

PROJECT NAME

Northwest Florida Borrow Pits Inventory and Assessment Project

CONTACT INFORMATION

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Caveat — The contents of this proposal may not be incorporated into a non-SAIC contract, agreement, or other document.

PROJECT LOCATION

The proposed work area would include approximately 8 million acres (18 hydrologic unit codes [HUCs]) in northwest Florida that extends from Escambia to Jefferson County (Table 1 and Figure 1). Potential stakeholders would include the Northwest Florida Water Management District, Florida Department of Environmental Protection, Florida Department of Transportation, Florida Fish and Wildlife Conservation Commission, U.S. Fish and Wildlife Service, and 16 Florida counties within the work area.

Table 1. Northwest Florida Work Area Summary

HUC	Total Acres	Northwest Florida Counties
Apalachicola Bay	171,353	Franklin, Gulf
Apalachicola River	689,550	Calhoun, Franklin, Gadsden, Gulf, Jackson, Liberty
Aucilla River	468,224	Jefferson, Madison, Taylor
Blackwater River	460,050	Okaloosa, Santa Rosa
Chattahoochee River	115,789	Gadsden, Jackson
Chipola River	657,020	Bay, Calhoun, Gulf, Jackson, Washington
Choctawhatchee Bay	440,853	Okaloosa, Walton
Choctawhatchee River	909,159	Bay, Holmes, Jackson, Walton, Washington
Escambia River	260,653	Escambia, Santa Rosa
New River	329,045	Franklin, Liberty
Ochlockonee River	837,833	Franklin, Gadsden, Leon, Liberty, Wakulla
Pensacola Bay	349,370	Escambia, Okaloosa, Santa Rosa
Perdido Bay	82,354	Escambia
Perdido River	153,664	Escambia
St. Andrews Bay	856,456	Bay, Calhoun, Gulf, Jackson, Walton, Washington
St. Marks River	686,111	Jefferson, Leon, Wakulla
Pea River	70,333	Holmes, Walton
Yellow River	550,105	Okaloosa, Santa Rosa, Walton
Grand Total	8,087,923	



Figure 1. Proposed Project Area Counties and Watersheds

PROJECT DESCRIPTION

Northwest Florida Borrow Pits — In northwest Florida, most borrow pits (also known as clay or sand pits) are surface mining operations where overburden soil materials are removed to expose clay, sand, and/or aggregate materials. These materials are excavated and transported off-site to construct and stabilize roads. Counties use pit materials to maintain the surface of unpaved roads, whereas, the Florida Department of Transportation primarily uses pit materials to construct a stable soil base for paved roads.

Pit construction includes excavation and scraping to remove the overburden and leveling to reduce slope gradients. Once the desired layer is exposed, specialized equipment is used to remove material from the pit floor. Since the early 1900s, borrow pits have been used to access soil and aggregate materials (Figure 2). It is estimated that over the past 100 years, hundreds of borrow pits have been constructed in northwest Florida. Historically, pits were constructed on sloped areas where near-surface sand, gravel, or clay layers could be exposed and excavated with minimal overburden removal with little or no regard for environmental impacts. Pit construction along sloped areas also meant that these high soil disturbance areas were often relatively close to waterways. As pit materials were exhausted, sites were abandoned; in some cases, landscape-altering gully erosion resulted (Figure 3).



Figure 2. Escambia County Borrow Pit, 1911 (left) and 1940 (right)



Figure 3. Borrow Pit-Induced Gully Erosion Okaloosa County 1910s (left) and Walton County 2010 (right)

To support stormwater management and accommodate mining operations, borrow pits are generally configured as “enclosed” or “open” sites. An *enclosed pit* has extensive fill extractions that have created an area bounded by vertical or near vertical cutbanks that constitute at least 80 percent of the pit perimeter (Figure 4). The distance from the pit floor to natural ground is normally tens of feet. The configuration of these pits is normally related to amount of overburden required to access the desired geologic layer, site topography, vehicle access requirements, vertical extent of minable material, and/or site permit constraints. Some enclosed pits impound stormwater and do not discharge runoff off-site. In contrast, *open pits* are sites where mining operations have created relatively shallow excavations (Figure 4). Typically, minimal amounts of overburden were removed to access desired geologic layers.

Borrow pits are similar to a lunar landscape, with denuded surfaces that are void of vegetation and geologic soils that often have low permeability and high runoff and soil erosion potentials. Pits can range from less than an acre to tens of acres in size. Active and abandoned pit runoff discharge points may include access roads, constructed cuts or structures along pit boundaries, and gully systems. Even abandoned pits may continue to be major sources of pollution. Pit floor soils are most often infertile, and the naturally cemented or compacted conditions impede the germination and growth of vegetation (Figures 4 and 5).



Figure 4. Northwest Florida Enclosed (left) and Open (right) Borrow Pits



Figure 5. Northwest Florida Borrow Pit Floor Soils

Issues — Environmental issues of particular concern to borrow pit management include:

- ✚ Soil erosion and sedimentation impacts to waters of the state
- ✚ Sensitive geologic karst feature groundwater impacts

Because of their state of perpetual surface disturbance, accumulations of loose soil materials, exposure of relatively impervious soil layers, sloped topography, and frequent location near streams and wetlands, borrow pits are potentially significant sources of landscape damage, soil erosion, and sedimentation of streams and wetlands. Once deposited in waterways, sediment and other materials can impair water quality and degrade habitats for aquatic species. In some cases, extensive gully systems that develop on- and off-site can have catastrophic effects. Runoff and suspended sediment released off-site into waters of the state may result in a violation of federal and state regulations.

Depending on the site type, geology, hydrology, and topography, pit gully systems may continue to evolve, dislodging and transporting soil materials off-site. Gullies function like streams, headcutting and moving sediment within defined channels working towards a stable grade. Similar to typical watershed drainage, gully systems often create multiple branches that funnel into a central discharge channel. Depending on the site, gully channels can remove thousands of metric tons of soil in achieving a stable grade. Examples of borrow pit gully erosion, off-site sediment discharge, and potentially impacted water resources are presented in Figures 5 through 7.

As stated in the *Department of Environmental Protection and Northwest Florida Water Management District Environmental Resource Permit Applicants Handbook – Volume I*, “Subsection 62-346.050(1), F.A.C., provides that a noticed general permit under Chapter 62-341, F.A.C., or an individual permit under Chapter 62-346, F.A.C., is required prior to the commencement of construction, alteration, operation, maintenance, removal, or abandonment of any stormwater management system, including any dam, impoundment, reservoir, appurtenant work or works that is part of the stormwater management system, when such systems do not meet the grandfathering provisions of Section 373.4145(6), F.S., or are not exempt under Sections 373.406, 373.4145(3), or 403.813, F.S., or Rule 62-346.051, F.A.C.” Section 373.4145(6), Florida Statutes, stipulates that operation and maintenance activities associated with a legal activity prior to October 1, 2007, may continue without the need for an environmental resource permit (ERP).

Existing stormwater systems for borrow pits constructed under Chapter 62-25, Florida Administrative Code (FAC), may be operated and maintained for the life of the system provided that the permit, exemption, or authorization terms and conditions are met and the work is conducted in a manner that does not violate state water quality standards (Chapters 62-4 and 62-302, FAC). However, under the provisions of Chapter 62-25, if the system is altered, modified, expanded, abandoned, or removed, that activity is regulated under Chapter 62-346, FAC. ERPs may be required for borrow pits that discharge stormwater runoff into waters of the state—a potential violation of state water quality standards.

On-site borrow pit maintenance primarily focuses on managing pit-generated sediment rather than preventing soil erosion from the perpetually denuded pit landscape. The treatment objective is to physically intercept and defuse the erosive energy and sediment transport capacity of runoff at frequent intervals, promoting water infiltration into the soil and on-site sediment deposition. Only under specified and permitted applications should water discharge into off-site environments.

Based on field observations, many northwest Florida active and inactive borrow pits lack functioning stormwater management systems. As exemplified in Figures 6 through 9, the uncontrolled release of stormwater runoff can deliver gross amounts of sediments and other contaminants into potentially sensitive and/or regulated ecosystems. In addition to unpaved road-stream crossings and row-crop agriculture, borrow pits may be one of the most pervasive sources of ecosystem degradation and pollution. Yet there is limited access to information regarding their locations and conditions, and borrow pit treatment practices tailored to managing stormwater and site decommissioning are practically nonexistent.



Figure 6. Northwest Florida Borrow Pit Soil Erosion and Off-Site Sediment Discharge (Google Earth)



Figure 7. Northwest Florida Borrow Pit Soil Erosion and Off-Site Sediment Discharge (Google Earth)



Figure 8. Northwest Florida Borrow Pit-Induced Gully Erosion and Stream Sedimentation



Figure 9. Examples of Northwest Florida Borrow Pit-Induced Erosion and Sedimentation

Because of the vertical excavation of soil material, borrow pits can have significant impacts on near-surface karst features. Karst topography results from the dissolution of limestone and dolomite geologic layers by surface water and groundwater forming interconnected underground cavities, solution pipes, and caverns and surface depression sinkholes. Because of their high permeability and lack of a natural filtration system, sensitive karst landscapes, which occur throughout much of northwest Florida (Figure 10), are particularly prone to groundwater contamination. Borrow pit operations that breach karst layers and introduce sediment or other pollutant materials could result in the contamination of the Floridan aquifer system.

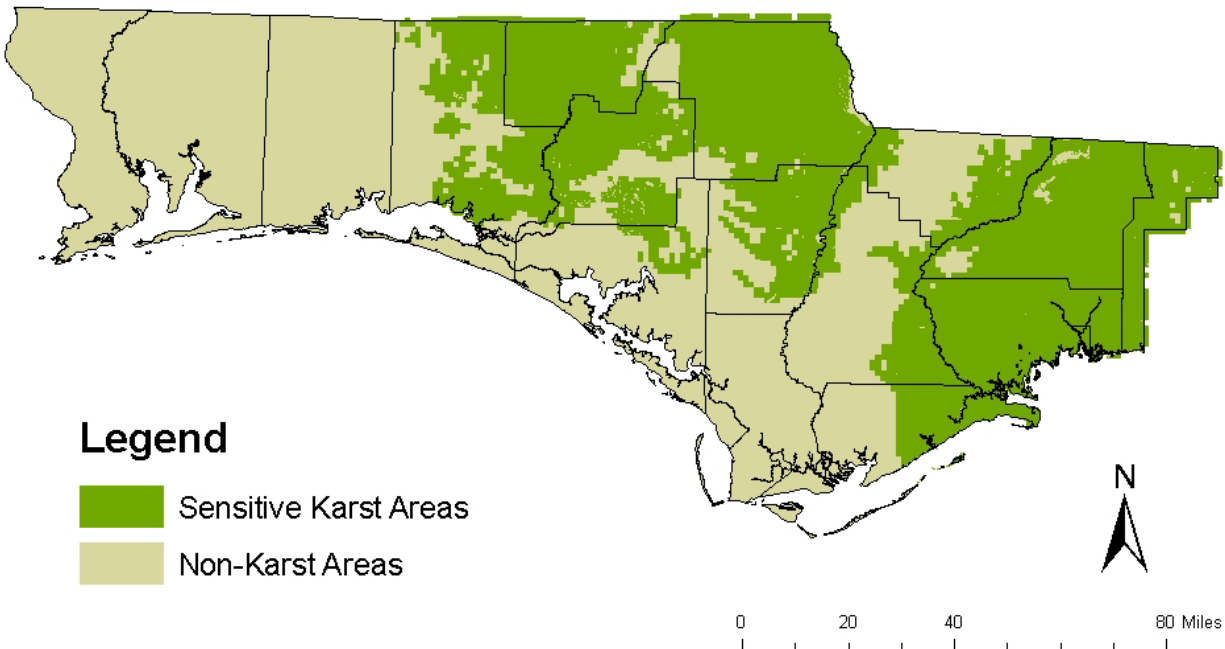


Figure 10. Northwest Florida Sensitive Karst Areas

(Source: FDEP/NWFWMD, 2010, Environmental Resource Permit Applicant's Handbook Volume II)

Proposed Solution — We propose an assessment of northwest Florida borrow pits including an inventory, environmental risks analysis, and site prioritization. Objectives are to:

- ✚ Identify active and inactive borrow pit locations.
- ✚ Collect site-specific pit features, conditions, and operations data.
- ✚ Screen and analyze risks associated with site-induced soil erosion, off-site sedimentation, and sensitive on-site karst vulnerabilities.
- ✚ Prioritize borrow pit treatment projects.

The proposed project would provide stakeholders with field-validated data concerning the distribution, characteristics, and environmental risks of northwest Florida borrow pits. The resultant database and map atlas would provide the basis to develop:

- ✚ Site-specific borrow pit restoration or stormwater management projects that target measurable improvement in environmental quality.
- ✚ A borrow pit stormwater management and restoration guide to assist stakeholders.

Technical Approach — The northwest Florida study would include pits on private-, county-, and state-owned lands and exclude federally owned lands. The six proposed project phases described below would create a nonregulatory baseline of technical data, interpretive results, and tools to conduct the inventory and assessment of borrow pit-induced environmental issues.

Phase 1: Planning. For this phase, data would be collected relating to the land area soils, geologic, hydrology, and geomorphologic resources; water quality, listed aquatic species, and existing mining operations information from available sources. Research data would be evaluated, summarized, and archived as applicable in digital formats. A borrow pits assessment plan would be developed outlining field survey, documentation, data collection, record keeping, database management, and quality assurance/control processes. A relational database would be developed to integrate and store field survey and investigations data for analysis, assessments, screening, and prioritization processes. In addition, SAIC would utilize cutting-edge technologies to locate, survey, and prioritize borrow pits and manage pit data. In particular, work would be conducted to develop borrow pit recognition protocols and mobile GIS field survey tools.

Phase 2: Borrow Pit Recognition Study. The purpose is to demonstrate the capabilities of remote sensing (RS) and geographic information system (GIS) technologies to inventory potential borrow pits. The demonstration concept is that RS can be utilized to locate and screen potential borrow pit features and candidate areas. SAIC would develop and deploy an in-house RS/GIS software, imagery, and hardware test package and applicable processing and archiving hardware components. The test package would be used to conduct analysis using an unsupervised classification method to evaluate borrow pit geomorphologic feature discrimination capabilities. Known active and inactive borrow pits, representing different life stages and gully discharge systems (as illustrated in Figures 6 through 9) would be used as the baseline for comparative analysis.

Validation surveys would be conducted to ground-truth and quantify analysis test results. Validation surveys would include in-office reviews of aerial photographs and site field visits. The findings of Phase 1 research and RS testing would be evaluated under field conditions to assess information and data applicability, practicality, and implications. A remote sensing borrow pit recognition protocol would then be developed to locate and screen potential active and inactive borrow pit sites. Modeling coefficients would include variables such as recognition clusters, waterway connectivity, soils, slopes, water quality, listed species and habitats, sensitive karst geology, and anthropogenic disturbance. The GIS modeling software would be trained and calibrated using a supervised classification technique to pinpoint and screen potential borrow pit features and impact areas.

Phase 3: Mobile GIS Borrow Pit Survey Tool Research and Development. A mobile GIS field data collection tool would be developed to support accurate, efficient field data collection, analysis, and storage. The tool would be built using ArcPad on the PocketPC platform; integrate GIS, GPS, and PDA technologies to facilitate digital data record keeping; and establish horizontal control to define borrow pit characteristics and photopoint-based visual records of pit features and conditions. System development would be based on the current SAIC StreamX unpaved road-stream crossing field survey tool that has been in use since 2007.

Much of the development effort would be focused on the in-office post-processing of the data, methods, and procedures to assist in data management. The office segment would involve the correction of the data positions and the subsequent update of the positional attributes of all features based on corrected position. Once a project is completed and processed, the geometry for that area would be isolated into a project-based GIS library. This would enable the project area to be further studied and processed without interruption from data collection on other designated projects and facilitate enhanced project portability in the event additional field data collection is required.

Phase 4: Borrow Pit Inventory and Characterization. The work conducted in Phases 1, 2, and 3 would culminate in the execution of comprehensive surveys of borrow pits within the study area. Research data and imagery modeling would be used to characterize regional geology and discriminate active and inactive pits. Based on research, preliminary screening would be conducted to evaluate site issues. Screening results would be used as a basis for sequencing site visits and estimating the intensity of site data collection. Pit access would be at the discretion of the landowner and/or facility operator.

Data collection would include site area topography, soils, geology, hydrology, water quality, and sensitive aquatic species and habitats information acquired from research and literature reviews and field surveys of the pit activity status, soil erosion, and stormwater runoff discharge features and conditions and photopoint documentation. As available, data would also be collected regarding pit history, permitted expansions, excavated material quality and quantity, and anticipated life cycle. It is assumed that field survey would be conducted on 50 borrow pits.

Phase 5: Borrow Pit Prioritization. The results of the Phase 4 site inventory and characterization would be used to screen and prioritize impact potentials for active and inactive borrow pit water resources. The objective is to distinguish pits that discharge sediment-laden stormwater runoff that is impacting surface water of the state and/or pits that exhibit potentials for impacting sensitive karst areas. Following the screening process, borrow pit site dossiers would be developed. These dossiers would be in a standardized format and include coordinates, measurements, metrics, photographs, survey comments, natural resource data, and other information.

Phase 6: Reporting. The anticipated deliverable for the proposed project is the Northwest Florida Borrow Pit Inventory and Assessment Map Atlas. The atlas would include:

-  Project area natural resource and regulatory information.
-  Overview of borrow pit types, mined materials, operations, and stormwater management.
-  Borrow pit treatment priorities and recommendations.
-  Borrow pit site dossiers that include geography, geology, disturbance regimes, operation and maintenance activities, stormwater features and conditions, water quality and sensitive karst index analysis results, and site photograph logs.
-  GIS maps and database.

ESTIMATED PROJECT COSTS

The total estimated cost for the proposed 16-month project is \$131,200 (Table 2). There are no matching funds, in-kind contributions, or state/federal dollars associated with the project.

Table 2. Proposed Project Rough Order of Magnitude Costs Summary

Project Cost Item	Cost Estimate
Administration and Management	\$6,900
Phase 1: Planning	8,600
Phase 2: Borrow Pit Recognition Study	21,200
Phase 3: Mobile GIS Survey Tool	11,300
Phase 4: Borrow Pit Inventory and Characterization	44,500
Phase 5: Borrow Pit Prioritization	15,700
Phase 6: Map Atlas	23,000
Total Costs	\$131,200

OTHER FUNDING

This project has not been submitted for additional grant funding nor is it being used to leverage other funding sources.

TECHNICAL FEASIBILITY

Technology Description — The proposed project would utilize proven, state-of-the-art remote sensing and GIS technologies to identify, characterize, prioritize, and map project areas borrow pits. The innovative use of these technologies would streamline resource allocation to maximize the accessibility and utility of project data. The proposed technical approach is innovative in that it combines select, vetted hardware and software applications into a managed framework of data collection and analysis that highlights site inventory considerations, priorities, and pivotal issues that would be critical to the development of successful long-term projects.

Field-validated borrow pits data would provide the baseline for developing treatment alternatives to measurably improve and monitor aquatic resource water quality and habitats and maintain active sites in an environmentally responsible manner. The process deliverables would provide planners, engineers, and technicians with access to data they can use to screen and select treatment projects that align with available resources and maintenance capabilities.

Technology Maturity — Over the past few years, SAIC StreamX technologies similar to those proposed for this project have been used to collect, screen, analyze, and prioritize unpaved road-stream crossing information. Data collection and management protocols, GIS mapping, and information recording procedures are well established. Specialized borrow pit recognition study technologies and field survey, photopoint collection, mobile GIS applications, and custom databases are available and have been proven effective.

Technical Risks — It is anticipated that there would be minimal technical risks associated with the proposed project. Internal tools and techniques have been validated and resource data is available from

existing sources. Equipment and techniques similar to the ones proposed for this project have been vetted in the field.

Technology Transition — Borrow pits inventory and assessment technology would primarily be transitioned to end users through documentation and mapping deliverables and/or directed project contracting.

Relevant Project Experience — Past work conducted by SAIC relating to the proposed project include:

- ✚ Chattahoochee-Oconee National Forests Roads Analysis for the U.S. Forest Service, Georgia (2003)
- ✚ Northwest Florida Lower Choctawhatchee Subbasin Road-Stream Crossings Assessment for the Florida Department of Environmental Protection (2007)
- ✚ Northwest Florida Choctawhatchee-Pea Basin Road-Stream Crossings Assessment for the Florida Department of Environmental Protection (2008–2009)
- ✚ On-Site Unpaved Road and Crossing Treatment Consultations for Holmes and Walton County, Florida and the Northwest Florida Water Management District (2008)
- ✚ Range Road Network Asset Management Projects for Eglin Air Force Base, Florida (2001–2009)
 - Range Roads Maintenance Handbook* (2001)
 - Range Road Segments Decommission and Rehabilitation Plans* (2001–2003)
 - Range Roads Programmatic Environmental Assessment* (2002)
 - Range Roads Maintenance Biological Assessment* (2003)
 - Range Road-Stream Crossing Process Specific Opportunity Assessment* (2005)
 - Range Road-Stream Crossings Management Strategic Management Plan* (2007)
 - Range Road-Stream Crossings Manual* (2007)
 - Range Road-Stream Crossings Assessment* (2009)

BENEFITS

Environmental — The proposed project would have distinct benefits to affected northwest Florida environments. Borrow pit data and deliverables would provide location, conditions, and aquatic resource sediment-impact risks information for high priority borrow pits. This project would provide the site-specific information necessary to develop and implement treatment projects to:

- ✚ Improve water quality.
- ✚ Enhance the quality and range of aquatic habitats for imperiled fisheries and mussels.
- ✚ Reduce wetlands loss and degradation, including coastal marshes, waterways, estuaries, and forested wetlands.

The process would foster collaboration among diverse stakeholders in developing optimal pit maintenance strategies to achieve ecological recovery objectives and minimize potential environmental liabilities associated with pit-induced environmental impacts. The process would establish a baseline for

realistically estimating pit-induced soil erosion and sediment delivery that can be used to measure progress in reducing ecosystem impacts and evaluating project benefits.

Economic and Social — The proposed project would provide a diversity of socioeconomic benefits including:

-  Enhanced local employment and commerce associated with the purchase of goods and services to support future pit treatment project construction and maintenance.
-  Improved commercial and recreational fisheries and other recreational water uses.
-  Optimized allocation and benefits of ecosystem recovery financial and technical resources.

The site-specific issues presented by problematic pits must be considering in developing corrective approaches that effectively guide project development. This information would be used to prevent the misalignment of resources and focus expenditures on viable project implementation. Deliverables would provide information that counties and other agencies could use to assess their technical strengths and gaps in addressing site treatment issues.

Efficient and manageable borrow pits are essential to sustaining and enhancing county road networks. To that end, the borrow pits inventory and assessment is critical to developing treatment strategies to minimize environmental impacts and address the economic impacts of ineffective and costly maintenance of substandard conditions that plague many problematic borrow pits.

Community Resilience — The recovery of aquatic ecosystems impacted by borrow pits would lead to improvements in ecosystem form and functions. As conditions improve, aquatic environments are more resistant to and recover more efficiently from the effects of significant storms and hurricane events. This project would provide the information necessary to develop targeted pit treatment projects that:

-  Reduce the depletion of natural resources.
-  Provide community education opportunities.
-  Encourage community support for ecosystem recovery strategies, programs, and projects.
-  Create opportunities for local citizens to become involved in the monitoring and preservation of their ecosystems.

CONFLICTS OR COMPLEMENTS TO EXISTING EFFORTS

The U.S. Fish and Wildlife Service, Panama City, Florida, along with regional and Washington offices, in coordination with state agencies, are developing programmatic strategies to address impacts to federally listed fisheries and mussels in northwest Florida river basins. Workshops are planned for 2013 to gather and distribute information regarding the hydrologic and water quality conditions and trends within the Escambia, Yellow, and Choctawhatchee River Basins and construct species status assessments for recently listed mussels. The proposed project would provide site-specific data regarding current potential impacts from borrow pit-induced sedimentation. The process would provide the data and tools to strategically apply resources to treat high-priority pits, targeting improvements in the habitats of imperiled species.

COMPLIES WITH FEDERAL, STATE, LOCAL, AND TRIBAL LAWS/REGULATIONS

The proposed project would be in compliance with all federal, state, and tribal laws and regulations. No permits would be required to implement the project and no legal conflicts are anticipated.

READINESS FOR IMPLEMENTATION

The project is poised for immediate deployment and implementation. Borrow pit access issues would generally be limited to private lands. If access to private holdings is required steps would be taken to attain permission prior to any entry. No potential access issues have been identified that would compromise project implementation.

PUBLIC ACCEPTANCE

There are no known public opposition issues identified for the proposed project. On the contrary, contacts with local citizens during CPB crossing field data collection during 2008 through 2009 revealed that the locals were concerned with the declines in the quality of their waterways and wetlands and were welcoming of any efforts to facilitate improvements.