Briefing Document: Cost and Benefit Estimates for Green Infrastructure

Executive Summary

This document provides a synthesized overview of cost and benefit estimation methodologies for site work and landscape projects, with a specific focus on Green Infrastructure (GI). The analysis is grounded in a framework that encompasses the full financial lifecycle of a project, including capital costs, operational expenses, and long-term value metrics like Net Present Value and Life Cycle Cost.

Two primary tools are identified for cost estimation: the **Gordian 2024 Site Work & Landscape Costs Book (with RSMeans Data)** for detailed unit cost analysis, and the **CNT Green Values® Stormwater Management Calculator** for lump-sum cost evaluation and comparative analysis of GI solutions. The Green Values® Calculator is highlighted as a critical tool for planning and justifying GI investments, as it not only estimates costs but also quantifies a wide range of environmental and economic benefits. These benefits are categorized for both property owners (e.g., energy savings) and the wider community (e.g., pollution reduction, increased property values, and reduced water treatment costs), providing a holistic view of the value generated by sustainable stormwater management practices.

Framework for Cost and Benefit Analysis

A comprehensive approach to financial evaluation requires assessing multiple cost categories over the entire lifespan of a project. The primary considerations include:

- **Capital Cost:** The initial investment required for construction and implementation. This can be estimated using two primary methods:
    - **Unit Cost:** Detailed, line-item costs for materials and tasks, often sourced from databases like RSMeans.
    - **Lump Sum Cost:** A broader, aggregated cost for a project or system, which can be estimated using tools like the Green Values® Calculator.
- **Operation and Maintenance (O&M) Cost:** The recurring expenses associated with the upkeep and functioning of the infrastructure.
- **Design Life Time:** The expected operational lifespan of the project, with common benchmarks set at 10, 50, or 100 years.
- **Net Present Value (NPV):** A metric that calculates the present value of future cash flows, accounting for the time value of money.
- **Life Cycle Cost (LCC):** The total cost of ownership over the project's entire life, including initial capital costs, O&M, and disposal or replacement costs.

Key Estimation Tools and Methodologies

RSMeans for Unit Cost Data

The **2024 Site Work & Landscape Costs Book** by Gordian, which incorporates RSMeans Data, serves as a foundational resource for detailed cost estimation. It is designed for a range of projects, including infrastructure improvements and environment-oriented construction.

- **Publisher:** Gordian
- **Item Number:** 602824
- **Price:** $400.00
- **Purpose:** Provides granular cost data for exterior improvements, building utilities, polyethylene pipe, concrete forms, demolition, security items, and more.
- **Scope:** Contains over 19,800 unit costs and 4,000 assemblies for efficient estimating.
- **Supplemental Information:** Includes data on Equipment Rentals, Crews, Historical and City Cost Indexes, Location Factors, and Project Size Modifiers.
- **Level of Cost Detail:** Unit Costs and Assemblies.

Green Values® Stormwater Management Calculator

The **Green Values® Stormwater Management Calculator**, developed by the Center for Neighborhood Technology (CNT), is a specialized tool designed to evaluate and compare Green Infrastructure against conventional stormwater management practices.

- **Primary Function:** Compares the performance, costs, and benefits of GI solutions.
- **Objective:** To help plan GI strategies that prevent flooding at various scales, from single buildings to entire communities.
- **Target Audience:** Planners, landscape architects, municipal staff, and homeowners.
- **Capabilities:** The calculator allows users to model a specific site or use pre-defined templates to evaluate which combination of Green Infrastructure Best Management Practices (BMPs) can achieve necessary water volume capture goals in a cost-effective manner.
- **Scenario Templates:** The tool includes templates for various land uses, including:
    - Urban Home (Small lot: 6,075 ft²)
    - Apartment (Medium lot: 8,400 ft²)
    - Suburban (Large lot: 24,000 ft²)
    - Commercial (Large lot: 50,000 ft²)
    - Urban Park Area (6.8 Acres)
    - Community Garden (Small lot: 6,075 ft²)

Case Study: Rain Garden Analysis via Green Values® Calculator

The Green Values® Calculator provides default values and formulas for specific GI installations. The following data for a Rain Garden illustrates the level of detail available for analysis.

Cost and Lifespan Specifications

Specification	Initial Default Value
Construction Cost	$6.07 / ft²
Maintenance Cost	$0.41 / ft²
Typical Useful Life	22.5 Years

Physical and Performance Specifications

Specification	Value
Ponding Depth	8 Inches
Amended Soil Depth	8 Inches
Amended Soil Porosity	0.35
Aggregate Depth	2 Inches
Aggregate Porosity	0.25

Water Volume Calculation

The volume of water a rain garden can hold is calculated using the following formula:

```
VCRG = (SDRG * SPRG + ADRG * APRG + PDRG * 0.667) * ARG
```

Where:

- **VCRG** = Volume captured from the area of the rain garden
- **ARG** = Area of the rain garden
- **SDRG** = Amended soil depth
- **SPRG** = Amended soil porosity
- **ADRG** = Aggregate depth
- **APRG** = Aggregate porosity
- **PDRG** = Ponding depth (The volume of ponding is scaled by two-thirds as an approximation for sloping sides).

Quantifying the Benefits of Green Infrastructure

A key feature of the Green Values® Calculator is its ability to assign monetary values to the benefits generated by GI, separated into owner and community categories.

Owner Benefits

These are direct financial advantages realized by the property owner.

Benefit	Description	Annual Value	Unit
Reduced Energy Use from Trees	Trees save energy for nearby buildings.	$36	Per Tree
Reduced Energy Use from Green Roof		$18	Per 100 ft^2

Community Benefits

These are broader economic and environmental advantages that benefit the surrounding neighborhood and municipality.

Benefit	Description	Annual Value	Unit
Reduced Air Pollutants from Trees	Trees absorb and redirect air pollution.	$0.18	Per Tree
Carbon Dioxide Sequestration from Trees	Trees take in CO_2.	$0.12	Per Tree
Compensatory Value of Trees	Trees add value to property and the neighborhood.	$275	Per Tree
Water Treatment Cost Reduction	Savings from not treating water absorbed by BMPs.	$29.94	Per acre-foot
Groundwater Replenishment	Value of replenishing groundwater with reduced runoff.	$86.42	Per acre-foot