

# STORMWATER COST ANALYSIS

## GOAL

Determine lifecycle costs and savings associated with low impact development techniques and best management practices for stormwater utilities.

## CREDIT REQUIREMENTS

Conduct a **lifecycle cost analysis** (LCCA) for stormwater utilities according to the National Cooperative Highway Research Program (NCHRP) Report 565: Evaluation of Best Management Practices for Highway Runoff Control Guidelines Manual.

NCHRP Report 565 can be accessed at the following link:

[http://144.171.11.107/Main/Blurbs/Evaluation\\_of\\_Best\\_Management\\_Practices\\_for\\_Highwa\\_158397.aspx](http://144.171.11.107/Main/Blurbs/Evaluation_of_Best_Management_Practices_for_Highwa_158397.aspx)

The Guidelines Manual is available to download as a CD image file (\*.iso). This file can be burned to a CD and then viewed as a PDF.

### Details

**Note:** This credit is applicable only for projects where PR-8 has identified that low impact development technologies are appropriate for implementation for stormwater management.

## DOCUMENTATION

Provide a copy of the LCCA spreadsheet showing the final results of the cost analysis and highlighting the final alternative chosen. The results must show, at minimum, that the following criteria have been addressed:

- Expected service life
- Construction costs
- Maintenance costs
- Interest rate
- Salvage value
- Estimated annual cost of the stormwater management system



EW-4

1 POINT

### RELATED CREDITS

- ✓ PR-2 Lifecycle Cost Analysis
- ✓ PR-7 Pollution Prevention Plan
- ✓ PR-8 Low Impact Development
- ✓ PR-10 Site Maintenance Plan
- ✓ EW-2 Runoff Flow Control
- ✓ EW-3 Runoff Quality

### SUSTAINABILITY COMPONENTS

- ✓ Ecology
- ✓ Economy
- ✓ Extent
- ✓ Expectations
- ✓ Exposure

### BENEFITS

- ✓ Improves Accountability
- ✓ Reduces Lifecycle Costs
- ✓ Creates New Information

## APPROACHES & STRATEGIES

- Use a financial approach (strictly monetary costs and benefits) for the LCCA.
- Evaluate design alternatives based on the goals of the stormwater management plan.
- Set up a spreadsheet to compute costs based on budget inputs.
- Use estimated costs for LID BMPs available from the BMP Database (BMPDB) available at: <http://www.bmpdatabase.org>.
- Consider avoided costs of stormwater treatment at off-site locations, or avoided permitting costs.
- Include several different methods and alternatives in the evaluation of the stormwater system when performing the LCCA. Investigate both structural and non-structural controls, including conventional controls such as detention or infiltration (Huber et. al., 2006).

### Example: LCCA Calculation

The following example uses the NCHRP Report outline to perform an LCCA for a potential stormwater system. The system being analyzed consists of 150 linear feet of 12-inch portland cement concrete pipe connected to two 48" manholes.

Table EW-4.1 shows the initial construction costs associated with the potential stormwater system.

**Table EW-4.1: Initial construction costs.**

Cost of 150 LF of 12" Concrete Pipe	\$1,200.00
Cost of 2 48" Manholes	\$4,800.00
Right of Way Cost	\$100.00
<b>Total Initial Construction Cost</b>	<b>\$6,100.00</b>

Table EW-4.2 shows some of the other costs associated with the stormwater system, including salvage value, interest rate, and design life.

**Table EW-4.2: Incidental Costs**

Annual Maintenance Cost	\$300.00
Salvage Value	\$750.00
Interest Rate	4.00%
Design Life (Years)	30

To begin the lifecycle cost analysis, all of the future and annual costs associated with the system must be converted into a present worth value.

First, the annual maintenance cost is converted into a present worth using Equation EW-4.1:

**Equation EW-4.1:**

$$P = A \left( \frac{(1+i)^n - 1}{i(1+i)^n} \right) = 300 \left( \frac{(1+.04)^{30} - 1}{.04(1+.04)^{30}} \right) = \$5187.61$$

Secondly, the salvage value is converted into a present worth using Equation EW-4.2:

**Equation EW-4.2:**

$$P = \frac{F}{(1+i)^n} = \frac{750}{(1+.04)^{30}} = \$231.24$$

The total initial cost is then found by adding the total construction costs to the two calculated present worth values. This makes the total cost associated with this stormwater system \$11,518.85.

Next, by annualizing this value using Equation EW-4.3, it can be shown that the annual cost for the new stormwater system will be \$666.14 per year for a 30 year lifetime.

**Equation EW-4.3:**

$$A = P \frac{i(1+i)^n}{(1+i)^n - 1} = 11,518.85 \frac{.04(1+.04)^{30}}{(1+.04)^{30} - 1} = \$666.14$$

## POTENTIAL ISSUES

1. Complexity of the cost analysis will be proportional to the extent and labor involved in installing the stormwater utilities system.
2. LCCA does not necessarily reflect the actual cost or functionality of the finished stormwater system.

## RESEARCH

Many agencies' project evaluation process considers only the initial capital costs of projects without considering long-term operations and maintenance. Focusing only on capital costs makes it less likely that projects will adopt stormwater controls that may have higher initial costs, but are less expensive to operate and maintain in the long term. There are also non-monetary risks and costs associated with stormwater systems that are relevant to decision-making such as permanent land use changes associated with detention ponds, a common feature of conventional stormwater infrastructure.

Overall capital and maintenance costs are not the only costs that should be involved in the lifecycle cost assessment. The cost of actually treating the stormwater should be included as well. Preliminary estimates in NCHRP Report 565 show that the cost of treating stormwater can vary from \$0.10 to \$3.00 per gallon based on the treatment methodology (Huber et.al, 2006).

Drastic changes to stormwater systems can affect both water quality and flow rates. Evaluating both in a lifecycle cost analysis as well as a water quality analysis can be an effective method of design evaluation. The design team should ensure that the overall goals of the stormwater system are not generated specifically on cost, but functionality as well (Huber et. al., 2006). Other possible factors to consider in design evaluation include existing infrastructure, property ownership, health and safety, and volume reduction (Huber et. al, 2006).

Case studies of 17 low-impact development installations for stormwater flow control and quality management were completed by the Environmental Protection Agency in 2007. Results of the study showed that applying LID techniques usually reduced project costs and had the added benefit of improved environmental performance (for both flow control and quality of discharge). In some cases, LID was more expensive than conventional best management practices, due in part to contractor unfamiliarity. In most cases, significant capital costs were reduced by avoiding grading, stormwater infrastructure, additional paving and vegetation. Savings ranged from 15-80 percent with the few exceptions mentioned (EPA, 2007).

## GLOSSARY

**LCCA**

Lifecycle cost analysis

## REFERENCES

Environmental Protection Agency (2007). Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices. [Publication Number EPA 841-F-07-006, December 2007]

Huber W.C., Strecker, E.W., Heaney, J.P., & Weinstein, N. (2006). Evaluation of Best Management Practices and Low Impact Development for Highway Runoff Control User's Guide for BMP/LID Selection Guidelines Manual. National Cooperative Research Program.

