



Metrics and Measurement

A very important tool in facilitating change is establishing a metrics and measurement program that can help you benchmark existing conditions, set goals, identify “high bar” or “reach” goals, identify ranges of “acceptable” performance, and marshal empirical evidence on performance of projects in other areas. Quantitative and qualitative data can be remarkably powerful allies as you work to dispel fears about risk and performance failure, compare costs and benefits, evaluate year-to-year performance, and build a case for your program over time.

How should I start collecting data?

Use published performance values

Data collected from other studies either locally or in other areas of the country may be applicable to your situation. Some universities and other research organizations perform laboratory tests on BMPs under controlled conditions and publish their results in scientific journals. The benefits of this approach are that it is low-cost or no-cost and does not take a lot of time or effort to receive results. One drawback is that the results may not be directly applicable to climate, soil, and other site factors present in your area.

Collect your own data

An alternative approach is to collect your own data by measuring results from BMPs you have implemented in your area. These may be pilot or demonstration projects or they may be BMPs integrated into a commercial or residential site. One benefit of collecting your own data is that results are based on local conditions, allowing for easier application of measured values to other local sites. Another advantage is that you can select the metrics in which you are most interested rather than relying on the judgments of independent researchers. Some drawbacks include the costs associated with monitoring and the time required to achieve statistically valid results.

Use models and estimates

If you are trying to estimate the impacts of a particular project or approach, you can use existing data and values you have measured, along with some reasonable assumptions, to model scenarios and test outcomes. It is important to be transparent about your methodology and assumptions so that your approach can be evaluated and critiqued by your audience and stakeholders. You also can use models and estimates to test the sensitivity of an outcome to different variables to identify which factors are most important in achieving your desired results.

Measure “outside the box”

Look at variables that are less often quantified, such as likeability or amount of use. Public opinion is a very important and often overlooked variable, and it is fairly easily quantified by surveying owners, neighbors, and the public at large about their impressions. (It’s also a great way to reach out and educate the public.)

Reasons to measure performance:

- Show success
- Build a case for future projects
- Identify design flaws
- Identify maintenance needs
- Meet regulatory requirements
- Establish performance benchmarks

What should you measure?

When it comes time to develop a plan to measure system performance, your first step is to identify the goals and objectives of your project (these should include objectives related to community acceptance). Below are a few metrics that can help you quantify how well a BMP is performing:

Conservation:

- **Water use/irrigation** – how much water, fertilizer, and other inputs are needed?
- **Green space** – how many acres of open space are created? How many people will benefit?
- **Habitat** – how much wildlife habitat is created? Will high-value species benefit?



A BMP's appearance can tell a story about its health and performance

Economic:

- **Cost** – what are the capital installation and maintenance costs? How does this project compare to other alternatives?
- **Infrastructure** – how much piping is needed to provide adequate site drainage?
- **Real estate value** – what affect did the project have on local property values? Is there now the possibility for additional density?
- **Other economic factors** – will there be a long-term economic payoff from reduced stormwater utility fees? Will it cost more or less to maintain than traditional stormwater controls?

Environmental:

- **Water quality performance** – what level of water quality benefits are achieved?
- **Flood mitigation** – how much rainwater is infiltrated?
- **Heat island effect** – what are the thermal effects of more green space and trees?
- **Sewer overflows** – how many gallons of stormwater will enter the combined sewer system? How does this compare to other systems?

Social:

- **Recreation** – to what extent does the project offer opportunities for the community to gather and enjoy the space? How many people benefit?
- **Education** – does the BMP offer educational opportunities (e.g., signage or living classroom)?

Benchmarking and establishing goals

The metrics used to evaluate project performance and success should be done as soon as project goals are identified. For a stormwater BMP, you may choose to measure inflow and outflow water quality and quantity, appearance, maintenance needs, and public acceptance, for example. This way, you can build monitoring into each project stage, from early planning through implementation and maintenance. The next step is to take initial measurements for the identified metrics at the project site to determine existing conditions and current parameters. These initial measurements will establish a baseline against which future measurements can be compared. This will allow you to identify trends over time – is water quality improving or declining? Is the appearance improving as vegetation matures or is it less attractive? Does

maintenance lessen over time as plants mature? Are the neighbors still happy with it after one year or five years? Establishing this track record is important for a number of reasons. First, it will help inform future projects by identifying design flaws and establishing feasibility. Second, it will help identify problems with the system that require maintenance or redesign before catastrophic failures can occur.

What is acceptable performance?

Each identified metric should have a “pass/fail” threshold to allow you to judge whether the BMP is meeting expectations with corresponding remedial actions to take once that threshold is reached. How much plant dieback is too much? At what point should action be taken and what form should that action take? These decisions should be linked directly to the goals you initially set for the project, and they may change over time as priorities shift and as the realities of implementation set in. You don’t want to set the bar too low, yet your expectations should still be reasonable and achievable.

What should you do with the information after you collect it?

Data should be organized and presented in a way that appeals and makes sense to the stakeholders you communicate with. City engineers will want to hear about water quality, recharge, and flood control benefits, whereas residents will want to hear about recreational, aesthetic, and social benefits. A technical memorandum might be appropriate for scientists, whereas the general public would be more receptive to a brochure with photos and other graphics. The key is to identify what your audience values and show the measurements that have the most meaning to them.

Who is using metrics?

[Portland](#) has a long-term BMP monitoring program that measures the performance of eeroofs, bioswales, rain gardens, and other innovative practices throughout the city. They publish reports on BMP performance annually on the Sustainable Stormwater Program website.

[Philadelphia](#) showed how BMPs would impact stream health and infrastructure needs by identifying metrics and modeling outcomes. They compared the costs of infrastructure solutions versus land-based BMP solutions and showed that each dollar spent resulted in a tangible improvement. They also showed that the new local stormwater regulations reduced infrastructure costs by eliminating the need for 40 million gallons of stormwater storage tank capacity.

[Chicago](#) establishes an annual Environmental Action Agenda that sets performance targets for a variety of "inputs," such as disconnected downspouts, the number of installed rain gardens, etc., and provides an annual "report card" showing how well the city met its targets. [Santa Monica](#) has a similar Sustainable City initiative that has been ongoing since 1994 and produces an annual report card that is mailed to residents and posted on the city’s website.

You may also be interested in:

[Benefits of green development](#)
[BMPs from start to finish](#)
[Bring your ideas to the community](#)
[What makes a project successful?](#)

Case studies cited above:

- [Chicago, IL](#)
- [Philadelphia, PA](#)
- [Portland, OR](#)
- [Santa Monica, CA](#)