NCHRP 778 discusses Bridge Spill Frequency and states *"The U.S.DOT database (U.S.DOT 2013) on hazardous material incidents was analyzed for the period 2003–2012 to determine the frequency of spills associated with discharge to waterways…*

For the purposes of the bridge spill frequency evaluation, only in-transit incidents resulting in spillage were evaluated. Thus, of the total reports of incidents resulting in spillage, there were 23,095 (17%) designated as "in transit." Of these in-transit spill incidents, there were only 329 reports of spills with discharges to storm drains or waterways (less than one/year/state). Only nine spills were identified as being associated with a bridge located over a waterway. Consequently, these events are extremely rare (less than 0.01% of all reported spills for the analyzed period of record)."

Historical evidence has shown that probability of spilling a hazardous chemical over a sensitive receiving water is remote and is best handled by first-responders to contain the pollution.

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