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The Oldest Operating Wetland Mitigation Bank In The U.S.

A Review of the Goose Creek Wetland Bank in Chesapeake, Virginia; It's Development and Utilization

*Thomas A. Barnard, Jr., Carl H. Hershner
and Megan Greiner*

Introduction

The construction of a wetland as a means of compensating for the loss of a natural wetland has been an operative practice in the management of the resource for many years. Generally, compensation by creation of new areas is a last resort in the mitigation sequencing used by wetlands management programs. Typically, development of a land parcel must first attempt to avoid any wetlands present. Where this is not possible, the degree of impact is brought to a practical minimum. Finally, any unavoidable losses associated with a desired project are compensated by replacing the affected wetland with an anthropogenic counterpart. In the early applications of a *no net loss* policy, replacement was attempted somewhere on the same site creating the same general type of wetland (Barnard and Mason 1990). This approach has generally proved

practical only for small projects on relatively large sites when existing conditions allowed establishment of appropriate hydrologic conditions.

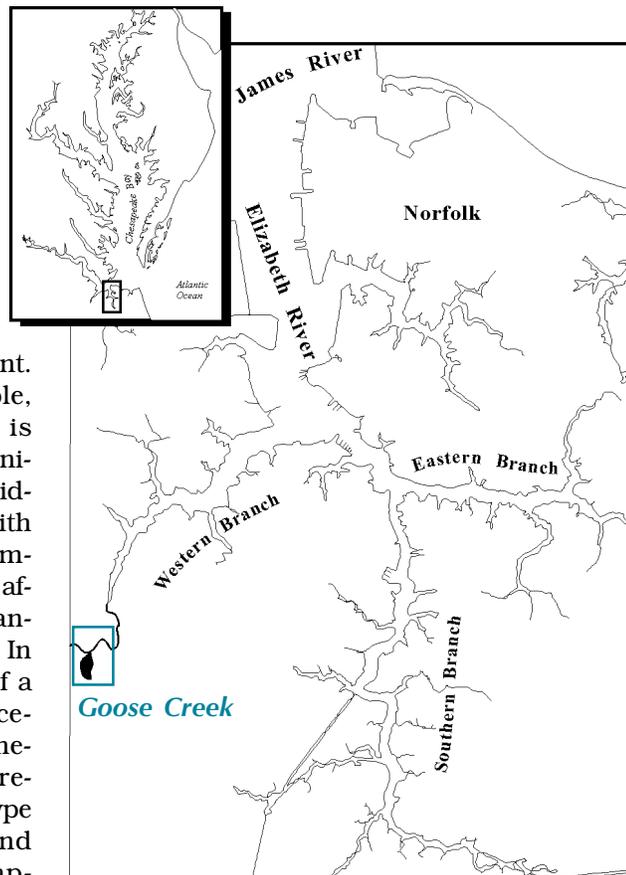


Figure 1. Location of mitigation bank in Chesapeake, Virginia.

The degree to which effective compensation for wetland losses was accomplished by this "on-site, in kind" replacement has always been a subject of considerable technical debate (Kusler and Kentula 1990). As the understanding of wetland functions and values has increased, the likelihood that a brand new wetland system surrounded by a new type of land use actually recreates previous wetland functions and achieves equivalent values has been increasingly suspect. This reality, combined with the frequent engineering and economic impracticalities of on-site creation, has led managers and developers to con-

sider alternatives for preservation of wetland functions and values. Other options now considered include off-site creation, enhancement of existing degraded wetland areas, and preservation of existing high value systems. All of these approaches suffer to some degree from a lack of certainty that a *no net loss* objective might actually achieve. In response to this concern, one option for compensatory mitigation that has found increasing favor is establishment of a wetland bank.

The concept of a wetland bank may involve creation of an artificial wetland, or restoration of a former wetland which has lost all or most of its wetland function. In general, when the created or restored wetland has achieved a previously agreed upon degree of self-sustained viability, it serves to provide a compensatory credit account. Numerous small losses of natural wetlands can be *debited* from the bank account, allowing some greater surety of effective wetland replacement than case-by-case replacement efforts.

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Commonwealth's Declared Policy: "to preserve the wetlands and to prevent their despoliation and destruction..."

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The potential benefits of banking as a management tool in wetlands can be summarized as follows:

1. Consolidation of many small marsh compensation segments into a large, singular effort may make a greater overall contribution to the natural system, particularly if the wetland is large and is designed and sited within an existing landscape or watershed plan.

2. Economies of scale can be attained in design, implementation and long term management of created wetland compensation areas. Larger, consolidated efforts generate more efficient use of available expertise, eliminate redundancy and generally lower construction costs per wetland unit. More and better planning, design and other necessary "up front" efforts should increase the probability of achieving performance standards and the goal of attaining functional equivalency with the impacted wetland.

3. Reductions in permit review and monitoring effort within the regulatory sector are possible.

4. The compensatory wetland can be established prior to the loss of any natural wetland area. As in the case of the Goose Creek bank, compensatory wetlands may be in existence and functional for years before much of the marsh is debited.

5. Banks offer the potential for long term, active management by owners who maintain a financial interest at least until the wetland is fully debited.

6. Opportunities for efficient long term monitoring may advance knowledge of the evolution and manipulation of specific wetland functions.

While wetland banks can address concerns about areal losses of wetlands, the question of effective replacement of function and values remains. The reality of management programs has been that the need for some means of compensation has forced implementation of the banking option even in the face of uncertainty about appropriate *accounting* procedures. Banks can now be found in many areas, and protocols for balancing losses and gains vary widely. In some areas an acre of created marsh is allowed to balance an acre of loss elsewhere. In other areas, the balance is based on a ratio of created wetland to lost wetland, typically at greater than 1:1. Concerns for replacement *out of kind* are also highly variable, and the issue of relative proximity of a bank to a lost wetland remains largely

unresolved. Existence of wetlands banks also creates the potential that the *sequencing* steps of avoidance and minimization will not continue to receive the emphasis that they have with individual on-site, in kind compensation actions.

Banking must be incorporated into landscape and watershed management plans if it is to realize its full potential. Few localities have such plans at present and there are significant differences of opinion among experts about how features such as wetland banks may best be utilized within such management plans. Successful implementation of the banking concept on a large scale depends on a stable regulatory framework which will continue to view the approach favorably and thus an environment allowing a suitable return on the substantial up-front investments required whether the bank is single purpose governmental or for-profit, entrepreneurial (ELI 1993).

land losses incurred from highway construction and maintenance since 1984.

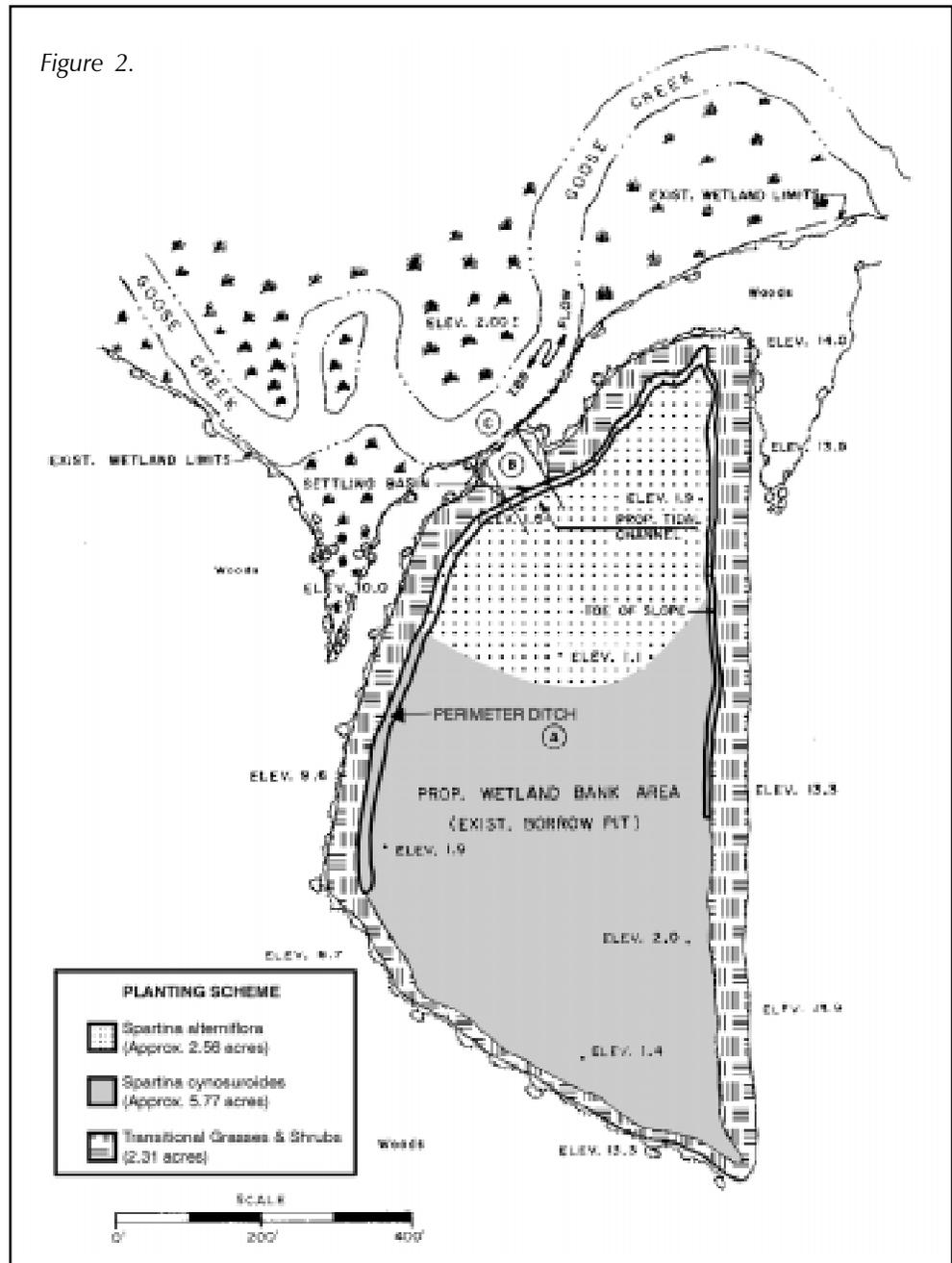
Initial design of the tidal marsh envisioned the entire borrow pit planted with Big Cordgrass, *Spartina cynosuroides* since this was the dominant grass in the adjacent Goose Creek natural marshes. Scientists from the Virginia Institute of Marine Science (VIMS) were asked to review the plan and recommended that approximately 1/3 of the 10 acres be planted with Smooth Cordgrass, *Spartina alterniflora*, and that the side slopes of the pit be planted with salt tolerant species to an elevation of 4.5 feet above mean

The Goose Creek Wetlands Bank

Location and Early Development

The Goose Creek mitigation bank was established in 1982 in Chesapeake, Virginia (see Figure 1, front page) by the Virginia Department of Transportation (VDOT). VDOT created this 10 acre tidal wetland from an old borrow pit and has been using it to compensate for small, unavoidable wet-

Figure 2.



low water. Figure 2 (on page 3) shows the final design used to construct the wetland in the late summer of 1982. The final cost of construction was approximately \$70,000 covering the hand-sprigging of 90,000 to 100,000 plants and establishment of a 60 feet wide opening through a 100 feet wide embankment to connect the pit to the tidal waters of Goose Creek.

Because mitigation banking, as well as the whole



Figure 3. (top) Goose Creek Bank, 1985. Note planting zones.

Figure 4. (bottom) Goose Creek Bank, 1988.

concept of marsh creation, was new and untested in the early 1980's, numerous questions were posed by the newly created wetland bank.

These were of two basic types: ecological and management. Managers and scientists were uncertain how the vegetative community would evolve and whether the area would be a useful intertidal habitat addition to Goose Creek. These ecological issues were addressed by initiating a long term monitoring effort. Management issues included determination of an accounting protocol (i.e. compensation ratio), which types of wetlands could be compensated, extent of *service area*, identification of an official *bookkeeper*, and when debiting might begin. Most of these questions were answered in an *ad hoc* fashion, allowing need to establish the precedent.

Planting the second grass species turned out to be an important factor in the development of the new wetland because much of the big cord-grass did not survive the first winter. It appeared to have been planted in areas too low for survival or reproduction. The smooth cordgrass, on the other hand, survived well and immediately began to spread. Through seed and rhizome growth it filled the area where it had been planted and moved into the area left open by the unsuccessful big cordgrass planting (see Figures 3 and 4). Vegetative cover estimates showed that after three full growing seasons, smooth cordgrass dominated the marsh with 30% cover while big cordgrass occupied only 4% of the 10 acres. Between 1984 and 1989, twenty-nine species of plants were documented within the developing marsh. Maximum total plant cover reached 70% at the end of the 1988 growing season (Priest and Barnard 1993). Regarding vegetation, one significant question which remains is to what de-

TABLE 1. Cumulative wetland debits by wetland type

Wetland Type Dominant	Vegetation	Area in Sq. Ft.
palustrine forested	Taxodium, Fraxinus	3,500
palustrine scrub shrub		888
estuarine intertidal	<i>Spartina</i> spp.	92,526
	<i>Phragmites</i> spp.	32,352
	groundsel tree/salt grass	800
	scrub shrub	9,906
	emergent	5,299
TOTAL		145,271

gree the presence of the highly invasive common reed, *Phragmites australis*, will affect the wetland. In their percent cover studies, Priest and Barnard (1993) have documented a 10% increase in the *Phragmites*-dominated area of the bank between 1989 and 1993. The area of the bank dominated by the invader was 36.7% in April 1994 (Havens *et al.* 1997).

Monitoring the bank since 1985 has demonstrated the utilization of the wetland by 22 species of fish along with numerous crustaceans, mollusks and other invertebrates. The dominant fish species were the marsh killifish, *Fundulus heteroclitus*, and the silversides, *Menidia beryllina*. Other species captured in the wetland included spot, *Leiostomus xanthurus*; striped bass, *Morone saxatilis*; bay anchovy, *Anchoa mitchelli*; and menhaden, *Brevoortia tyrannus* (Barnard and Priest 1993).

Productivity, in terms of both plants and fish, peaked after 4 full growing seasons with the fish population dropping in numbers after this point and the plant productivity remaining steady in terms of both cover and standing stock estimates. Monitoring, although far from comprehensive in measuring a complicated system such as a marsh, indicated that the system was well-established and self-sustaining at this point. Both the plant and fish communities were representative of those reported for other similar marsh systems within similar salinity regimes.

The Goose Creek Wetland Bank is now a regu-

TABLE 2. Wetland debits by hydrologic type

Wetland Hydrology	Area in Sq. Ft.
regularly flooded	9,179
irregularly flooded	131,704
seasonally flooded	4,388

larly flooded estuarine inter- and supratidal wetland, dominated by *Spartina alterniflora* and *Phragmites australis*. Salinities vary between 1‰ and 19‰, responding to conditions in

the adjacent creek. The plant community has established a legitimate litter layer and at least in the lower half of the marsh, the surficial sediments now contain an organic fraction approaching that of nearby natural wetlands. The spread of *Phragmites australis* is a focus of the continuing monitoring program.

Management of the Goose Creek bank has effectively established a 1:1 compensation ratio. Many different types of wetlands, destroyed by road construction and maintenance projects, have been replaced by the *Spartina* marsh in the bank. Table 1 reflects the current tabulation of losses by wetland type which have been debited. Table 2 shows the same losses summarized by hydrologic type. The bank is considered a regularly flooded marsh.

The accounting practice, to date, has allowed wetland losses in other watersheds (some as distant as Chincoteague on the Eastern Shore of Virginia) to be offset by wetlands in the bank at Goose Creek. Figure 5 shows the distribution of these sites.

Discussion

In summarizing the utilization of the Goose Creek bank, it is clear that the practices to date have been to allow compensation for losses of several different types of wetlands spread over a very

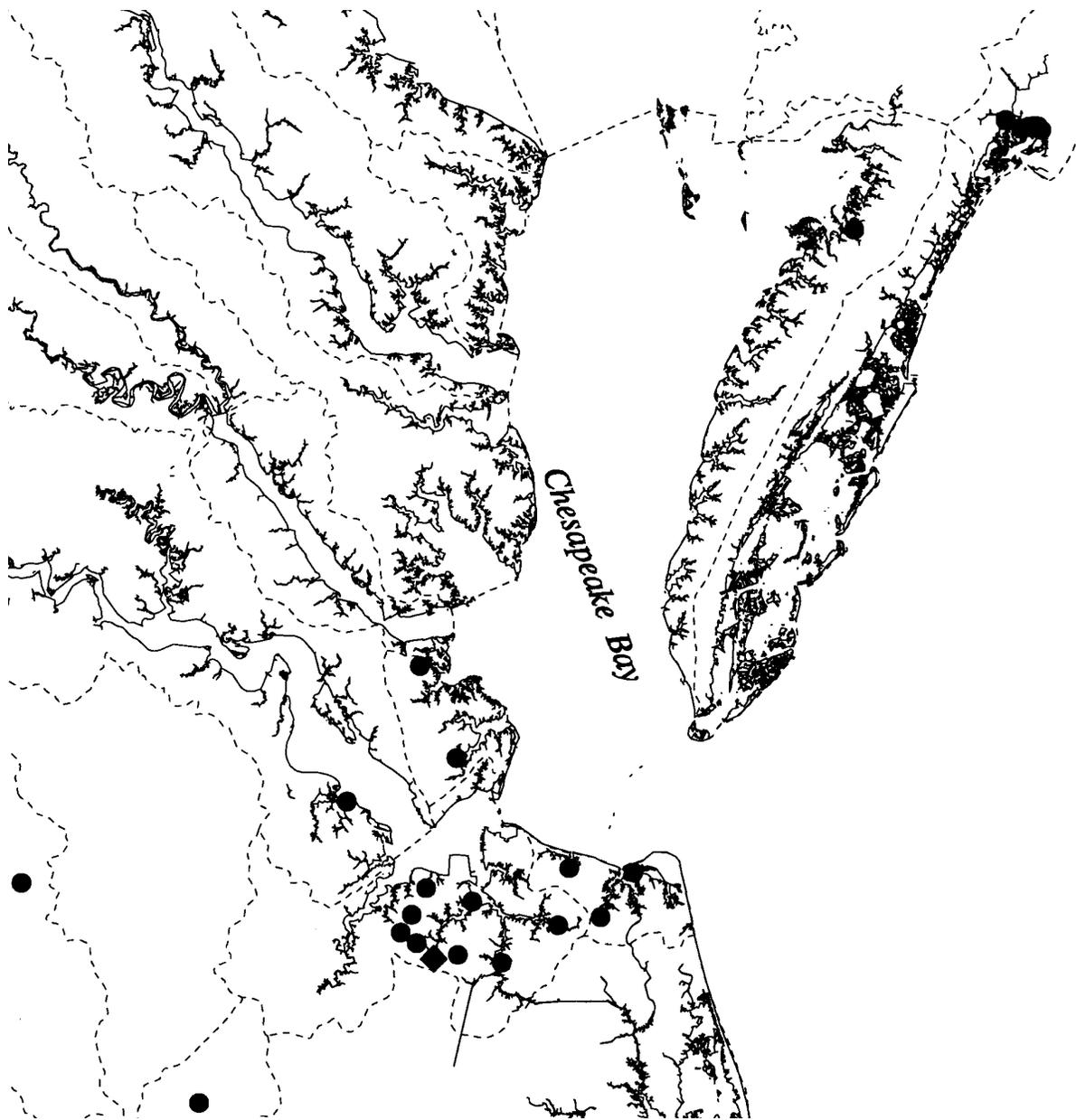
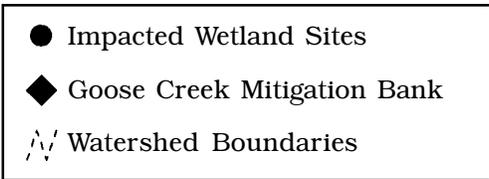


Figure 5. Distribution of wetland losses compensated in the Goose Creek Bank.



large geographic area. In fact, over half of the bank debits, calculated strictly on an areal basis, have been used for out-of-kind compensation for losses in other watersheds. In addition, following the operative accounting protocol, Goose Creek still retains over 75% of its available credit value to VDOT.

There are a number of issues raised by this analy-

sis. The first is whether straightforward areal accounting is more or less desirable than function based accounting. In terms of ease of implementation, simple areal accounting has a clear advantage. It requires little data collection and analysis effort and it does not pose the problem of a bank only being able to provide partial credit for some types of wetland losses. On the other hand, given the increased understanding of how

wetlands perform functions in the landscape and what values may be assigned those functions by society, it is clear that we are capable of a more refined assessment of the environmental costs and benefits of wetlands replacement. Given that the purpose of management programs is to preserve society's interests in these resources, simple areal accounting would seem to compromise efforts to attain a best possible solution to the problem of unavoidable destruction of existing wetlands.

Acceptance of a function based approach to wetland bank accounting places a premium on appropriate assessment of those functions and their values to society. This may be the most problematic issue in bank management. First, all assessment methods are nothing more than conceptual models of wetlands and there is no absolutely accurate and precise method. Indeed all extant and developing methods reflect a compromise between incomplete understanding and practicality. Implementation of a function based accounting protocol anytime in the near future will require a policy decision about acceptable levels of accuracy and precision. Second, there is a definite need to extend our current knowledge base on how to measure the performance of functions by created wetlands. Assessment methods must be developed, or at least refined, for application to these systems. The underlying assumptions about relationships between selected structural attributes and performance must be documented and adequately tested in created wetlands if assessment methods are to serve this purpose.

This study highlights some of the current concerns about appropriate limitations on a bank's ability to compensate adequately for a loss of a completely different type of wetland in a distant watershed. It is not intuitively obvious that Goose Creek, situated on a tributary to the James River system, can satisfactorily replace wetlands destroyed along the oceanside of the Delmarva peninsula. Neither is it clear that an acre of regularly flooded *Spartina alterniflora* in the midst of a larger estuarine intertidal wetland in an urbanized watershed, is a satisfactory replacement for a seasonally flooded forested wetland in a hydrologically separate rural watershed. It is also relevant to note that at the present time none of the extant methods of wetland functional assessment can provide anything but the simplest, incomplete technical responses to inquir-

ies addressing this process. Until such time as advance assessment of entire watersheds is a reality, these limitations will have to be handled as policy determinations.

Conclusions

The operation of the Goose Creek wetlands bank indicates that concerns about the effectiveness of simple areal-based accounting for compensatory replacement of wetlands may be realized. The bank under its current operational protocol, has resulted in out-of-kind, out-of-watershed compensation. There is no effective method, at present, for evaluating of the significance of this practice. It should be noted that approximately 75% of the wetlands in the bank have been functioning at some rate for quite a few years and have yet to be debited. In this sense, the bank can be viewed as delivering surplus compensation benefits up to the point it is fully debited. From this perspective, the current practice may have significant benefits. Until science advances sufficiently to address these questions, there will be a need for policy decisions to provide guidance.

At present the Goose Creek wetland bank operates under permits issued prior to its construction in 1981. The Virginia Department of Transportation, the Norfolk District of the Corps of Engineers, and several other state and federal regulatory and resources agencies are close to adoption of an overall banking protocol agreement. The agreement sets up the "Federal Guidance for the Establishment, Use and Operation of Mitigation Banks" as the document which will guide all future VDOT banking activities. Such activities will include individual banking instruments and site development plans.

It is not clear at this writing whether the new agreement will foster a different trend in compensation decisions for VDOT banking. The federal guidance document has been in effect nationally since being published in November 1995 (Volume 60, No. 228). Whether the new agreement has an effect on Goose Creek or not may be very important since only 3.2 of the original 10.6 acres has been debited to date (5/97).

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