Offset Banking – A Way Ahead for Controlling Nonpoint Source Pollution in Urban Areas

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Abstract

Nonpoint source discharges remain one of the major causes of non-attainment of water quality goals in urban areas in the United States. Controlling nonpoint source discharges is a critical part of achieving water quality goals within urban areas. Efforts to reduce nonpoint discharges are expected to intensify with implementation of Total Maximum Daily Loads (TMDLs) and changes to National Pollutant Discharge Elimination Program (NPDES) permits. Given the need to reduce existing nonpoint source discharges in many urban areas, regulatory authorities are likely to become more circumspect about approving new developments with negative environmental impacts. We discuss the use of *Offset Banking*, which is a flexible mechanism that can facilitate development, but with no net environmental impact.

Key Terms: Nonpoint Source Pollution, Economics, Incentive Schemes, Offsets, Tradable Permits

1. Conflicts between Achieving Water Quality Goals and Development: A Motivation for the Use of Offset Banking

Nonpoint source pollution is one of the main cause of violations of water quality goals in many urban areas (eg Georgia Department of Natural Resources 2000). Achieving water quality goals will require control of nonpoint source discharges. However, nonpoint sources are more difficult to control than point source discharges. They are also more difficult to monitor, and enforcement of controls is harder because of their diffuse nature.

The impetus for controlling nonpoint source discharges is likely to increase in future years. In the United States, the setting of Total Maximum Daily Loads (TMDLs) makes explicit nonpoint source loads that will allow attainment of water quality goals prescribed under the Clean Water Act. As part of the TMDL process, implementation plans need to be developed within 12 months of the setting of the TMDL so that water quality goals will be achieved. If TMDLs are not achieved, state regulatory authority may restrict new point and nonpoint source developments. Federal Court rulings that the EPA enforce the Clean Water Act will mean that eventually these implementation plans will have to be acted upon (Environmental Reporter 1996).

The requirement by the EPA to include stormwater outlets within the NPDES program will also provide motivation for nonpoint source control. Under Phase I of the Storm Water Program, stormwater outlets in towns of more than 10,000 people are considered to be point sources and receive permits, similar to other point sources. Phase II of the Program becomes operational in March 2003, and requires the issuing of permits for certain regulated small municipal stormwater systems, and also for construction activity disturbing between one to five acres of land. The full impacts of these policy changes will be felt when stormwater authorities are required to make the requisite changes necessary to achieve water quality goals. In part, this could involve installing structural stormwater controls such as sedimentation ponds, infiltration basins and trenches, swales and other control devices. However, it may also necessitate costly retrofitting at previously

unpermitted nonpoint sources. It could be expected that further development would be restricted or delayed in areas where violations of stormwater permits are occurring.

Thus the TMDL process, in conjunction with the issuing of NPDES permits for stormwater outlets, is likely to lead to pressure to restrict development in urban areas. It can be expected that conflicts between environmental conservation and development will increasingly occur in the future because of these water issues unless new policy initiatives are developed.

One approach to dealing with this potential conflict between these goals is to establish policies that allow development to occur but in an environmentally sustainable way. That is, enabling development to proceed provided that there are no *net* environmental impacts. At the heart of this proposal is the concept of "offsets". An offset occurs when a developer "offsets" impacts on the development site, by undertaking equivalent environmental improvements at a second, nearby, site. The developer may undertake offsets or a third party who specializes in undertaking offsets may complete them. Offsets may also be designed so that they achieve net-environmental improvements. This would happen if a developer were required to achieve larger environmental improvements than any impacts they have caused. Typically offsets are undertaken and approved prior to causing development impacts so that there are no temporal effects on environmental quality (US Corps of Engineers et al 1995).

The concept of using offsets to manage development pressures and environmental impacts has been advocated in other contexts. Perhaps its best-known application is wetland mitigation banking (US Corps of Engineers et al 1995). Here, if new developments cause wetland impacts and it is not possible to mitigate these impacts on-site (using best available technology), then wetland offsets at secondary sites may be approved. More recently, offsets have been used for mitigating streambank impacts. Other water-based applications have occurred, such as flood storage offsets in Louisville, Kentucky along the Salt and Ohio Rivers, and in Albany, Georgia and Florida. Offsets have been used for other pollutants such as controlling air quality impacts in areas that are not meeting federal

air quality standards, as prescribed under the Clean Air Act. Examples of offset schemes can also be identified abroad (see www.epa.nsw.gov.au/greenoffsets/index.htm). There is increasing use of offset programs to facilitate environmentally friendly development.

The use of offsets could provide a practical solution to the tension caused by the need to achieve water quality goals and the pressure for increased development in many urban areas. New developments can be assessed for contributions to the main pollutants of concern, and required to offset their impacts. They would offset their impacts through purchasing credits from privately and/or publicly owned offset banks before creating any impacts. Done properly there should be no net negative environmental effect and, if desired, environmental improvements could be achieved if developers are required to purchase more credits than the pollution generated. In addition, the use of offsets may generate substantial cost savings for businesses compared to having to fully mitigate any impacts on-site. Providing a straightforward method of satisfying environmental requirements will also reduce risk and encourage investment within urban areas.

The use of consolidated offset banks rather than disparate site-specific remediation efforts could have a number of advantages, as suggested by the US Corps of Engineers et al (1995) in the context of wetland mitigation:

- *It may be more advantageous for maintaining the integrity of the aquatic ecosystem to consolidate compensatory mitigation into a single large parcel or contiguous parcels when ecologically appropriate;*

- *Establishment of a mitigation bank can bring together financial resources, planning and scientific expertise not practicable to many project-specific compensatory mitigation proposals…*

- *Use of mitigation banks may reduce permit-processing times and provide more cost-effective compensatory mitigation opportunities for projects that qualify.*

- *Consolidation of compensatory mitigation within a mitigation bank increases the efficiency of limited agency resources in the review and compliance of monitoring projects…*

Thus there are strong motivations for considering the use of offset banking to achieve water quality goals and manage development pressures in urban areas. In this paper, we next consider economic incentive programs that can be used to cost-effectively control nonpoint source discharges more broadly. Then in Section 3, consider some practical issues involved in setting up an offset program, and in Section 4 we describe the necessary elements of an offset banking program to control nonpoint source discharges. Conclusions are offered in Section 5.

2. Economic Incentive Programs for Achieving Water Quality Goals

Achievement of environmental quality standards through command and control approaches – such as requirements for use of technology standards and that ambient discharge limits are met – can be unnecessarily costly. Experience with flexible economic approaches has demonstrated that standards can be achieved at a lower cost. The EPA (2001) in its draft report *Total Cost to Implement Total Maximum Daily Loads (TMDLs)* estimated that flexible approaches to improving water quality as part of implementing TMDLs could save $900m annually compared to the least flexible approach.

Tradable Permit Programs

Tradable permit programs are one economic incentive scheme that has generated considerable interest. Currently in the US there are 37 watershed trading or offset programs in operation or under development (Environomics 1999).

Watershed trading is a broad term that is often used to describe a fairly wide variety of economic incentives. This includes *point source trading* which involves trading between point sources of discharge *credits*. Point sources who find it expensive to reduce discharges will buy credits as long as it is cheaper for them to do so than implement more stringent controls. They will thus save money. In contrast, polluters who find it relatively cheap to reduce discharges will undertake additional controls and sell the credits they obtain by doing so and make money. In this way, trading encourages discharges to be controlled by point sources who can do so at least cost (Baumol and Oates 1998). In addition, the aggregate load is limited by the total number of permits available to trade, thus environmental goals are met. Trading schemes can also be extended to include nonpoint sources. In a point-nonpoint source trading program, point sources can earn credits by choosing to reduce nearby nonpoint source discharges. In some contexts this may be a more cost-effective form of control that further reducing their own discharges or purchasing credits from other point sources.

Only a couple of point source or point-nonpoint source trading programs in the United States and overseas have been successful at generating large amounts of trading. Perhaps the best two examples are the Grassland Farmers Trading program in California and the Hunter River Salinity Trading program in Australia (Austin 2001, NSW EPA 2000). Most other point source trading programs have not generated any trades (Environomics 1999). This raises questions about the features of the Californian and Australian programs that led to the creation of successful markets. While there are probably a number of explanations, two main factors appear to have led to their success. The first is the nature of the pollutant traded. In the California program selenium was traded, while in the Australian program salinity was traded. Both of these pollutants are conservative, meaning that they will remain in a water body over long period of time. Secondly, the point sources in these programs have reasonable control over the timing and extent of their discharges. Because of these differences, credits are based on daily discharge loads. Hence there is scope for day to day trading of discharge rights. However, many of the pollutants causing violations of water quality at other sites – such as BOD, fecal coliforms and sediment – do not have

these characteristics. While trading programs can be developed for these pollutants, the evidence is that it can be more difficult to generate effective markets.

Offset Banking

Offset banking is a second economic incentive program that may have greater potential for use in urban areas. While it is conceptually different to the trading programs just discussed, it is often considered to be a form of trading (Woodward, Kaiser and Wicks 2002). The basic idea of offset banking is that if a source wishes to either create new loads or increase existing loads it must first offset its increase by reductions in loadings elsewhere. For instance, the developers of a new golf course might be required to fund best management practices in nearby agricultural areas in addition to on-site best management practices. Or a new housing development might only be approved if, as part of the development, septic tanks in an existing development are sewered

Offset programs can be established so that development has no net environmental impacts, or so that development leads to net environmental improvements. In the enabling legislation it is possible to require an offset ratio greater than one, so that sources have to more than offset their planned increase in loadings. This can be used to achieve additional environmental improvements and to hedge against any uncertainties regarding water quality impacts.

Offset contracts can be implemented via bilateral negotiations between stakeholders (ie where developers directly contract with owners of potential mitigation sites), or through privately or publicly owned offset banks. An offset bank is not a bank in the usual sense. Rather it involves the completion of one or more projects in which environmental remediation works are undertaken. By completing these works, offset banks earn “credits” which can then be sold to developers who are creating net-impacts on environmental quality.

In the case of wetland mitigation and streambank mitigation banking, offset banks are run by either private business, non-profit organizations or, in some states, by government

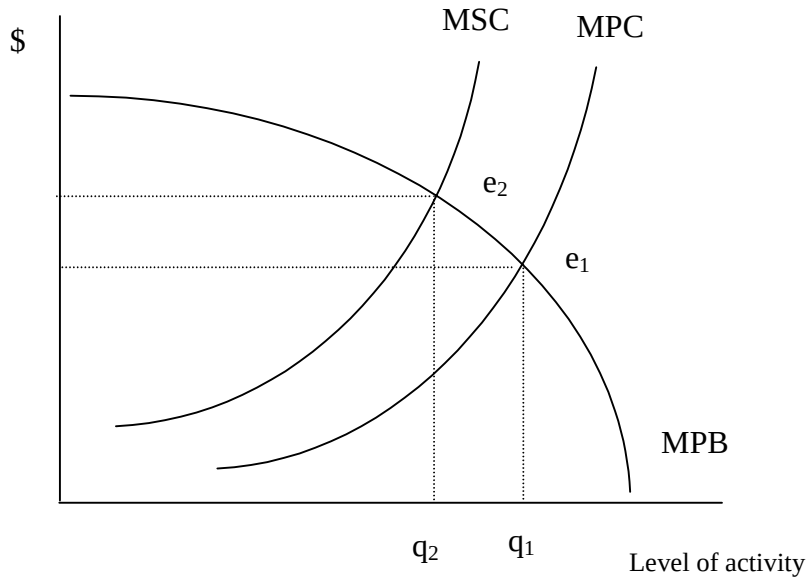
organizations. The majority of banks are privately run (ELI, 2001, http://www2.eli.org/wmb). In 2001, there were estimated to be over 200 operational wetland mitigation banks in the USA, and over 100 awaiting regulatory approval (ELI, 2001). The advantage of either setting up a private or a government program to oversee implementation of offsets is that it would greatly reduce the transaction costs of using offsets. It has been found that increasing transaction costs will reduce the propensity of sources to use incentive programs such as offset banking (Hahn and Hester 1989).

3. A Theoretical Perspective on Offset Banking

Offset banking has a lot of intuitive appeal. However, before examining practical issues in the implementation of offset banking it is appropriate to consider offset banking from the perspective of theory. Baumol and Oates (1988) have examined the situations where there are potential gains from using offsets, while Godden and Vernon (2003) have examined several of the theoretical issues relating to the use of offsets in biodiversity. The intention here is to consider the potential effect of offsets on the socially optimal level of economic activity and implicitly economic welfare using a simple graphical analysis.

In the absence of an offset program, or any other form of government intervention, the effect of an externality in production is shown in Figure 1. Market equilibrium is at Point e_1, where the marginal private cost curves and the marginal private (and social) benefit curves intersect. The equilibrium level of economic activity is higher than the social optimum, which is at quantity q_2. We assume non-linear demand and supply curves.

Figure 1: Market Equilibrium in the Absence of Government Intervention



The effect of an offset program is to internalise and effectively remove the externality, causing the marginal social cost curve to move back towards the marginal private cost curve (see Figure 2). However, because of the cost of paying for the offsets, marginal private cost will clearly increase, causing the marginal private cost curve to shift to the left (from MPC to MPC_1).

Transaction costs are another relevant factor when considering offsets. Included within transaction costs are the costs of administering the offsets program. Government interventions are not costless to government or business, and transaction costs do differ across economic instruments. In the absence of full-cost recovery, some transaction costs will be borne by government authorities. In these cases, this would increase marginal social cost, causing the marginal social cost curve to deviate from the marginal private cost curve (MPC_1), as shown in Figure 2.

There is also the possibility that the use of offsets may still result in externalities. While offsets aim to maintain or improve levels of environmental quality, there will always be a

change in the mix of environmental assets. It is possible that the new mix of assets may be valued differently by the community (arguably this is more likely to be the case for biodiversity offsets than pollution offsets). For example, suppose that use of offsets meant that environmental quality is reduced within an urban area, but improved upstream. This may cause environmental quality to be maintained, but the new mix of environmental assets may be valued less in total by the community[1]. This would be represented by a shift in the marginal social cost curve to the left (to MSC_1), leading to a further reduction in socially optimal equilibrium level of environmental quality. By implication, if this occurs the offset program has lead to its own externalities.

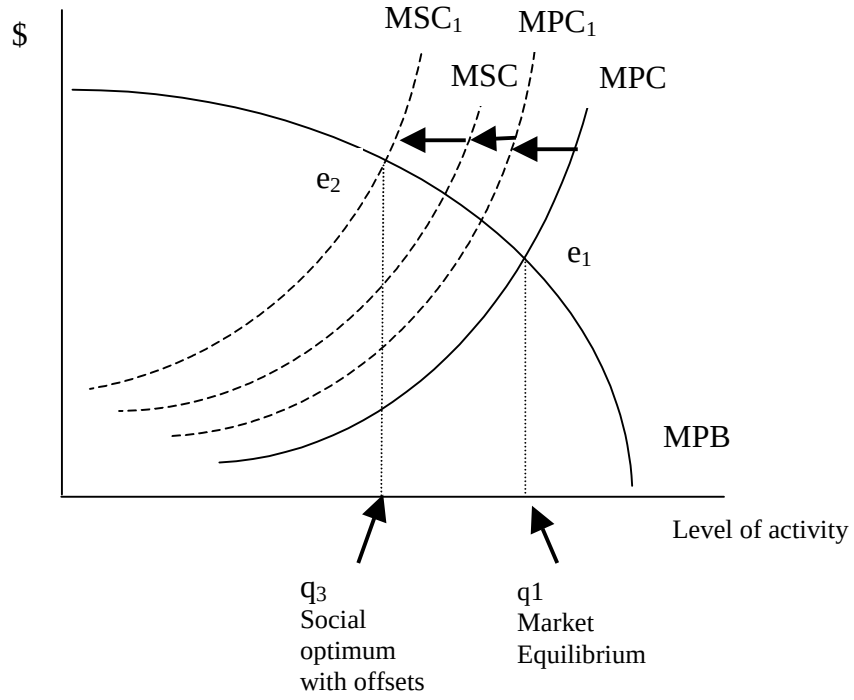
Given these effects and shifts of the marginal cost and benefit curves, the questions that begs to be asked are (1) will the use of offsets lead to an equilibrium different from the original socially optimal outcome, and (2) will this final equilibrium be socially optimal. The answers to these questions will clearly depend on several factors:

- The costs to developers of purchasing offsets
- The costs of administering the offset scheme plus any other transaction costs
- The change in community benefits due to changes in environmental assets

It is apparent that these are important factors that may affect the success of an offset program. Given that these factors will be context specific, there is a case for using economic analysis to determine whether there will be net benefits from proposed offset programs. An important implication of this discussion is that when considering the use of offsets the focus should not just be on whether levels of environmental quality are maintained and whether there are cost savings to business. Rather, changes in the benefits to the community and wider social welfare from using offsets should be assessed.

[1] A related issue is that there may be a change in the distribution of benefits across the community.

Figure 1: The Effect of an Offset Program on the Market Equilibrium



4. Practical Issues Involved in Establishing an Offsets Program

When considering an incentive program such as the use of offset contracting, a number of issues arise about the practicability of such a program. For instance, is it possible to estimate loads at such a detailed level, and which nonpoint source pollutants should be the focus of the program? Other relevant issues pertain to the possibility of localized impacts, temporal impacts, financial and/or management failure and whether banks should be privately or publicly run. These issues are considered next.

Estimating nonpoint source loads

The use of offset programs is predicated on the ability of regulators or their agents to estimate loadings from potentially fairly small development sites. In the past this has been difficult, and efforts to estimate loads have relied on the use of proxies such as the area of

impervious surface. However, improved technology means that loads can be estimated with greater accuracy. The EPA (2002), for instance, comments:

> *EPA recommends estimating pollutant loads, load reductions and credits from storm water runoff… based on local hydrology and pollutant loading factors that relate land use patterns, percent imperviousness and controls or management practices in a watershed to per acre pollutant loads…This is done by determining pollutant-specific loading factors for each land use type in the watershed or area where trading occurs, calculating the average annual storm water runoff volume from pervious and impervious area for each combination of land use type and control and management practices; and, computing the average total annual load for the watershed or trading area by the sum of all land use loading factors multiplied by the area for each land use type.*

Selecting Nonpoint Source Pollutants for an Offset Program

Another question is which pollutants should be the focus of an offset program. In some watersheds there will only be a single pollutant of concern, which will simplify selection. Where there are multiple pollutants causing violations in standards, all can be included within the program. For instance, suppose fecal coliform and TSS were both causing violations of standards in a watershed. Then offset banks could earn credits by undertaking projects that reduce both of these pollutants. Credits earned would be specific to each pollutant. So if fecal coliform is reduced by X units, then B1 * X fecal coliform credits are earned (where B1 indicates the number of credits earned for a unit reduction in fecal coliform). Similarly, if TSS is reduced by Y units, then B2 * Y TSS credits would be earned. These credits could then be sold to developers creating net increases in either of these pollutants. An important reason for making credits pollutant- specific is that control works would be expected to have differential effects on the reduction of each pollutant. For instance, repair of septic tanks would be expected to cause a greater reduction in fecal coliforms than TSS, while the use of infiltration filters would cause a greater reduction in TSS. More careful definition of how credits are earned or used would be expected to lead to more effective control of problematic nonpoint source pollutants.

Controlling localised impacts

A concern with the use of any water-based incentive program is the possibility of localised impacts. Localised impacts occur when increases in discharges in a specific area cause violations of water quality standards. The EPA policy on watershed trading specifically prohibits any trading that would cause this sort of impact:

> *Any use of pollutant reduction credits or allowances that would cause a localized impairment of existing or designated uses at the point of use, or that would exceed an in-stream target established under a TMDL is not acceptable.*

However, the EPA policy on watershed trading also states that trades that achieve no-net increase in loads of a pollutant will satisfy the anti-degradation requirements of the Clean Water Act.

There are several ways of ensuring that localised impacts do not arise. First, the use of offsets can be limited to regional watersheds. Second, distance ratios can be used in the calculation of credits. This means that as the distance between the offset bank's project site and the development increases, additional credits needs to be purchased. By making the offset more expensive, this creates an incentive to locate the development within closer proximity to offset bank sites. Third, all contracts should be subject to regulatory review. Contracts that may give rise to such impacts would not be approved.

Controlling Temporal Impacts

The timing of the completion of projects through an offset bank and the start of new developments can be controlled so that temporal reductions in environmental quality do not occur. Offset projects must generally be completed prior to a development impact to ensure that there are no temporal environmental losses. However, there is normally a period of time between the completion of a control project and the final determination of success in terms of load reduction. It is common practice in wetland mitigation banks to allow the release of a proportion of credits (eg 10-30%) when the project has been

completed, and with the remainder released over a period of several years when success criteria have been met (eg US Corps of Engineers 2000). The advantage of staggering the release of credits is that it reduces the likelihood of temporal impacts and provides greater certainty that environmental gains will be achieved.

Reducing the Risk of Bank Failure

When establishing an offset bank, the environmental benefits created through the bank must be long term. Staggering the release of credits provides some guarantee of the effectiveness of environmental controls. However, some controls also require long-term management, which is more likely to be the case for nonpoint source controls than with other offsets (eg wetland mitigation). When selling credits, banks need to ensure that adequate revenue is received to fund future operation and maintenance costs (US Corps of Engineers et al 1995). Currently there is little evidence of bank failure, but if it became a concern legislation could be enacted requiring the establishment of annuities to provide for ongoing costs. Furthermore, for wetland mitigation banks it is common practice for offset banks to post performance bonds. These are effectively an insurance policy that would fund management of the bank's projects if the bank either failed to meet its management obligations or collapsed. Appropriate legal arrangements such as ownership of key resources and use of easements can provide additional safeguards (US Corps of Engineers et al 1995).

Private versus Public Management

A final issue of concern in establishing an offset program is whether the offset banks should be private or publicly owned, or both. Little empirical analysis has been undertaken to determine the relative merits of different types of bank ownership. From a theoretical perspective, private ownership would deliver greater entrepreneurial effort and cost reduction, and potentially a competitive and efficient market outcome. However, public ownership would provide greater potential for economies of scale.

5. Elements of a Nonpoint Source Offset Banking Program

The existence of functioning offset programs for wetlands and streambank mitigation provides guidance on the elements that would be required in a nonpoint source offset program. However, some differences would be expected because of the differences in the natural resource being protected. We now discuss some of the main elements of a nonpoint source offset banking program.

Enabling Legislation

The legal foundation for using offset contracts to control nonpoint source pollution can be inferred from several federal laws and policies (Woodward, Kaiser and Wicks 2002). While not explicitly prohibited in federal legislation, it is not explicitly authorised either. However, legal authority can be inferred from several sections of the Clean Water Act (33 U.S.C. § 1312, 1313), recently approved TMDL regulations (40 CFR part.9), and - most significantly - the EPA's "Proposed Water Quality Trading Policy" (EPA 2002). Legal authority also depends on state water law and policy, as well as local government ordinances.

The first requirement for establishing an offset banking program would be the development of an enabling statute. The statute would be required to prohibit development unless (1) all nonpoint source discharges are mitigated on site or (2) any new net discharges are offset through the purchase of offset credits. The statute would also have to establish rules for the offset program. These rules would have to cover a number of areas (US Corps of Engineers et al 1995).

A. *Acceptable sites for establishing banks*. This will include ecologically suitable degraded sites where no remediation plans currently exist. Banks can be sited on public or private lands (US Corps of Engineers et al 1995).

B. *Mitigation, performance, monitoring and maintenance*. This would involve specifying offset techniques, criteria for determining whether offsets have been successful, amount of time monitoring is required, and maintenance standards.

C. *Long-term site maintenance at offset sites*. This could include use of perpetual conservation easements or the purchase of land. Inclusion of bank funds in long-term trust funds and annuities could be used to provide funding for site maintenance. Financial guarantees could be used to safeguard future funding.

D. *Governing market structure.* This includes whether private operators are allowed to establish offset banks. Rules are needed to determine whether any or all of the credits can be sold prior to the completion and testing of the environmental gains. Different rules for the latter may apply to government and privately owned offset banks. Financial assurances or insurance requirements may be specified if an offset bank partly or fully fails.

E. *Pricing rules*. May be established for government-managed banks.

F. *Identifying the service area for offset banking.* That is, the areas within which a development and the offset need to be located. This will typically be within regional watersheds or other more narrowly defined areas. Consideration will also need to be given to whether offsets will only be allowed within county boundaries or within watershed boundaries.

G. *Calculation of trading ratios*. These issues are considered next.

Establishment of Trading Ratios

A critical aspect in the establishment of offset banking is the determination of the trading ratio. The trading ratio determines the number of credits that must be purchased from an offset bank to offset an environmental impact.

Trading ratios are typically a function of several factors. The first is desired environmental gain. If the objective of the program is to achieve net environmental improvements, then the ratio would be set at higher than 1:1. For instance, in existing point source and nonpoint source trading programs, it has been common for trading ratios to be set at 1.5:1 or 2:1.

The second factor is uncertainty about impacts. For example, about the ability of the offset bank to properly offset environmental impacts, or about how impacts at the development site may change over time. However, uncertainty should be reduced by requiring offsets occur prior to the development impact.

The third factor is distance between the development impact and offset. By applying a non-trivial distance related trading ratio, the likelihood of severe localised impacts will be reduced. It will encourage developers to seek offsets that are much closer to the impact. This would also be expected to reduce the probability that the use of offsets will alter the benefits to the community from the stock of environmental assets.

The final trading ratio will be calculated based on all of these factors. While the method used for calculating the trading ratio will be pre-defined, the specific trading ratio for each development is likely to be variable.

Development of Offset Banks

Establishing an offset bank requires several steps. The US Corps of Engineers et al (1995) suggest several steps in developing mitigation banks. First, entrepreneurs proposing an offset bank discuss the appropriateness of a particular offset banking site with the regulatory authorities. Second, the entrepreneurs submit a prospectus that outlines the objectives of the bank, how it will be established and operated. This will provide the opportunity for feedback prior to the development of an offset banking instrument.

An offset banking instrument is a written agreement that formalises the establishment of an offset bank. The instrument would be prepared by the bank proponent and would be expected to include information about (see US Corps of Engineers 2002, http://sas.usace.army.mil/permit/bankguid.htm):

- Ownership of bank lands
- Bank goals and objectives
- Geographic service area

- Description of baseline conditions at the bank site
- Potential offsets
- Specific success criteria to determine when credits are available
- Assessment methodology or procedures for determining credits and debits
- Accounting procedures for tracking credits and debits
- A monitoring plan that identifies an evaluation schedule and reporting responsibilities
- Contingency and remedial actions and responsibilities
- Financial assurances if early credit withdrawal is proposed
- Method for determining trading ratios
- Provisions for long-term management and maintenance
- Method or instrument for the perpetual legally binding protection and preservation of the bank site

Approval of the banking instrument would be via a regulatory authority.

Calculation of Impacts

For offset banking to be operational, formulas need to be developed for calculating the "debits" that will be assigned to impacts and the development site, and "credits" that will be assigned for environmental improvements at the offset banking site. At a development site, modifications such as increases in the area of impervious surface would be expected to increase nonpoint source discharges. However, on-site controls would reduce some of these impacts and would need to be factored into the formula. Similarly other factors that influence the extent of nonpoint source discharges such as distance from a creek or river, topography, soil type and vegetation may be relevant for calculating debits. Spreadsheet programs could be developed so that debits for a particular development site can be quickly calculated given the key parameters at a site. This would also be helpful for developers so that they can understand how to design developments so that they have minimum impact on nonpoint source discharges, and to determine which controls can be cost-effectively implemented on-site. Similar formulas need to be developed for calculating credits, although the nature of these formulas will be different, since they will calculate the credits associated with works to improve environmental quality.

It is important that the formulas be sufficiently detailed to effectively describe the generation of credits and debits. Salzman and Ruhr (2000) reported that in the early days of the wetland mitigation program in the USA, the use of crude formulas led to the replacement of important wetland function with larger areas of less valuable wetlands.
The use of more sophisticated formulas would be expected to reduce the risk of this type of outcome, however they would be more costly to implement and oversee.

Modified Stormwater Permits

An important aspect of the use of offset banking will be the modification of existing stormwater permits for new developments. Currently, most existing stormwater permits specify control works that must be implemented to meet permit conditions. For new developments, new permits will need to be modified so that developers are required to offset, through the purchase of credits, any predicted net increase in discharges. The existing permitting program may also need to be changed so that smaller scale developments are also included under the umbrella of the offset program. The EPA's Proposed Water Quality Trading Policy is supportive of several different approaches for incorporating provisions for trading within NPDES permits.

Approval Process

The purchase of credits by developers will need to be governed by an approval process. Part of this approval process will be to ensure that public values are not being compromised by proposed offsets. Site inspections and submission of development and site plans would be expected to be part of this process and used to confirm debits. Accredited agents could be used to expedite this process for smaller developments. Web-based purchase of credits could be allowed for smaller developments, through a clearinghouse as occurs in other incentive programs currently operating. Larger developments could be overseen, and debit calculations and credit purchases approved directly by the regulator authority.

Public Comment

An important part of encouraging public acceptance for the use of an offset program will be to have public involvement early in the development of any offset program. Stakeholder involvement during key phases of bank development is essential. The Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (US Corps of Engineers et al 1995) recommends that the public should be notified of and have the opportunity to comment on all bank proposals.

6. Some Final Thoughts

Nonpoint source discharges are the major cause of violations of water quality goals in many urban areas. Pressure to achieve environmental improvements will be more pronounced because of the Federal Court requirements to meet the water quality objectives specified in the Clean Water Act and changes to the NPDES permits to include stormwater outlets. In areas experiencing high growth rates, achieving water quality goals is likely to be particularly difficult without controls on development.

Offset banking involving nonpoint source discharges provides an opportunity for allowing development and achieving environmental goals simultaneously. Another attractive feature of offset banking is that additional environmental improvements can be achieved, based solely on private funding. Similar offset programs have proven to be successful in several other contexts, including wetland mitigation, streambank mitigation and floodwater retention. They are intuitive and flexible programs that have generally been well accepted by the community. They have the advantage of potentially being a cost-effective form of control, of providing a practical means for allowing future development, and providing developers with a defined process for dealing with impacts associated with new developments. The use of centralised offset banks to oversee the creation and maintenance of nonpoint source controls may also prove to be environmentally more effective than the piecemeal installation of additional controls at individual sites. The use of offset banking

appears to have the potential to be a viable option for assisting in the management of nonpoint source discharges and development within urban areas.

However, the limitations of using offset banking should also be borne in mind. Government interventions are not costless, and – to be beneficial to the community – offset programs need to be designed so that the gains from using offsets are not compromised by excessive administration and transaction costs. Also, offsets programs need to be designed so that the benefits to the community from their stock of environmental assets are not compromised. The latter has been an issue of concern with existing offset programs, and widespread support is unlikely without the development of sufficient safeguards in this area.

Acknowledgments

This research was conducted while the author was Visiting Professor, Environmental Policy Program, Andrew Young School of Policy Studies, Georgia State University. The author would like to thank Laura Taylor for helping to develop the ideas presented in this paper, and the North Georgia Metropolitan Water Policy Center for funding this research. All opinions contained herein are those of the author.

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