BIRMINGHAM
A WALKABLE CITY

AGENDA
BIRMINGHAM ENVIRONMENTAL SUSTAINABILITY COMMITTEE
MONDAY, JANUARY 26, 2026
BIRMINGHAM CITY HALL, 151 MARTIN ST, ROOM 202-203, BIRMINGHAM MI *
******************* 5:30 PM*******************

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1) **Call to Order**
2) **Roll Call**
3) **Review the Minutes**
   - A. **Minutes of the Regular meeting of November 17, 2025**
4) **Review of the Agenda**
5) **New Business**
   - A. **Sustainability Fee – Study Session**
   - B. **Birmingham Rain Garden Program – Study Session**
   - C. **Single-Family Stormwater Management – Draft Ordinance Language**
6) **Miscellaneous Communications**
   - A. **SolSmart Program – Bronze Designation**
   - B. **Clinton River Watershed Council WaterTowns® Resolution**
   - C. **Community Engagement & Birmingham Green Webpage Updates**
   - D. **MoGo eBike Stations in Birmingham**
   - E. **Oakland County Materials Management Program**
7) **Open to the Public for Items Not on the Agenda**
8) **Adjournment**

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*Please note that board meetings will be conducted in person once again. Members of the public can attend in person at Birmingham City Hall, 151 Martin St., or may attend virtually at:

Link to Access Virtual Meeting: https://bhamgov-org.zoom.us/j/84305107066
Telephone Meeting Access: 833 928 4608 US Toll-free
Meeting ID Code: 843 0510 7066

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A PERSON DESIGNATED WITH THE AUTHORITY TO MAKE DECISIONS MUST BE PRESENT AT THE MEETING.

City of Birmingham
Regular Meeting of the Environmental Sustainability Committee
November 17, 2025
Rooms 202-203
151 Martin Street, Birmingham, Michigan

Minutes of the regular meeting of the City of Birmingham Environmental Sustainability Committee held on November 17, 2025. The meeting convened at 5:30 p.m.

1) Roll Call

Present: Vice Chair Debra Horner; Committee Members Trenton Chapman, Lara Edwards, Joe Mercurio, Sara Rubino

Absent: Chair Jess Newman; Committee Member Harvey Bell; Student Representatives Penelope Graves, Abhishek Thota

Staff: City Planner Aldred-Arens; City Engineer Coatta, Planning Director Dupuis, Assistant City Manager Fairbairn, Planning Intern Milia

2) Minutes of the Regular Meeting of September 15, 2025

Motion by Edwards
Seconded by Mercurio to pass last month's minutes.

Motion carried, 5-0

VOICE VOTE
Yeas: Edwards, Mercurio, Chapman, Rubino, Horner
Nays: None

3) Review of the Agenda
4) New Business

A. Single-Family Stormwater Management – Draft Ordinance Language

CP Aldred-Arens, PD Dupuis, and CE Coatta presented the item and answered informational questions from the ESC.

ESC members raised the following points during discussion:

- Compliance with the ordinance would be checked via staff plan review.
- This was a good start.
- Exploring a stronger credit and incentive structure would be worthwhile.
- A rain barrel would require a homeowner to release the water actively, whereas a dry well passively releases the water.
- Infiltration versus detention might be more useful categories than natural versus constructed.

B. Sustainability Fee – Study Session

PD Dupuis and CP Aldred-Arens presented the item and answered informational questions from the ESC.

ESC members raised the following points during discussion:

- Staff indicated that an ordinance might be preferable to a resolution.
- Funds would roll over year-to-year.
- The fee would apply to internal combustion engine (ICE) and electric vehicles alike.
- This was originally contemplated as a congestion fee. Both ICE and electric vehicles impact vehicle congestion in the downtown area.
- The funds could be used in part to make the downtown area more supportive of multi-modal transportation.
- This was a great start to this item.

5) Miscellaneous Communications

SOCRRA magnets with recycling instruction QR codes were distributed.

Staff and Steve Claer, a teacher at Seaholm High School, have begun collaborating to give Birmingham students more opportunities to get involved in the City's sustainability efforts.

PD Dupuis joined SEMCOG's Flooding Taskforce.

Staff anticipates completing its final FloodWise Report in December and beginning to plan quarterly sustainability community engagement opportunities.

Staff and Ms. Horner will be doing a presentation on sustainability for Next.

ESC members were encouraged to let other interested residents know that the committee has openings.

Since the Chair's spouse was recently elected to the City Commission, the Chair may have to resign from the ESC per City policy. The City was exploring whether that would be the case.

6) Open to the Public for Items Not on the Agenda
7) Adjournment

No further business being evident, the meeting adjourned at 6:18 p.m.

Summer Aldred-Arens, City Planner

Laura Eichenhorn, City Transcriptionist

MEMORANDUM

Planning Department

DATE: January 26, 2026

TO: Environmental Sustainability Committee

FROM: Nicholas Dupuis, Planning Director

SUBJECT: Sustainability Fee – UPDATE

As the City continues to move towards its ambitious sustainability and climate action goals, the Planning Department has long recognized the need for consistent and robust funding to ensure that projects can be completed in the appropriate time frame, and that the full breadth of the Birmingham Green: Healthy Climate Plan can be explored without the need to depend on General Fund resources in a tight municipal budget.

The Planning Department has been working through the development of a "sustainability fee" charged to vehicles using the City's automated parking system, which has been in the process of refinement since August 2025. At this time, the Planning Department is providing the Environmental Sustainability Committee (ESC) with an update on the fee itself, as well as providing some new concepts that have come from the process.

The ESC last reviewed a report regarding the sustainability fee on November 17, 2025 (Agenda). Since that meeting, the Planning Department has twice been to the Advisory Parking Committee (APC) to introduce and discuss the sustainability fee alongside associated parking rate increases. Overall, the APC appears to be supportive of the sustainability fee increase, but has been raising several questions of the City in regards to the broader increases. Most of their concern rests in the scale of the overall increase, which will affect only the parking revenues – the sustainability fee revenue would remain intact at this point. In resolving the questions and concerns from the APC, the Planning Department has further refined the sustainability fee proposal, which is now estimated to produce roughly $422,00 annually (down from the last estimate of $566,000). In addition, the Planning Department has stumbled on a new idea that could be of interest to the ESC – the cost of carbon reduction.

The Cost of Carbon Reduction

Over the course of the last couple of months, several people have asked what the revenue for the proposed sustainability fee may be used for, and whether or not it would be too much or too little based on the goals of the City. As we know, the specific sustainability fee revenue will have limitations on where the funds can be spent, but it could still be immensely useful when lowering carbon emissions from vehicles, which is the second highest source of GHG emissions in Birmingham.

While developing the Birmingham Green: Healthy Climate Plan, it was eventually agreed between the Planning Department and the ESC that cost is an important factor to consider, but that pricing out each individual action item would be not only difficult, but may also prove unhelpful. Ultimately, the Plan provided an order of magnitude cost for each action item ranging from "Very Low" to "High." Now that we are proposing a consistent revenue stream that [if unchanged] will generate around $3.4 million over the lifetime of the current Plan, it is worth at least conceptualizing what that might be able to accomplish in relation to our carbon reduction goals.

This has led to the idea of pricing out the Plan based on estimates as to how much it costs to reduce one metric ton of CO_2, then applying that cost over the 284,618 metric tons of CO_2 that the Plan looks to reduce by 2050. Unfortunately, there appears to be a wide range of costs associated with reducing carbon based on the approach taken. Nature based options may be cheaper, while technological approaches can be much higher. The Planning Department will be researching this adjacent to the sustainability fee discussion, but does not wish to slow down the proposal to flesh out this new concept.

NEXT STEPS

The Planning Department will be back at the APC on February 4, 2026 seeking a recommendation to bring to the City Commission. We would then return to the ESC on February 23, 2026 to request a formal recommendation from the ESC. At that time, we would expect that all required reviews will be completed, including legal. Once all recommendations are received, we would target the City Commission meeting of March 23, 2023 to petition their approval of both ordinance language and fee schedule updates. At this time, the rate increases would not be expected to be active until July 1, 2026 (start of the fiscal year), upon which time we would begin collecting revenue.

Journal of Economic Perspectives—Volume 32, Number 4—Fall 2018—Pages 53–72

The Cost of Reducing Greenhouse Gas Emissions

Kenneth Gillingham and James H. Stock

What is the most economically efficient way to reduce greenhouse gas emissions? The principles of economics deliver a crisp answer: reduce emissions to the point that the marginal benefits of the reduction equal its marginal costs. This answer can be implemented by a Pigouvian tax, for example a carbon tax where the tax rate is the marginal benefit of the emissions reduction or, equivalently, the monetized damages from emitting an additional ton of carbon dioxide (CO_2). The carbon externality will then be internalized and the market will find cost-effective ways to reduce emissions up to the amount of the carbon tax.

However, most countries, including the United States, do not place an economy-wide tax on carbon, and instead have an array of greenhouse gas mitigation policies that provide subsidies or restrictions typically aimed at specific technologies or sectors. Such climate policies range from automobile fuel economy standards, to gasoline taxes, to mandating that a certain amount of electricity in a state comes from renewables, to subsidizing solar and wind electrical generation, to mandates requiring the blending of biofuels into the surface transportation fuel supply, to supply-side restrictions on fossil fuel extraction. In the world of a Pigouvian tax, markets sort out the most cost-effective ways to reduce emissions, but in the world

■ *Kenneth Gillingham is Associate Professor of Economics, Yale University, New Haven, Connecticut. James H. Stock is the Harold Hitchings Burbank Professor of Political Economy, Harvard University, Cambridge Massachusetts. Gillingham is a Faculty Research Fellow and Stock is a Research Associate, both at the National Bureau of Economic Research, Cambridge Massachusetts. Their email addresses are kenneth.gillingham@yale.edu and james_stock@harvard.edu.*

† For supplementary materials such as appendices, datasets, and author disclosure statements, see the article page at
https://doi.org/10.1257/jep.32.4.53 doi=10.1257/jep.32.4.53

we live in, economists need to weigh in on the costs of specific technologies or narrow interventions.

This paper reviews the costs of various technologies and actions aimed at reducing greenhouse gas emissions. Our aim is twofold. First, we seek to provide an up-to-date summary of costs of actions that can be taken now using currently available technology. These costs focus on expenditures and emissions reductions over the life of a project compared to some business-as-usual benchmark—for example, replacing coal-fired electricity generation with wind or weatherizing a home. We refer to these costs as static because they are costs over the life of a specific project undertaken now, and they ignore spillovers. In the environmental economics literature, these static costs are an element in creating what is called a marginal abatement cost (MAC) curve, which plots out the marginal costs of achieving a cumulative level of emissions abatement in order from the lowest- to highest-cost technology or measure.

To economists not in the energy-environment field, these marginal abatement costs might contain some surprises. Although we are skeptical of most "free lunch" static estimates, for some technologies the cost of emissions reductions is remarkably low. For example, blending corn ethanol into gasoline up to a 10 percent ratio provides essentially costless emissions reductions (our point estimate is in the "free lunch" range) in the United States because ethanol is a less-expensive octane booster than alternatives derived from petroleum. Another low or negative static cost source of emissions reductions is replacing coal-fired electricity generation with natural gas, a switch that has been widely adopted by power generators located where gas prices are low because of the fracking revolution. On the other hand, some actions that might seem green are, from a static perspective, anything but. For example, driving a Ford Focus electric vehicle in a region in which electricity is generated by coal has approximately the same CO_2 footprint as a Ford Explorer sport utility vehicle that averages 25 miles per gallon, and costs nearly as much. We find a wide range of costs for interventions currently being employed, both across and within different types of interventions. This heterogeneity in costs implies that we could achieve the same amount of greenhouse gas emissions reductions that we are achieving now at a much lower static cost, or greater emissions reductions for the same cost. Possible reasons for the use of more expensive policies include the chosen policies having less transparent costs, individual policies having justifications beyond just climate policy, differences in the marginal costs across locations, and lobbying by businesses that could potentially be affected by lower-cost policies. In some cases, especially policies aimed at developing nascent technologies, the policies are developed with a longer-term vision in mind.

These estimates of static costs help to inform discussions about climate policy, but they miss the critical consideration that climate change is a long-term problem. As a result, the proper answer to our opening question is not necessarily what is the least expensive mitigation strategy among options available today, but what are the actions if, taken today, will minimize the cost of mitigation both today *and* into the future, recognizing that actions taken today can influence future costs. We refer to such costs as dynamic, because they outlive the life of a specific project.

Our second aim is to distinguish between dynamic and static costs and to argue that some actions taken today with seemingly high static costs can have low dynamic costs, and vice versa. We make this argument at a general level and through two case studies, of solar panels and of electric vehicles. The cost of both technologies has fallen sharply, arguably driven in part by demand-side incentives that in turn stimulated learning-by-doing and technological improvements, the benefits of which are only partially captured by the manufacturing firm. In addition, purchasing an electric vehicle today drives the demand for charging stations, which in effect reduces the cost (here, the cost of time and worry) to potential future purchasers. Under the right circumstances, such dynamic effects can offer a justification for policies that a myopic calculation suggests have high costs.

Estimates of Static Abatement Costs

Before we begin, we briefly digress on units. The standard units of emissions costs and benefits are dollars per metric ton (1,000 kilograms) of CO_2 emissions avoided. As a point of comparison, the social cost of carbon is an estimate of the net present value of monetized social damages from emission of an additional metric ton of CO_2; under the Obama administration, the US government estimated the social cost of carbon to be approximately $46 in 2017 dollars for a ton of emissions in 2017 (IWG 2016).[1] Burning one gallon of petroleum gasoline produces roughly nine kilograms of CO_2, so a social cost of carbon value of $46/metric ton CO_2 corresponds to $0.41 per gallon. Also, carbon dioxide is only one of many greenhouse gases; others include methane, nitrous oxide, and hydrofluorocarbons. To facilitate comparisons, it is conventional to convert costs for reducing non-CO_2 greenhouse gases into CO_2-equivalent units, and we adopt that convention here.[2]

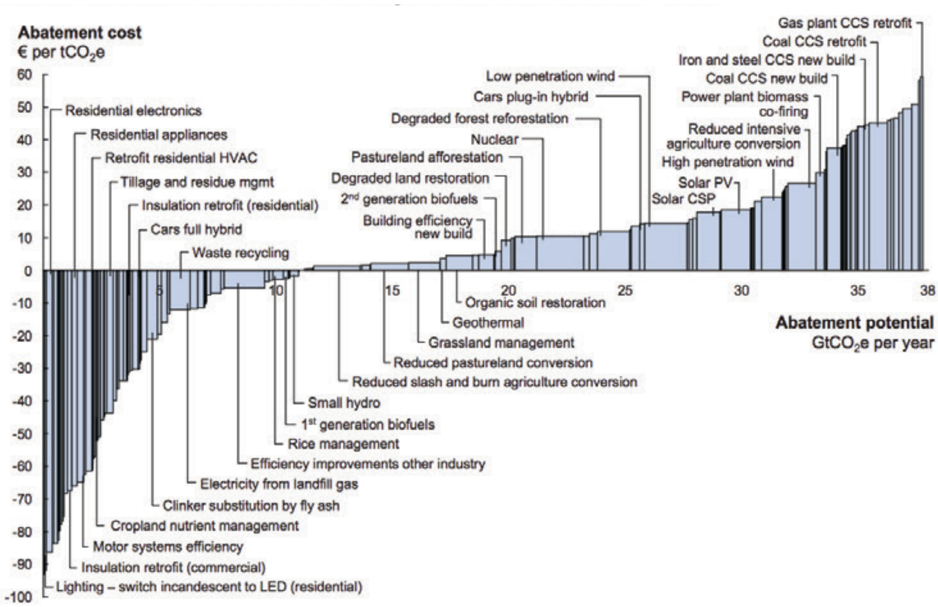
Brief Background on Marginal Abatement Cost Curves

The marginal abatement cost (MAC) curve plots measures to abate emissions in order from the least to most expensive. For each, there is a cost per ton of emissions reduced and a quantity of emissions reductions available at that cost. The

[1] The Trump administration withdrew this estimate by executive order and forbid agencies from using the underlying research for regulatory purposes; as of this writing, the Environmental Protection Agency is using two estimates, $1 and $6 per ton, depending on the discount rate (3 or 7 percent) (Newell 2017). The estimate of $46/ton is in the range of the academic literature, although some estimates are much higher (as one example, see Gillingham et al. 2018). There is currently a cross-institutional interdisciplinary effort to provide a comprehensive update to the social cost of carbon based on recommendations made by the National Academy of Sciences (2017), which is discussed on the Resources for the Future website at http://www.rff.org/research/collection/rffs-social-cost-carbon-initiative.

[2] A complication in developing CO_2-equivalent estimates is that the atmospheric residence time of greenhouse gases varies. The most common approach, the global warming potential approach, is only an approximation when used to calculate the social cost of non-CO_2 greenhouse gases. See Marten and Newbold (2012) for a more comprehensive approach to calculating the social cost of non-CO_2 greenhouse gases.

Figure 1
The McKinsey (2009) Marginal Abatement Cost Curve: "Global GHG Abatement Cost Curve Beyond Business-As-Usual-2030"



Source: Global GHG Abatement Cost Curve v2.0. Figure and notes reproduced with permission from McKinsey (2009).
Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

use of MAC curves to support climate policy analysis dates back at least a quarter century (for an early review, see Grubb, Edmonds, ten Brink, and Morrison 1993). All models that estimate the mitigation costs of climate policy either implicitly or explicitly use a MAC curve.

The most prominent attempt at developing a comprehensive marginal abatement cost curve is the well-known McKinsey curve, which is constructed using engineering estimates of the cost of implementing new technologies or other measures.

Figure 1 displays the global version of the McKinsey curve (McKinsey & Company 2009). A striking feature of the McKinsey curve, which is shared by MAC curves more generally (for example, see figure 2 in Grubb et al. 1993), is that some interventions have negative abatement costs: that is, emissions can be reduced, and money saved, at the same time. Economists, including ourselves, are often skeptical of these "free lunch" estimates, unless they are supported by convincing evidence and explanations. Negative costs require institutional entities, such as firms, not to be optimizing, or require the existence of behavioral failures in consumer decision-making (like consumers acting myopically). In some cases, entities such as

Table 1
New Source Generation Costs when Compared to Existing Coal Generation
(ordered from lowest to highest)

Technology	*Cost estimate ($2017/ton CO_2)*
Onshore wind	24
Natural gas combined cycle	24
Utility-scale solar photovoltaic	28
Natural gas with carbon capture and storage	42
Advanced nuclear	58
Coal retrofit with carbon capture and storage	84
New coal with carbon capture and storage	95
Offshore wind	105
Solar thermal	132

Source: Author's calculations updating methodology from Clean Air Task Force (2013) based on Energy Information Administration estimates from the 2018 Annual Energy Outlook. Costs are projected for facilities that come online in 2022. Costs do not incorporate federal renewable tax credits.

governments are institutionally complex and/or not minimizing costs, so these free-lunch savings are potentially valid but institutionally difficult to realize. When these negative costs are for energy efficiency programs, this is often called the "energy efficiency gap" and there is a continued debate in the literature on whether there is a real gap or whether the gap can be explained by unaccounted-for costs (Gerarden, Newell, and Stavins 2017; Gillingham and Palmer 2014; in this journal, Allcott and Greenstone 2012).

The concern over negative costs highlights a limitation of marginal abatement curves like the McKinsey curve in Figure 1: specifically, that they are based on engineering estimates, which have their own assumptions and typically do not include behavioral considerations. An example of such a behavioral effect is turning the heat up because the cost of doing so has declined because of weatherization. Economists are typically interested in the combined effect of behavioral responses and the engineering costs.

Static Cost Comparisons

In addition to these and other methodological concerns, the cost estimates in the McKinsey curve in Figure 1 are out of date. We therefore turn to more current estimates of marginal costs. These estimates are drawn from the economics and trade literatures, supplemented by our own calculations.

To fix orders of magnitude, we begin with some "bottom-up" or engineering cost estimates for the power sector, presented in Table 1. These estimates compare the cost per ton of CO_2 abated by replacing electricity generated by an existing coal-fired power plant with electricity generated by a cleaner alternative. The estimates are based on the US Energy Information Administration's (2018) so-called "levelized" cost of electricity for the different sources, which combines discounted capital, operating, and maintenance expenses to produce a cost of energy per megawatt-hour, given the typical utilization rate or capacity factor for each generation type. These estimates are similar to private sector estimates, such as those by Lazard (2017).

According to these estimates, the least expensive technologies to reduce emissions relative to existing coal are onshore wind, natural gas combined cycle, utility-scale solar photovoltaics, and natural gas with carbon capture and storage technology. Advanced nuclear technologies are more expensive, followed by other carbon capture and storage technologies, offshore wind, and solar thermal. The technologies in this set of estimates that are less expensive (when replacing existing coal) than the Obama administration's social cost of carbon estimate of $46 per ton of CO_2 are onshore wind, natural gas combined cycle, utility scale photovoltaic, and natural gas with 90 percent carbon capture and storage. In comparison, offshore wind and solar thermal are currently quite expensive ways to reduce emissions (although offshore wind costs are falling). These estimates only consider climate benefits of switching from coal, not any other health co-benefits arising from reductions in local air pollutants.

From a policy perspective, engineering cost estimates such as those in Table 1 have important limitations. Some of these technologies are in wide current use, so cost estimates are reasonably reliable (onshore wind, natural gas combined cycle), whereas other technologies have demonstrated technical feasibility but current projects are subject to large cost overruns, so the engineering costs could be underestimates (for example, advanced nuclear, carbon capture and storage). Another limitation is that these are national averages, and costs vary regionally depending on local conditions (for example, local fuel prices, wind conditions, and insolation). In addition, these are costs of switching technologies, which differ from the costs of a policy designed to encourage technology switching. These engineering estimates do not incorporate behavioral responses or any indirect emissions such as fugitive methane emissions from the production and transport of natural gas.

We therefore turn to a systematic review of costs of interventions—typically policies—aimed at reducing greenhouse gas emissions. This review draws on more than 50 recent articles in the economics literature. We selected papers based on a few criteria. First, the paper must be an economic analysis, so we draw most heavily from papers published in economics journals and economics working paper series. Second, the paper must either have enough information so that we can calculate a cost per ton of emissions reduction or include an explicit estimate of this cost. Most papers we review have an explicit estimate in dollars per ton CO_2. Third, we focus on papers published in the past decade, and nearly all of the papers included in our review are published after 2006. In some cases, we have supplemented the estimates from the economics literature with studies from the trade literature and/or our own calculations.

The results are summarized in Table 2. The table presents ranges of estimates whenever there are multiple estimates from either the same study or multiple studies; the online Appendix available with this paper at http://e-jep.org provides

Table 2
Static Costs of Policies based on a Compilation of Economic Studies
(ordered from lowest to highest cost)

Policy	*Estimate (\$2017/ton CO_{2e})*
Behavioral energy efficiency	−190
Corn starch ethanol (US)	−18 to +310
Renewable Portfolio Standards	0–190
Reforestation	1–10
Wind energy subsidies	2–260
Clean Power Plan	11
Gasoline tax	18–47
Methane flaring regulation	20
Reducing federal coal leasing	33–68
CAFE Standards	48–310
Agricultural emissions policies	50–65
National Clean Energy Standard	51–110
Soil management	57
Livestock management policies	71
Concentrating solar power expansion (China & India)	100
Renewable fuel subsidies	100
Low carbon fuel standard	100–2,900
Solar photovoltaics subsidies	140–2,100
Biodiesel	150–250
Energy efficiency programs (China)	250–300
Cash for Clunkers	270–420
Weatherization assistance program	350
Dedicated battery electric vehicle subsidy	350–640

Note: Figures are rounded to two significant digits. We have converted all estimates to 2017 dollars for comparability. See Appendix Table A-1 for sources and methods. CO_{2e} denotes conversion of tons of non-CO_2 greenhouse gases to their CO_2 equivalent based on their global warming potential.

an expanded version of Table 2 with sources and methods. As in a marginal abatement cost curve, we have ordered the estimates in Table 2 from lowest to highest cost.

We highlight seven features of Table 2.

First, the range of costs of these interventions is extremely wide, from less than \$10 per ton to over \$1,000 per ton. What is striking about this range is that all the interventions in Table 2 are either policy steps that have been implemented, at least in some jurisdiction, or have been actively proposed and considered. Most of the costs are relatively expensive, in the sense that they exceed \$46/ton. Evidently, static cost is only one consideration when a policy is proposed or considered. This heterogeneity likely stems from multiple sources, including the carbon intensity of the displaced fuel (for example, is the electricity on the grid coming from coal or hydropower?) and the other policies in place.

Second, there is a wide range of costs *within* a type of intervention. For example, subsidies to wind generation, such as the wind production tax credit in the United States, have estimated carbon abatement costs ranging from \$2 to more than \$260 per ton of reduced CO_2. For wind power, one reason for the large range is that there is large variation across sites in wind potential. The range is even wider for subsidies for solar photovoltaics, in part because there is wide variation in solar potential across locations (the solar power potential in southwestern Arizona is roughly twice that in upstate New York[3]), in part because of the timing of the programs (for example, earlier programs faced higher solar panel costs than later programs), and in part because of differences in scale (utility-scale arrays cost much less to install per kilowatt than rooftop arrays) (Baker, Fowlie, Lemoine, and Reynolds 2013). The wide ranges of estimates in Table 2 underscore that policies may have very different costs per ton of CO_2 depending on the empirical setting and/or the methodology of the study. The ranges of the estimates should not necessarily be taken as a proxy for uncertainty, for they simply show how estimates vary across studies. Due to within-study uncertainty, values above and below the ranges are likely to occur with some probability.

Third, some of the interventions that have negative economic costs in the McKinsey curve (and in other marginal abatement cost curves) have positive costs here. For example, engineering estimates of weatherization programs often suggest that they have negative costs. So why have such changes not already been undertaken? This is the energy efficiency paradox. In a randomized controlled trial, however, Fowlie, Greenstone, and Wolfram (2018) found that the actual costs of the weatherization exceeded the savings, leading to the \$350/ton estimate of the mitigation cost reported in Table 2. They attribute the difference between the negative engineering costs and the actual positive costs for the homes in their study primarily to flaws in the engineering models.

Fourth, some of the costs in Table 2 *are* negative. A striking estimate arises from behavioral economics studies of how small nudges can get consumers to reduce their energy consumption, thereby saving money while reducing emissions; the estimate in Table 2 is taken from Allcott and Mullainathan's (2010) meta-analysis of behavioral interventions. An example of such a nudge is the OPOWER program, in which an insert in the residential electricity bill compares the homeowner's usage to that of neighbors, costing the utility very little and leading to consumer savings. One concern, which we share, is that while the cost of such reductions is negative, the total emissions reductions from such nudges are likely to be relatively small and partially transitory. The other negative estimate in Table 2 is for corn ethanol, which some might find surprising.

In the United States, petroleum gasoline blend stock must be blended with an octane booster to bring it up to the 87 octane standard of regular unleaded gasoline. Ethanol is a lower-cost octane booster than its petroleum alternatives (Irwin and Good 2017). In 2012—a year in which there were no direct federal subsidies and the federal ethanol mandate under the Renewable Fuel Standard was not binding—ethanol comprised just under 10 percent of the US retail gasoline supply.

[3] See the National Renewable Energy Laboratory (NREL) National Solar Radiation Database (NSRDB) Data Vewer at https://maps.nrel.gov/nsrdb-viewer/.

The California Air Resources Board (2018) estimates that ethanol from new corn ethanol plants has roughly 70 percent of the life-cycle CO_2 emissions of petroleum, including the carbon effects of induced land use change. Thus, for blends up to 10 percent, ethanol has negative greenhouse gas emissions reductions costs, and indeed is the market choice. Blending ethanol up to approximately 30 percent continues to enhance octane. The US fueling infrastructure, however, generally cannot handle blends above 10 percent, nor are engines designed to harness those octane advantages to improve energy efficiency, a situation known as the "E10 blend wall." As a result, subsidies are needed to incentivize ethanol consumption in blends higher than E10, and those costs increase quickly when measured in dollars per ton of CO_2 avoided.

Fifth, a few of the interventions have very low costs. Some, like the Clean Power Plan—the Obama administration's rulemaking for CO_2 emissions standards in the power sector—and regulations to reduce methane flaring from fracked oil wells that coproduce natural gas, are examples in which the regulation intensity was chosen with cost in mind. The Clean Power Plan is notable for its low cost per ton of emissions reductions (this estimate is taken from the *Regulatory Impact Analysis for the Clean Power Plan*, US Environmental Protection Agency 2015). This cost per ton is less than any of the engineering costs in Table 1, for two reasons. First, some of the emissions reduction comes from switching generation from existing coal-fired plants to existing gas-fired plants, and so does not require building a new plant as in Table 1. Second, because the Clean Power Plan allowed interstate trading of emissions permits, new low-greenhouse gas generating facilities would be built where it is most economically efficient to do so, yielding lower costs than the generic plant replacement costs in Table 1. The Clean Power Plan is also notable because its projected CO_2 emissions reductions are the largest, or nearly so, among the interventions in Table 2.

Sixth, some of the interventions have very high static costs. The United States and Europe have programs that require blending biodiesel into the diesel fuel supply. Biodiesel can be made from many oil feedstocks, including waste grease, but on the margin it is made from food-competing feedstocks such as soybean oil. These food oils are expensive and production of soy biodiesel requires a large subsidy, which is provided in the United States primarily through a tax credit and through the Renewable Fuel Standard. In other cases, the high costs are a result of inefficiencies in program design. For example, the temporary Cash for Clunkers program was installed at the depth of the recession in 2009 to provide an infusion of demand for new cars to support the auto industry and to provide countercyclical fiscal stimulus. Because the program exchanged old vehicles for more efficient new ones, it boosted fleet fuel economy. However, it had substantial temporary inframarginal transfers that were not a problem for its primary purpose—to pull forward auto demand—but made it a costly way to reduce emissions.

Seventh, the literature suggests that the cost of reducing carbon is low for some land use policies (see "Reforestation" on Table 2). In a randomized controlled experiment that lasted two years, Jayachandran et al. (2017) found that cash payments for forest conservation in Uganda substantially reduced deforestation and cost $1 per ton of carbon sequestered. They do not, however, provide evidence on what happened after the payments stopped, and a natural concern is that there would be a reversion to the deforestation baseline. If so, the emissions reduction would be temporary, that is, the emissions would simply be postponed, not eliminated.[4] This distinction between permanent and temporary sequestration, along with the difficulty of ascertaining whether the payments actually induce incremental carbon retention in practice (something that was in fact found in Jayachandran et al.'s experiment), are at the heart of the controversy over the use of carbon offsets (for example, van Benthem and Kerr 2013; Bento, Kanbur, and Leard 2016).

One sobering insight from the estimates in Table 2 is that many of the least-expensive interventions cover a small amount of CO_2 reductions, whereas the scalable technologies that that are at the center of discussions about a transformation to a low-carbon economy—electric vehicles, solar photovoltaic panels, and offshore wind turbines—are among the most expensive on the list. Behavioral nudges are a very small step towards deep decarbonization. In contrast, the more expensive scalable technologies have a much greater potential for substantial emissions reductions. For these technologies, what matters most are not the static costs today, but the costs and consequences of these interventions over time, that is, the dynamic costs of the intervention. It is informative to know what are the cheapest interventions to do today, but we would argue that it is even more important to know what interventions might most effectively drive down the price of large-scale reductions in emissions in the future.

Dynamic Costs

The long residence time of CO_2 in the atmosphere makes climate change a long-term problem, in which (to a first approximation) what matters is the total number of tons emitted over some long horizon. As a result, the key to reducing emissions in the future is to have low-cost alternatives to fossil fuels that are zero- or low-carbon. The true total cost of investments or interventions today therefore must include both their static or face-value cost, and any spillovers those investments have for future costs of emissions reduction. The importance of a dynamic perspective is hardly new—see Popp, Newell, and Jaffe (2010) for a review—but it is often neglected both in the public debate and in the literature on costs of abatement. Yet, the welfare benefits of even small growth rates in the efficiency of clean technologies may be large, as suggested by simulations in Hassler, Krussel, Olovsson, and Reiter (2018).

[4] The distinction between temporary and permanent forest sequestration is important. Temporary rainforest sequestration is equivalent to storing emissions then releasing them later. In a manner analogous to how generating electricity from wind displaces retired coal-fired electricity, permanent sequestration permanently keeps the CO_2 in question out of the atmosphere.

Conceptual Framework

The static cost estimates of the previous section focus on direct reductions in emissions in the relatively short-run. However, expenditures on certain kinds of short-run reductions in emissions today can also affect emissions in the future, above and beyond direct emissions from the project. There are at least four reasons why this second component of emissions reduction could be nonzero and possibly large for some green technologies. Three of these stem from externalities, while the fourth is the difference between myopic and dynamic cost minimization.

First, many of these low-carbon technologies are nascent, and there could be substantial gains in production efficiency as more units are produced. Such gains can arise from engineering and managerial improvements made as production increases, a channel referred to as learning by doing, and from scale economies. To the extent that such gains are only partially appropriable by the firm, an expenditure today provides a positive externality that reduces costs in the future. The first case study that we discuss in the next subsection—solar panels—focuses on this learning-by-doing effect.

Second, a related externality arises from research and development spillovers because research results are only partially appropriable. These spillovers also represent a market failure, and economists have argued that the spillovers are likely to be particularly large for emerging clean technologies (Nordhaus 2011). To the extent that purchases today spur additional research, which then reduces costs, expenditures today reduce emissions tomorrow. It can often be difficult to separate the effects of research and development spillovers from learning-by-doing spillovers, for as a firm ramps up production, it also may ramp up research. For this reason, economists have often encouraged caution in relying too heavily on learning-by-doing to model technological change (Nordhaus 2014).

Third, a separate externality that is present for some technologies is a network or "chicken and egg" externality, in which an expenditure today influences the options that are available to others in the future. For example, purchases of electric vehicles today will, on the margin, stimulate demand for charging stations, which once installed will lower the effective cost for future potential purchasers of electric vehicles. Our second case study, of electric vehicles, in principle includes both learning-by-doing and network externalities.

Fourth, energy investments typically have substantial irreversible components, which in general implies state dependence so that the dynamically optimal path may differ from a sequence of myopic optimizations each chosen at a point in time. This potential for lock-in is at the heart of the debate about the merits of natural gas as a bridge fuel towards decarbonizing the power sector, in which renewable proponents argue that natural gas is cheaper only if one optimizes myopically and fails to recognize that the power sector will eventually need to be decarbonized. This intuition underlies Vogt-Schilb, Meunier, and Hallegatte (2018), who show that if abatement is achieved through investment in long-lived capital, it can be optimal to begin emissions abatement with expensive abatement investments that have large emissions reduction potential because they crowd-out dirtier long-lived investments. Irreversibility (state dependence) also underlies the results of Fischer and Newall (2008), Acemoglu, Aghion, Bursztyn, and Hemous (2012), and Acemoglu, Akcigit, Hanley, and Kerr (2016), who show that a carbon price combined with research subsidies for low-greenhouse-gas technologies may be desirable to attain dynamically efficient outcomes.

Of course, long-term considerations may not always lower the cost of emissions reductions. For example, nuclear power has long had major federal research subsidies but its cost has gone up, not down (Davis and Hausman 2016). Additionally, as the marginal ton of displaced electricity becomes cleaner (for example, displacing natural gas instead of coal), the cost per ton abated by low-carbon renewables will tend to increase. One major reason why dynamic considerations are often ignored is that they tend to be highly uncertain. But that uncertainty should be viewed as a research challenge rather than an excuse to ignore dynamic considerations. And there is some evidence from the recent literature.

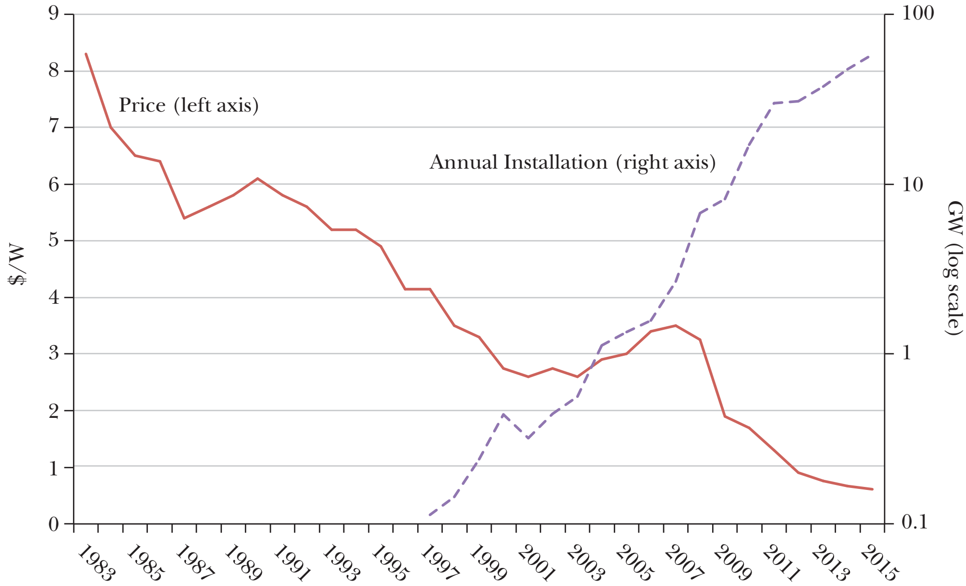
Dynamic Cost Case Study 1: Solar Panels

From 2010 to 2015, the price of solar photovoltaic panels fell by two-thirds, while annual global panel installations grew by 250 percent, as shown in Figure 2. The fact that panel sales increased when their price fell is hardly surprising, but more intriguing is that the steepest decline in panel prices after about 2007 post-dated the initial growth in panel sales, which began around 2002. The growth in sales in the mid-2000s was associated with policies that provided aggressive financial support for installing rooftop photovoltaic arrays through the German Energiewende, which provided a substantial feed-in tariff that allowed solar installations to be compensated at a very high rate for electricity fed into the grid, and the California Solar Initiative, which provided generous upfront subsidies for solar installations.[5] These early panel purchases were very expensive and account for some of the high photovoltaic cost estimates in Table 2. As stressed by a number of researchers (for example, Borenstein 2017), the static cost per ton of CO_2 reduced from policies to encourage solar installations tends to be high. Our literature review finds costs ranging from more than \$100 per ton of CO_2 to in the thousands per ton of CO_2. On the lower end, Hughes and Podolefsky (2015) estimate costs of the California Solar Initiative at between \$130 and \$196 per ton. On the high end, Abrell, Kosch, and Rausch (2017) find a static cost per ton of €500–1300 (roughly \$574–\$1,492 in 2017 dollars) for solar feed-in tariffs in Germany and Spain (a solar feed-in tariff is a long-term fixed price contract for purchasing electricity from a solar array).

However, both the timing shown in Figure 2 and recent research suggests that the early push in demand, stimulated by deep government subsidies, did in fact help to drive down the price of solar panels. One channel is that current subsidies may

[5] Many US states have generous net metering policies that act as implicit subsidies by compensating solar fed into the grid at the retail rate. Some states have Renewable Portfolio Standards that require utilities to procure certain amounts of renewable power (sometimes with a solar carve-out) by certain dates. At the federal level, since 2008, there has been a 30 percent investment tax credit for the installation of a residential solar system.

Figure 2
Solar Panel Price Indexes Excluding Subsidies and Cumulative Worldwide Installed Capacity, 1983–2015



Source: International Energy Agency (2017), Navigant Consulting (2009), and Gerarden (2018).

encourage firms to innovate to reduce their future costs. Gerarden (2018) estimates that this induced innovation effect, which does not include learning-by-doing, contributed to the decline in solar array prices and increased the long-run external social benefits from global government subsidies to solar adoption by at least 22 percent. His results further suggest an important spillover from any single country that subsidizes solar to the rest of the world due to the investment in innovation by international firms. In this sense, the German Energiewende subsidized lower-cost solar for the rest of the world.

Other channels for cost reduction in the production of solar panels include learning-by-doing and economies of scale. Nemet (2006) decomposes the reduction in cost into the manufacturing plant size, module efficiency, and cost of silicon, finding that between 1980 and 2001, economies of scale from larger manufacturing plant sizes accounted for 43 percent of the cost reduction. Most of the remaining cost reduction could be attributed to improvements in module efficiency due to research and development investment. The substantial cost declines in solar module prices over the past decade are often attributed to economies of scale (Carvalho, Dechezleprêtre, and Glachant 2017). Economies of scale and learning-by-doing can in many cases be appropriable by the firms making decisions to scale up (this appears to be the case for learning-by-doing among rooftop solar installers, as Bollinger and Gillingham 2018 explain), so that learning-by-doing and scale economies do not by themselves necessarily constitute reasons for policy intervention. Absent a carbon price, however, the demand for solar panels will be less than it would be were there a carbon price. As a result, second-best policies that are initially expensive (like the German Energiewende) can in principle stimulate production that would not normally happen because fossil fuels are cheaper than they would be, were their externality priced. For solar panels, at least, all this seems to have been the case.

Going forward, we might continue to see policy-induced cost reductions for solar technology. As the penetration of solar rises, and as the rest of the electricity system decarbonizes, such cost reductions will have to continue to be substantial to offset the higher potential costs of additional storage needed because of solar intermittency.

Dynamic Cost Case Study 2: Electric Vehicles

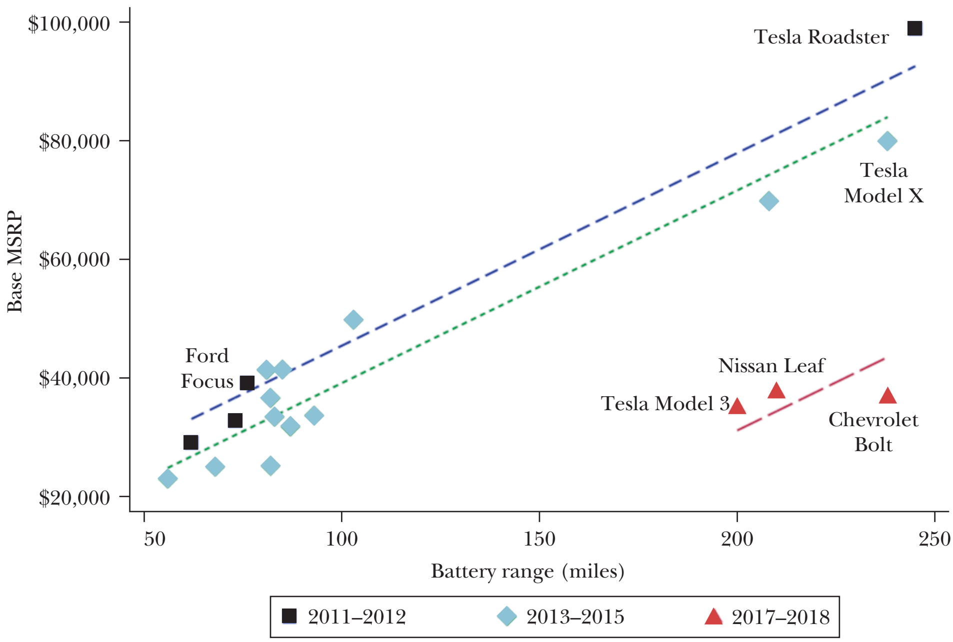
Like solar panels, the static costs of CO_2 reductions obtained by using electric vehicles is high in Table 2 (the last row). Today, many electric vehicles in the United States are charged using electricity that on the margin is produced by fossil fuels. Holland, Mansur, Muller, and Yates (2016) use the method of Graff Zivin, Kotchen, and Mansur (2014) for computing marginal emissions to examine the static optimal second-best purchase subsidy on electric vehicles accounting for both greenhouse gases and local air pollution. Holland, Mansur, Muller, and Yates (2016) find that the subsidy ranges from a subsidy of $2,785 in California (with relatively clean electricity on the margin) to a *penalty* of $4,964 in North Dakota, where electricity is generated from coal. Archsmith, Kendall, and Rapson (2015) perform similar calculations that additionally include life-cycle considerations, and find that on average electric vehicles currently only slightly reduce greenhouse gases relative to gasoline-powered vehicles.

From a dynamic perspective, however, the case against programs to support electric vehicle purchases is far less clear. The static calculations ignore the fact that the grid is evolving and becoming cleaner. Moreover, the general issues raised for solar panels—induced innovation, learning by doing, and economies of scale that would not otherwise be achieved because carbon is not priced—apply to electric vehicles as well. Unlike the case of solar panels, however, we are not aware of any research that investigates drivers of price dynamics for electric vehicles, perhaps because the cost declines and sales growth are so recent. The available data are, however, suggestive that the analogy to demand-pull effects for solar panels also applies to electric vehicles.

Figure 3 plots electric vehicles that entered the market from model years 2011 to 2018 based on their suggested retail price (y-axis) and battery range (x-axis). The price-range frontier has strikingly shifted out: more recent market entrants have greater battery range at lower cost, underscoring this rapid improvement in technology.

The large declines in price for vehicles with the same range is mainly due to the ongoing decline in battery prices. From 2009 to 2015, the price of batteries for electric vehicles fell by 75 percent (US Department of Energy 2016). Like solar

Figure 3
Electric Vehicle Manufacturers Suggested Retail Price (MSRP) Plotted against the Battery Range Shows Impressive Technology Improvements within a Short Time



Source: J. Li (2017) and authors' calculations.
Note: Dates indicate year the model is introduced. Regression lines are fit with a common slope and different intercept for each group of model years.

photovoltaic arrays, electric vehicles have been a target of demand-pull subsidy programs. Since the Energy Policy Act of 2005, there has been a US federal income tax credit of $7,500 (which phases out with production by any given manufacturer). Many states have additional incentives, such as a $3,000 rebate in Connecticut, eligibility for driving in a high-occupancy lane with only a single occupant in California, and a zero-emissions vehicle mandate in 10 states that requires automakers to sell a certain number of zero tailpipe emission vehicles (including electric vehicles) for every non-zero-emissions vehicle sold. Numerous papers in the transportation literature have provided evidence suggesting that electric vehicle subsidies increase demand for electric vehicles, as one would expect (reviewed in Zhou, Levin, and Plotkin 2016). The general pattern of demand-pull policies combined with subsequent sharp declines in costs is similar to that found for solar panels. We note that it is consistent with learning-by-doing and scale economy effects, and that confirming or refuting this hypothesis is an important area for future research by economists.

Electric vehicles also exhibit network effects, whereby the purchase of an additional electric vehicles makes the installation of a charging station more profitable. Thus, a positive feedback can exist, leading to multiple equilibria. For example, there may be one equilibrium with few charging stations and few or no electric vehicles, and another with many charging stations and electric vehicles. There is a growing literature on electric vehicles and network effects. Zhou and S. Li (2017) point out the possibility of multiple equilibria in electric vehicles and argue that a subsidy targeted at the marginal electric vehicle purchaser can be much more efficient than a policy that provides large inframarginal gains to those who would purchase an electric vehicle anyway. Yu, S. Li, and Tong (2016) discuss how network effects can lead the market solution to underinvest in electric vehicles compared to what is socially optimal. J. Li (2017) develops a structural model of two-sided market estimated with vehicle registration data from the United States and finds that mandating compatibility in charging stations would benefit consumers, enhance network effects, and increase the size of the electric vehicle market. Springel (2018) uses vehicle registration data from Norway—the country with the highest penetration of electric vehicles—to estimate a structural model showing that subsidies for charging stations are more effective for increasing electric vehicles uptake than are purchase subsidies for electric vehicles, but their effectiveness tapers off with increased subsidy.

The findings of these papers on network effects point to how a static perspective on policies to encourage technologies such as electric vehicles miss important aspects germane to the long-term cost-effectiveness of different policy approaches.

Static versus Dynamic Costs: Other Examples

Our two case studies present the sanguine view that seemingly expensive investments today result in lower costs in the future, a finding broadly akin to the theoretical work of Vogt-Schilb, Meunier, and Hallegatte (2018), Newbery (2018), Acemoglu et al. (2012), and Acemoglu et al. (2016). This happy result, however, is not preordained. For example, taking the dynamic approach may lead one to invest *less* in a carbon abatement technology if costs are expected to increase, rather than decrease, over time. Nuclear technology may fall into this category as construction costs of nuclear energy have risen, not fallen (Davis and Hausman 2016). Increasing costs of integrating renewable electricity into the electric grid can also work in this direction. In other cases, the static approach is perfectly appropriate. Consider policies to reduce methane leaks from the natural gas distribution system: the costs of sealing these leaks is likely to be similar in the near future as it is today because the process of sealing leaks is well understood but costly (digging up pavement and replacing pipes). Still other cases are less clear. Policies that would promote fuel switching to natural gas may reduce emissions in the short-run, but have potential to lead to investments in long-lived capital assets, and possibly even technological lock-in (Gillingham and Huang 2018).

Challenges

The costs of reducing carbon emissions discussed in this paper pose several challenges. One of these challenges is that some politically appealing programs, such as support for biodiesel or subsidies for energy efficiency programs, can be quite costly either for technological reasons or because of behavioral responses. Because the costs for these programs are often masked and only apparent upon scrutiny by economists, they appear low-cost—but are not.

A second challenge is the reverse, where highly visible programs are perceived as high-cost, but are not. A prominent example is the Clean Power Plan, which would have resulted in large emissions reductions for a cost far below that of many other programs already in place.

A third challenge is that the static costs provide at best an incomplete picture of the true costs of a particular action, which must include the dynamic consequences. The sign of those dynamic consequences in general depends on the intervention. If the intervention is replacing coal electricity generation by natural gas, low short-term costs might lead to higher longer-term costs if the result is long-lived natural gas infrastructure that is locked in and costly to abandon as the price of renewables drops. In contrast, if the intervention is providing subsidies for purchasing electric vehicles, the demand-pull effects of induced learning by doing and economies of scale can make dynamic costs much lower than a myopic static calculation would suggest. Because climate change is a long-term problem and the changes ultimately needed to reduce emissions are vast, the dynamic costs are far more important than the static ones.

A fourth challenge is to the economic research community, and it stems from the previous observation. As is clear from our review, most of the empirical studies of costs by economists focus on static costs, typically static costs of programs that have already been in place. This is natural because there is data on these programs, and understanding the costs of previous programs is a helpful guide to designing future programs. But particularly in the field of climate change research, more attention is needed on the determinants of dynamic costs. This exciting field of research merges environmental and energy economics with the extant literature on productivity, diffusion, and learning-by-doing. We have highlighted two areas—solar photovoltaics and electric vehicles—in which demand-pull policies appear to have induced cost reductions; however, that need not always happen and magnitudes surely vary from one case to the next.

Climate change is a long-term problem, and the focus of policy must be on long-term solutions. To make major progress on climate goals, like 80 percent decarbonization by 2050 in the United States, will require new technology deployed on a vast scale. Even if each technological step is evolutionary—cheaper electric vehicle batteries, connecting the grid to harness the wind potential in the Midwest, reducing the cost of offshore wind, developing and commercializing low-carbon fuels for air transport—the overall change will be revolutionary. If a price on carbon is not politically feasible—and arguably even if it is—these long-term considerations need to be incorporated into our short-term policy tradeoffs. From the perspective of the cost calculations in this paper, one clear implication is that choosing low-cost interventions without a future, including ones that lock in fossil fuel infrastructure, can result in too much emphasis being placed on what is cheapest to do today. We are always surprised by the specifics of technological progress, but as economists, we are not surprised that it is more likely to occur when the right incentives are in place.

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BIRMINGHAM
A WALKABLE CITY

MEMORANDUM

Planning Department

DATE: January 26, 2026

TO: Environmental Sustainability Committee

FROM: Nicholas Dupuis, Planning Director

SUBJECT: Residential Rain Garden Program

As discussed in the Birmingham Green: Healthy Climate Plan (the "Plan"), single-family residential land uses makeup half of the City's total land area, which presents a major opportunity in mitigating the effects of stormwater on the City's infrastructure. The Plan also presents a consistent theme that suggests that much of the work required to meet the City's sustainability and climate action goals will require the help of private property owners and residents.

To that end, the City developed an action item in the plan, WS-2, which states that the City should adopt a residential rain garden program to support rain garden installation in the City, particularly on single-family residential property. When considering this action item, it was discussed that the best case scenario for the success of a residential rain garden program would be to incentivize it. However, at a minimum, a standard DIY rain garden program would still be useful, especially if it is marketed well.

To that end, the City took advantage of the Catalyst Leadership Circle's Fellowship program in 2024 and was awarded fellow to design a Residential Rain Garden Rebate program for the City of Birmingham, which was completed in the fall of 2024 (around the same time that the Plan was adopted). The phasing of the action items in the plan envisioned WS-2 being completed in the first 1-2 years after adoption as not only an easy win, but potentially a high-impact project.

The final draft of the plan as delivered by the CLC Fellow is attached for initial review by the ESC. At this time, the Planning Department is working through three major considerations:

1. Program incentives
2. Rollout and messaging
3. Application procedures

BIRMINGHAM

RAIN GARDEN REBATE PROGRAM

Wirtten and Designed by Paige Hughart, 2024

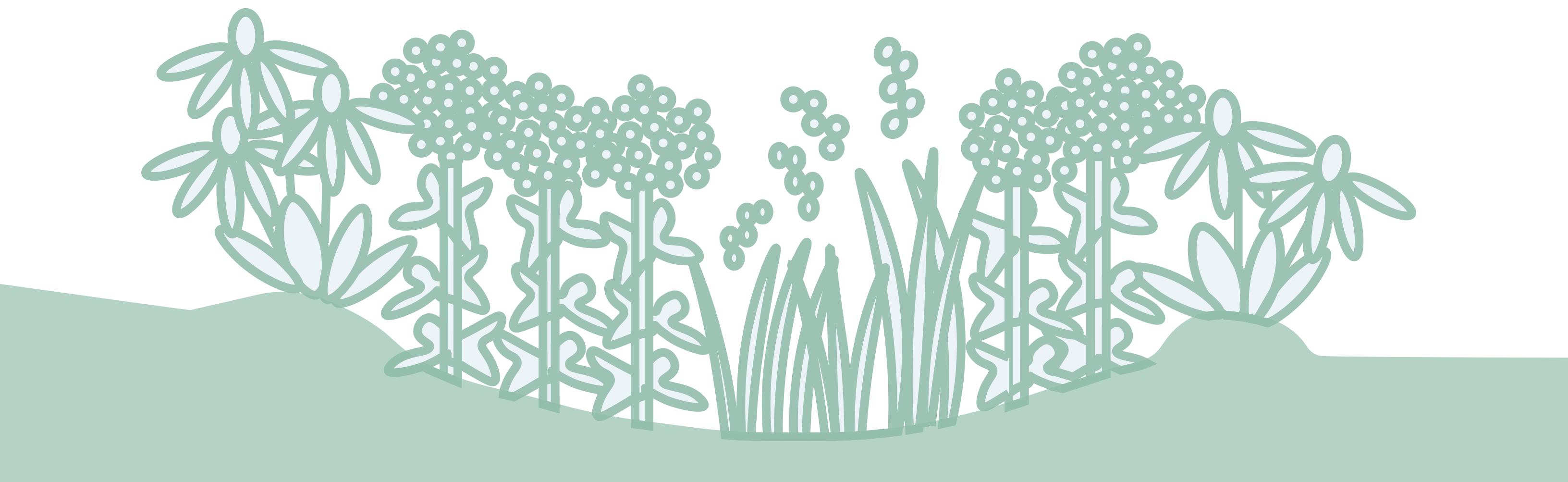
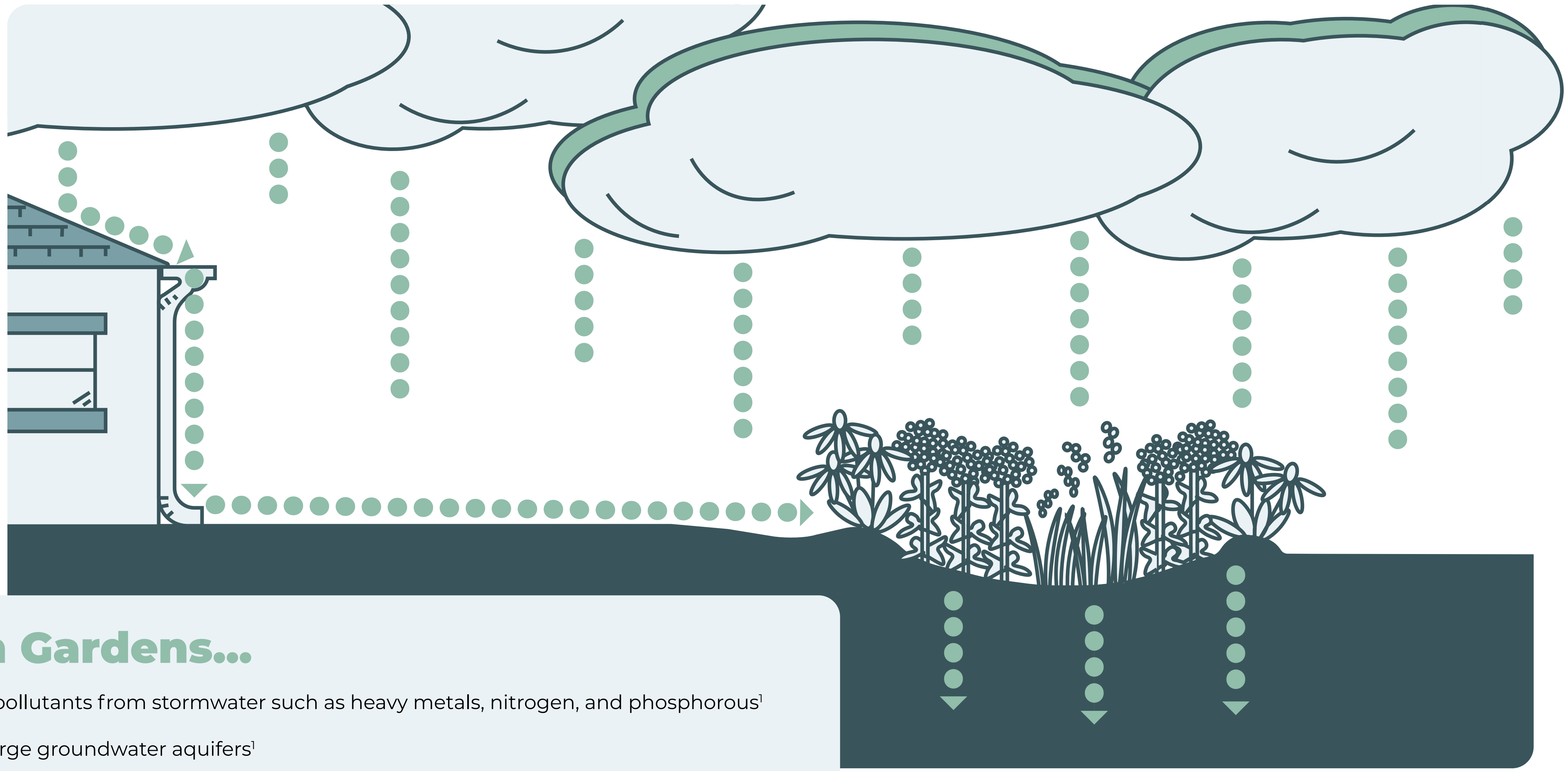


TABLE OF CONTENTS


Photo: Clinton River Watershed Council

ALL ABOUT RAIN GARDENS



Learn More!

[About Rain Gardens]()

[Testimonial]()

[Master Rain Gardener]()

Rain Gardens...

- Filter pollutants from stormwater such as heavy metals, nitrogen, and phosphorous[1]
- Recharge groundwater aquifers[1]
- Protect rivers, lakes, and streams, and everything living in them[1]
- Support pollinators such as bees and Monarch butterflies[2]
- Feed songbirds during all four seasons[3]
- Support biodiversity and strong ecosystems by restoring native plant populations[2]
- Reduce basement flooding by diverting stormwater away from your home
- Reduce water pooling in yards and sidewalks
- Provide a beautiful garden for you and neighbors to enjoy

Rain gardens are shallow depressions, refilled with appropriate soil, planted with native plants, and covered with mulch. They allow stormwater from ***impervious surfaces*** (buildings, pavements, etc.) to be filtered, and ***infiltrated*** into the groundwater rather than quickly running into basements, sewer systems, or waterways. Infiltration is the process of moving water down into the soil where it becomes part of the ***groundwater***.

The Birmingham Rain Garden Rebate Program is an integral part of the Birminham Healthy Climate Plan, while installing a rain garden to manage stormwater runoff on your property aligns with the MI Healthy Climate Plan and the Southeast Michigan Priority Climate Action Plan 2024! When you install a rain garden, you're hleping bring these plans to life!

Rain Garden Diagram: Paige Hughart; 1. https://wires.onlinelibrary.wiley.com/doi/10.1002/wat2.1507; 2. https://doi.org/10.3390/land12071289; 3. https://doi.org/10.1007/s11355-017-0331-0

EXAMPLES

Photo: Paige Hughart

Photo: Clinton River Watershed Council

Photo: Carolyn M Crane

Photo: Michael Baker

Photo: Meridian Township

Rain gardens have essential parts, but can look really different! You can add materials like stones or fences in the beginning or add them later.

Photo: Emily Ferstle

BIRMINGHAM RAIN GARDEN REBATE

STEP BY STEP

1. **Review Program Overview and Requirements**

   Page 4-5

2. **Submit the Rain Garden Rebate application**

   Found separately; The application will include a photo of utlility lines marked by Miss Dig, a site sketch, and a section sketch. The Rain Garden Manual will guide you through this process on pages 7-18.

3. **Receive feedback on your application**

   The City of Birmingham will provide feedback will be related to the functionality of your design.

4. **Install your rain garden**

   Page 19-20; Gardens should be installed in the spring or early fall for best sresults.

5. **Submit the Rebate Request Form**

   Available alongside the program application; Save your receipts!

6. **City officials will visit your rain garden**

   They will give feedback on installation and functionality.

7. **A rebate check will be mailed**

   In the meantime, watch your plants grow!

8. **Maintain your garden for at least 2 years**

   Pages 21-22; The Rain Garden Manual will support this process.

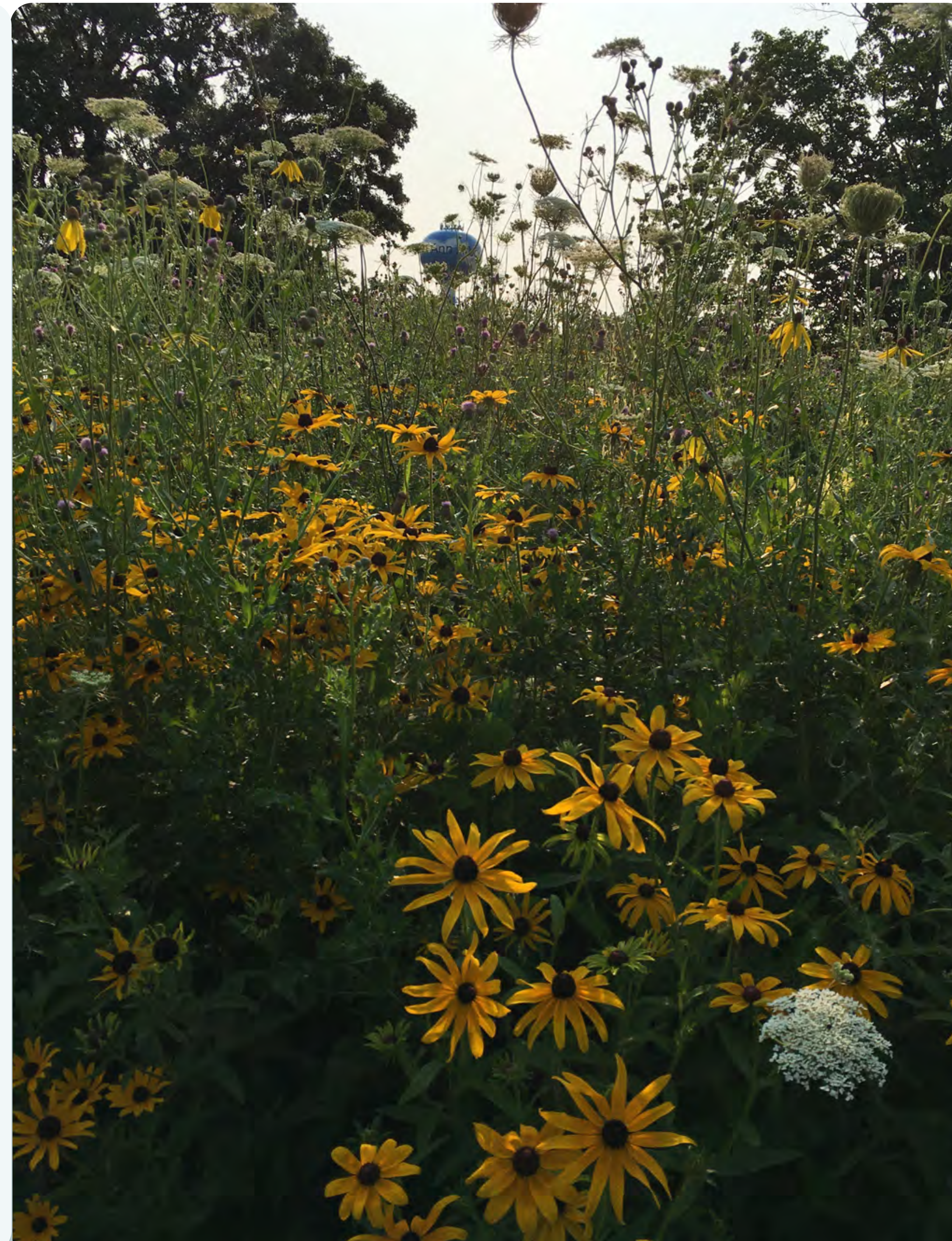


Photo: Fatimah Bolhassan

BIRMINGHAM RAIN GARDEN REBATE

The City of Birmingham's Rain Garden Rebate program reimburses residents who install Rain Gardens and provides other indirect support listed to the right! This program exists to supplement rain garden installations for Birmingham residents when funding is available.

Please check the city website or contact Community Development for application timelines and forms.
151 Martin St.
Birmingham MI, 48009
(248) 530-1850

Eligibility:

To be considered for the Birmingham Rain Garden Rebate Program, you must meet the following:

- The project address must be within the City of Birmingham.
- The property must be a single family residential site.
- The project must be maintained for a minimum of two years following installation.

Photo: Fatimah Bolhassan

The Birmingham Rain Garden Rebate Program provides:

Rebate: a one time rebate will be provided to approved applicants when funding is available. If no funding is available at that time, applicants will be notified and are eligible to reapply later.

Master Rain Gardener Certification Support: Part of the Birmingham Rain Garden Rebate can be used to cover your Master Rain Gardener certification. Participation in the Master Rain Gardener Certification Course is optional to receive the Birmingham Rain Garden Rebate. The course will walk you through the rain garden design and installation process in alignment with the program requirements and is a great supplement to your project.

Planning, Installation, and Maintenance review: Part of the application process is submitting plans to the City of Birmingham for review. City officials will provide feedback in the planning, installation, and maintenance process. City officials will not provide support through manual labor, but will provide site visits to your garden at different points throughout the rain garden's lifecycle to give feedback and guidance. Additionally, the Rain Garden Guidebook created as part of the program provides a step by step manual and lists of resources to support residents throughout the life of their rain gardens.

Rain garden registration: Your approved application and finished project registers you in the Rainscaping in Southeastern Michigan Map and with the City of Birmingham. This connects you to a wide network of rain gardeners throughout multiple counties and will prevent citations.

Stormwater Utility Credit fast track application and support: The existing Stormwater Utility Credit is offered by the City of Birmingham to promote multiple types of green stormwater infrastructure. Rain garden installation qualifies for the credit and the information provided during the Rain Garden Rebate application is used to fast track your Stormwater Credit application.

Photo: Fatimah Bolhassan

FREQUENTLY ASKED QUESTIONS

Do I need a permit?

No permits are required to install a rain garden on private property.

Is the Birmingham Rebate applicable to other stormwater infrastructure?

Only rain gardens are applicable for the Rain Garden Rebate Program. However, the City of Birmingham encourages the use of other green stormwater infrastructure through the Stormwater Utility Credit. If you're installing a rain garden, you are eligible for both the Rebate and the Stormwater Credit.

Do I need to pay for my materials?

This program provides a rebate following rain garden installation when funds are available. You should be prepared to cover the upfront costs for designing, installing, and maintaining a rain garden.

Can I hire someone to design and install my rain garden?

Yes! You're welcome to hire anyone you would like to design, install, and maintain your rain garden. Since rain gardens have to meet specific requirements to manage stormwater successfully and to be eligible for the Rain Garden Rebate Program, you still have to submit all application requirements along the same timeline. Hiring a professional does not increase the amount of funds you may be awarded.

How do I maintain a rain garden?

Maintaining your rain garden is extremely important for its ability to manage stormwater and mitigate flood damage. The Rain Garden Guidebook has a section dedicated to maintenance and city officials can visit your garden to give maintenance pointers. Participating in this program requires a commitment to maintaining your rain garden for at least 2 years following installation.

Will I get a ticket or citation for my rain garden?

Native plants used in rain gardens DO NOT fall under those referenced in the "Grass and Noxious Weeds" Ordinance upheld by the City. Keeping your garden free of cold-season grass and weeds just as any other garden bed will prevent citation.

Is there funding to help me install a rain garden on my property?

Rain gardens DO qualify for a Stormwater Utility Credit at any point, and a Rain Garden Rebate when funding is available. The overview and application for the Rebate program are provided in this guidebook. Applying for the Rain Garden Rebate Program fast tracks your application for the Stormwater Credit. If you're eligible to receive either of these funds, they are a reimbursement and you will be responsible for the upfront costs.

Can I get more than one rebate?

If both the RainSmart program serving Oakland County and the Birmingham program have funding, you can apply for rebates from both programs.

What happens if there is no funding available for the Rebate Program?

Applicants will be notified as soon as possible if there is no funding available. Funding is given out on a first-come, first-served basis. Once funding is secured, an announcement will be made, and you are welcome to reapply. If you decide to install a rain garden even if your application is denied because of lack of funding, you can still apply for the Stormwater Utility Credit.

Can I receive a rebate if I previously installed a rain garden?

Unfortunately we cannot offer rebates for existing rain gardens. If you have an existing rain garden, you can still apply for the Stormwater Utility Credit.

Can I install a rain garden in the easement?

If you want to install a rain garden in the easement, secure a permit from this site. Currently easement rain gardens do not qualify for a rebate.

If you have any questions please contact Community Development.

151 Martin St.
Birmingham MI, 48009
(248) 530-1850

Photo: Fatimah Bolhassan

DIY RAIN GARDEN GUIDEBOOK

1 GATHER PLANNING TOOLS

Planning Tools:

- ☐ Tape Measure
- ☐ Rain Garden Rebate Application to mark information as it's collected
- ☐ Paper + pencil for notes
- ☐ Folder to save receipts
- ☐ Graph paper (provided in application)
- ☐ Hand trowel
- ☐ Hose or bucket of water
- ☐ Timer
- ☐ Marking/Garden spray paint OR hose to mark garden bed

2 CALL MISS DIG

Call Miss Dig at 811 or submit an online request at missdig811.org before digging.

Miss Dig will send folks to mark the location of your gas, electric, and water utilities. This can take around a week. Be aware that Miss Dig may not always mark private cable, propane, electric, and similar lines, so some additional site work may be necessary to locate these.

3 SELECT LOCATION

Review Requirements and Considerations:

- Locate the rain garden at least 10 feet away and downhill from the foundations of any building and at least 2 feet from property lines.
- Do not place rain gardens over utility lines, septic systems, etc.
- Choose a flat or gently sloped place and ensure any overflow from the garden will go to a safe location away from any structures. If you have a hilly yard, place your rain garden near the bottom of the slope.
- Do not place a rain garden under existing trees to avoid large tree roots when digging so that trees are not damaged.
- The best location is where you have seen water pooling on your property downhill from any buildings.
- Not all sites are suitable for rain gardens! Rain gardens shouldn't be placed on steep slopes or where there is permanent standing water.

Photo: Fatimah Bolhassan

DETERMINE GARDEN SIZE

4

Drainage Area:

Measure the area of the ***impervious surfaces*** that will flow to the rain garden. Typically, this is the area of the roof drainage being collected by a gutter downspout, but may include driveways and sidewalks that are immediately uphill from your rain garden.

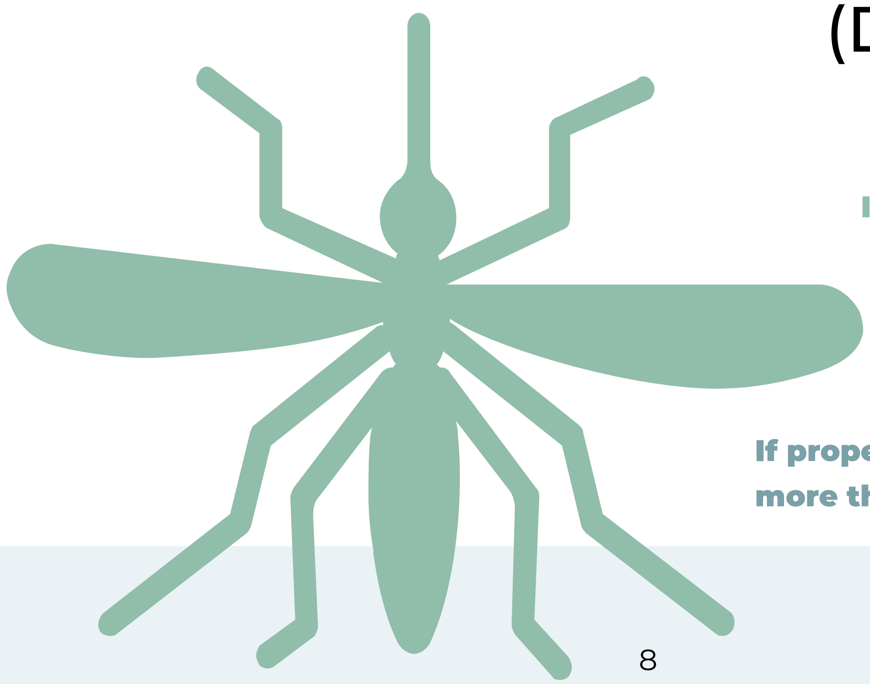
You can use the measure tool in Google Earth or start from the known square footage of your home.

Soil Type and Infiltration Rate:

Why is this important? Infiltration rate helps us understand your soil type and how quickly water might be able to be moved from the ground surface down into the soil. This helps determine the overall size and depth of your rain garden. Soil type is an important factor in infiltration. Clay soils tend to drain water more slowly while sandy soils drain more quickly.

Note that much of Birmingham soil has high levels of clay. This means we recommend shallow rain gardens with a large surface area to avoid long standing water and regular overflow. We recommend a depth of 3-5 inches. Read more about installing rain gardens in clay soils here! We will also recommend plants that do well in clay soils. If your infiltration test shows less clay in your soil, you can experiment with native plants not included in the provided list!

This video aligns with the instructions in this guidebook.



Infiltration Test:

1. Dig a hole that is about 6 inches in diameter and 18 inches deep.

2. Fill with water, wait until it is completely drained.
The hole should drain within 24 hours or this site may not be suitable for a rain garden without the complete removal of soil and/or a sub-drain installation. If this happens, you can choose another location. Feel free to call for assistance.

3. Fill the hole again with 12 inches of water.

4. Use Table 1 to determine your infiltration rate.

5. Determine the basic soil type.
Take the infiltration rate from Table 1 to determine the basic soil type. Use that to determine the sizing multiplier using Table 2.

Table 1

Drains Within	Infiltration Rate
6 hours	2.00 inches per hour
12 hours	1.00 inches per hour
18 hours	0.75 inches per hour
24 hours	0.50 inches per hour

5. Calculate Rain Garden Size.
Take the drainage area previously measured and multiply it by the sizing multiplier. This will be the approximate size of the garden.

Table 2

Infiltration Rate	Soil	Sizing Multiplier
>1.25 inches per hour	Sandy	0.19
0.75 - 1.00 inches per hour	Silty	0.34
<0.50 inches per hour	Clayey	0.43

(Drainage area in sq ft) x (sizing multiplier)
= **approximate rain garden size**

If your infiltration test results are less than 0.25 inches per hour, you may have to excavate your soil or choose another location.

If properly installed, rain gardens will not hold water for more than 24 hours so they are not a risk for mosquitos.

5 PLAN FOR EXCESS SOIL

Photo: Fatimah Bolhassan

When you dig your rain garden, you will have to move your excess soil to a different location. Make sure you have the tools to move soil and a place to store it long term.

Here are some recommendations:

- Use your clay soil to build a berm around your garden -

- Move it to another garden bed -

- Fill outdoor pots, planters, and raised beds -

- Fix grading issues throughout your yard -

- Offer some to neighbors -

6 DESIGN YOUR GARDEN

Site Plan:

A site plan is an aerial view of a given area with key details drawn out. Once you've determined a general location for your rain garden, you can draw it on your site plan. You'll submit this site plan as part of your Rain Garden Rebate Application and it helps you determine what your project will look like in context and make sure it meets all the spacing requirements.

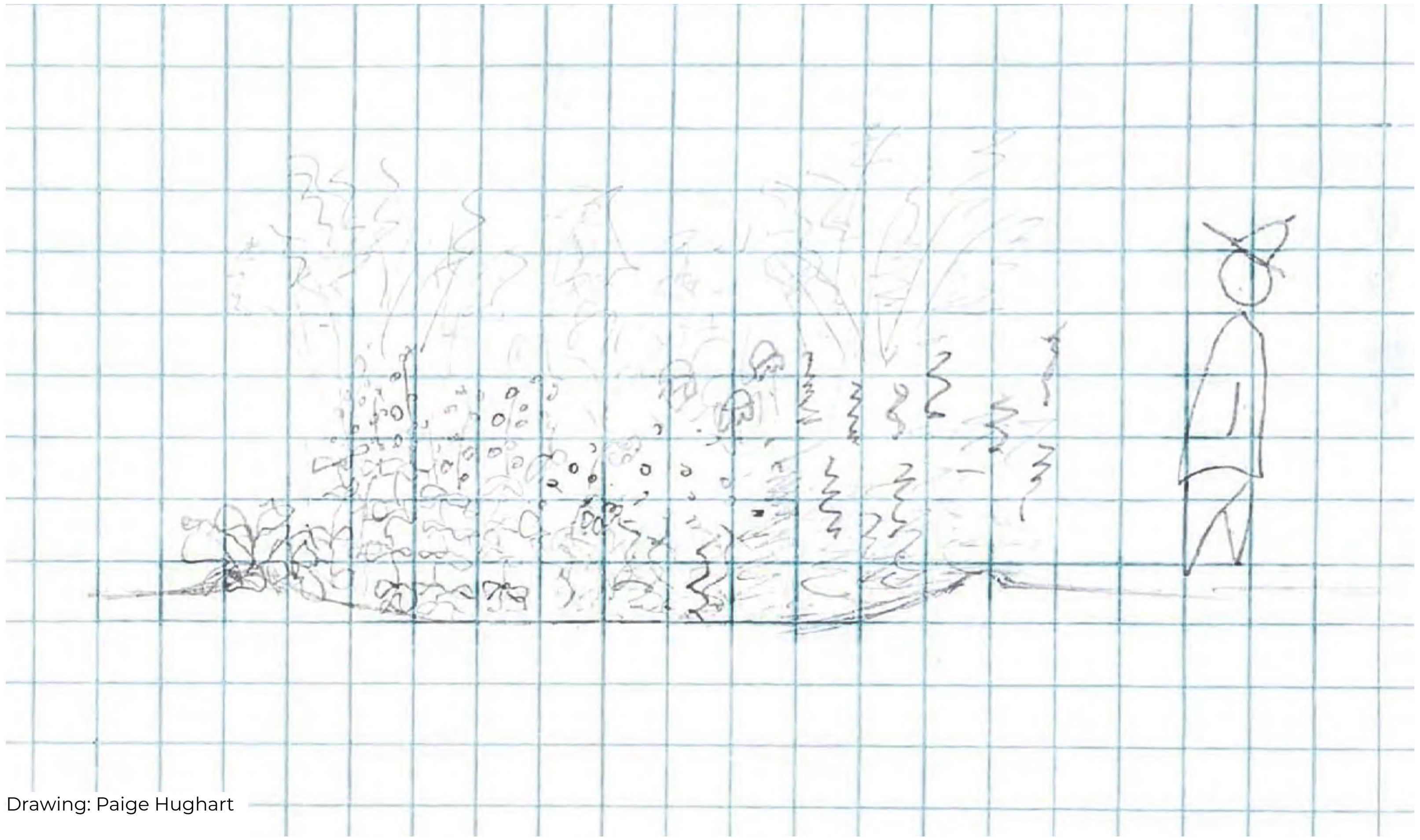
You don't have to cover your entire property in the site plan, but it should cover the immediate context to the rain garden, such as the portion of the roof and other impervious surfaces draining into the garden, adjacent porches, trees, and garden beds, etc.

- Mark the downspout and/or impervious surfaces you would like to drain into your rain garden.
- Measure the impervious surfaces that will flow into your garden and draw them to scale on the graph paper.
- Locate objects in the yard, such as trees, fences, existing garden beds, and draw them as close to scale as possible on the site plan.
- Lightly sketch the approximate size and location of your future rain garden. Rework until you have the shape you want. Remember to include the berm around your rain garden in the sketch. Your berm will likely be about 1-1.5 feet wide.
- Draw the inlets. Inlets move water from impervious surfaces to the rain garden. They can be an overland swale or an underground drain. This guidebook will take you through how to build both.
- Label the overflow outlet and location. Make sure overflow isn't going into any buildings and try to avoid overflow directly onto impervious surfaces like sidewalks and driveways.
- Optional: include personalized details like a rock or brick border outside the berm. Neat borders can help make a native plant rain garden match the rest of your yard. These can be drawn in now or added later.

Section:

A section is a view of your garden if you cut right down the middle. The main purpose of a section is to show height variation between objects.

Including a section helps ensure that your rain garden depth is correct and that berms are planned for. The section will also help you decide which plants should go where since height variation creates visual interest. Your section doesn't need to include context.



Drawing: Paige Hughart

Graph paper that you can print is included with the application.

Generally, use *each square = one square foot*

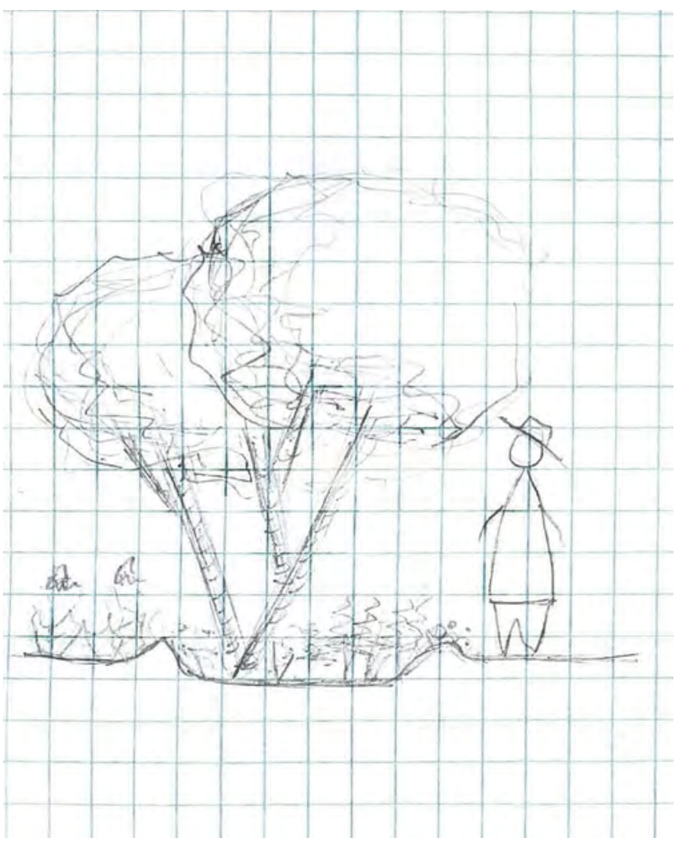
Optional:
Draw your garden design onto your lawn using marking spray paint. To do this, determine the exact distance between the planned garden and existing points, spray those known points and then connect them into approximately the desired shape. Remember to include the berm!

- Rework until the shape feels right.
- Let the grass grow a little taller in that area to get a sense of what your rain garden will look like.
- You will have to mark the garden shape before digging anyway, but this can help make sure you'll be satisfied with the final product.

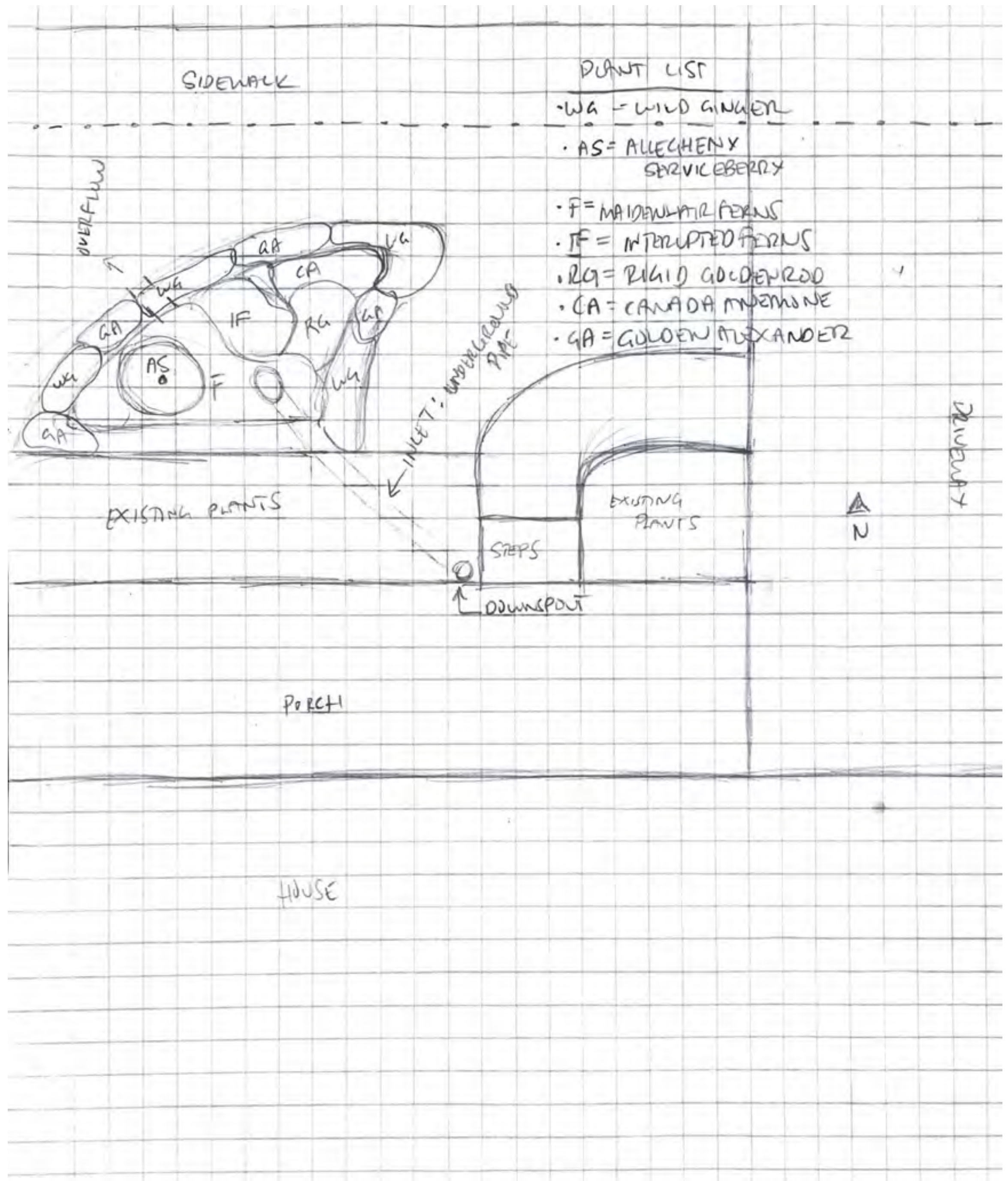
Check your work!
Count the number of squares your drawn rain garden includes and make sure it equals close to the calculated rain garden size in square feet.

EXAMPLE DESIGNS

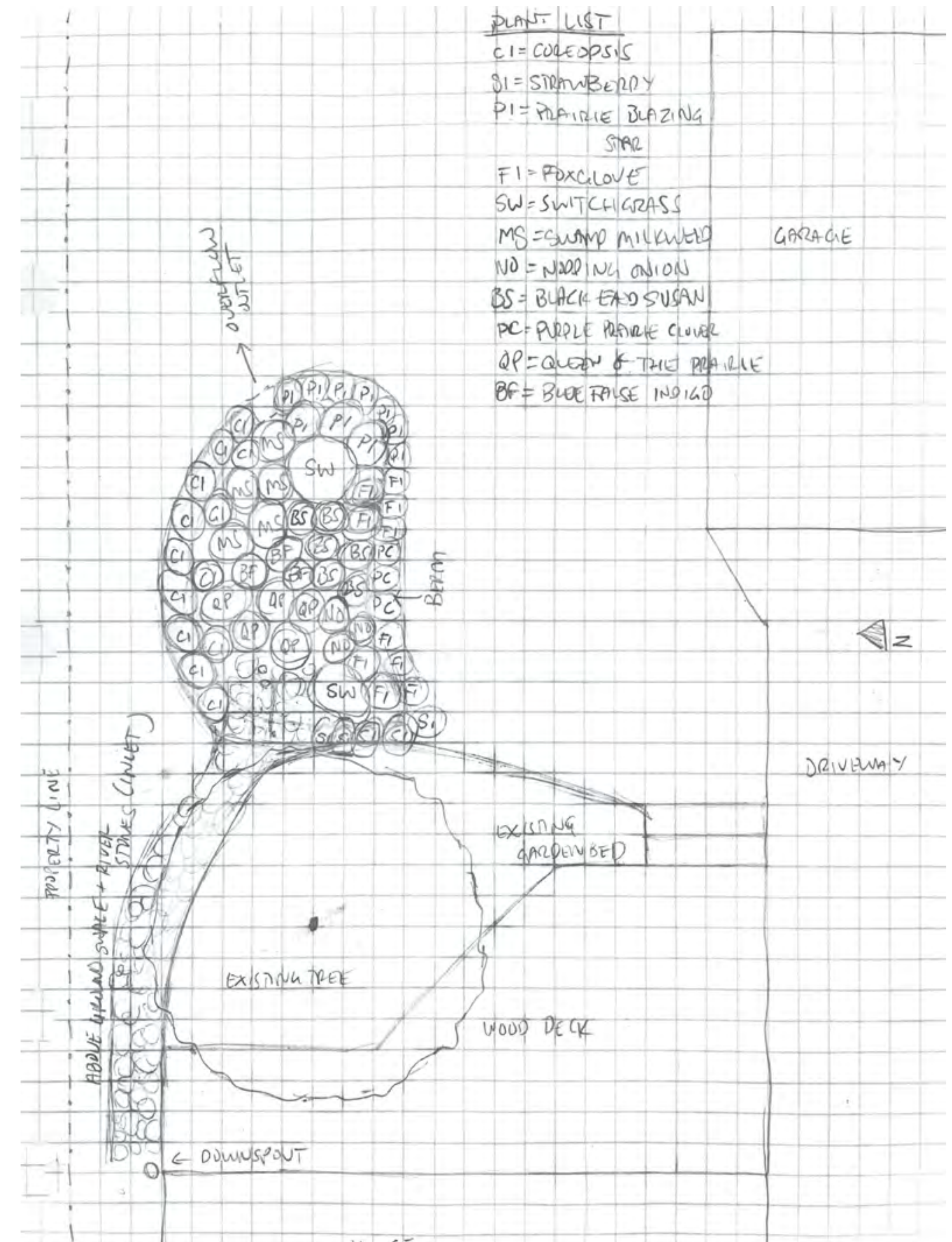
You can find more example designs in the resources shared by Friends of the Rouge!



Drawing: Paige Hughart



Drawing: Paige Hughart



Drawing: Paige Hughart

7 DETERMINE PLANTS

Native plants are used in rain gardens because they are well suited to both standing water and extremely dry conditions. Their roots are long enough to infiltrate water deeply into the soil and filter out pollutants before they end up in our waterways. Only transplants or potted plants can be used in rain gardens. Seeds will likely be washed away. If you have any of the listed plant species in your yard, you can transplant them to the rain garden!

Make sure you're not planting invasive species.

How many plants do I choose?

Use the garden size you calculated on page 8 and the equation below to determine the number of plants you need for your rain garden. This equation is based on planting 18 inches apart from the center of each plant.

(Garden size in sq ft) / 2.25 = **# of plants**

What kinds of plants do I choose?

The most important things to consider when choosing plants are the type of soil, sun requirements, and water requirements. Water loving plants should be planted at the center of the rain garden where water is likely to stand the longest. Dry loving plants should be planted near the edges of the rain garden and on berm slopes when needed.

It's nice to consider things like bloom time and color so there is something beautiful to look at in your garden all season long and so that you're providing food for pollinators as often as possible! Height is a helpful consideration for aesthetics and logistics. Latin names are included so you can verify that the plant you're purchasing is definitely the one listed.

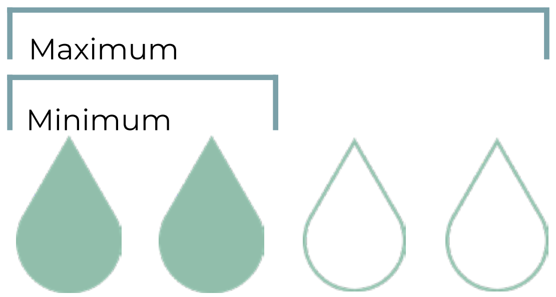
It's more visually appealing to plant herbaceous plants in groups of 3 or 5. On the other hand, if you want a truly natural, meadow feel to your garden, you can plan "on a matrix-" meaning you plant all your plants randomly and do not intentionally group the same species together.

Check out the nursery recommendation list from Friends of the Rouge!

Plant List Symbols

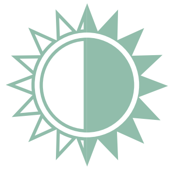
These symbols are used in the plant list on the following pages. They will help you determine which plants will thrive in each section of your rain garden.

Moisture Requirements

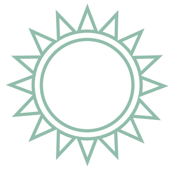


Sun Requirements

Full Sun: 6+ hours per day

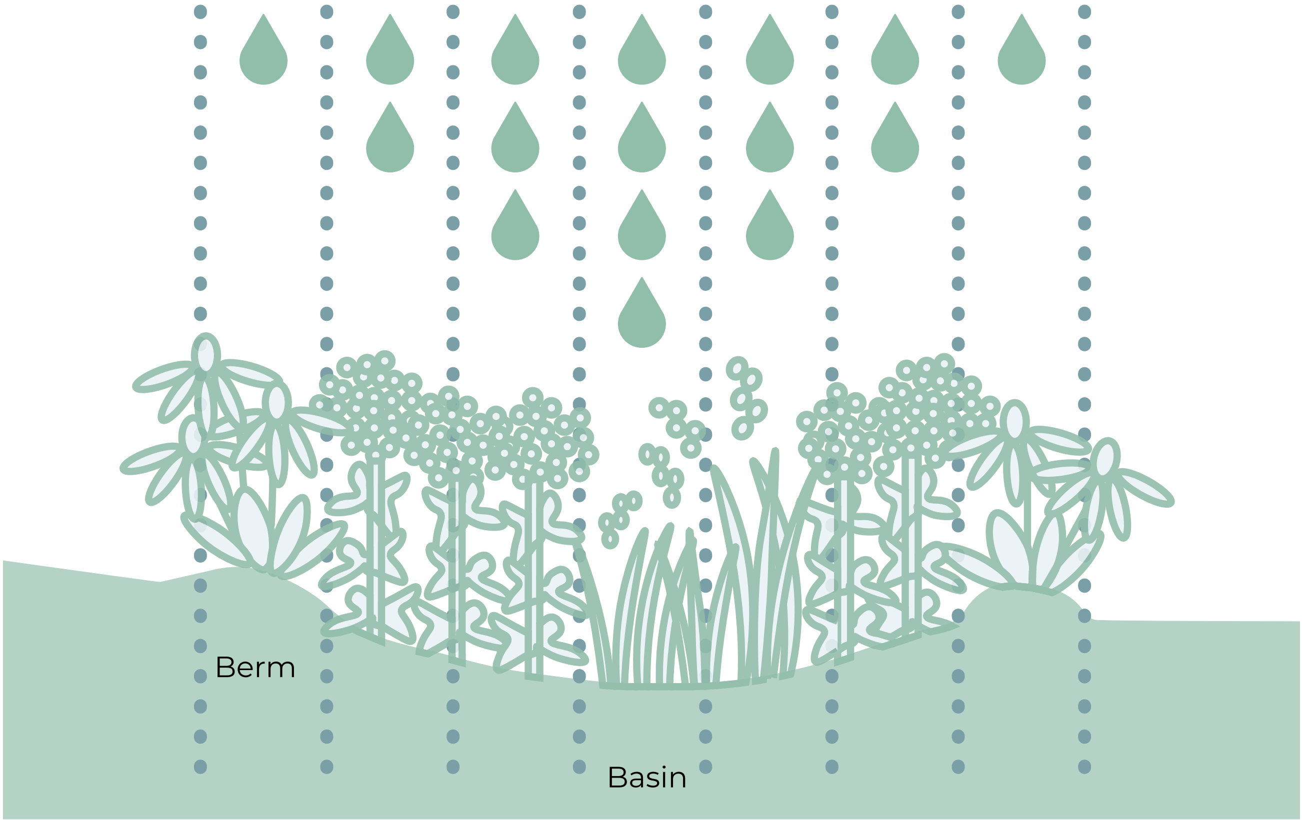


Partial: 3-6 hours per day



Shade: Less than 3 hours per day

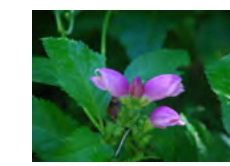
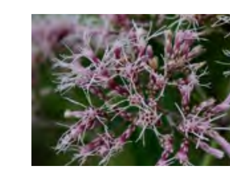
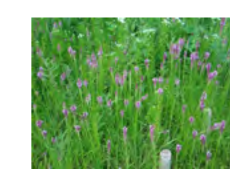
Rain Garden Moisture Map



Ran Garden Diagram: Paige Hughart

PLANT LIST

All the plants in the this list thrive in clay soil - which is the most common type in Brimingham. Your infiltration test will help you determine your soil type. If you have soil that isn't mostly clay, you're welcome to choose plants from other lists like the ones provided here by Friends of the Rouge. Searching plants by their latin name will ensure you're getting accurate photos!

Plant Name	Latin Name	Light	Moisture	Flower Color	Bloom Time	Height	Photo
Canada Anemone	Anemone canadensis	☀ ◐ ○	● ● ○	White	May-July	1'-1.5'	
Swamp Milkweed	Asclepias incarnata	☀ ◐	● ● ○ ○	Pink/Purple	July	3'-4'	
Baptisia OR False Indigo	Baptisia australis	☀	● ○ ○	Blue	June	3'-4'	 Photo: Mt. Cuba Center
Hot Lips Turtlehead	Chelone lyonii 'Hot Lips'	☀ ◐	● ○ ○	Pink	Aug-Sept	2'-3'	
Purple Coneflower	Echinacea purpurea	☀ ◐	● ○ ○	Pink/Lavender	July-Aug	3'-3.5'	
Joe-Pye Weed	Eupatorium purpureum	☀	● ●	Pink	July-Sept	3'-5'	
Queen of the Prairie	Filipendula rubra	☀ ◐	● ● ● ○	Pink	June-July	4'-5'	
Prairie Blazing Star	Liatris pycnostachya	☀	● ○	Purple	July-Oct	2'-3'	
Marsh Blazing Star	Liatris spicata	☀ ◐	● ● ○	Pink	June-July	4'-5'	

Photos: Michigan Flora by species, unless otherwise marked

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Plant Name	Latin Name	Light	Moisture	Flower Color	Bloom Time	Height	Photo
Wild Bergamot	Monarda fistulosa			Lavender	July-Sept	2'-5'	
Interrupted Fern	Osmunda claytoniana			n/a	n/a	1'-2'	
Foxglove Beard-tongue	Penstemon digitalis			White	June	3'-4'	
Compass Plant	Silphium laciniatum			Yellow	July-Aug	4'-7'	
Prairie Dock	Silphium terebinthinaceum			Yellow	Aug	8'	
Ohio Goldenrod	Solidago ohioensis			Yellow	Aug-Sept	3'-4'	
Riddell's Goldenrod	Solidago riddellii			Yellow	Aug-Oct	2'-4'	
Rigid Goldenrod	Solidago rigida			Yellow	Jul	3'-4'	
Yellow Coneflower	Ratibida pinnata			Yellow	July-Sept	4'-5'	

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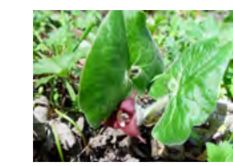
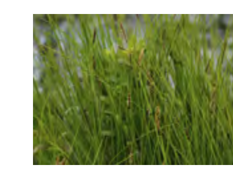
Plant Name	Latin Name	Light	Moisture	Flower Color	Bloom Time	Height	Photo
Rosin Weed	Silphium integrifolium	☀	● ○ ○	Yellow	July-Sept	3'-5'	
Cup Plant	Silphium perfoliatum	☀ ◐	● ● ○ ○	Yellow	July-Sept	5'-10'	
Smooth Aster	Symphyotrichum laeve	☀	● ○	Lavender, Blue	Aug-Oct	2'-4'	
New England Aster	Symphyotrichum no-vae-angliae	☀ ◐	● ● ○	Purple	Aug-Oct	3'-6'	
Ironweed	Vernonia missurica	☀	● ○ ○	Purple	July-Oct	4'-5'	
Golden Alexander	Zizia aurea	☀ ◐ ○	● ● ○ ○	Yellow	May-June	1'-3'	
Big Bluestem	Andropogon gerardii	☀	● ○ ○	Green, Red	Aug-Oct	5'-8'	 Photo: UMass Amherst Extension
Canada Wild Rye	Elymus canadensis	☀	● ○	Cream	Jul-Aug	4'-5'	
Switch Grass	Panicum virgatum	☀	● ○ ○	Green, Cream	Aug-Sept	3'-6'	

Photos: Michigan Flora by species, unless otherwise marked

PLANT LIST

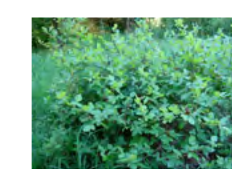
All the plants in the this list thrive in clay soil - which is the most common type in Brimingham. Your infiltration test will help you determine your soil type. If you have soil that isn't mostly clay, you're welcome to choose plants from other lists like the ones provided here by Friends of the Rouge. Searching plants by their latin name will ensure you're getting accurate photos!

Plant Name	Latin Name	Light	Moisture	Flower Color	Bloom Time	Height	Photo
Maidenhair Fern	Adiantum pedatum	○	● ● ○	n/a	n/a	1'-2'	
Nodding Pink Onion	Allium cernuum	☀	● ● ○	White, Pink	July-Aug	1'-2'	
Common Bluestar	Amsonia tabernaemontana	☀ ◐	● ● ○	Blue	May-June	2'-3'	 Photo: North Carolina Extension Gardener
Wild Ginger	Asarum canadense	◐ ○	● ○	Burgundy	May-June	<1'	
Purple Prairie Clover	Dalea purpurea	☀	● ○	Purple	July-Aug	1'-2'	
*Sedges	*Most species of Carex genus	◐ ○	● ● ● ○	n/a	n/a	Varies	
Bee Balm	Monarda didyma	☀	● ● ○ ○	Red	June-Aug	2'-5'	
Indian Grass	Sorghastrum nutans	☀	● ○ ○	Green, Gold	Aug-Sept	5'-7'	
Black-eyed Susan	Rudbeckia hirta	☀ ◐	● ○ ○	Yellow	June-Sept	1'-3'	

Photos: Michigan Flora by species , unless otherwise marked

TREES & SHRUBS LIST

If you're planting large shrubs or trees, choose other plants based on the current light conditions and plan to make changes to your rain garden as the shrubs and trees grow larger, crowding and shading other plants.

Plant Name	Latin Name	Light	Moisture	Flower Color	Bloom Time	Height	Photo
River Birch	Betula nigra	☀ ◐	●●○○	n/a	n/a	70'	
Northern White Cedar	Thuja occidentalis	☀ ◐	●○○	n/a	n/a	30'-50'	
Allegheny Serviceberry	Amelanchier laevis	☀ ◐	●●○	White	April-May	6'-15'	
American Hazelnut	Corylus americana	☀ ◐	●○○	Red	April-May	3'-6'	
Ninebark	Physocarpus opulifolius	☀ ◐	●○○	White	May-June	5'-8'	
Black Chokeberry	Aronia melanocarpa	☀ ◐	●○○	White	May-June	4'-6'	
Red Osier Dogwood	Cornus sericea	☀ ◐	●●○○	White	May-June	6'-9'	
Low Gro Fragrant Sumac	Rhus aromatica 'Gro Low'	☀ ◐	●○	Red Berries	n/a	2'-3'	

Photos: Michigan Flora by species, unless otherwise marked

8 SOURCE MATERIALS

Compost & Mulch

Use the formulas below to calculate the amount of compost and mulch you will need to lay it 2 inches deep in the garden.

Adding compost to rain gardens increases the amount of pollutants the garden can filter from stormwater.

Plan to store mulch and compost between when it arrives and when it is added to the rain garden!

In your driveway or on a tarp in your yard. Just consider how far you will be moving it with a wheelbarrow.

(Garden area in sq ft) x .00617 =
Compost in Cubic Yards

(Garden area in sq ft) x .00617 =
Mulch in Cubic Yards

Inlet Materials

Measure and note the distance from the downspout or other impervious surface that will supply water to the rain garden. This will tell you how much material is needed for the inlet.

Photo: Fatimah Bolhassan

Tools & Materials:

- ☐ Tape Measure
- ☐ Shovels
- ☐ Rakes
- ☐ Trowels
- ☐ Level
- ☐ Wheelbarrow
- ☐ Marking/Garden spray chalk
- ☐ Compost: fully finished/broken down
- ☐ Mulch: double or triple shredded and aged minimum 6 months

For Dry Swale Installation:

- ☐ Optional: stones
- ☐ Optional: native plants
- ☐ Optional: downspout extender

For Pipe Installation:

- ☐ Black non-perforated pipe or PVC
- ☐ Grate or Pop Up Emitter to fit chosen pipe
- ☐ Two small screws
- ☐ Electric Drill
- ☐ Rocks for end of pipe
- ☐ Optional: Sawzall with metal appropriate blade

STEP BY STEP INSTALLATION

1. Transfer site plan to the ground

Make the general shape and size of your rain garden using either spray chalk or a garden hose. Start by measuring known distances from set points included in your site plan such as the corner of a porch, a fence, or the trunk of a tree.

This video can help with the hose method!


Photo: Paige Hughart

2. Remove grass

Remove grass from your garden site + 12-18" to make space for the berm and prevent grass growth into the rain garden. You can remove grass using a shovel, sod cutter, or by laying cardboard over the defined area for about two weeks.

Remember to have a plan for where to take the sod and soil removed during the rain garden installation! Load a wheelbarrow while you're digging and move it periodically.


Photo: Paige Hughart

3. Dig!

Dig 3-5 inches PLUS 2 inches to be back filled with compost. Build the berm about two inches tall as you're digging out the garden basin using mostly clay soil that comes from your basin. Make sure the bottom is level and the slope up the berm is gradual. The berm is most important at the downhill side of your rain garden. Add a notch in the downhill side berm to lead water to your overflow location.

Do not dig while soil is wet!


Photo: Paige Hughart

4. Build your inlet

You can choose a buried pipe or an overland swale to move water into your rain garden.

Underground pipe:
The pipe should run downhill to the rain garden and the inlet should be above the elevation of the emergency overflow notch. Use a non-perforated pipe made of either black plastic or PVC. The end of the pipe can end with a grate or a pop-up emitter.

1. Dig trench from directly underneath downspout into the rain garden. Using a level, make sure the trench is downsloping the entire way.
2. Lay the pipe in the trench and double check that it is still continuously sloping toward the rain garden.
3. Cut downspout about 12" from ground and attach pipe to downspout using small screws.
4. Add either a grate or pop-up emitter at the end of the pipe in the garden and surround it with stones to decrease soil erosion when water comes out of the pipe.
5. Make sure to rebuild and level any part of the rain garden changed by installing the inlet.


Photo: Paige Hughart

Overland Swale:
If your garden is downhill from your downspout, rain water will flow over land and will often infiltrate into the ground while moving through the channel. Your swale can be made of stones, native plants, or simply be a lowered grassy pathway. If you're using this method, make sure your downspout is extended at least four feet from the building before entering the overland swale in order to avoid water damage to your foundation.

1. Dig very shallow overland swale from end of downspout to the rain garden. Make sure the swale is down sloped toward the garden the entire length using a level.
2. Fill with stones or plant with native plants, or let grass grow.


Photo: Clinton River Watershed Council

5. Add compost

Lay two inches of compost along the basin and make sure it is still level.

Adding compost to your rain garden increases the amount of pollutants your rain garden can filter from stormwater. This keeps those pollutants out of waterways!


Photo: Paige Hughart

6. Add plants

Place plants where you want them. Bury them about level with the top of the compost. Burying them too deep or shallow could cause them to die. Plants can be added after mulch if needed!


Photo: Clinton River Watershed Council

7. Add mulch

Lay two inches of mulch almost touching the plants. Do not pile mulch too close to the base of the plant or it may cause disease.


Photo: Clinton River Watershed Council

Expect better infiltration once plants are more established. Their roots will push through clay particles over time!

8. Restore the disturbed area

Level out all disturbed areas and lay grass, clover seed, or a garden bed as desired.


Photo: Paige Hughart

9. Monitor your rain garden!

Check on your rain garden during and between the next couple of storms! Is water flowing into the garden? Are the plants doing well? Has mulch moved? If you have any questions, you can contact the Birmingham Rain Garden Rebate Program for support!

Community Development: (248) 530-1850


Photo: Clinton River Watershed Council

If you lose young plants to standing water, open up the berm and allow plants to establish. Once they are larger, close the berm and allow the rain garden to function as planned.

RAIN GARDEN MAINTENANCE

- Check inlets for debris and make sure the water is flowing smoothly into your rain garden. Remove accumulated sediment at the inlet annually.
- Water your newly planted rain garden during periods of drought until plants are established. This is more of a concern for rain gardens built in the spring. Your rain garden will require less watering than other garden beds, so water just enough to keep them from perishing in the first growing season. Your garden won't need to be watered after the first year.
- If you have trees or shrubs in your rain garden, these will need to be watered more regularly during the first season. Follow the planting instructions from the nursery to make sure these establish themselves.

DO NOT USE PESTICIDES, HERBICIDES, OR FERTILIZERS IN YOUR RAIN GARDEN.

Part of rain garden's purpose is to filter pollutants from the water. Using chemical management negates this. Do not apply fertilizers to your lawn too close to your rain garden and especially not in your above-ground swale leading to the rain garden if that is your inlet style.

- Maintain the rain garden border by clipping and weeding. Lining the berm with natural stone or bricks is helpful.
- After the first year, you should cover bare spaces in your rain garden with additional native plants. If plantings become too dense, you can split plants and move them to other locations or swap them with friends.
- If your rain garden holds water for more than 48 hours after it is planted, you may need to replace the soil or choose another location.
- Remove dead plant material in the spring following the first three consecutive days of 50 degree + weather. Leave dead plant materials standing during the fall and winter for visual interest, birds, and insects. Remember that rain garden plants provide food and shelter for birds all year long!
- Remove weeds by hand regularly.

Photo: Fatimah Bolhassan

WHAT TO EXPECT

Weeding

Weeding your rain garden is extremely important in the first and second growing season. There are two methods we recommend. You can stick to one or use both when it works best!

String stage weeding

This is where you identify a plant as young as possible, often in the cotyledon phase (when the seed has germinated and only one or two leaves have grown), then remove the entire plant. This method ultimately saves time because plants are easily removed at this stage and do not crowd your native plants. It is important to be able to recognize weed cotyledons over native plant cotyledons. Which is a skill that can take time to build.

Chop and Drop weeding

This is where you identify a large weed and chop the top off, leaving the roots in the ground. This weakens the plant without removing the organic material from the soil. The organic matter continues to build the soil health, while the unwanted plant is weakened and your native plants can eventually smother it. Leaving the roots and soil undisturbed builds healthier soil over time without potentially activating the seedbank and causing more weeds to germinate. Note - we do not recommend this for creeping grasses or invasive species. Those should be pulled as soon as possible.

Photo: Meridian Township

Use this common weed list as a guide!

Photo: Paige Hughart

Year 1

Photo: Paige Hughart

Year 2

Photo: Paige Hughart

Year 3

Rain gardens, like any native plant garden, look different from year 1 to year 3. There is variation depending on the age and type of plants you choose, but these photos give a general idea of what to expect your rain garden to look like from year to year. By year three, your plants will likely be well established.

ACKNOWLEDGEMENTS

Made Possible By...

This guidebook was written and designed by Paige Hughart in July of 2024 as part of the Catalyst Leadership Circle Fellowship through the Graham Sustainability Institute at the University of MIchigan. Nicholas Dupuis and Leah Blizinski with the City of Birmingham served as program mentors, and Ruth Kline-Robach from Michigan State University served as the technical advisor.

This material is based upon work supported by the Department of Energy and the Michigan Energy Office (MEO) under Award Number EE00007478 as part of the Catalyst Communities program. Find this document and more about the CLC Fellowship that supported this project at graham.umich.edu/clcf

Following the lead of...

The followoing rain garden programs have established leading practices in Southeastern Michigan residential rain garden installation and rebate programs. Much of this content pulls from their expertise.

Rain Catchers Collective

Clinton River Watershed Council

Friends of the Rouge

Huron River Watershed Council

RainSmart Rebates (coordinated by Oakland County in partnership with the Clinton River Watershed Council)

Rain Gardens to the Rescue (coordinated by Friends of the Rouge and Sierra Club of Michigan)

Ann Arbor Rain Garden Program

Master Rain Gardener Program (coordinated by Washtenaw County Water Resources)

Dearbon Rain Garden 50/50 Cost Share Program for Sustainable Lawns

Royal Oak Rain Garden Program

BIRMINGHAM

Birmingham Rain Garden Rebate
Application for New Rain Garden Installation

Applications can be submitted by mail or in person at the Office of Community Development: 151 Martin St. Birmingham, MI 48009. If you are building a new rain garden, please complete this 2-page form to be considered for the Rain Garden Rebate. Please note that if funds are not available, applicants will be notified and can reapply when funding becomes available. Following consideration, the City of Birmingham will provide a note about funding availability and:

1. Project approval, OR 2. Approval pending modifications, OR 3. Project denial with explanation.

Personal Information

First + Last Name:		Phone:	
Mailing Address:		Email:	
Project Address if different:			
Are you the property owner? ☐ Yes ☐ No		Preferred Communication:	☐ Phone ☐ Email ☐ Mail

Rain Garden Information

Please provide all requested information. Describe your idea to the best of your ability. You may submit drawings that you have designed yourself or you may hire a professional. Preliminary application drawings will NOT be reimbursed by this program. ***Please reference the Rain Garden Guidebook to guide your design and application processs.***

Garden Designer:		Rain Garden Area: (sq ft)	
Garden Installer:		Drainage Area: (sq ft)	
Pre-Project Landcover: (lawn, concrete, etc.)		Infiltration Test Results:	
Describe Rain Garden location:			
Is this a resubmission? ☐ Yes ☐ No		Please Check that you have included items below:	

☐ **Photo of utility lines marked by Miss-Dig (811)**: Reference page 7 of the Rain Garden Manual.

☐ **Rain garden cross section:** side view of garden ponding depth and berm height. Reference pages 10-11 of the Rain Garden Manual.

☐ **Site Sketch:** The sketch should be a view from above indicating where on the property the rain garden will be installed and property context. Please include a north arrow, outline of buildings, driveways, sidewalks, streets + names (if applicable), fences, existing trees, garage/ shed, existing landscaping, etc. Feel free to attach Google Maps aerial image as a base map. Reference pages 10-11 of the Rain Garden Manual.

For Internal Use Only

Reviewed By:		Date:	
Approved:	☐ Yes ☐ No	Explanation:	

Plant List

List the plants you plan to use in your rain garden. Why are you being asked to include this? It's extremely important that rain gardens are populated with native plants because they are best suited to rain garden conditions and have deep enough roots to infiltrate water from the ground surface down into the water table. There is a plant list in the DIY Rain Garden Guidebook on pages 13-17.

Plant Name	Number	Height	Source

Compost and Mulch

List the quantity and source of your mulch and compost. ***Please reference the Rain Garden Guidebook on page 18 to help determine needed quantities.***

Material	Quantity	Source

Statement of Understanding

I have completed this form accurately and to the best of my ability. To obtain the Rain Garden Rebate, I must submit photos of the completed rain garden, including a photo of the mechanism for moving water into the rain garden, and a written explanation of any deviations from the approved plan. Upon receiving the Rain Garden Rebate, I agree to maintain the project for at least 2 years.

Signature: ______________________ Date: ______________

Check List:

- Propoerty Lines
- Impervious Surfaces + Structures
- Rain Garden Inlet
- Rain Garden Overflow
- Rain Garden Berm
- Plant Labels

BIRMINGHAM

Birmingham Rain Garden Rebate
Rebate Request Form

Rebate Request Forms can be submitted by mail or in person at the Office of Community Development: 151 Martin St. Birmingham, MI 48009. Following receipt of this form and all required documentation, rebates will be mailed to the address provided below.

Personal Information

First + Last Name:		Phone:	
Mailing Address:		Email:	
Project Address if different:			
Are you the property owner? ☐ Yes ☐ No	Preferred Communication: ☐ Phone ☐ Email ☐ Mail		

Expense Information

Please provide all requested information. If anything from the list below is missing, a city official will reach out. Your rebate will not be sent until all the proper items are submitted.

Please Check that you have included the following:

☐ **Itemized Receipts**: for all rain garden related expenses including the Rain Garden Master Program if you participated

☐ **Finished Garden Photos:** including a photo of the mechanism for moving water into the rain garden, and a written explanation of any deviations from the approved plan. Please write your explanation below:

Statement of Understanding

I have completed this form accurately and to the best of my ability. Upon receiving the Rain Garden Rebate, I agree to maintain the project for at least 2 years.

Signature: ______________________ Date: ______________

For Internal Use Only

Reviewed By:		Date:	
Rebate Sent:	☐ Yes ☐ No	Explanation:	
Rebate Sent:	☐ Yes ☐ No	Date:	

BIRMINGHAM
A WALKABLE CITY

MEMORANDUM

Planning Department

DATE: November 17, 2025

TO: Environmental Sustainability Committee

FROM: Summer Aldred-Arens, City Planner

SUBJECT: Single-Family Stormwater Management – Proposed Ordiance Language

Background Summary

The City is currently exploring adding single-family stormwater management ordinance language in alignment with our Birmingham Green: Healthy Climate plan.

On August 25, 2025 (Agenda – Packet), staff outlined the rationale for extending stormwater requirements to single-family residential projects, including redevelopment activity that increases impervious surface coverage and contributes to unmanaged runoff. The Committee was presented with Michigan examples such as Ann Arbor and Grand Rapids, discussed the "first flush" management approach, and reviewed best management practices appropriate for lot-level stormwater mitigation.

On September 15, 2025 (Agenda – Packet), the Environmental Sustainability Committee (ESC) continued its discussion of single-family stormwater management and provided detailed feedback on the proposed framework first introduced in August. Staff's objective remains the same which is to extend stormwater requirements to single-family residential properties in a way that is both technically feasible and easily understood by homeowners.

The City Engineer reviewed the draft ordinance language and provided feedback, with the changes reflected in the updated language below. City staff will develop a "mix and match" worksheet for applicants to assist them in calculating what measures will be required for the project.

Next Steps

Staff will integrate new mix & match worksheet and send draft ordinance language on to the City Attroney for review prior to sending it to the Planning Board and City Commission review in early 2026.

AN ORDINANCE TO AMEND PART II OF THE CITY CODE, CHAPTER 114. – UTILITIES, TO ADD ARTICLE VII. – SINGLE FAMILY STORMWATER MANAGEMENT STANDARDS

THE CITY OF BIRMINGHAM ORDAINS:

The City Code, Part II, Chapter 114. – Planning, Article VII. – Single Family Stormwater Management Standards:

ARTICLE VII. – SINGLE FAMILY STORMWATER MANAGEMENT STANDARDS

Sec. 114-451. – Purpose

The purpose of this section is to protect the health, safety, and welfare of the public by managing stormwater runoff from single-family residential properties in a manner that improves water quality and promotes on-site infiltration and retention of the first inch ("first flush") of rainfall. This section establishes standards for new construction, additions, and site modifications, consistent with the Oakland County Water Resources Commissioner's stormwater design standards and the City's Storm Water Utility Ordinance.

Sec. 114-452. – Definitions

For the purpose of this section, the following definitions shall apply:

Natural Measures means stormwater management methods that rely on vegetation, soils, and natural hydrologic processes to retain or infiltrate runoff at the source. *Examples include:* rain gardens, vegetated swales, tree planting or retention, infiltration lawns, downspout disconnections, and rain barrels or cisterns with drawdown capability.

Constructed Measures means engineered systems that utilize manmade materials or structural elements to capture, store, or infiltrate stormwater. *Examples include:* infiltration trenches, dry wells, sewer pipes, storm structures, subsurface galleries, and permeable pavements with aggregate storage layers, etc.

Retention means the capture and permanent removal of stormwater from surface runoff through infiltration, evapotranspiration, or reuse. Retained water does not discharge to the municipal sewer.

Infiltration means the movement of stormwater into the soil where it percolates and recharges groundwater. Infiltration is one mechanism of retention and may occur in both natural and constructed systems.

First Flush Volume means the first one (1.0) inch of rainfall over a defined impervious area, representing the most pollutant-laden portion of stormwater runoff.

Sec. 114-453. Applicability.

This section shall apply to all single-family residential development projects that:

a) Involve new construction or complete demolition and rebuild ("tear-down" projects); or
b) Add or replace impervious surface area exceeding 100 square feet.

Projects under 100 square feet of new impervious area are exempt from formal submittal requirements but are encouraged to utilize natural stormwater management measures voluntarily.

Category	Applicability	Requirement
New Builds / Complete Demolition and Rebuild	New homes or full tear-downs	Capture and manage first 1" of stormwater across max lot coverage (30%) and min open space (40%)
Additions/ Incremental Impervious Surface	Driveways, patios, additions or replacements of impervious surface exeeding 100 square feet.	<500 sq. ft.: natural measures only; ≥500 sq. ft.: 40% natural / 60% constructed split

Sec. 114-454. Performance Standards.

a) New Construction / Tear-Downs

1) For complete new builds or tear-down replacements, the applicant shall design and install stormwater management measures that retain the first one (1.0) inch of rainfall over the *maximum lot coverage* permitted by zoning, regardless of the actual impervious area constructed.

b) Additions and Expansions

1) For additions or site improvements increasing impervious area, the applicant shall design and install measures that retain the first one (1.0) inch of rainfall over the *net increase* in impervious surface area.

c) Minimum Storage Volume

1) Required retention shall be calculated using the following conversion:
   1. Required Volume (cubic feet) = Area (square feet) × 0.08

d) Acceptable Measures by Scale

1) For projects adding less than 500 square feet of new impervious surface: Only Natural Measures shall be used to meet the retention requirement.

2) For projects adding 500 square feet or more of new impervious surface or any new build/tear-down:
    1. At least 40 percent of the required retention volume shall be achieved through Natural Measures, and up to 60 percent may be achieved through Constructed Measures.

Sec. 114-455. Design Guidance.

All stormwater management measures shall comply with the design criteria of the Oakland County Water Resources Commissioner and applicable City standards and ordinances.

- Natural Measures such as rain gardens shall be designed for temporary ponding of at least 0.5 feet and may incorporate engineered soil media with 25 percent void space.
- Constructed systems such as infiltration trenches or dry wells shall demonstrate adequate percolation capacity and be designed with a minimum 40 percent void ratio.
- Tree retention and new plantings may receive planning-level retention credit consistent with the City's approved "Residential Stormwater Mix-and-Match Worksheet."

Sec. 114-456. Administration and Enforcement.

The City Engineer shall review all submittals for compliance with this section. The Building Department may withhold certificate of occupancy until required stormwater measures are installed. Noncompliance or failure to maintain required measures shall constitute a violation of this code and may result in suspension of stormwater utility credits or other enforcement actions.

Sec. 114-457. Reference Documents.

Design calculations, sizing worksheets, and maintenance templates approved by the City Engineer shall be provided as appendices, including:

a) Birmingham Residential Stormwater Mix-and-Match Worksheet (2025)
b) Rain Garden and Tree Credit Guide
c) Storm Water Utility Credit Application Form (Treasurer's Office)

Ordained this _____ day of ___________________, 2026. Effective upon publication.

____
Clinton Baller, Mayor

____
Alexandria D. Bingham, City Clerk

I, Alexandria D. Bingham, City Clerk of the City of Birmingham, do hereby certify that the foregoing ordinance was passed by the Commission of the City of Birmingham, Michigan at a regular meeting held _______________, 2026 and that a summary was published _______________________, 2026.

____
Alexandria D. Bingham, City Clerk

BIRMINGHAM
A WALKABLE CITY

MEMORANDUM

Planning Division

DATE: January 12th, 2026

TO: **Environmental Sustainability Committee**

FROM: Lauren Milia, Planning and Sustainability Intern

SUBJECT: SolSmart Program – Bronze Designation

The City Planning Department has requested fulfillment of the SolSmart program requirements for the Bronze Designation. SolSmart is a nationwide program led by the Interstate Renewable Energy Council and the International City/County Management Association, and funded by the U.S. Department of Energy Solar Energy Technologies Office. It provides free technical assistance, education, and a clear path to the expansion of solar energy in cities. The program also recognizes communities who follow the SolSmart process by rewarding Bronze, Silver, Gold, and Platinum designations. In Birmingham, the SolSmart program is intended to provide jobs, help guide the City toward its sustainability goals delineated by the Healthy Climate Plan, gain recognition with degrees of designation, and reduce energy costs.

The SolSmart Program's Bronze Designation requires recommendations for changes to the City's zoning ordinance to be compiled in a memo to the planning board. The SolSmart team reviewed the zoning and land use regulations in fall of 2023, and has provided recommendations for changes in language to clear barriers and fill gaps in allowing for expanded solar energy use.

The assessment recommends the Planning Board make the following changes to the zoning ordinance:

1. Codify roof-mounted solar PV systems as a by-right or allowed accessory use in the zoning ordinance.
2. Exempt roof-mounted solar PV from height restrictions.
3. Ensure the zoning ordinance language does not include intentional or unintentional barriers to accessory use rooftop solar PV, including but not limited to aesthetic or performance standards, screening requirements, limits to visibility, excessive restrictions to system size or rooftop coverage, glare or glint regulations, and subjective design reviews.
4. Ensure the zoning ordinance permits accessory use ground-mounted solar PV systems as a by-right or allowed use in at least one zoning district.

5. Ensure the zoning ordinance exempts small ground-mounted solar PV from certain restrictions on accessory uses (e.g. setbacks, coverage or impervious surface calculations, or other restrictions).
6. Codify placement standards for accessory use ground-mounted solar PV (e.g. the side or rear yard of the property).
7. Exempt accessory use ground-mounted solar PV from lot coverage and/or impervious surface standards.
8. Ensure the zoning ordinance establishes a clear regulatory pathway for large-scale solar PV (e.g. through a special use permit or through inclusion among allowed conditional uses).
9. Remove standards to limit system visibility.
10. Remove aesthetic standards from the zoning code.
11. Remove glare, glint, and/or noise standards from the zoning code.
12. Remove the discretionary review process for accessory use solar PV.

The next step will be for staff to take these prospposed ordinance amendments in March to the Planning Board. No action is required by the Environmental Sustainability Committee at this time.

MEMORANDUM

Planning Division

DATE: January 26th, 2026

TO: **Environmental Sustainability Committee**

FROM: Lauren Milia, Planning and Sustainability Intern

SUBJECT: WaterTowns Resolution

The Clinton River Watershed Council (CRWC) is an organization that works to protect, enhance, and celebrate the Clinton River, its watershed, and Lake St. Clair through education, stewardship, restoration, and community engagement. CRWC's WaterTowns® initiative compels cities to recognize their impact on the Clinton River and collaborate with residents, businesses, and stakeholders to promote public interactions with the River and improve access to recreation on and near the River and Lake St. Clair. Cities will also develop and advance measures to improve water quality through green infrastructure. Communities will engage in placemaking approaches to improve the water's appeal and accessibility, and work to protect the River's quality through ecological features such as rain gardens, permeable pavers, bioretention cells, and naturalized shorelines. Other current WaterTowns include Royal Oak, Berkley, Ferndale, Troy, and Rochester. The Planning Department has requested Birmingham's participation in the WaterTowns® initiative.

The WaterTown designation provides access to environmental engineers who can work with the City to conceptualize and estimate green infrastructure projects on public property, and assist with community engagement and grant funding for such projects. The City can also receive assistance with other grant applications if seeking funding for water recreation, GSI installations, or public art installations related to water. The CRCW team will also provide plan reviews and suggestions for water-related environmental ordinances.

The WaterTowns® initiative aligns with the goals of the Birmingham Green Healthy Climate Plan to restore natural ecosystems, promote accessible educational opportunities in sustainability, and promote nature-based solutions, as well as meeting the key action item for water and stormwater: WS-10: Engage with the Clinton River Watershed Council and become a designated WaterTown.

The attached resolution is a draft template which declares the City of Birmingham's formal participation in the WaterTowns® initiative through the Clinton River Watershed Council. It will be formatted for City Commission using the same verbiage.

The next step will be for staff to take No action is required by the Environmental Sustainability Committee at this time.

STATE OF MICHIGAN
CITY OF BIRMINGHAM

RESOLUTION NO. __

STATEMENT OF PURPOSE

The purpose of this resolution is to declare the Birmingham's formal participation in the WaterTowns® initiative through the Clinton River Watershed Council. The resolution reflects Birmingham's support for the Clinton River and its tributaries as valuable community assets and the City's commitment to collaborate with residents, businesses, neighboring cities, non-profit organizations, and other stakeholders to advance watershed management, the blue economy, tourism, and green infrastructure.

A RESOLUTION declaring Birmingham's participation in the WaterTowns® initiative

WHEREAS, WaterTowns® is a water-oriented community development initiative designed to assist towns and cities within the Clinton River Watershed service area to leverage the assets of the Clinton River and Lake St. Clair and to protect and improve water quality;

WHEREAS, the WaterTowns® initiative is managed by the Clinton River Watershed Council, an organization dedicated to protecting, enhancing and celebrating the Clinton River, its watershed, and Lake St. Clair for the benefit of communities, the environment and our future.

WHEREAS, Birmingham recognizes the recreational and economic potential of its water resources;

WHEREAS, Birmingham desires to incorporate environmental best management practices as an integral part in community planning and development;

WHEREAS, Birmingham is located within the Clinton River Watershed service area, and is a member of the Clinton River Watershed Council;

WHEREAS, there is no financial commitment required to participate in the WaterTowns® initiative;

WHEREAS, Birmingham desires to collaborate with the Clinton River Watershed Council to develop and implement a local WaterTowns® strategy;

NOW, THEREFORE, be it resolved, that the Birmingham Mayor and Council declare Birmingham a participant in the WaterTowns® initiative.

This resolution shall become effective upon adoption.

PASSED AND ADOPTED this ______ day of January 2026.

City of Birmingham

ATTEST

_____________________________________ _____________________________________

BIRMINGHAM
A WALKABLE CITY

MEMORANDUM

Planning Department

DATE: January 26, 2026

TO: Environmental Sustainability Committee

FROM: Summer Aldred-Arens, City Planner

SUBJECT: Community Engagement & Birmingham Green Webpage Updates

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City staff have updates related to community engagement efforts for the Birmingham Green Healthy Climate Plan.

In alignment with the Plan's Community Engagement Strategy, staff are aiming to increase our sustainability-related communications by having approximately one Birmingham Green–focused social media post per week. These posts will be used to share plan updates, highlight City actions, promote upcoming events, and provide residents with simple, practical sustainability actions they can take at home and in the community. This includes the possibility of a social media challenge to coincide with Earth Week.

Staff are also working on developing general informational materials that can be distributed at events or in the new resident packet. Attached below is an example of one such item, a home sustainability checklist for residents.

In addition, the City's sustainability landing page has recently been updated and reorganized to better reflect current initiatives and resources. The page can be accessed at www.bhamgov.org and will continue to serve as a central hub for Birmingham Green information, progress updates, and engagement opportunities.

BIRMINGHAM GREEN

Sustainable Habits checklist

energy

	estimated savings per year*
☐ SWITCH TO LED BULBS	$200
☐ UNPLUG CHARGERS & UNUSED ELECTRONICS	$20-60
☐ ADJUST THERMOSTAT BY 1-2 DEGREES	$50-150
☐ USE PROGRAMMABLE THERMOSTAT	$100-180
☐ USE COLD WATER FOR LAUNDRY	$50

water

	savings per year
☐ TAKE SHORT SHOWERS (2-5 MINUTES)	$30-70
☐ FIX LEAKS (TOILET/FAUCET)	$60-150
☐ INSTALL HIGH EFFICIENCY SHOWERHEAD	$20-50
☐ REDUCE OR ELIMINATE LAWN IRRIGATION	$50-200
☐ INSTALL A RAIN BARREL (BIRMINGHAM STORMWATER CREDIT)	$15 CREDIT EVERY 2 YEARS + WATER SAVINGS

waste reduction

	savings per year
☐ USE REUSABLE WATER BOTTLE	$100
☐ USE "FRIDGE FIRST" RULE TO REDUCE FOOD WASTE	$300
☐ COMPOST FRUIT & VEGGIE SCRAPS IN YARD WASTE	$5-10
☐ USE CLOTH TOWELS INSTEAD OF PAPER	$50-150
☐ RECYCLE USING SOCRRA WASTE WIZARD	$20-$50

transportation

	savings per year
☐ WALK/BIKE FOR TRIPS UNDER 1 MILE	$50-300
☐ CHECK TIRE PRESSURE MONTHLY	$25-75
☐ CARPOOL TO WORK/SCHOOL/ACTIVITIES	$200-500

*BASED ON NATIONAL RESEARCH AVERAGES

MEMORANDUM

Planning Division

DATE: January 26th, 2026

TO: **Environmental Sustainability Committee**

FROM: Lauren Milia, Planning and Sustainability Intern

SUBJECT: MoGo eBike Stations in Birmingham

The Planning Department has been exploring multimodal options for the City, including MoGo eBikes. MoGo is a Detroit-based nonprofit bike share organization operating in Metro Detroit that has partnered with Henry Ford Health, HAP, and the City of Detroit Department of Transportation. MoGo provides on-demand bikes that are available 24 hours a day, 7 days a week, 365 days a year. MoGo is a 501(c)(3) non-profit organization that receives much of its funding from grants.

MoGo eBikes would provide equitable access to reliable transportation and could promote non-motorized travel in Birmingham leading to a reduction in vehicle emissions. MoGo riders also receive perks for showing their member card, receipt, or Transit app screen at local businesses to receive a percentage off their purchase. If implemented in Birmingham, these perks could expand to include some of Birmingham's small businesses. The implementation of MoGo eBike stations would also satisfy transportation goals T-1 and T-3 of the Birmingham Green Healthy Climate Plan.

MoGo responded to our inquiry outlining projected costs for 5-6 eBike stations with 5-6 eBikes at each station. A one-time grant would cover station installations, and the City or other sponsoring entity would provide ongoing operational expenses.

Staff will continue to explore other alternative vendors and gather quotes, as well as work on estimating budgeting and operating costs to the City.

No action is required by the Environmental Sustainability Committee at this time.

OAKLAND COUNTY MICHIGAN
ECONOMIC DEVELOPMENT
DAVID COULTER
OAKLAND COUNTY EXECUTIVE

INTRODUCING

MATERIALS MANAGEMENT PROGRAM

REDUCE | REUSE | RECYCLE | COMPOST

OVER

1 Million Tons

of Materials Sent to Landfills Annually from Oakland County

20-45%
Could be recycled

30%
Could be diverted or composted

RECYCLABLE VALUE =

$10 million*

**Based on average commodity values as sold into end markets*

Let's Work Together to Send Less Waste to Landfills

You can make a difference. Oakland County invites you to be a part of building a circular economy that sends less waste to landfills, saves money, and improves our quality of living.

MAKE YOUR RECYCLE BIN BIGGER THAN YOUR GARBAGE CAN

Oakland County is reaching out to residents, municipalities, businesses, schools, and organizations before preparing the new Materials Management Plan (MMP). Please participate where you can and share your impressions, perspectives, and ideas.

The long-term goal is to send less waste to landfills. Currently, we follow a "take-make-waste" model. The MMP will seek alternative methods to repurpose materials after their initial use through repair, reuse, recycling, or composting.

DID YOU KNOW?

- By weight, food is the largest waste item in American landfills.
- By volume, paper is the largest waste item in American landfills.
- Aluminum and glass can be recycled infinitely.
- Styrofoam does not biodegrade.
- It takes approximately 25 years for a head of lettuce to decompose in a landfill—alternatively, it can be composted in a matter of weeks.

Join the mailing list for updates: OakGov.info/MMP

Questions? Please contact
Oakland County's Department of Economic Development at:
mmp@oakgov.com | (248)-858-2071

OAKLAND COUNTY

Materials Management Plan Development

The Materials Management Plan (MMP) is a requirement for all Michigan counties following changes made to Public Act 451, Part 115, which is administered by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The State's goal is to reach a 45% recycling rate.

The MMP Committee has been formed to advise and assist the County with its responsibilities to prepare, develop, and implement the Oakland County Materials Management Plan.

PLAN COMPONENTS TO INCLUDE:

- Identification of the highest and best uses for discarded materials
- Strategies that improve the collection and processing of discarded materials
- Data to quantify the impact of new strategies on the recycling rate, organics recovery rate, greenhouse gas emissions, economic development, and other environmental benefits
- Ways to strengthen the local circular economy through reuse, repair, recovery, composting, and/or recycling
- Resources to build awareness for all stakeholders

PROCESS AND SCHEDULE

During the 18-month planning process, the County will engage with local communities and stakeholders to identify goals, objectives, and action items.

MAJOR MATERIALS MANAGEMENT CATEGORIES

- Organics (e.g. food scraps, yard waste)
- Mixed-paper and Carboard
- Plastic
- Metal
- Glass
- Electronic Waste
- Household Hazardous Waste
- Construction/Demolition
- Textiles
- Tires
- Furniture
- White Goods (e.g. appliances)
- General Waste and more

OakGov.info/MMP