

CASE i3
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Environmental Impact Bonds

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CASE
CENTER FOR THE ADVANCEMENT
OF SOCIAL ENTREPRENEURSHIP

CASE i3: *The CASE Initiative on Impact Investing*

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About CASE i3: The CASE i3 Initiative on Impact Investing is part of CASE (Center for the Advancement of Social Entrepreneurship), the award-winning research and education center based at Duke University's Fuqua School of Business. CASE i3's mission is to establish a rich set of resources and activities for MBA students, entrepreneurs, investors, funders, academics and policymakers to explore and support the field of Impact Investing over its critical period of development over the next 5-10 years.

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Executive Summary

This paper serves as the environmental response to a McKinsey & Company paper on Social Impact Bonds (SIBs) issued in May 2012. SIBs are the “hot topic” in the world of impact investing, yet few are discussing the possibility of applying the SIB model to environmental causes. This paper aims to correct that omission within the field of impact investing and spark a rigorous discussion on the potential for Environmental Impact Bonds (EIBs).

Overview:

1. **Social Impact Bonds (SIBs) – An Introduction:** This section provides an overview of SIBs.
2. **An Expanded View of SIB Structures:** While many reports on SIBs have been issued over the last 1-2 years, there is a dearth of analysis on how SIB structures could be modified to serve various marketplace needs. This paper attempts to spark more rigorous discussion on different ways to structure SIBs and the resulting and risk and return profiles associated with them. The key structures discussed are:
 - ▶ Principal-at-Risk
 - ▶ Standard Return-at-Risk
 - ▶ Annual Bonus Return-at-Risk
3. **Environmental Impact Bonds (EIBs):** This section of the paper defines the EIB and provides an analysis framework for potential EIBs through the lens of one specific environmental issue: water quality.
4. **Water Quality EIBs:** Three water quality programs are analyzed, using publicly available information, to demonstrate the potential applicability and effectiveness of EIBs in addressing environmental concerns. The three programs include:
 - ▶ The Nature Conservancy’s Latin American Water Funds
 - ▶ The Freshwater Trust’s Water Quality Trading Program
 - ▶ Philadelphia’s Stormwater Management Plan

Each program is analyzed with three major criteria that help determine applicability to an EIB model. The final analysis finds that Philadelphia’s Stormwater Management Plan is most conducive for an EIB structure, while the other two programs are best suited for more traditional financial mechanisms.

Key Findings:

- ▶ **Standardized EIB metrics already exist or can be developed more quickly than SIB metrics.** In the SIB ecosystem, metrics and measurement techniques often must be developed from scratch in order to fully satisfy investors and government stakeholders. In the EIB ecosystem, however, many standardized metrics already exist or can be readily developed as a result of robust environmental record keeping and measurement.
- ▶ **Revenue streams are a regular occurrence for natural resources.** For social issues, the government is the primary source of payments. As a result, there are few established revenue streams for SIBs. For the environment and conservation, many natural resources have been linked to regularly occurring revenue streams, which helps to reduce the complications associated with relying upon government-supported revenue streams.
- ▶ **Future EIBs may not depend on government regulation.** Government regulation is not always required to develop a consistent cash flow from natural resource assets or to develop an environmental market. As a result, there is great potential to leverage environmental markets that do not depend entirely on government regulation for EIB structures.

This paper is an attempt to spark a debate in the SIB ecosystem in order to encourage further analysis of EIBs and further discussion of SIB structures and risk profiles. More work is needed to advance this evolving segment within the field of impact investing. We hope that this paper serves as a stepping-stone for continuing that conversation.

Thank you.

David J. Nicola

Catherine H. Clark

Introduction

The global economy currently consumes natural resources equivalent to 1.5 times that which the earth annually produces.¹ This is equivalent to spending \$75,000 a year when your annual salary is \$50,000 – a common practice prior to the 2008 credit crisis, but one that is no longer considered financially responsible. If our planet were a Wall Street bank, it would require an immediate government bailout and a drastic reduction in lending activities to survive.

Despite this alarming trend, “the environment” was barely mentioned in the 2012 presidential election. Furthermore, a reduction in government spending on conservation and the environment in recent years has abetted the continued degradation of earth’s natural resources.² As a result, a burgeoning movement to leverage private capital for conservation and environmental restoration has taken on added urgency for the preservation of our planet.

Finance has long been a part of the conservation and environmental movements. Bill Ginn, currently Chief Conservation Officer at The Nature Conservancy (TNC), documented these efforts in his 2005 book: *Investing In Nature*.³ Additionally, in late 2007, prior to the credit crisis, the integration of high finance with environmental efforts was hailed in the book: *From Walden to Wall Street*,⁴ by James Levitt at Harvard Forest. These and other resources are augmented by the creation of finance-focused groups at some of the world’s largest conservation and environmental NGOs: The Nature Conservancy (TNC) has a Conservation Finance Team that arguably leads the world in conservation and environmental finance. The Natural Resources Defense Council (NRDC) has the Center for Market Innovation and the World Wildlife Fund has a conservation finance focus. These are just a few examples of how the conservation and environmental movement has successfully integrated both traditional and innovative finance into their business models. This shift in approach, combined with a reduction in government outlays for environmental issues, renders continued financial innovation imperative for the preservation and restoration of our natural systems.

Social Impact Bonds (SIBs) are one of the newest and most innovative financial structures to emerge from the world of impact investing.⁵ This paper aims to explore the potential for Social Impact Bond (SIB) or “pay-for-performance” (PFP) contracts to be applied to conservation and the environment.

Can the Environmental Impact Bond (EIB) become part of the conservation and environmental finance toolkit?

1. Social Impact Bonds (SIBs) - An Introduction

In May 2012, McKinsey & Company issued a report on Social Impact Bonds (SIBs): “From Potential to Action: Bringing Social Impact Bonds to the US.”⁶ The McKinsey report examined the potential for the SIB structure to boost the efficacy of specific social programs in the U.S., most notably chronic homelessness and juvenile recidivism. At the time of the report, only one SIB had been attempted: the Peterborough Prison Bond issued by Social Finance in the U.K.⁷ Since May 2012, New York City (NYC) released the first U.S. based SIB that aims to address youth reincarceration, with Goldman Sachs as the sole investor.⁸ Other initiatives inspired by the SIB movement include: efforts in Massachusetts to tackle juvenile justice and chronic homelessness with “pay for success” contracts,⁹ President Obama’s \$100 mm federal “Pay for Success” initiative,¹⁰ and Minnesota’s “Pay for Performance” program.¹¹

What Is A Social Impact Bond (SIB)?

Despite the name, a Social Impact Bond is not a bond and not a registered financial instrument. It is a partnership or contract, more specifically a “pay-for-performance” (PFP) or “pay-for-success” (PFS) contract, whereby contracting entities pay for, or are paid for, their services based on defined criteria and previously agreed-upon goals. In the context of an SIB, this usually entails government agencies working together with private capital and the non-profit sector to fund cost effective solutions for alleviating social problems. The PFP mechanism embedded in a SIB is defined as a contract, whereby a government entity pays a return to investors only if the implemented program meets or exceeds previously agreed upon impact performance targets. As McKinsey’s SIB report points out, PFP or PFS contracts are already utilized by governments for construction and environmental remediation (i.e., EPA superfund sites), but are not common practices in the implementation of most social or environmental activities.¹²

Why Does Finance Need SIBs?

Social Impact Bonds fill a niche in finance and impact investing that has yet to be filled by traditional financial instruments. There are three main ways in which SIBs are different:

1. **SIBs align social and environmental impact with financial returns:** Traditional financial instruments are focused exclusively on financial returns while ignoring social and environmental factors. SIBs seek to reverse this prevailing logic by providing financial returns that are aligned with the achievement of specific social and environmental impacts.
2. **SIBs leverage private capital for non-profits and impact-focused organizations:** Non-profits have historically relied upon donations and grants to run their operations. SIBs provide an alternative source of funding - private capital - which can augment or replace the need for donations and grants at non-profits and impact-focused organizations.
3. **SIBs reduce government risk and outlays:** In a world of large budget deficits and highly indebted national governments, SIBs serve as an avenue for leveraging private capital to help reduce government spending on social and environmental endeavors.

How Does A SIB Work?

The following table outlines a simplified, hypothetical Social Impact Bond (SIB):

TABLE 1: Hypothetical 5-year Homelessness SIB

Stakeholder	Action
Private Investor	Invests \$10 mm in SIB with a 5-year term and 10% target reduction in homelessness
Non-Profit	Receives \$10 mm of capital to facilitate reduction in the homelessness rate over 5-year period
Government	Pays investor \$10 mm +/- a financial return (or interest payment) at end of 5-year term. Payment is set forth in the contract and based on the reduction in homelessness. For example, a reduction in homelessness of 10% or more may earn the investor a financial payment that equates to an 8% annualized return.

NOTE: This is a hypothetical SIB contract between private investors, a municipal government, and a non-profit focused on homelessness. Exact deal terms and returns will vary according to the actual SIB contract.

This hypothetical “5-year Homelessness SIB” would have the following benefits for contracting entities:

TABLE 2: Benefits of Hypothetical 5-year Homelessness SIB

Stakeholder	Benefit
Private Investor	Investment return and “impact” on homelessness
Non-Profit	Upfront capital infusion, which reduces the need to fundraise
Government	Potential for cost savings versus current government programs, capacity building to scale more effective homeless treatment, and lower costs and lower risk versus current government programs

For additional information on SIBs, the McKinsey & Company 2012 report goes into further detail in describing SIBs. The Center for American Progress also has a report from 2011 describing Social Impact Bonds.¹³ Most recently, the Rockefeller foundation commissioned a report, *Building a Healthy & Sustainable Social Impact Bond Market: The Investor Landscape*, which provides an in-depth look at the current state of the SIB market.¹⁴

2. An Expanded View of SIB Structures

This section of the paper expands upon the SIB introduction and helps set the stage for a more thorough analysis of Environmental Impact Bonds (EIBs). Although many reports have been produced on SIBs, few reports adequately detail the various structures that an SIB can take. Structural considerations are key to the SIB debate as they set the stage for understating investor risk profiles and potential applicability of SIB models to social or environmental causes. This section of the paper provides definitions and overviews of three potential SIB structures and analyzes the risk and return profiles of each structure. Continued future analysis of the three structures outlined below is important for future SIB or EIB issuance.

The “Pay-for-Performance” Mechanism & Three Structures

SIB structures hinge upon the “pay-for-performance” (PFP) mechanism. At first glance, this innovative financing mechanism may help change the face of impact investing as the PFP contract works by “aligning incentives among a broad set of stakeholders and shifting financial risk away from the government.”¹⁵ Upon further investigation, however, hesitation about the PFP structure arises, particularly with respect to determining: 1) payouts for investors, and 2) scalability of the investment.

This paper defines the PFP mechanism for SIBs in two main forms as described below: Principal-at-Risk and Return-at-Risk. A hypothetical “5-year Homelessness SIB” (outlined on page 8) serves as an example for illustrating the PFP financial mechanisms as well as the resulting cash flows and returns to investors. Table 4, at the conclusion of this section, provides quantitative detail and support for the concepts outlined below.

1. **Principal-at-Risk:** This form of the PFP mechanism is similar to a zero coupon bond,¹⁶ whereby the investor receives principal and interest as a lump sum payment at maturity.
2. **Return-at-Risk:** This form of the PFP mechanism is similar to a traditional “bullet” bond, whereby investors receive annual coupon payments and receive the “bond principal” at maturity. This form can also be subdivided into two sub-forms;
 - a. “Standard” *Return-at-Risk*
 - b. “Annual Bonus” *Return-at-Risk*

TABLE 3: PFP Forms and Description

		Principal-at-Risk	Standard Return-at-Risk	Annual Bonus Return-at-Risk
Investment (“Bond Principal”)		\$10 mm	\$10 mm	\$10 mm
Annual Coupons		None	Yes (e.g., 5% of principal)	Yes (e.g., 5% of principal)
Annual Bonus		None	None	Yes
Performance Targets Are Met	Payment at Maturity	>\$10 mm (\$ figure specified in contract)	\$10 mm	\$10 mm
	Investor Return on Investment (ROI)	Positive	Positive	Positive
Performance Targets Are Unmet	Payment at Maturity	<\$10 mm (\$ figure specified in contract)	<\$10 mm (\$10 mm less the nominal value of prior coupon payments)	<\$10 mm (\$10 mm less the nominal value of prior coupon and bonus payments)
	Investor Return on Investment (ROI)	Negative (<0.0%)	0.0%	0.0%

Key explanations for table above:

- ▶ The recent NYC-Goldman Sachs SIB is an example of a Principal-at-Risk SIB structure. In the NYC-Goldman Sachs deal terms, an investor experiences a 30-50% loss of principal at maturity if the performance target is not met.¹⁷
- ▶ The “Standard” and “Annual Bonus” *Return-at-Risk* sub-forms, in the event that impact performance targets go unmet, serve to adjust the lump sum payment at maturity to ensure the investor is made “whole” on the original investment but receives a 0% return on invested capital. The sum of gross cash flows to investors at the 5-year term would equal the original investment.
- ▶ The “Annual Bonus” *Return-at-Risk* sub-form would only be applicable for social or environmental issues that can be measured (or have been specified in the contract to be measured) on an annual basis. If the measurement of the impact performance target only occurs at or near maturity, the “Standard” *Return-at-Risk* is most relevant.

TABLE 4: PFP Mechanisms – Contract Details, Cash Flows & Investor Returns

PFP Mechanism	% Reduction Homelessness	Original Investment	Annual Payments	Payment at Maturity	Cash Return to Investor ¹⁸	Investor IRR
Principal-at-Risk	15.0%+	\$10.0	\$0.0	\$18.0	1.80x	12.5%
	10.0 - 15.0%	\$10.0	\$0.0	\$16.0	1.60x	9.9%
	5.0 - 9.9%	\$10.0	\$0.0	\$10.0	1.00x	0.0%
	0.0 – 4.9%	\$10.0	\$0.0	\$8.0	0.80x	-4.4%
	< 0.0%	\$10.0	\$0.0	\$6.0	0.60x	-9.7%
Return-at-Risk (standard)	15.0%+	\$10.0	\$0.5	\$13.0	1.55x	9.9%
	10.0 - 15.0%	\$10.0	\$0.5	\$11.0	1.35x	6.7%
	5.0 - 9.9%	\$10.0	\$0.5	\$7.5	1.00x	0.0%
	0.0 – 4.9%	\$10.0	\$0.5	\$7.5	1.00x	0.0%
	< 0.0%	\$10.0	\$0.5	\$7.5	1.00x	0.0%
Return-at-Risk (annual bonus)	15.0%+	\$10.0	\$0.7	\$13.0	1.65x	11.7%
	10.0 - 15.0%	\$10.0	\$0.7	\$11.0	1.45x	8.7%
	5.0 - 9.9%	\$10.0	\$0.5	\$7.5	1.00x	0.0%
	0.0 – 4.9%	\$10.0	\$0.5	\$7.5	1.00x	0.0%
	< 0.0%	\$10.0	\$0.5	\$7.5	1.00x	0.0%

NOTE: The SIB “market” is not standardized and has experienced only a handful of deals. Table 4 serves to illustrate potential cash flows and investor returns. In a “live” SIB deal, the terms and cash flows will be specified in the contract and may not adhere to the examples listed above.

IRR = internal rate of return. Serves as a proxy for investor Return on Investment (ROI).

There are a number of reasons to distinguish the *Principal-at-Risk* and *Return-at-Risk* forms and further segment the *Return-at-Risk* into “Standard” and “Annual Bonus” sub-forms. The most pertinent reasons include differences in investor risk appetite, impact performance measurement and outcome features.

Investor Risk Appetite: The *Principal-at-Risk* structure is better suited for investors that have a higher tolerance for risk, while the *Return-at-Risk* form is better suited for more conservative investors. The *Principal-at-Risk* structure presents a new risk that is both unique to SIBs and new for traditional investors: if impact performance targets go unmet by the maturity date, investors are at risk of losing their principal or a portion of their principal. This potential loss is not based on the probability of counterparty default, which is the standard method for measuring and hedging payment risk in financial markets. This new risk is based solely on the efficacy of the proposed social or environmental intervention, an attribute of the investment that will remain “unhedged” throughout the life of the project. This new risk is a potential hindrance for widespread adoption of *Principal-at-Risk* SIBs or EIBs. The *Return-at-Risk* form works to protect “bond principal” from the risk of impact

target underperformance, thereby potentially resulting in higher appetite for these types of SIBs and EIBs from traditional investors. In order to attract significant investment capital to a *Principal-at-Risk* SIB or EIB the following would need to occur:

- ▶ Larger risk/reward tradeoff. If an investor could double their money in 5 years, they may more readily take on the risk of principal loss
- ▶ Outside guarantees, such as in the NYC-Goldman deal
- ▶ Tranches for an SIB deal that segment investors into different capital structures

Impact Performance Measurement: In addition to differences in investor risk appetite, the *Principal-at-Risk* and *Return-at-Risk* structures are best suited for impact performance measurements that fit specific profiles. Since the *Principal-at-Risk* structure does not require investor returns until maturity, this structure is best suited for social and environmental interventions that require a long-term horizon for accurate measurement. The *Principal-at-Risk* form also “buys time” for both the government and non-profits involved. Many social and environmental issues will fall into this category, because their respective interventions will bear accurate measurements only after multiple years.

The *Return-at-Risk* structure has annual coupon payments and is best suited for social and environmental interventions that can be measured more frequently (provided that measurement is accurate). The “Annual Bonus” *Return-at-Risk* sub-form is best suited for interventions where accurate, frequent measurements are capable.

Outcome Features: As with measurement attributes, outcome features help drive the choice for PFP structure. The existence of accurate measurement techniques is only relevant if the possible outcomes from intervention are quantifiable on a level that is scientifically accurate.

For social and environmental outcomes that require long-term horizons and cannot be quantified on an annual basis, either the *Principal-at-Risk* structure for risk-seeking investors, or the “Standard” *Return-at-Risk* structure for risk-averse investors are the best form. For social and environmental outcomes that occur over shorter time horizons and that can be accurately quantified on an annual basis, the “Annual Bonus” *Return-at-Risk* structure is most relevant.

Other Considerations For Implementation Of SIB Structures

Scalability of SIBs or EIBs: The scalability of SIBs and EIBs is, in large-part, based on the structure of the PFP mechanism. The NYC-Goldman Sachs reincarceration SIB provides a real-life example of this obstacle.¹⁹ The NYC-Goldman SIB has a principal guarantee on 75% of the \$9.6 mm “principal” where a charitable foundation, Bloomberg Philanthropies, provided a \$7.2 mm guarantee of principal to the lending entity, Goldman Sachs. While this effort is commendable for being the first SIB in the United States, the details of the contract demonstrate that SIBs may have limited effectiveness and scalability when individual deals must be ~75% guaranteed by a foundation. The need for government or philanthropic guarantees, particularly if pursued on a one-off basis, may prove problematic for scaling. Since SIBs are in their early stages, the process of experimentation and eventual standardization will prove important for determining the correct structures for future SIB and EIB offerings.

Role of Government: The role of municipal, state and federal governments will be crucial in the development of future SIB and EIB deals. In many respects, the government's role cannot be avoided since governments are the primary providers and financiers of the social and environmental services targeted in SIB and EIB deals. That said, the role of the government must be monitored and developed carefully. Since the SIB and EIB structure aims to leverage private capital in order to replace or augment government spending, the SIBs and EIBs end up "shifting financial risk away from the government."²⁰ This is a productive outcome given the over-leveraged balance sheets of developed countries. However, the shifting of risk must also be carefully monitored and considered. Some SIB/EIB structures, particularly the *Principal-at-Risk* form, potentially give government a "free option" with little "skin in the game" for alleviating many of the social and environmental problems facing society. The most scalable SIB and EIB structures will work to reduce government risk and resulting cost, but will also maintain a healthy dose of risk sharing and "skin in the game" for governments pursuing positive social and environmental objectives. The recent Rockefeller report discusses this risk in further detail.²¹

Furthermore, if governments focus solely on cost savings in future SIB/EIB structures, there is a risk that unintended consequences may arise. Focus on the "lowest cost" provider may prove cheaper in the short-term, but may also prove more expensive in the long run as performance targets go unmet and government costs for future interventions may increase. There must be a balance between cost savings and effective intervention.

Lastly, there may be opportunities for SIB/EIB structures to become established in the absence of direct government involvement. Foundations or private capital could directly engage with non-profits or service providers to generate an effective PFP intervention or SIB/EIB structure. It should be noted, however, that even in the absence of direct government involvement, many SIB/EIB structures are dependent on cash flows and costs savings that result directly from federal and state regulation.

3. Environmental Impact Bonds (EIBs)

This paper serves as the “environmental response” to the McKinsey report on SIBs. Despite the alarming rate with which the global economy is consuming natural resources, the world of impact investing is too silent on the environment. Social investments are the main focus despite an identified link between social inequality and environmental health.²² The bifurcation of the impact investing world into those that are “socially-focused” and “environmentally-focused” is counterproductive in achieving our common goals: social equality, improved opportunities for the disadvantaged, healthy people and a healthy planet. As previously cited, innovative finance has been a part of the conservation and environmental movement for decades. Therefore, it would be sensible for both the “socially minded” and “environmentally focused” members of the impact investing community to share resources and ideas, and leverage their respective skill-sets in order to quickly and effectively develop innovative financial structures that produce positive social and environmental impact.

The Environmental Impact Bond (EIB) – Defined

For the purposes of this paper, an EIB will be defined as a “pay-for-performance” (PFP) contract that addresses an environmental issue. The PFP mechanism inherent in EIBs will be similar to that of SIBs, whereby the government (or another contracting entity) pays an agreed-upon return if impact performance targets, as specified in the investment contract, are met.

EIBs tend to represent a “monetization” of future costs savings, whereby investors are paid a return based on the amount of cost savings generated by a particular project. Monetization of future cost savings is a staple of environmental finance. For example, in the alternative energy sector, a private investment firm that provides upfront investment for energy saving technologies in an office building complex would be paid principal and a return based on the savings associated with the reduced monthly energy bill of that office complex. McKinsey addresses this point in their SIB report, in which ESCOs²³ are cited as models for future SIB structures.²⁴ In many respects, EIBs will mimic ESCOs and other energy efficiency projects in their structure by paying a return to investors with a portion of actual or projected cost savings.

In order to analyze the potential for SIB or pay-for-performance (PFP) contracts to be applied to conservation and the environment, and answer the question – *Can the EIB become part of the conservation and environmental finance toolkit?* – this paper will examine water quality as an example environmental issue for determining the applicability of an EIB structure.

4. Water Quality EIBs

Water is essential for all life and is considered a “priceless” commodity. As it turns out, the term “priceless” is an accurate description. In the U.S. the average price for 1,000 gallons of water is \$2.00.²⁵ That is \$0.002 per gallon or approximately \$0.00 per gallon when rounded. At today’s prices, 1,000 gallons of gas would cost well over \$3,500²⁶ – 1,750 times the equivalent amount of water! Valuing water at \$0.00 has a host of unintended consequences. Over one-half of the globe’s wetlands, which provide “free” water filtration services, have been lost since 1900.²⁷ As the global economy eliminates “free” services provided by nature’s “green infrastructure,” more man-made, “grey infrastructure” must be built to replace the lost ecosystem functions. In the U.S. alone, there is an estimated \$500 billion funding gap over the next 20 years for providing clean water and access to drinking water for a growing human population.²⁸ Despite this daunting funding gap, a better method exists to provide clean drinking water and avoid billions of dollars in “grey infrastructure” expenditures.

New York City (NYC) has demonstrated that this alternative approach is possible and profitable. In the early 1990s, NYC placed a large wager on forest conservation in order to prevent billions in “grey infrastructure” expenditures required to supply clean water for 8 million people. The program is simple: the watersheds for NYC drinking water are conserved through forest preservation, restoration and improved streamside management (i.e., increasing natural stream buffers and fencing cattle out of streams). This program enabled the city to avoid an estimated \$4-10 billion dollars worth of “grey infrastructure” expenditures in exchange for approximately \$1 billion worth of watershed protection investments.²⁹ Furthermore, NYC’s estimated annual cost for maintaining the “grey infrastructure” would have been \$300-500 million³⁰ while the annual expenditures for watershed protection are currently \$100 million.³¹ Not only did NYC save vast amounts of money by investing in “green” infrastructure, it also provided recreational opportunities for NY residents and a healthy landscape for generations to come. NYC’s decision to invest in conservation is a clear win from both a financial and environmental perspective.³²

Can NYC’s efforts be replicated? Can an Environmental Impact Bond (EIB) focused on water quality help to expand the benefits of conservation “investment” throughout the U.S. and abroad?

In order to answer these questions, three water quality improvement programs will be examined:

1. The Nature Conservancy’s Latin American Water Funds
2. The Freshwater Trust’s Water Quality Trading Program
3. Philadelphia’s Stormwater Management Plan

These programs will help demonstrate the capacity for an EIB structure or PFP mechanism to address water quality improvement. Furthermore, the three programs will help to determine the necessary criteria that must be in place for successful pursuit of an EIB.

Each water quality improvement program will be analyzed through the following three criteria:

1. Standardized Metric: Is there a standardized, scientifically-verified metric that can be accurately measured either annually or at the end of the EIB contract term?

2. Consistent Annual Payments: What does the revenue stream look like? Are payments annual and predictable? This helps to determine the possibility of supporting a fixed income instrument such as an EIB and also helps to determine the final EIB and PFP structure.

3. Required Regulation: Does government regulation drive compliance and associated payment streams? Can the water quality program survive without government intervention?

Based on the answers to these three criteria, the last two columns in the table below also display the following recommendations:

Need for an EIB: Is an EIB possible and necessary?

PFP Form: Proposed Pay-for-Performance form for an EIB structure: *Principal-at-Risk or Return-at-Risk*

TABLE 5: Criteria for EIBs

Water Quality Improvement Program	1. Standardized Metric	2. Consistent Annual Payments	3. Required Regulation	Need for an EIB	PFP Form
The Nature Conservancy's Latin American Water Funds	No	Yes	No	No	-
The Freshwater Trust's Water Quality Trading Program	Yes	No	Yes	No	-
Philadelphia's Stormwater Management Plan	Yes	Yes	Yes	Yes	Principal at Risk

1. The Nature Conservancy's Latin American Water Funds

The Nature Conservancy (TNC) has undertaken efforts similar to NYC's watershed protection program in Latin America. In the year 2000, TNC established its first "Water Fund" in Quito, Ecuador.³³ These Water Funds are "based on the premise that natural ecosystems and conservation management practices by people living upstream in the watershed can help provide a clean, regular supply of water [for] downstream service users (including water utility companies, hydropower companies, and other industries) who depend upon these services..."³⁴ The goal of this mechanism is three-fold: 1) improve water quality, 2) reduce the likelihood of future water shortages, and 3) minimize future water treatment costs.³⁵ TNC's Water Funds, as with NYC's watershed protection program, help downstream water users avoid expensive investment in "grey infrastructure" through the conservation of valuable upstream watershed habitat. By maintaining a sufficient supply of clean water, TNC's Water Funds bolster the economic prospects of downstream water users.

The protection of watersheds through TNC's Water Fund structures occurs through three methods:³⁶

1. Conditional cash payments in which a landowner is paid on a per-acre basis to eliminate land-use practices that degrade water quality (e.g., deforestation, cattle in streams, etc.).
2. Funding deficits in protected natural areas (e.g., national parks, etc.). This helps to ensure security in already-established conservation zones.
3. Direct purchasing of land or easements to prevent degradation and deforestation.

TNC's Water Funds are structured as trusts whereby water users contribute either voluntary or compliance payments on an annual basis to the Water Fund. These payments are generally not driven by regulation but result from an economic or business motive to avoid the large potential future costs associated with man-made "grey infrastructure."³⁷ The corpus of the Water Fund trust pays annual income that is used to fund conservation initiatives in the upper reaches of a particular watershed. More information on TNC's Water Funds can be found in this report.³⁸

CRITERION 1: Standardized Metric - NO

Two metrics are possible for measuring the effectiveness of TNC's Water Fund initiatives:

- ▶ In-stream sediment levels
- ▶ In-stream water quantity

Although theoretically possible to establish these metrics as a basis for determining the effectiveness of Water Fund initiatives, there is no standardized method in place for accurate measurements of sediment and in-stream water quantity.

Both metrics pose potential implementation and measurement risk as they are subject to unpredictable weather, natural disasters and development pressure within the watershed. Unpredictable weather and natural disasters may affect sediment levels and water quantity despite the best efforts of conservation activities. For example, heavy rains can cause an increase in sediment above "normal" levels even if large tracts of land have been conserved. This type of complication will cause large-scale difficulties with measurement and verification of sediment or water quantity metrics in a hypothetical Water Fund EIB.

Similarly, construction and real-estate development in watershed may also cause difficulty with accurate measurement and verification of sediment or water quantity metrics. Unless a chosen measurement methodology has the ability to account for future construction and development in the watershed, metrics will be inaccurate as a result of human activities that occur outside the control of TNC's Water Fund initiatives.

Lastly, a focus on metrics and measurement of either sediment or water quantity runs the risk of missing the bigger picture. Land-use restrictions associated with TNC's Water Funds bring benefits above and beyond that of sediment level reductions or water quantity increases. Other benefits include habitat preservation, species protection, clean air, etc. TNC specifically states that biodiversity is a priority when choosing to invest Water Fund dollars.³⁹

CRITERION 2: Consistent Annual Payments - YES

As outlined in a 2010 Water Fund report, TNC's Latin American Water Funds act as "trusts" whereby voluntary or compliance contributions are pooled for the benefit of watershed protection.⁴⁰ The trust corpus, which produces income, allows for annual payments for the benefit of watershed protection. As with most investment pools and trust, the level of annual payments will fluctuate with:

- ▶ Performance of Water Fund trust corpus investments (i.e., performance of global capital markets)
- ▶ Prevailing interest and dividend rates
- ▶ Additional voluntary or compliance contributions to the Water Fund

Despite the potential volatility of annual payments, a minimum level of annual payments can be "predicted" within a relative degree of certainty, but will depend on the level of risk associated with trust investments. If the trust consists primarily of fixed income (a reasonable assumption), the level of income can be "predicted" within a manageable range.

CRITERION 3: Required Regulation - NO

While a subset of TNC's Water Funds is based on compliance payments for watershed preservation, contributions are primarily driven by voluntary payments and are not driven by regulation.⁴¹ Despite the lack of regulation, TNC has been successful in collecting voluntary contributions because businesses recognize the forward economic benefits of avoiding large costs associated with man-made "grey infrastructure."

RESULT: Need for an EIB - NO

TNC's Water Funds are an effective vehicle for implementing water quality and conservation programs in Latin America and potentially throughout the globe. The addition of an EIB either to the Water Fund structure or in replacement of the Water Fund structure is not necessary and not recommended for the following reasons:

1. Lack of standardized metric
2. More effective alternatives

The most glaring issue with respect to a potential Water Fund EIB is the lack of a standardized metric for ensuring that sediment, water quantity or water quality levels meet pre-specified targets. While the development of an effective metric may be possible, this would required many years of

development and testing before an agreed-upon metric could be incorporated into an EIB. The main risk associated with instituting a premature Water Fund metric includes saddling investors with large impact performance implementation and measurement risk, thereby preventing the effective development of a Water Fund EIB.

The Water Fund structure is already effective and does not require an overhaul to continue funding crucial conservation activities. Furthermore, the consistent annual revenues of TNC's Water Funds are more conducive to traditional financial structures, such as a series of securitized or non-securitized environmental loans.

TNC's Water Funds could use interest or corpus from the trust to service secured or unsecured loans in either "zero-coupon" or "bullet bond" structures.

A standard loan structure would be preferable to an EIB as it acts to:

1. Eliminate any risk associated with metrics or impact performance targets,
2. Allow investors to participate in current structure without the complexity of an EIB, and
3. Support the "full suite" of environmental benefits associated with conservation and restoration efforts instead of concentration on EIB impact performance targets.

The ability to standardize, pool, and sell these environmental loans to large-scale investors also brings benefits that EIBs may not be able to provide. Pooling loans and providing risk-weighted capital structures (e.g., tranches) can more effectively leverage guarantees and government involvement and incorporate current water fund structures.

For more detailed analysis on the Water Fund securitized loan (Water Fund CDO) mentioned above, please contact the author: david.nicola@fuqua.duke.edu. For purposes of brevity, detailed models and analysis have been omitted.

2. The Freshwater Trust's Water Quality Trading Program

The Freshwater Trust (TFT), an innovative organization in Oregon, is focused on enhancing stream water quality for trout and salmon fisheries.⁴² TFT has developed a robust water quality trading mechanism that allows downstream water users to buy "credits" that promote upstream restoration and rehabilitation of riparian zones. These credits are used to offset or eliminate fees levied by regulatory bodies that monitor water quality.

The salmon and trout fisheries of the Pacific Northwest require not only clean water, but also cold water. Many wastewater and power plants have improved the cleanliness of their effluent, but new regulations now require a decrease in the temperature of effluent released.⁴³ These downstream water users are required to abide by maximum "thermal loads" for streams where effluent is released. If downstream water users fail to meet these standards, they are subject to a fine by the Oregon Department of Environmental Quality (DEQ). TFT's water quality trading program allows regulated entities⁴⁴ to buy water quality credits instead of investing in man-made infrastructure to cool effluent. The money raised from the sale of credits funds the restoration of riparian zones upstream from the regulated entity. This restoration, which includes planting trees and other

vegetation to shade the stream, serves to reduce temperatures in the upper reaches of the watershed, thereby reducing downstream water temperatures. This mechanism is similar to other ecosystem service trading or credit programs such as wetland mitigation, which is an established and profitable marketplace in the field of ecosystem services. More information on the water quality trading program can be found on The Freshwater Trust website.⁴⁵

“The water quality trading model creates for the first time a lingua franca between the economy and the environment. With this, the two biggest forces in the biosphere can now do business together, rather than just fight.”

– Joe Whitworth, President, The Freshwater Trust⁴⁶

CRITERION 1: Standardized Metric - YES

Given the specifications of the current trading program and goals of the downstream water users, one metric stands out:

▶ In-stream water temperature

TFT’s current program has a rigorous monitoring and evaluation system in place that largely circumvents the need for physical measurements of temperature in particular streams or watersheds. In the current program, “eventual cooling benefits of the planted trees are calculated using rigorous standards approved by the Oregon Department of Environmental Quality (DEQ) and then translated into credits.”⁴⁷ A third party also verifies the validity of the credits, which are then officially registered. The purpose of this rigorous system is to:

1. Increase the efficiency of the program
2. Reduce costs in measurement and verification
3. Prevent misuse or “double counting” of credits
4. Reduce uncertainty surrounding the effectiveness of restoration efforts

CRITERION 2: Consistent Annual Payments - NO

TFT’s water quality trading program is structured in a fashion that is similar to the national wetland mitigation program in the United States and works as follows:⁴⁸

- ▶ “Regulated Entities” (i.e., businesses or government facilities seeking compliance with Oregon water quality regulations) contract with TFT to purchase “stream temperature” offset credits;
- ▶ TFT generates offset credits through restoration projects, securing upfront financing and assuming all risk;
- ▶ A non-profit (The Willamette Partnership) oversees the verification, certification and registration process for all offset credits;
- ▶ Regulated entities purchase offset credits in order to reduce water quality compliance fees from the Oregon government; and
- ▶ Revenue from offset credits funds restoration and financing costs as well as future monitoring and maintenance costs.

Annual fines levied by Oregon for water quality compliance violations can be considered annual payments, but do not necessarily qualify as consistent. Also, only organizations that are in violation of water quality (in-stream temperature) standards will be required to fund such payments, as there is no “base-line fee” for water users. Companies or government facilities that are in violation of Oregon standards can avoid potential fees by 1) purchasing of offset credits, or 2) building expensive water-cooling facilities. Potential annual payments under this system are not consistent as payments occur only on an “as-needed” basis.

CRITERION 3: Required Regulation - YES

TFT’s water quality trading program is driven by federal and state regulation. Federal laws such as the Clean Water Act and the Endangered Species Act as well as various state laws allow the Environmental Protection Agency (EPA) and Oregon Department of Environmental Quality (DEQ) to establish standards and fines for enforcing water quality and in-stream water temperature.⁴⁹

RESULT: Need for an EIB - NO

There is no need to replace TFT’s water quality trading program with an EIB. Although the existence of established metrics, rigorous measurement techniques, and impact performance targets seemingly make an EIB structure attractive, there is no need to further complicate a successful system that generates improved stream water quality, effective conservation and investor returns. Furthermore, the current program is not conducive to an EIB investment for the following reasons:

- ▶ The Oregon government has no incentive to be involved in an EIB;
- ▶ Private capital is already deployed through TFT’s program providing a return to investors; and
- ▶ “If it ain’t broke, don’t fix it.”

The Oregon DEQ levies fees on water users that do not comply with federal and state water quality standards. This is a “no cost” or “low cost” method for the government to achieve regulation. The government does not directly fund large infrastructure projects to specifically improve in-stream water temperature, instead relying on regulation and fees to compel private business to invest in the necessary infrastructure. Since Oregon’s DEQ is not currently required to pay directly for in-stream temperature improvements, it is unlikely that they will partner in a future EIB, particularly if that requires new cash outlays from the state.

Private capital is currently used in the trading program to fund the upfront costs of restoration and conservation efforts. A return for private investors is based on the price of credits and the ability of TFT or other organizations to implement cost-effective restoration. As cited previously, this type of financing is similar to the wetland mitigation market in the U.S. Investors are familiar with this type of risk and may be reluctant to shoulder any additional risks embedded in an EIB structure.

Lastly, TFT’s water quality trading program works well as currently structured. There is no need to replace the program. Substantial time and effort has already been invested by TFT, the Oregon government, investors and other non-profits in order to create a regulatory and legislative framework that supports conservation and water quality improvements. The rigorous certification process of TFT’s water quality trading program ensures that an effective offset market will be created.

Despite the inapplicability of an EIB within TFT’s current trading program, the EIB model can potentially be used in lieu of a water quality trading programs in other U.S. watersheds. The implementation of a water quality EIB focused on in-stream temperature reduction would include monitoring, measurement and enforcement mechanisms that are similar to TFT’s trading program.

For watersheds or municipalities that have not invested in the substantial regulatory and legal framework necessary to get an Oregon-type water quality trading program off the ground, an EIB contract may be quicker and easier to establish. This option will require further research and refinement before implementation.

3. Philadelphia's Stormwater Management Plan

Effective stormwater management is a crucial component for water quality control in major urban areas. As of 2004, the EPA estimated that 850 billion gallons of untreated wastewater mixed with stormwater overflow was discharged into the nation's waterways.⁵⁰ This polluted water affects nearly 40 million people living in 32 states, and is a major health concern in 772 cities.⁵¹ Not only is health a major concern, but future costs for regulatory compliance are also a concern for municipalities. The cities of Omaha, NE, Kansas City, MO and St. Louis, MO estimate municipal water treatment facility upgrades at \$1.7 billion, \$2.5 billion, and \$4.5 billion, respectively.⁵² The EPA also estimated in 2000 a \$50.6 billion⁵³ cost over 20 years for an 85% reduction of the 850 billion gallons of polluted discharge.

Stormwater is defined by the EPA as “runoff generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground.”⁵⁴

Stormwater is regulated by the EPA through the National Pollutant Discharge Elimination System (NPDES) Stormwater Program,⁵⁵ which requires municipalities to treat stormwater that is collected in municipal sewer systems. In relatively dry periods, this collection allows pollutants from stormwater to be treated in a municipal waste system. In wetter periods, however, the overflow from combined wastewater and stormwater can release untreated sewage and stormwater pollutants into surrounding water bodies. Either municipal water treatment infrastructure must be expanded or alternative methods for reducing stormwater during rainy periods must be improved and implemented.

As with NYC's watershed protection program, preventative “green infrastructure” to alleviate stormwater pollution can reduce the costs associated with expensive, man-made “grey infrastructure.” As a result, stormwater runoff is an environmental issue that is ripe for an Environmental Impact Bond (EIB). Environmental damage associated with stormwater pollution is measurable (i.e., estimated gallons of overflow resulting from square footage of impervious structure⁵⁶) and the remediation costs are very high (\$50 billion or more). This combination of factors suggests a need to implement innovative financial mechanisms that encourage cost effective methods for reducing stormwater runoff.

The Nature Conservancy (TNC), Natural Resources Defense Council (NRDC) and EKO Asset Management Partners are leading a group of investors and non-profits to help the city of Philadelphia address stormwater pollution with “green infrastructure” improvements (i.e., capture of stormwater or removal of impervious surfaces).⁵⁷ The estimated size of the Philadelphia stormwater finance market is over \$400 million.⁵⁸

NRDC has published an extensive report on stormwater finance and the potential costs savings associated with preventative “green infrastructure” investments.⁵⁹

CRITERION 1: Standardized Metric - YES

Given the details of Philadelphia’s stormwater management plan, two possible metrics stand out:

- ▶ Square footage (ft²) of impervious structure removed
- ▶ Gallons (or acre feet) of stormwater runoff avoided

Philadelphia is in the process of transitioning to a new system of stormwater fees that are based on square footage (ft²) of impervious structure.⁶⁰ This square footage metric can also be translated into gallons (or acre feet) of stormwater produced with a conversion ratio of rainfall per ft² based on historical and projected annual rainfall. This conversion ratio allows Philadelphia to project the amount of stormwater avoided based on square footage of impervious structure removed. For simplicity of implementation, the City levies stormwater fees based on ft² of impervious structure.⁶¹ More information on Philadelphia’s stormwater program and relevant rates can be found in the previously cited NRDC report, or by visiting the Philadelphia Water Department (PWD) website.⁶²

CRITERION 2: Consistent Annual Payments - YES

Philadelphia’s stormwater fees are levied on an annual basis and in a consistent matter. The method for determining fees is based on publicly available formulas. As long as the political atmosphere in Philadelphia remains conducive to maintaining the current structure of stormwater fees, annual payments will remain consistent and predictable for municipal-based facilities that are subject to stormwater regulation. The political and regulatory environment is a potential risk for the establishment of SIB/EIB structures and is consistently cited as a potential obstacle for widespread adoption of these structures.

CRITERION 3: Required Regulation - YES

NRDC’s 2012 report, *Financing Stormwater Retrofits in Philadelphia and Beyond*, provides an in-depth overview of the regulatory aspects of Philadelphia’s stormwater fee structure.⁶³ Regulation is clearly required for the establishment of a stormwater fee in a given municipality. This fee serves as the primary, if not only, source of annual payments for EIB or other financing mechanisms. As the NRDC report outlines, and as is mentioned above, the permanence of regulatory regimes is an important risk factor for determining the type of financing vehicle needed to address social or environmental issues.

RESULT: Need for EIB - YES

Of the three U.S. based water quality programs discussed in this paper, Philadelphia’s stormwater management program is the most conducive to an EIB structure. In fact, this program may benefit substantially from the financial and environmental creativity embedded in a Stormwater EIB. For the City of Philadelphia, all the pieces are in place to develop a successful EIB for alleviating stormwater pollution, such as:

1. Conservation methods (i.e., green infrastructure) are more cost effective than man-made grey infrastructure;
2. Consistent payments to service debt and provide investor returns are available via annual stormwater fees;
3. Regulation is in place to compel action; and
4. Clear momentum is behind the movement with TNC, NRDC and EKO leading the charge to forge a solution.

A hypothetical Stormwater EIB for Philadelphia would have the following characteristics:

TABLE 6: Hypothetical Stormwater EIB

Stormwater EIB	Description
Upfront Capital	▶ \$10 mm, 5-year term
Metric	▶ 3.4 mm ft ² of impervious structure removed. ⁶⁴ Equivalent to \$2.94/ft ² cost
Contract	<ul style="list-style-type: none"> ▶ Upfront capital provided to consortium of conservation non-profits, construction and engineering firms ▶ Philadelphia pays investors at maturity based on schedule listed below
Payouts	<ul style="list-style-type: none"> ▶ Meet target of 3.4 mm ft²: \$10 mm returned ▶ Below target of 3.4 mm ft²: < \$10 mm returned based on waterfall schedule as specified in contract ▶ Exceed target of 3.4 mm ft²: > \$10 mm returned based on waterfall schedule as specified in contract

Furthermore, these characteristics would correspond to the following benefits for EIB stakeholders:

TABLE 7: Benefits from Stormwater EIB

EIB Stakeholders	Benefits
Investors	<ul style="list-style-type: none"> ▶ Financial return via two methods: <ul style="list-style-type: none"> • Difference between the \$2.94/ft² average payment for impervious structure retrofit and the actual cost of removal or restoration (provided that average costs is lower than \$2.94/ft²) • Participating in the “additional payments” for ft² greater than 3.4 mm
Non-profit	<ul style="list-style-type: none"> ▶ Accomplishes conservation and “green infrastructure” goals without the need for substantial fundraising ▶ Potentially participate in the “upside” with investors, as outlined above
Government	<ul style="list-style-type: none"> ▶ Reduces risk associated with stormwater retrofits ▶ Reduces overall costs of stormwater retrofits by at least 20% (\$2.94/ft² versus a budgeted \$3.67/ft²)⁶⁵

PFM FORM: Principal-at-Risk

Both PFM forms are potentially applicable for a Stormwater EIB, with the *Principal-at-Risk* looking particularly attractive for implementation in Philadelphia. The stormwater performance metric (ft² of impervious structure removed or equivalent rainwater capture) is easily measured, occurs on an annual basis and can be independently verified by the City. These attributes make the *Principal-at-Risk* or *Return-at-Risk* (either sub-form) attractive for implementation of stormwater retrofits. For Philadelphia, the added benefit of the *Principal-at-Risk* form is the reduction in need to fund annual coupon payments and the ability to ensure that all stormwater retrofits are complete before any cash is distributed.

Table 8 (next page) outlines investor payments and returns associated with the hypothetical Stormwater EIB outlined in Table 6.

TABLE 8: Investor Payments, Costs & Returns Over 5-year Term

PFP Mechanism	Metric	Upfront Capital	Cost of Retrofit	Annual Payment	Bonus Payment	Maturity Payment	Cash to Investor ⁶⁶	Investor IRR
Principal-at-Risk	Exceed	10.0	8.0	-	-	15.0	1.88x	13.4%
	Meet	10.0	8.0	-	-	10.0	1.25x	4.6%
	Lower	10.0	8.0	-	-	6.0	0.75x	-5.6%
Return-at-Risk (Standard)	Exceed	10.0	8.0	0.5	-	10.0	1.56x	10.3%
	Meet	10.0	8.0	0.5	-	8.0	1.31x	6.3%
	Lower	10.0	8.0	0.5	-	5.5	1.00x	0.0%
Return-at-Risk (Annual Bonus)	Exceed	10.0	8.0	0.5	0.2	10.0	1.69x	12.6%
	Meet	10.0	8.0	0.5	-	8.0	1.31x	6.3%
	Lower	10.0	8.0	0.5	-	5.5	1.00x	0.0%

NOTE: These numbers are hypothetical and represent one set of possible scenarios. A Stormwater EIB issued out of Philadelphia or another city may include a more granular payout structure to account for various scenarios not represented in this table.

IRR – Internal Rate of Return. Serves as proxy for Investor Return on Investment (ROI).

Conclusion

In order to establish a successful and effective EIB ecosystem, a robust framework with strict criteria must be utilized to determine the applicability of EIB structures to alleviate environmental issues. The initial criteria for analyzing EIB potential includes:

1. Standardized Metrics
2. Consistent Annual Payments
3. Required Regulation

These three criteria are not drastically different than those identified for SIBs in the 2012 McKinsey report, which identified robust metrics and government involvement as paramount for SIB success.⁶⁷ There are, however, unique differences that are specific to environmental issues and the EIB ecosystem.

Standardized EIB metrics already exist or can potentially be developed more quickly than SIB metrics: In the SIB ecosystem, metrics and measurement techniques must be developed from scratch in order to fully satisfy investors and government stakeholders. In the EIB ecosystem, however, many standardized metrics already exist or can be readily developed as a result of robust environmental record keeping and measurement. For example, both the Philadelphia Stormwater Management Plan and The Freshwater Trust’s water quality trading program have standardized metrics that do not require 3+ years of development. Furthermore, the EPA and other federal, state, university and non-profit entities readily track environmental issues and release reliable environmental data. As a result, it may be possible for future EIBs to adapt current environmental metrics as impact performance measures and targets.

Revenue streams are a regular occurrence for natural resources: For social issues, the government is the primary source of payments and there are rarely any “natural” revenue streams. For the environment and conservation, many natural resources have been linked to regularly occurring revenue streams. For example, timber, water and seafood all produce revenue in the absence of government involvement. Although government regulation will likely play a pivotal role in environmental markets, the ability for natural resources to “self-fund” an EIB structure should be investigated to the fullest extent.

Future EIBs may not depend on government regulation: TNC’s Water Funds demonstrate that regulation is not always required to develop a consistent cash flow or environmental market. In some circumstances, private business drives the need for an environmental or conservation solution in order to avoid large future costs. In the EIB ecosystem, there is great potential to leverage environmental markets that do not depend entirely on government regulation.

Takeaways & Recommendations

Despite the intense levels of excitement, SIBs and EIBs should not be viewed as a panacea for the world’s social and environmental issues. They are simply one of the tools in the tool-kit. For example, TNC’s Water Funds and TFT’s water quality trading program demonstrate that more traditional financial mechanisms can be more effective in addressing water quality issues. Furthermore, various

SIB and EIB structures will only be relevant to investors that fit certain risk and return profiles and have the desire to invest with impact instead of simply for a financial return. Clearly, SIB and EIB structures warrant further experimentation and investigation in order to reveal their full potential for helping to alleviate social and environmental issues.

This paper is an attempt to spark a debate in the SIB/EIB ecosystem and encourage further analysis of the Environmental Impact Bond (EIB). In order to create innovative financial products with lasting and scalable impact, more action is needed on the following:

- ▶ A “breaking of the barrier” between “socially minded” and “environmentally focused” financial innovators – our efforts must be merged to maximize impact.
- ▶ Further analysis and case studies of the SIB and EIB payment structures outlined in this paper, including: investor profiles and risk appetite.
- ▶ Increased discussion of Environmental Impact Bond (EIB) structures, including:
 - Further analysis of the criteria necessary for successful EIBs, and
 - Additional environmental issues, other than water quality, that can benefit from an EIB structure.

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65. \$2.94/ft² is 80% of \$3.67/ft², which represents Philadelphia’s baseline cost for impervious structure removal/retrofit. Baseline estimate calculated as \$1.67 billion authorized to convert 10,000 acres or 435.6 mm ft² of impervious structure. 3.4 mm ft² is based on \$10 mm bond divided by \$2.94/ft²
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