



ACTION PLAN 1 OF 3

IMPROVE WATER QUALITY THROUGH NONPOINT SOURCE POLLUTION ABATEMENT (NPS)

One of the most difficult areas of environmental management is the control of NPS pollution, particularly in rapidly growing areas with varying land uses. Rainfall runoff or flood waters contain contaminants from many land-based sources, including agriculture, construction, on-site sewage facilities, pet waste, lawn care products, and auto maintenance. These contaminants can degrade the tributaries of Galveston Bay, and then eventually affect the bay. The contaminants most commonly associated with NPS pollution are bacteria, sediment, nitrogen, and phosphorus.

The Houston-Galveston region is projected to add 3.5 million people by 2040 (H-GAC, 2017). Increased land disturbance and impervious surfaces associated with ongoing development can generate NPS pollution from a wider geographic area, while a decrease in permeable surfaces and natural areas, including wetlands, can further reduce the opportunity for runoff to be filtered as it flows to the bay. As urban and suburban development increases, implementation of BMPs that reduce or eliminate runoff are of increasing importance to manage NPS pollution.

What is Nonpoint Source Pollution?

NPS pollution is any type of pollution affecting a waterway that originates from many diffuse sources and not from a single identifiable discharge point. This may include rainfall runoff flowing over land, seepage, or illegal dumping.



The Armand Bayou stormwater treatment wetland at the University of Houston-Clear Lake (more information on page 46) (photo credit: Environmental Institute of Houston, University of Houston at Clear Lake).

Example of Nonpoint Source Pollution Action Implementation

During development of *GBP'18*, the GBEP and its partners emphasized the need to implement BMP projects that include a monitoring and research component to reduce NPS pollution in and around Galveston Bay. Some existing BMPs in the region already included performance data.

The Armand Bayou stormwater treatment wetland at the University of Houston at Clear Lake is an example of a successful BMP that was installed and monitored, demonstrating a reduction in NPS pollution. The stormwater wetland was found to be effective for the removal of phosphorus and indicator bacteria depending on flow regime and bank stability (Guillen, Mokrech, Oakley & Moss, 2014, p. 12). With the decreased levels of phosphorus and indicator bacteria, the frequency of algal blooms in Armand Bayou was reduced as the overall level of dissolved oxygen increased (Guillen, Mokrech, Oakley & Moss, 2014, p. 12). As the plant community becomes more established, the filtration of the stormwater treatment wetland is expected to increase and attract more aquatic and wildlife species. Considering the broad range of land uses, looking at land-based pollutants on a watershed scale allows for simultaneous analysis of potential NPS pollution in the lower Galveston Bay watershed. Moving forward, the GBEP and its partners will work with organizations implementing new and existing BMPs to analyze data and produce a regional BMP white paper that reviews select BMPs.

Action Plan Overview

The NPS Action Plan includes four Actions that address this issue, including support for WBP development and implementation (**NPS-1**); support of NPS education campaigns (**NPS-2**); implementation of structural and nonstructural NPS projects (**NPS-3**); and presentation of workshops to enhance technical understanding and expand use of BMPs (**NPS-4**).

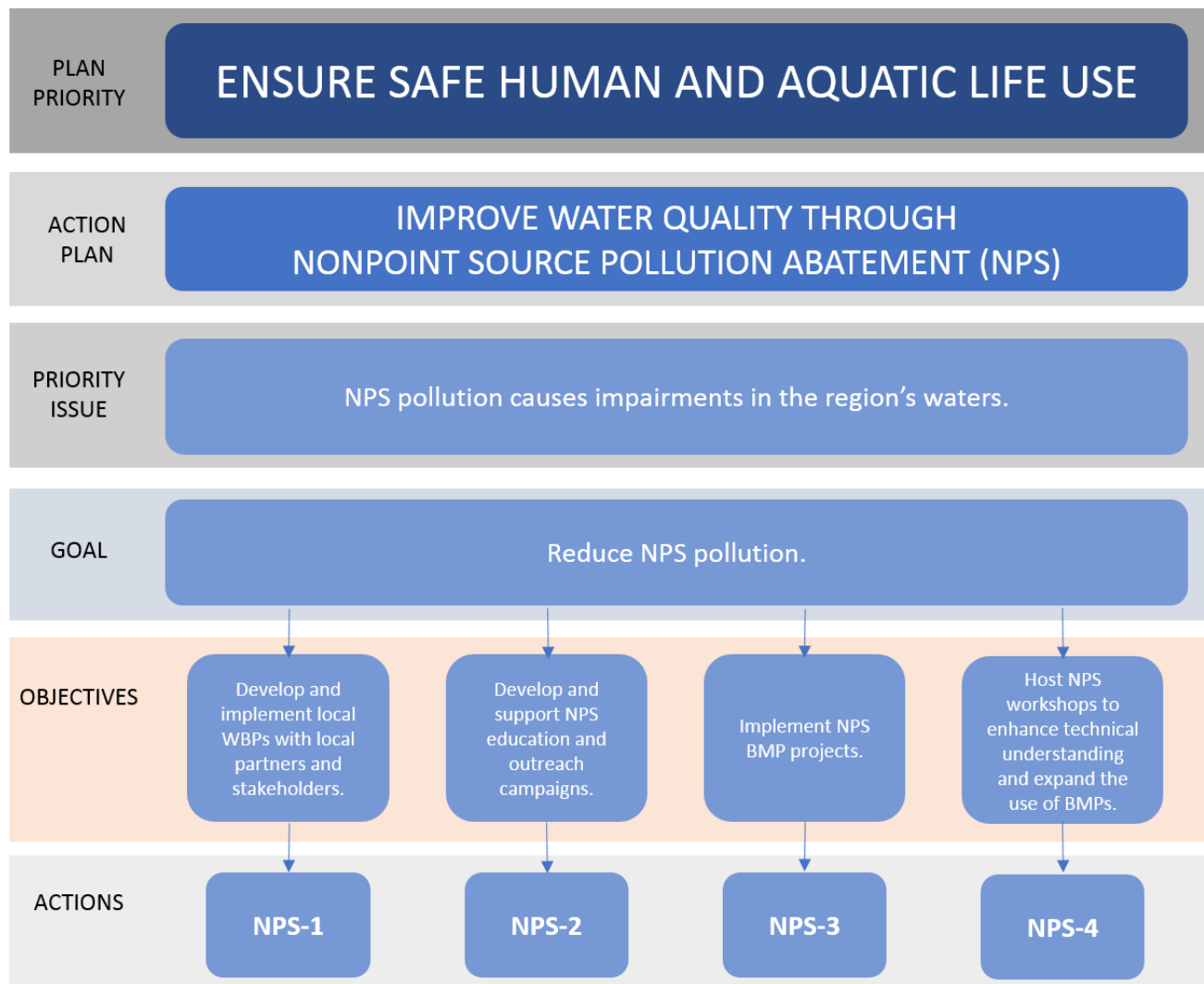
FIGURE 11
NPS ACTION PLAN MATRIX

ACTION PLANS AND CORRESPONDING ACTIONS		PLAN PRIORITIES			
		Ensure Safe Human and Aquatic Life Use	Protect and Sustain Living Resources	Engage Communities	Inform Science-Based Decision Making
Action Plan: Improve Water Quality Through Nonpoint Source Pollution Abatement (NPS)					
NPS-1	Support Watershed-Based Plan Development and Implementation	x	x	x	x
NPS-2	Support Nonpoint Source Education and Outreach Campaigns	x	x	x	
NPS-3	Implement NPS Best Management Practices	x	x		x
NPS-4	Host Nonpoint Source Workshops	x		x	x

Successful implementation of WBPs (**NPS-1**) and supporting BMPs (**NPS-3**) will broadly support Plan Priority Two: Protect and Sustain Living Resources. **NPS-1** requires coordination with the M&R subcommittee on Plan Priority Four: Inform Science-Based Decision Making. Similarly, NPS education (**NPS-2**) requires coordination with the NRU and PPE subcommittees of the Council, specifically on Action **SPO-3** included under Plan Priority Three: Engage Communities. Expanding understanding and use of BMPs in the region through workshops and speaking engagements (**NPS-4**) closely aligns with the Activities for Action **SPO-2** and will also be coordinated between the WSQ, PPE, and M&R subcommittees.

More information on **SPO-3** is presented on page 110. More information on **SPO-2** is provided on page 109.

**FIGURE 12
NONPOINT SOURCE ACTION PLAN**



NPS-1



Support Watershed-Based Plan Development and Implementation

Objective: Develop and implement local WBPs with local partners and stakeholders.

Priority Issue: NPS pollution causes impairments to the region's waters.

Description: The GBEP and its partners are identifying target area(s) to schedule implementation of WBPs by developing prioritization measures, such as relationship of water body to water quality standard impairment, local source of funding or match available, ongoing watershed planning effort, size of water body, access to monitoring data, etc.

Implementation location: Lower Galveston Bay watershed.

ACTIVITIES	TIMEFRAME AND OUTPUT(S)	IMPLEMENTATION COST
Identify target project areas and support development and implementation of 10 WBPs.	Within 2-5 years, support development and / or implementation of two WBPs (20% of goals met).	\$0 - \$200,000
	Within 5-10 years, support development and / or implementation of three additional (five total) WBPs (50% of goals met).	\$200,000 - \$1 Million
	Within 10-plus years, support development and / or implementation of five additional (10 total) WBPs (100% of goals met).	\$1 Million - \$50 Million

POTENTIAL IMPLEMENTERS

City of Houston
 Future Watershed Partners
 Galveston Bay Foundation
 Galveston County Health District
 HARC

H-GAC
 Texas A&M AgriLife Extension Service
 Texas Parks and Wildlife Department
 Texas Sea Grant Program
 Texas State Soil and Water Conservation Board

PERFORMANCE MEASURES

1. Number of WBPs developed and / or implemented.

REFERENCES

GBP'95 Reference: NPS-1, NPS-2, NPS-5, NPS-10, NPS-11, NPS-14, NPS-15, NPS-16

SAP Reference: Ecosystem and Human Health – WSQ: Goal 1 / Objective A

NPS-2



Support Nonpoint Source Education and Outreach Campaigns

Objective: Develop and support NPS education and outreach campaigns.

Priority issue: NPS pollution causes impairments to the region's waters.

Description: The GBEP and its partners support NPS education and outreach campaigns that target area(s) using specific messaging to foster public awareness, improve education, and encourage action to improve water quality. (Education is defined for Plan Priority Three: Engaging Communities on page 100.)

Implementation location: Lower Galveston Bay watershed.

ACTIVITIES	TIMEFRAME AND OUTPUT(S)	IMPLEMENTATION COST
Work with PPE subcommittee and partners to coordinate and facilitate ongoing NPS education and outreach through existing campaigns, such as Back the Bay.	Within 2-5 years, conduct initial assessment of target population.	\$0 - \$200,000
Continue NPS education and outreach and engage target populations.	Within 2-5 years, initiate target area NPS education campaign.	\$200,000 - \$1 Million
	Within 5-10 years, track number of individuals involved, target populations, or groups engaged.	\$0 - \$200,000
Successfully engage target populations and track results.	Within 10-years, track changes in public perception through follow-up evaluation/questionnaire. In addition, track changes in behavior and in environmental parameters (i.e., water quality, SSO events, etc. based on program focus).	\$0 - \$200,000

POTENTIAL IMPLEMENTERS

Galveston Bay Foundation
H-GAC
Texans for Clean Water

Texas A&M AgriLife Extension Service
Texas Parks and Wildlife Department
Texas State Soil and Water Conservation Board

PERFORMANCE MEASURES

1. Number of individuals or groups engaged in NPS campaigns.
2. Number of public assessments completed.

REFERENCES

GBP'95: NPS-1, NPS-2, NPS-5, NPS-11, NPS-14, NPS-15, NPS-16, PPE-3

SAP Reference: Ecosystem and Human Health – WSQ: Goal 1 / Objective A; Ecosystem and Human Health – WSQ: Goal 1 / Objective B / Objective F; Public Participation and Education – Public Education: Goal 1 / Objective B

NPS-3



Implement Nonpoint Source Best Management Practices

Objective: Implement NPS BMP projects.

Priority Issue: NPS pollution causes impairments to the region's waters.

Description: The GBEP and its partners are identifying specific structural and nonstructural measures to implement to improve water quality. The GBEP and its partners are applying structural and nonstructural NPS BMPs to identified target area(s).

Implementation location: Lower Galveston Bay watershed.

ACTIVITIES	TIMEFRAME AND OUTPUT(S)	IMPLEMENTATION COST
Develop and install five BMP projects.	Within 2-5 years, initiate two BMP projects.	\$0 - \$200,000
	Within 5-10 years, initiate three additional BMP projects (five total).	\$0 - \$200,000
	Within 10-plus years, complete five BMP projects.	\$200,000 - \$1 Million
Complete effectiveness monitoring and share results with partners, including possible data evaluations, white papers, and project mapping.	Within 10-plus years, evaluate project results and develop white paper on findings.	\$0 - \$200,000

POTENTIAL IMPLEMENTERS

Galveston Bay Foundation
H-GAC
Texans for Clean Water

Texas A&M AgriLife Extension Service
Texas Parks and Wildlife Department
Texas State Soil and Water Conservation Board

PERFORMANCE MEASURES

1. Number of BMPs implemented.
2. Estimated pollutant load reduction.

REFERENCES

GBP'95: NPS-2, NPS-5, NPS-11

SAP Reference: Ecosystem and Human Health – WSQ: Goal 1 / Objective C

NPS-4

Host Nonpoint Source Workshops

Objective: Host NPS workshops to enhance technical understanding and expand the use of BMPs.



Priority Issue: NPS pollution causes impairments to the region's waters.

Description: The GBEP and its partners are providing NPS technical workshops in target area(s) to enhance the reach of structural and nonstructural BMPs that address failing on-site sewage facilities, feral hogs, illicit discharges, illegal dumping, boater wastes, and agricultural sources. The GBEP and its partners are also tying in with regional campaigns, such as Back the Bay, where applicable.

Implementation location: Lower Galveston Bay watershed.

ACTIVITIES	TIMEFRAME AND OUTPUT(S)	IMPLEMENTATION COST
Understand current awareness of BMPs by conducting pre-workshop assessments.	Within 2-5 years, conduct BMP awareness level assessments prior to hosting workshops.	\$0 - \$200,000
Conduct 10 BMP workshops to enhance technical understanding and awareness.	Within 2-5 years, conduct one BMP education workshop per year.	\$0 - \$200,000
	Within 5-10 years, conduct one BMP education workshop per year.	\$0 - \$200,000
	Within 10-plus years, conduct one BMP education workshop per year.	\$0 - \$200,000
Measure impact of workshops by conducting BMPs post-workshop assessments.	Within 10-plus years, conduct BMP awareness level assessments after hosting workshops.	\$0 - \$200,000

POTENTIAL IMPLEMENTERS

Texas General Land Office
H-GAC
Texas A&M AgriLife Extension Service

Texas Parks and Wildlife Department
Texas State Soil and Water Conservation Board

PERFORMANCE MEASURES

1. Number of NPS workshops with pre- and post-assessments completed.

REFERENCES

GBP'95, NPS-1, NPS-2, NPS-5, NPS-11, NPS-14, NPS-15, NPS-16, PPE-3, PPE-7
SAP Reference: Ecosystem and Human Health – WSQ: Goal 1 / Objective D / Objective E