Smokes Creek Habitat Connectivity and Improvement Opportunity Assessment

New York State Office of General Services and the New York State Department of Environmental Conservation

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List of Terms and Acronyms

ACOE (USACE)	U.S. Army Corps of Engineers
Agricultural BMPs	practices that relate to conservation tillage, crop nutrient management, weed and pest management, and conservation buffers
ARA	Active River Area
BMP	Best Management Practice
channelization	straightening, narrowing, and deepening of a stream channel; often includes removal of debris and channel obstructions that may impede flow
creation	construction of a new habitat or ecosystem where it did not historically exist
enhancement	improving the quality of a habitat through direct manipulation
establishment	construction of a new habitat or ecosystem where it did not historically exist
floodplain	a flat depositional feature of a river valley adjoining the channel, the floodplain is formed by climate and hydrological conditions and is subject to periodic flooding
fluvial processes	associated with rivers and streams and the deposits and landforms created by sediments
forb	an herbaceous flowering plant other than a grass
headwaters	the source of a stream or river; located at the furthest point from where the water body empties or merges with another
HEC-RAS model	simulation software used in computational fluid dynamics – specifically, to model the hydraulics of water flow through natural rivers
hydric soil	soils that, in an undrained condition, are saturated, flooded, or ponded long enough during a growing season to develop an anaerobic condition that supports the growth and regeneration of wetland vegetation
incised channel	where the stream bed is deepened to a point where flow is no longer connected the surrounding floodplain but cuts through the stream bed, resulting in further erosion and instability
invasive	tending to spread especially in a quick or aggressive manner and is likely to cause economic or environmental harm
lateral connectivity	the periodic inundation of the floodplain and the resulting exchange of water, sediment, organic matter, nutrients, and organisms
level spreader	a level, graded area designed to slow and spread concentrated runoff and release it as sheet flow to a stabilized area

longitudinal connectivity	the pathways along the entire length of a stream (upstream-downstream)
mesic forest	type of habitat with a well-balanced or moderate supply of moisture throughout the growing season
mesophytic forest	an ecoregion of the temperate broadleaf and mixed forests biome
NRU	Natural Resource Unit
NWI	National Wetland Inventory
NYNHP	New York Natural Heritage Program
NYRAM	New York Rapid Assessment Method for Wetlands
NYSDEC	New York State Department of Environmental Conservation
NYSOGS	New York State Office of General Services
ORV	Off-road vehicle
QHEI	Qualitative Habitat Evaluation Index
restoration	returning an ecosystem to its pre-disturbed condition
riparian	the banks of a river or the terrestrial aquatic interface that exerts a direct influence on stream channels or lake margins, and the water or aquatic ecosystems
SB	South Branch of Smokes Creek
SC	Main Branch of Smokes Creek
Stormwater Management	the process of controlling the storm runoff that comes primarily from impervious surfaces like parking lots, driveways, and rooftops
Stormwater Management BMPs	devices, practices, or methods that are used to manage stormwater runoff by controlling peak runoff rate, improving water quality, and managing runoff volume
streambank (bank) stabilization	practices that protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries to reduce erosion
succession	changes in species composition of plants and animals in an ecosystem with time, often in a predictable order
tributary	a stream or river that flows into another stream or river
watershed	entire land–drainage area of a river

1. Introduction

GHD Services, Inc. (GHD) was retained by the New York State Office of General Services (OGS) and the New York State Department of Environmental Conservation (DEC) to assist in the development of a comprehensive Smokes Creek Habitat Connectivity and Improvement Opportunity Assessment (Assessment). The goal of the Assessment was to identify and evaluate habitat restoration opportunities and flood mitigation alternatives to improve natural stream hydrology and habitat connectivity along the entire Smokes Creek corridor and an adjacent stretch of Lake Erie shoreline. The targeted project area included areas adjacent to and within the Smokes Creek mouth and mainstem, including the main and south branches of the Creek to their headwaters and the Lake Erie shoreline between Woodlawn Beach State Park and the Buffalo Outer Harbor.

The Assessment consisted of three phases of work: Phase 1 – Resource Inventory and Review, Phase 2 - Identification and Assessment of Potential Habitat Connectivity and Improvement Alternatives, and Phase 3 - Potential Habitat Opportunities Strategy. This report contains the comprehensive results of all three Phases of the Assessment along with associated maps, photos, figures, tables, and appendices.

2. Phase 1 – Resource Inventory & Review

GHD conducted a desktop review of existing data that was previously collected within the Smokes Creek watershed. After reviewing the available information, GHD biologists participated in a field visit with members from OGS and DEC on May 17th and 18th, 2022. The field visit was comprised of various stops along Smokes Creek from public and private locations to observe the condition of the waterway and associated riparian areas. Following the field visit, GHD coordinated virtual meetings with four (4) local municipality leaders within the Smokes Creek watershed (City of Lackawanna, Town of Hamburg, Town of West Seneca, and Town of Orchard Park) to notify leaders of this Assessment, and to request any municipality-specific data or input on any areas concern for incorporation into GHD's Assessment. Moving into Phase 2, GHD identified data gaps needing to be filled to identify stressors on the watershed and to develop habitat connectivity strategies.

2.1 Smokes Creek Assessment Framework

The Assessment incorporated a watershed-scale framework that integrates multiple habitat and stressor assessment methods. GHD divided the project area into land management units (Natural Resource Units; NRUs), which generally correspond to the sub-watershed boundaries of Smokes Creek (SC) and South Branch Smokes Creek (SB), that were used as the geographic framework for this Assessment. Overlapping with the NRUs is the Active River Area (ARA), which is a spatially driven approach to identify the functional riparian corridor of SC and SB. The following describes how the NRUs and the ARA were developed and used for this Assessment.

2.2 Natural Resource Units

NRUs are geographically based land units that combine watershed, land use and other physical features, such as roads. NRU boundaries were developed from the National Hydrography Dataset (NHD), Great Lakes Stream Basins (GLSB), DEC stream layer, Light Detection and Ranging (Lidar) elevation data and aerial imagery. The NRU boundaries correspond to watershed catchment areas of approximately 500 acres. Lidar contour data, aerial imagery and stream layers were used to refine NRU boundaries to better match topographic divides and NHD boundaries and then were further adjusted to reflect current land use. Each NRU contains a unique stream reach and corresponding ARA. The NRUs provide a geographic framework for evaluating aquatic and terrestrial resources on a sub-watershed scale and for identifying and prioritizing strategies to address watershed stressors.

2.3 Active River Area

The ARA, originally developed by The Nature Conservancy (Smith et. al., 2008), encompasses floodplains, river terraces, riparian wetlands, meander belts and critical contribution zones of the stream corridor. The modeled ARA for the Erie Basin was used for this assessment to identify the riparian corridor for SC, SB, and their respective tributaries. In some cases, the modeled ARA boundary bisects floodplain forests and other features that are contiguous with SC or SB. To fully encompass significant natural resources that are contiguous with SC, SB, and their respective tributaries, an ARA Priority Buffer was created. The ARA Priority Buffer extends 300 feet around the outside boundary of the ARA and surrounding wetlands and natural communities that abut the ARA. The rationale for expanding the ARA in this way is that management of wetlands and forested areas can best be accomplished based on the actual boundaries of wetlands and/or natural communities. This may also serve as a geographic framework for identifying protection strategies that are correlated to the ARA or the ARA Priority Buffer. The location of the SC/SB watershed, NRU boundaries, and ARA is shown on Figures 1 through 3.

3. Phase 2 – Identification and Assessment of Potential Habitat Connectivity and Improvement Alternatives

The Phase 2 assessment was completed to fill identified data gaps and to lay the groundwork for identification of habitat connectivity and improvement alternatives. Phase 2 field work was completed July 31 through August 3, 2023, and included three key data components: instream habitat, wetland condition, and natural community type and quality. Prior to conducting the Phase 2 field work, a desktop review of spatial data was completed for each NRU. This review identified SC/SB stream reaches, wetlands and terrestrial/aquatic natural communities. For the lower-most reach of Smokes Creek, a geomorphic assessment was completed. The following describes the methodologies for each of these components.

3.1 Qualitative Habitat Evaluation Index (QHEI) Stream Assessment

GHD used available spatial data and aerial imagery to pre-select representative stream reaches for in-field data collection. At least one (1) location was selected in each NRU that was representative of that NRU. In NRUs with major differences in stream type or condition (e.g., area of channelization or significant changes in adjacent land use), two representative stream reaches were identified. GHD biologists used the Qualitative Habitat Evaluation Index (QHEI) methodology (Ohio EPA, 2001) to conduct the in-stream habitat assessment.

The QHEI assessment metrics include:

– substrate
– in-stream cover
– channel morphology
– riparian zone and bank erosion
– pool/glide and riffle/run quality
– watershed size vs. gradient

Collectively and individually, these metrics characterize habitat quality and are summed for a comprehensive QHEI score. The QHEI score can then be used to assign a narrative stream habitat qualitative rating (very poor, poor, moderate, good, excellent). QHEI Stream Reaches are shown in Figures 4.1 through 4.12.

3.2 NY Rapid Assessment Method (NYRAM) for Wetlands

GHD reviewed National Wetland Inventory (NWI) maps, hydric soils maps, elevation contours, and aerial imagery to delineate wetland areas within each NRU. Wetlands less than two (2) acres, artificial ponds, and impoundments were excluded from the assessment. The two-acre minimum size threshold focused available project resources on larger, generally higher quality wetland features. Although artificial ponds and impoundments may include small areas of incidental wetland, these features were not mapped as wetland and were excluded from the assessment. GHD used the New York Rapid Assessment Method (NYRAM; Shappell et. al. 2016) to evaluate wetland condition and identify stressors. The NYRAM assigns a condition rating calculated by summing points assigned to observed stressors within the wetland as well as a 540-meter field buffer. The NYRAM also includes a wetland condition rating that considers the level of disturbance within the wetland. The combined condition rating and stressor scores are summed to generate the NYRAM score.

It is important to note that NYRAM scores measure stressors on the wetland, and although the ecological condition of the wetland is considered as part of the condition rating, the stressor scores can lower the overall NYRAM score. For example, high quality wetlands that have significant development in the 540-meter field buffer may have a lower condition rating, while low quality wetlands with an undeveloped field buffer may have a higher condition rating than might be expected, if only the quality of the wetland alone is considered. The Natural Community Assessment, which includes wetland communities, provides a better measure of wetland quality.

The NYRAM assessment was completed on all wetlands within or adjacent to the ARA, unless limited by access, in which case a desktop review NYRAM was performed. The Natural Community Assessment described below provides additional detail on wetland community type and condition and was used to supplement the NYRAM assessment. Wetlands that were evaluated with the NYRAM are shown in Figures 5.1 through 5.12.

3.3 Natural Community Assessment

GHD used aerial imagery to delineate terrestrial and wetland communities/habitat. Areas with residential, commercial, or agricultural land uses or areas with recent disturbance were excluded from this assessment. GHD biologists classified the natural communities in accordance with the methods described in *Ecological Communities of New York State* (Edinger, et al., 2014). The natural community assessment included identifying dominant plant species in each stratum (canopy, shrub, herbaceous), structural elements (e.g., age, size class of trees), physiographic features, human disturbance, and invasive species. This assessment data was used to assign an element occurrence ranking that reflects the condition quality of the natural community. The natural community assessment was completed on terrestrial and wetland communities within or contiguous with the ARA unless limited by access, in which case a desk review to identify natural community type and quality was performed.

3.4 Geomorphic Assessment of SC Estuary and Shoals

GHD completed a pedestrian survey of lower SC including the channelized lower-most reach, the mouth at Lake Erie and the nearshore areas of Lake Erie adjacent to the mouth. GHD completed a desk review of lower SC and SC estuary including records of dredging, historic water level data and geotechnical information. The review also included the extent of past flooding events and the frequency and magnitude of dredging activities. As part of this assessment, the SC HEC-RAS model was reviewed to gain an understanding of flood issues, instream velocities, and suitability of model for evaluating or developing improvement opportunities.

4. Phase 2 Results

The results of the QHEI, NYRAM and Natural Community Assessment are summarized on NRU Summary Sheets provided in Appendix A. The Summary Sheets include the following: narrative description of key NRU elements; percent breakdown of NRU land use; QHEI, NYRAM and Natural Community maps and ratings; stressor identification

matrix; and potential opportunities for habitat connectivity and watershed improvement. The results that follow provide a high-level summary of each assessment parameter. For more detailed and site-specific information, refer to the applicable NRU Summary Sheet.

4.1 QHEI Stream Habitat Assessment

GHD completed QHEI assessments on 33 stream reaches (see Figures 4.1 through 4.12). Total QHEI scores ranged from 72.25 to 27.5, with an average score of 56.9. The count of reaches and their respective QHEI scores and narrative ratings is presented in Table 1. The reach count by QHEI score and narrative rating indicates that 70% of SC and SB, above their confluence, have a narrative rating of good or excellent.

With few exceptions, the highest quality reaches are in non-headwater portions of the upper reaches and tributaries of SC and SB. Instream habitat in the headwater reaches ranges from good to poor with habitat in the upper-most headwaters of SC and SB limited by intermittent streamflow. The remaining upper reaches of SC and SB (generally north of Powers Road) receive significant groundwater inputs from seeps and groundwater-dependent wetlands, contain a good diversity of substrates, and have forested riparian corridors. Groundwater inputs to SC and SB occur where the stream valley has down cut through till or beach deposits to Angola Shale, Cashaqua Shale and West River Shale bedrock. These bedrock deposits consist of shale, limestone, siltstone, and mudstone and are the dominant substrates in many SC and SB reaches above Highway 20 and Milestrip Road. The lower reaches of SC and SB are generally lower quality due to channelized or partly channelized reaches, entrenched channels with embedded substrate, eroded streambanks, and discontinuous and/or low-quality riparian corridors. As noted, there are exceptions. Several reaches in lower SC and SB flow through undeveloped floodplain and have excellent in-stream habitat. As noted in the discussion on groundwater inputs, some upper reaches flow continuously over bedrock and are referred to in this report as silt-stone limited. Siltstone-stone limited reaches often lack quality pool and riffle habitat since substrate is limited to scoured siltstone. Additional exceptions apply to the many road crossings where debris jams form on the upstream side of crossings creating large areas of scour and bank erosion. Refer to NRU summaries for a more detailed description of QHEI ratings and stream habitat condition.

Table 1 Breakdown of QHEI narrative scores and number of reaches in each rating group.

Narrative Rating	QHEI Range	Reach Count
Excellent	≥ 70	2
Good	55 – 69	21
Fair	43 – 54	5
Poor	30 – 42	4
Very Poor	< 30	1

4.2 NYRAM Wetland Assessment

GHD completed NYRAM assessments on 67 wetlands within the ARA and ARA Priority Buffer (see Figures 5.1 through 5.12). The count of wetlands and their respective NYRAM scores and stressor ratings is presented in Table 2. Total NYRAM scores ranged from 19 to 89, with an average score of 66. None of the assessed wetlands received a stressor rating of excellent and almost half of the wetlands received a stressor rating of very poor. Wetlands with the best stressor rating were generally located within or adjacent to large contiguous blocks of forest with limited urban development in the field buffer. These wetland communities generally consisted of diverse hardwood swamp communities in upper SC or SB. Wetlands with lower stressor ratings are impacted by invasive species, stormwater inputs, encroachment from adjacent land uses, and habitat fragmentation within the wetland buffer and the field buffer.

Table 2 Breakdown of NYRAM narrative scores and number of wetland areas in each rating group

NYRAM Stressor Rating		NYRAM Range	Wetland Count
Excellent		< 14	0
Good		< 38	7
Fair		38 – 53	12
Poor		> 53	15
Very Poor		> 70	33

4.3 Natural Community Assessment

GHD assessed 173 areas of natural communities within the ARA and ARA Priority Buffer (see Figures 6.1 through 6.12). Each natural community was assigned a condition rank based on observed ecological integrity, as defined in *The Ecological Communities of New York State* (Edinger et al., 2014). The condition ranks are coded symbolically in Table 3.

Natural communities that were identified include beech-maple forest, rich mesophytic forest, successional southern hardwoods, floodplain forest, red maple hardwood swamp, silver maple-ash swamp, shallow emergent marsh, shrub swamp and rich fen. Rich fen communities occur as small inclusions along valley slopes at edges of hardwood swamps and floodplain forests and were not mapped due to their small size. The natural community rating in upper SC and SB ranged from fair to good with three areas ranked as excellent. The natural communities in lower SC and SB are dominated by floodplain forest scrub-shrub, old field and successional southern hardwood communities and generally have a poor to fair rating. Observed natural community stressors include historic logging, fragmentation, invasive plant species, dumping, and misuse of natural areas.

Table 3 Breakdown of natural community narrative scores and number of areas in each ranking group

Narrative Rating		Condition Rank	Area Count
Excellent		A – Little to no human disturbance	3
Good		B – Lightly disturbed	28
Fair		C – Strong disturbance	78
Poor		D – Severely disturbed	64

Invasive species prevalence is strongly correlated with poor NYRAM and natural community ratings. In upper SC and SB, larger areas of contiguous natural communities generally had the lowest number and density of invasive species. While in the lower SC and SB, where natural communities are smaller in size and often fragmented, invasive species often dominated the shrub and herbaceous strata. The lower-most channelized reaches of SB and SC have the highest prevalence of invasive species, with Japanese Knotweed approaching 100% coverage in some areas.

Table 4 lists invasive species identified in SC and SB, including primary habitat type and whether the species is classified as prohibited in New York State (NYS). Note that other invasive species, not listed in Table 4, are likely present in adjacent urban and agricultural areas.

Table 4 Invasive Species Documented in SC and SB

Common Name	Scientific Name	Habitat*	NYS Part 575 Status
Tree and Shrub Species			
Autumn Olive	*Elaeagnus umbellata*	U	Prohibited
Common Buckthorn**	*Rhamnus cathartica*	U	Prohibited
English Ivy	*Hedera helix*	U	-
Privet	*Ligustrum obtusifolium*	U	Prohibited
Glossy Buckthorn**	*Frangula alnus*	W	Prohibited
Honeysuckle Shrub**	*(L. morrowii, L. maackii, L. tatarica)*	U	Prohibited
Honeysuckle Vine	*Lonicera japonica*	U	Prohibited
Japanese Barberry	*Berberis thunbergii*	U	Prohibited
Multiflora Rose**	*Rosa multiflora*	U	Prohibited
White Mulberry	*Morus alba*	U	-
**Primary habitat type: U=upland; W=wetland* ***Widespread occurrence*			
Herbaceous Species			
Birdsfoot trefoil	*Lotus corniculatus*	U	-
Canada Thistle**	*Cirsium arvense*	U	Prohibited
Creeping Jenny**	*Lysimachia nummularia*	W	-
Crown Vetch	*Securigera varia*	U	-
Garlic Mustard	*Alliaria petiolata*	U	Prohibited
Hybrid Cattail**	*Typha x glauca*	W	-
Japanese Knotweed**	*Reynoutria japonica*	U	Prohibited
Japanese Stiltgrass**	*Microstegium vimineum*	W	Prohibited
Mugwort**	*Artemisia vulgaris*	U	Prohibited
Phragmites**	*Phragmites australis*	W	Prohibited
Purple Loosestrife	*Lythrum salicaria*	W	Prohibited
Spotted Knapweed	*Centaurea steobe*	U	Prohibited
Yellow Iris	*Iris pseudacorus*	W	Prohibited
**Primary habitat type: U=upland; W=wetland* ***Widespread occurrence*			

4.4 Lower SC Estuary and Shoals

GHD completed a review of Lower SC from the Hamburg Turnpike (Highway 5) to Lake Erie to explore potential opportunities for improvement to channelized reaches, estuary and near shore areas adjacent to the estuary of SC. The purpose of the review was to explore potential opportunities for improvement to the fluvial system. The evaluation included the following:

– Review of available models
– Review of existing fluvial geomorphic processes
– Improvement recommendations

GHD's detailed report is included in Appendix B.

5. Phase 2 – Data Evaluation and Stressor Identification

GHD reviewed the data compiled for each NRU and identified stressor categories that may impact the ecological integrity of instream and riparian habitat. Within each category, key stressors that were directly or indirectly observed are listed. GHD notes that best management practices, such as stormwater treatment, may be effectively implemented at the local level, yet unmanaged stormwater is still listed as a stressor due to the cumulative impacts of upstream sources. GHD also explored the potential to create or enhance recreational opportunities throughout the watershed. While the Implementation Plans conceived during Phase 3 include some elements for public education (e.g. increasing educational signage or hosting volunteer days to implement projects), GHD did not discover any obvious locations to create new recreational opportunities nor were any locations brought up during Phase 1 municipality meetings. GHD recommends requesting public input during the stakeholder engagement portion of Phase 3.

A summary of stressor categories and associated key stressors is presented in Table 5. A listing of stressors, specific to each NRU, is provided on the NRU Summary Sheets (Appendix A).

Table 5 Stressor Identification

Stressor Category	Stressors	
Hydrology	IFM	Baseflow
	HSF	High/Stormflows
	USW	Unmanaged Stormwater
	S/GWI	Impacts to Surface/Groundwater Interaction
Structures	SO	Stormwater Outfall
	BCC	Bridge/Culvert Crossing
Water Quality	USD	Untreated Stormwater Discharge
	TU	Visual Turbidity
	TH	Lack of Thermal Protection
Geomorphic	SE	Streambank Erosion
	ENT	Entrenchment
	CH	Channelization
	DF	Disconnected Floodplain
Instream Habitat	S/E	Siltation/Embeddedness
	RD/Q	Poor Riffle Development/Quality
	PD/Q	Poor Pool Development/Quality
	W/VC	Lack of Woody/Vegetative Cover
	SSL	Siltstone Limited
Riparian Habitat	BW/Q	Poor Buffer Width/Quality
	IN	Invasive Species
	LUE	Land Use Encroachment
	CON	Lack of Corridor Connectivity

5.1 NRU Summaries

One-page, easy reference summaries for each NRU have been developed to summarize current conditions, results of stream, wetland and natural community assessments, stressor assessment, and potential opportunities (Appendix A).

6. Phase 3 – Potential Habitat Opportunities Strategy

6.1 Opportunities Assessment

A broad range of measures were assessed to address stressors identified in Phase 2, improve fish and wildlife habitat, enhance public access and environmental awareness, and foster an understanding of the unique ecological features in the Smokes Creek Watershed. Should an entity choose to move forward with implementing a recommended opportunity, the projects will need to comply with applicable local, state, and federal floodplain and land use zoning ordinances and for lower SC and SB, restrictions for work within the ACOE flood control project area.

Opportunities considered as part of Phase 3 included:

- Restore drained wetlands, re-meander channelized reaches and create riparian corridors in headwater areas of watershed.
- Address barriers (bridge crossings, culverts, etc.) that hinder geomorphic processes and fish and wildlife movement between high-quality resource areas.
- With a focus on gaps between high value resource areas, establish and/or improve width and quality of riparian corridors.
- Protect critical groundwater recharge/discharge areas and groundwater-dependent natural communities.
- Create model riparian buffer detail for residential and commercial properties that includes guidance on minimum width, species selection, invasive species control and strategies to limit human impact.
- Landowner education and outreach that includes explanation and examples of best management practices (urban, stormwater, and agricultural).
- In lower watershed, identify and implement comprehensive ecosystem restoration projects that restore instream geomorphic processes, reconnect floodplains, and restore native plant communities.
- Where adjacent land uses limit options for more comprehensive stream and riparian corridor restoration, implement instream habitat improvements that partially restore geomorphic processes and that mitigate poor habitat and thermal impacts though enhancement of riparian corridor.
- Restore Smokes Creek estuary through channel modifications, coastal wetland restoration and re-establishment of natural communities.
- Brownfield reclamation and redevelopment of Mainstem SC may provide opportunities to restore coastal natural communities and enhance connections between ecosystem restoration efforts in SBL3 and the shoreline of Lake Erie.
- The status of existing brownfields and land along the rail corridor should be evaluated to identify areas that can serve as ecological and community links between other natural areas and neighborhoods.

Based on the results of Phase 1 and Phase 2, opportunities to improve the riparian corridor along the Creek were identified and evaluated based on habitat and species benefits, flood mitigation potential and other co-benefits such as public engagement, recreational access, and water quality improvement. GHD established six main goals for restoration, each with associated strategies to achieve the goal. The restoration goals and strategies are presented in Table 6.

Table 6 Restoration goals and strategies

Goal	Key Strategies
Maintain or Restore Hydrologic Functions (reduce peak flow rates and provide for consistent baseflow)	Urban stormwater volume and rate control
	Wetland restoration/creation
	Protect/restore groundwater-dependent resources
	Replace direct stormwater discharges with infiltration or retention basins that regulate rate and volume of discharge to pre-development levels
	Re-establish floodplain connectivity
	Increase culvert sizes where feasible
Maintain or Restore Water Quality (nutrients, sediment, chloride, thermal, etc.)	Urban (residential/commercial/industrial) stormwater treatment
	Replace direct stormwater discharges with infiltration or retention basins that regulate rate and volume of discharge to pre-development levels
	Agricultural best management practices
	Wetland restoration/creation
	Riparian buffers (increase width and quality)
	Restore/enhance riparian canopy
Restore Longitudinal and Lateral Connectivity of SC and SB	Re-establish floodplain connectivity on aggraded/entrenched reaches
	Remove fill, structures, and constrictions (such as undersized culverts and bridge crossings) within floodplain
	Where feasible, remove dams, artificial levees, trails, and roads that block lateral movement of water; alternatively, mitigate impacts of these features through increased hydraulic capacity of culverts through these barriers
	Expand riparian buffers to limits of floodplain where possible
	Improve quality of riparian buffers through management of invasive species and restoration of natural communities
	Bank stabilization
	Instream habitat improvements
Protect and enhance wetland communities within the ARA	Wetland buffer standards/ordinances
	Apply land conservation tools to protect high quality examples of floodplain forest, red-maple hardwood swamp, silver maple-ash swamp, rich fen, and shrub swamp wetland communities
	Invasive species control (within wetlands and wetland buffers)
	Maintain/restore wetland hydroperiod (urban stormwater rate and volume control).
	Restore hydrology to ditched/tiled headwater wetlands
	Restore lateral, overbank flow to floodplain of SC/SB
	Control incompatible uses (e.g., dumping, ATV/bike trails, etc.
Protect and enhance upland natural communities within the ARA	Apply land conservation tools to protect high quality examples of beech-maple, maple-basswood, rich mesophytic forest communities
	Invasive species control
	Control incompatible uses (e.g., dumping, ATV/bike trails, etc.)

Goal	Key Strategies
Expand public access opportunities and environmental awareness	Where compatible with resource protection, integrate public engagement and access into habitat improvement and connectivity projects
	Develop locally based neighborhood stewardship plans that engage residents and provide focal point to communicate actions that residents can take to protect/improve habitat
	Develop resource protection templates that include techniques to mitigate stormwater and invasive species; planting/seeding species and practices, and guidance on co-existing with ARA

6.2 Implementation Plan

Utilizing the collected data and existing resources, GHD created an Implementation Plan for the Smokes Creek watershed (Figures 7 and 7.0-7.24. The Implementation Plan includes three key components:

- **Focus Areas:** Key areas of public land-private land with multiple project components, that when implemented, would benefit not only the focus area itself, but other areas of the watershed.
- **Riparian Buffer Areas:** Stream reaches that lack a viable riparian buffer. The Riparian Buffer Areas identify where landowners and local units of government could concentrate efforts towards implementing the three-zone buffer framework, which provides a flexible, yet effective approach to establishing, protecting and maintaining riparian buffers.
- **Conservation Areas:** Ecologically significant areas that may be targeted for protection. Conservation Areas can be protected with a broad range of land protection tools guided by site specific stewardship plans.

The following sections describe the implementation framework for Focus Areas, Riparian Buffer Areas, and Conservation Areas. These sections are followed by an overview of stakeholder outreach and regulatory considerations that would need to be addressed for focus area and riparian buffer establishment projects.

6.2.1 Focus Areas

GHD identified twelve (12) Focus Areas, totaling approximately 700-acres, which are geographically dispersed between the headwaters and mouth of SC. The potential for habitat enhancement exists throughout the watershed, however, GHD selected these specific locations due to their combination of addressing restoration goals and overall feasibility for implementation. The following criteria were applied in selecting focus areas:

- Proximity to ARA and ARA Buffer (focus areas are generally located within ARA/ARA Buffer)
- Proximity to high quality natural communities
- Large tracts of public/private land (land ownership determined with GIS data “NYS_Tax_Parcels_Public” from the NYS GIS Clearinghouse)
- Public land including parks, school property, dedicated land along creek, etc.
- Drained hydric soils, wetlands and channelized reaches of SC/SB and tributaries
- Within mapped floodplain
- Redevelopment projects (such as Bills Stadium, Tecumseh, etc.)
- Potential of project to establish connectivity to other natural resources

Focus areas that include wetland restoration were selected based on the presence of hydric soils and hydrologic alterations that could include ditching, topographic alterations, and potential presence of subsurface drainage systems. Wetland restoration sites that have the potential to provide instream flow and water quality benefits such as baseflow attenuation, peak flow reduction and nutrient/sediment load reduction were given additional consideration.

As-built constructed drawings of the *Local Flood Protection Smokes Creek at Lackawanna, New York* (ACOE 1965) and the *Operation and Maintenance Manual for Local Flood Protection Project on Smokes Creek at Lackawanna, New York* (ACOE 1972) were reviewed to identify Focus Areas that are within or adjacent to the U.S. Army Corps of Engineers Flood Control Project. Conceptual projects within the limits of the Smokes Creek Flood Protection Project would require Article 16 Flood Control Land Use Permits from the New York State Department of Environment Conservation and Section 408 Permissions from the U.S. Army Corps of Engineers. Project Integrity and Unimpeded Access for project Operation & Maintenance are requirements for issuing an Article 16 Flood Control Land Use Permit and may also require hydraulic analyses. Smokes Creek Flood Protection Project "As-Built" Drawings (ACOE 1965), Real Estate Key Maps (Erdman & Anthony Consulting Engineers 1966), and the project's O&M Manual (ACOE 1972) should be utilized during project planning.

GHD completed a desktop site assessment of each Focus Area with respect to soils, hydrology, geomorphology, vegetation, and land use to develop conceptual implementation plans. The implementation plans describe ecological restoration and enhancement measures, instream improvements, streambank stabilization and other actions specific to each Focus Area. Estimated planning, design, and construction costs are provided for each Focus Area with costs broken out by subarea or project type within the focus area. The Focus Area Implementation Plans can be found in Appendix C. There are several additional resources that are referenced in the Focus Area Implementation Plans and the Sections that follow:

– Instream Treatment Alternatives (Appendix D): This appendix provides standard construction details and specifications on practices recommended in the Focus Areas.
– NY Natural Heritage Program – Natural Community Guides (Appendix E): This appendix includes natural community fact sheets that describe ecological characteristics including species composition, physiographic features, management guidelines.
– Riparian Buffer Guidance (Appendix F) – This guidance document describes the three-zone buffer framework as adapted for the Smokes Creek Watershed.

6.2.2 Riparian Buffer Areas

GHD identified reaches of SC and SB where the riparian corridor is not of sufficient width, is discontinuous, or is impacted by various stressors that may include invasive species, stormwater discharges or human activity. Forty-two (42) reaches, totaling over eleven miles, were identified, and are shown in Figure 7 and the associated NRU Implementation Plans in Figures 7.0-7.24. The three-zone buffer guidance identified in the DEC's Stormwater Design Manual (NYSDEC, 2022), with some modifications, is recommended as a flexible framework to guide creation and enhancement of riparian buffers and is described in Appendix F. The three-zone buffer guidance can be implemented by individual landowners, homeowner's associations or on land owned by, or controlled by local units of government. This guidance can also be implemented on new and existing development through local zoning ordinances and stormwater management standards.

6.2.3 Conservation Areas

Conservation Areas are broadly defined in this document as ecologically significant blocks of land that contain one or more high quality natural communities; support unfragmented "interior" forest habitat; and/or include high quality riparian habitat. Conservation Areas identified in Smokes Creek are:

– Unfragmented natural communities that are 40-acres or more in size;
– Located within ARA or ARA Priority Buffer; and
– A significant component of the area includes a natural community with a qualitative rating of good or excellent.

Using these criteria, GHD identified 2,060-acres of mostly forest land on fourteen (14) separate tracts. These areas are intended as a starting point for identifying Conservation Areas. Additional areas that may be designated as Conservation Areas include groundwater-dependent wetland communities, areas with unique habitat or rare features, and focus areas after ecological restoration is implemented. A broad range of land protection tools is available to

protect Conservation Areas and could include purchase of fee title, conservation easements, low impact development design, and zoning ordinances. A number of these areas are already afforded some level of protection since they may include wetlands that are protected under New York's Freshwater Wetlands Act. Starting in 2028 the Freshwater Wetlands Act may protect wetlands 7.4 acres in size and greater (current threshold is 12.4-acres). Class I wetlands, or wetlands of "unusual importance" may be regulated regardless of size. The locations of Conservation Areas are shown in Figure 7 and the associated NRU Implementation Plans in Figures 7.0-7.24.

6.2.4 Consistency with Local, State and Federal Requirements

The recommendations provided in the Implementation Plan are conceptual and subject to public and private landowner approval. Engagement with affected landowners and community representatives would be a first step towards implementing any of the recommendations provided herein. Focus Area and Riparian Buffer Area projects would generally require further feasibility analysis and design that may include boundary and topographic surveys, ecological assessments, hydrologic and hydraulic analyses, and engineering/landscape design. Local, state, and federal permits may be required and any project within the limits of the Smokes Creek Flood Protection Project would require Article 16 Flood Control Land Use Permits from NYSDEC and Section 408 Permissions from the U.S. Army Corps of Engineers. Project Integrity and Unimpeded Access for project Operation & Maintenance are requirements for issuing an Article 16 Flood Control Land Use Permit. In addition, projects located within a mapped floodway and/or floodplain may require local floodplain permits. As noted in Section 6.2.3, protection and enhancement of conservation areas would require engagement with affected landowners and the local community.

6.2.5 Resources for Landowners

In response to comments received during the public comment period (June 4 - June 24, 2024), GHD and NYSDEC have compiled a list of resources for landowners seeking additional information on watershed improvement options.

6.2.5.1 Native Plantings

- **Native Flowers, Grasses, Shrubs, Trees, and Vines (ny.gov)**
  https://extapps.dec.ny.gov/docs/lands_forests_pdf/factnatives.pdf
- **Sustainable Landscaping - NYSDEC**
  https://dec.ny.gov/get-involved/living-green/sustainable-landscaping
- **Native Plant Guide - Buffalo Niagara Waterkeeper (bnwaterkeeper.org)**
  https://bnwaterkeeper.org/nativeplantguide/

6.2.5.2 Shoreline Stabilization

- **Shoreline Stabilization Techniques - NYSDEC**
  https://dec.ny.gov/regulatory/waterways-coastlines-wetlands-permits/protection-of-waters-program/shoreline-stabilization-techniques

7. Summary

A fundamental tenant of ecological restoration, stated in the Active River Area Conservation Framework (Smith, et al., 2008), is "*the ultimate source of failure of many restoration projects is likely the result of the continued absence of natural processes and associated disturbance regimes after project implementation. The projects have tried to fix a symptom of the problem, rather than the cause of the problem."* Keeping this in mind, our review of focus areas, riparian buffer areas and conservation areas prioritizes projects that address root causes, are sustainable, and address key stressors on terrestrial and aquatic resources within the Smokes Creek ARA. Project screening also includes other feasibility factors such as land ownership and estimated implementation costs. The criteria identified for

project screening are summarized in Table 7. It is acknowledged that some of these criteria can be difficult to measure and/or are subjective.

Table 7 Project Screening & Prioritization

Criteria	Evaluation
Land Ownership	Sites under existing public ownership are prioritized. Private land may be considered with preference for single landowner where possible. Projects with multiple landowners may be difficult to implement.
Address Root Cause	Does project remove or mitigate key stressors (e.g., stormwater rate/volume, riparian corridor encroachment, invasive species, etc.)?
Proximity to Conservation Areas	Is project within or adjacent to identified high quality terrestrial or aquatic resource that is identified as a conservation area?
Mitigation of Corridor Gaps	Does the project create new connectivity or enhance existing connections between otherwise fragmented natural resource features?
Public Access and Uses	Does project provide new access, improve existing access, or provide new opportunities for community engagement?
Sustainability	Assuming long term monitoring and maintenance can be provided, is the project expected to deliver long term ecosystem services?
Cost	What is the relative cost of the project when weighed against the benefits provided?

Following DEC and OGS review of this document, GHD will present findings to the PAC and other key stakeholders via virtual meetings, to be coordinated by DEC. GHD will work with the project team to incorporate all PAC and public comments and produce a public-friendly Final Assessment Report.

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