

Downspout Disconnection

Submitted to:
Southwest Florida Water Management District

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Background

Every time it rains, runoff from residential rooftops is collected by eaves troughs installed along the edge of the rooflines.¹ The runoff collected in the eaves trough then flows to ground level via one or more downspouts.² Downspouts may be connected directly to the storm sewer system, or in older neighborhoods, into a combined storm/sanitary sewer system.³ Consequently, rainstorms can fill combined sewers beyond capacity, resulting in a combined sewer overflow (CSO) in which untreated storm water *and* wastewater are discharged into local waterways.⁴ These overflows frequently result in beaches that are unsafe for swimming, flooded basements and contaminated lake water.⁵ Other runoff may travel more indirectly into storm drains or sanitary sewer lines by running down pavement, sidewalks and underground pipes.⁶ As a result, pollutants such as used motor oil, pesticides, fertilizers and pet waste may be swept along with the rainwater, thus entering lakes and streams untreated.⁷ This runoff negatively impacts river and lake systems by increasing the frequency and amount of flooding and by causing poor water clarity.⁸⁹ Excess nutrients and bacteria also increase stress on insects and fish, cause thermal pollution and contaminate drinking water supplies.¹⁰¹¹

The City of Toronto estimated the impact that an effective residential downspout disconnection program might have. Data from a study conducted in a primarily residential area of Toronto indicated that rooftops make up approximately 20% of all surface area.¹² This study suggests that redirecting or disconnecting downspouts can divert a large quantity of water.¹³ Assuming a typical Toronto yearly rainfall amount of around 28 inches, downspout disconnection of a home with an average rooftop size of 1,507 square feet would result in diverting approximately 26,000 gallons of storm water from the sewer system annually.¹⁴ Thus a neighborhood of 100 homes could divert around 2.6 million gallons of stormwater annually if the homes disconnected their downspouts from the sewer system and redirected them onto vegetative areas.¹⁵ It was estimated that disconnecting approximately one quarter of the downspouts in the study area would divert enough runoff to result in a 50% reduction of combined sewer overflows, and nearly a 100% reduction could be obtained if two-thirds of downspouts in the area were disconnected.¹⁶ A complete reduction in combined sewer overflows would help to minimize beach and fish closings due to polluted water, and basement floodings could also be avoided.¹⁷

A house can disconnect a downspout from the sewer to the ground for as little as approximately \$9 USD including labor and parts, but purchasing a rain barrel to redirect a downspout into may cost around \$90 USD.¹⁸ While there is an upfront cost to redirect and/or disconnect one's downspouts, it is estimated that a community can save \$25 USD per disconnected household by diverting rooftop storm water from wastewater treatment plants.¹⁹ A homeowner will also save money in avoided cleanup costs for basement flooding. Disconnecting and redirecting downspouts is beneficial to the environment, overall health and tourism, which are all related to a community's economic strength and stability.

Barriers and Benefits

The barriers to disconnecting or redirecting downspouts start with property structural design. One cannot just simply redirect their downspouts anywhere onto their property — runoff should be redirected to soft, landscaped surfaces such as lawns, gardens or swales to allow for penetration.²⁰ Also, if a property has too high a grade, infiltration will not be possible.²¹ It may also be difficult to disconnect downspouts if properties are too close together, because runoff will have no space to infiltrate and may instead wind up flooding someone else's basement or damaging the building's foundation.²² To overcome a property's structural barriers, rain barrels can be used to collect redirected runoff. However, there are also barriers associated with the use of rain barrels. As mentioned above, for a simple disconnection where a rain barrel is not involved, the cost is a meager \$9 USD, but if a rain barrel is required, the cost jumps to approximately \$90 USD.²³

Once one has a rain barrel, there are continued barriers to their proper functioning. A rain barrel may hold enough rooftop runoff to be useful for garden irrigation, but it may not reduce overall runoff volume if the barrel is not emptied between storms.²⁴ To counter this functional barrier, the rain barrel or cistern system should be designed to carry excess rain barrel storm water to an infiltration mechanism so that there is always available volume for retention.²⁵ Also, rain barrels offer no primary pollutant filtration, and homeowners may not think that the rain is suitable for their vegetable garden.²⁶ Educating residents that rooftop runoff often has fewer minerals and sediments than municipal water can eradicate this barrier. In addition, rain barrels must be childproof and sealed off against mosquitoes.²⁷ For parents, a concern that their child is in potential danger of drowning in a rain barrel is another possible barrier to the adoption of this behavior.

Another barrier to disconnecting or redirecting one's downspouts is that although the behavior requires minimal skill, it does require a number of tools and materials. People may also be minimally motivated with the mindset that they do not want too much water on their property or that they do not feel personally responsible for taking action in helping the city divert runoff from water bodies. Some cities may also require obtaining a permit from the plumbing division to make alterations to one's drainage system, which is another convenience-related barrier.²⁸

The benefits to adopting this behavior are saving/preserving water and saving money. Redirecting one's downspout can reduce water demand for irrigation, car washing and other nonpotable uses.²⁹ Property owners who have cisterns and rain barrels can use stored water for landscaping during outdoor watering bans, perhaps leaving less water-friendly neighbors envious.³⁰ Homeowners can save money on their water bills by conserving water in this manner, and public water systems will experience lower peak water demand and reduced stress on local water supplies.³¹ As well, adopting this behavior, as mentioned earlier, decreases the chance of flooded basements, beach closures and environmental damage.^{32 33} Another potential benefit is feeling, on the part of the homeowner, that their efforts are helping the environment.

Summaries of Programs

Combined Sewer Overflow Reduction -- Bremerton, Washington³⁴

The Cooperative Approach to CSO Reduction Program (see program logo, Appendix A) is considered “cooperative” because it is funded through a grant from the Washington State Department of Ecology Centennial Clean Water Fund (CCWF) as well as the city’s wastewater and stormwater utilities.³⁵ The program ran from 2000–2002.³⁶ The program had two main objectives: *educating* residents, city officials, business and property owners about CSOs and nonpoint-source pollution; and *facilitating* the separation of private property storm water from the sanitary sewer system.³⁷

The program accomplished the first objective in a number of ways. First, personal assistance was provided to property owners. Brochures and videos explaining the CSO program with instruction on how to disconnect one’s downspout were also provided. Videos were aired on local community access television.³⁸ Two different sets of brochures were designed — the first describes the program and is entitled “Be Part of the Solution,” while the second is a self-help guide for a simple downspout disconnection.³⁹ Approximately 15,000 of the 20,000 program description brochures and 7,000 of the 15,000 how-to brochures have been distributed.⁴⁰ There is also a web site that displays animations of how CSOs occur, brochure materials and related document summaries. The web site is visited by approximately 2,500 to 3,000 people from across the world each month.⁴¹ Also included on the web site are other Bremerton Water Resources Division programs, including a rain barrel program.⁴² Over 1,500 rain barrels have been sold across the county.⁴³ The program also included hands-on demonstration and instruction workshops that taught how to disconnect downspouts whilst informing attendees of the importance of controlling storm water on their property. Workshops were not well attended, reaching a total attendance of 45 people, at an average of 4.5 people per workshop.⁴⁴ Advertising through newspapers, billboards, direct mail, notices in utility bills and presentations at council meetings were also components of the program. Billboards were found more cost-effective than newspapers. Only four inquiries resulted from newspaper ads that were placed in the paper for one week at a cost of \$923 USD, while billboards resulted in 40 inquiries, and only cost \$210 USD for four sites, for one week.⁴⁵ The 11,000 direct mail-outs were responsible for the majority of replies from property owners.⁴⁶

The second objective was also made possible through a series of efforts. First, free site assessments were provided to determine a property’s need for downspout disconnection.⁴⁷ Property owners had access to free, personalized assistance prior to, during and following disconnection.⁴⁸ This was especially helpful for senior citizens and those in poor health who were incapable of completing the disconnection on their own.⁴⁹ In addition, grants from the city’s Wastewater Utility helped pay for separation projects on residential property, anywhere from \$25–\$500 USD depending on the property’s needs, which was especially beneficial for those on low or fixed income.⁵⁰ Separating downspouts from sewer systems was also facilitated by standardizing drawings for separation and by developing a letter of agreement/contract between the city and property owner.⁵¹ Most recently, the city passed ordinances 4685 and 4686, which

require the separation of all stormwater connections from the sanitary sewer system, unless the procedure is not deemed cost-effective by the initial site assessment.⁵²

The program cost approximately \$270,000 USD from 2000–2002, for a total of 34 months.⁵³ The city of Bremerton has informed all citizens about the program through a direct mail-out.⁵⁴ The city has received a 38% response rate to direct mail notifications.⁵⁵ Over 9,500 properties in the city of Bremerton are connected to the sanitary sewer system; and through this program, about 2,900 have had site assessments.⁵⁶ Of this number, 467 properties, or rather 16% of properties who received site assessments, had their stormwater runoff connected to the sanitary sewer system.⁵⁷ The program completed 44 separations in the right-of-way paid for by the city utility fund, and a total of 358 separations — 307 of which were paid for through separation reimbursements provided by city utilities.⁵⁸ An estimated 260,000 gallons of stormwater runoff have been removed from the public sewer system as a result of these separations.⁵⁹ The estimated cost per gallon of stormwater runoff removed from the sanitary sewer system is \$1.04 USD per inch of rainwater.⁶⁰ This program is deemed quite cost-effective, especially when compared to the city's other capital improvement projects, which range in price between \$5–\$10 USD for each gallon of water removed or treated.⁶¹

Toronto's Downspout Disconnect Program⁶²

The city of Toronto, Canada, is also working to improve its stormwater management. The city has come up with five main categories of objectives: water quality, water quantity, natural areas, wildlife and sewer systems. The city of Toronto has come up with a 25-year Water Pollution Solution Plan outlining a number of programs designed to meet their objectives. The Downspout Disconnection Program is one such water pollution solution (see logo, Appendix B).

Toronto encourages homeowners to call (416) 392-1807 to arrange for downspouts to be disconnected, free of charge. After making the call, all the homeowner has to do is complete the program's easy registration process. The city's web site gives out this information, as well as why disconnecting downspouts is beneficial to Toronto. The web site explains that combined sewer overflows cause basement flooding, as well as contaminate Lake Ontario water, causing beaches to be unsafe for swimming. The web site also contains a picture referencing what a connected downspout looks like so that residents can easily determine whether their downspouts are connected. The service that the city provides involves cutting residents' downspouts where they enter the ground, installing a plug where the downspout has been cut off and adding an extension or splash pad, or perhaps a rain barrel, if necessary, to ensure that water does not drain near a house's foundation.

In addition to encouraging the disconnection of downspouts, Toronto has constructed stormwater management retention/detention ponds to help capture runoff.⁶³

Portland, Oregon's Downspout Disconnection Program⁶⁴

Portland's Downspout Disconnection Program is part of a larger watershed planning and education program that has been around since 1991.⁶⁵ Portland, in fact, has a

Phase 1 NPDES Municipal Stormwater Permit and in 1996, was recognized as the nation's best stormwater permit program.⁶⁶ Portland is home to about 510,000 citizens who live in approximately a 130-square-mile area at the bottom of the Willamette watershed.⁶⁷ Portland is also home to a number of listed state and federal threatened and endangered species; namely, three species of salmonids have been listed over the last three years.⁶⁸ The concern for Portland is that approximately 33% of its land surfaces are paved or hard surfaces that are impervious, thus contributing to the flow of runoff to the Willamette watershed.⁶⁹ The city has attempted to reduce the impervious area to only an *effective* 10% in order to decrease runoff.⁷⁰ *Effective* is a term that refers to the portion of a site that discharges directly to a receiving system without any prior interception, infiltration or filtration.⁷¹ In order to achieve this objective, the city of Portland has a number of outreach and educational programs that attempt to: (1) educate residents and businesses of the city that they belong to a natural watershed, (2) educate residents and businesses of the final destination of their storm water and sanitary drainage, (3) educate residents and business about how their daily behaviors impact the environment, suggesting behaviors they can change to lessen those impacts, and (4) create active citizenry and advocates for stormwater improvement within Portland.

One particular outreach/educational program is the Downspout Disconnection Program for residential properties, which was developed in 1996.⁷² Through the program, properties in north, northeast and southeast Portland have had their rooftop downspouts disconnected from the sewer system and redirected onto lawns, flowerbeds or 'soakage trenches' to reduce runoff from hitting impervious surfaces.⁷³ The Bureau of Environmental Services (BES) has worked along with the Office of Neighborhood Involvement (ONI) and the city's Plumbing Division to create an interagency agreement in order to interact directly with homeowners to disconnect their downspouts without homeowners requiring a permit from the Plumbing Division for the alterations of their home's drainage system.⁷⁴ In turn, BES staff have developed safety criteria for permissible disconnections and have a monitoring and inspection program to ensure that disconnections are properly completed.⁷⁵ For each program implementation, a target area of properties connected to a CSO basin is selected and Disconnection Program staff begin their work with an aggressive door-to-door canvassing campaign to obtain voluntary agreement from owners to disconnect their downspouts.⁷⁶ After agreeing, property owners then have the choice of receiving a \$53 USD per downspout incentive to do it themselves or have the city provide the service for free.⁷⁷ The city provides the service through volunteer groups, such as scouting troops and students or through emerging and minority business contractors.⁷⁸ Volunteer groups receive a \$13 stipend for each disconnected downspout, and contractors are hired through a city bid process.⁷⁹⁸⁰ Whether it is a homeowner, a city volunteer or a city contractor who performs the disconnection, the city inspects the work in order to assure that disconnections were accomplished safely.⁸¹ If the goal for the targeted roof surface area has not been met through voluntary agreement, a mandatory version of the program can be implemented.⁸² Also under this program, other stormwater management messages are provided, such as the utility of planting trees to absorb water from disconnected downspouts.⁸³

Through this program, 17,000 homes had their downspouts disconnected in a period of six and a half years.⁸⁴ Another 20,000 homes were identified as having already disconnected their downspouts.⁸⁵ Portland's BES web site estimates that 94% of the overflows to the Willamette River will be eliminated by 2011.⁸⁶ The BES web site lists the most current number of disconnected homes at 44,000, estimating a removal of more than 1 billion gallons of storm water annually from the combined sewer systems.⁸⁷ This program receives funds primarily from a mixture of capital and operating funds. Through the program, enough storm water is diverted from the CSO system, which allows collection pipes to be downsized. This in turn provides significant savings from pipe construction costs, which helps to pay for the program.⁸⁸

Mid-America Regional Council Educational Programs⁸⁹

Mid-America Regional Council (MARC) has convened a committee of representatives from local governments and environmental organizations to create a regional watershed education program. Topics for 2005–06 campaigns included “how to build a rain barrel,” “disconnect and redirect your downspout,” “what is a watershed?” and “know your roots.” Each campaign runs in a different season, and “disconnect your downspout” was conducted during the summer of 2005. A number of outreach methods have been utilized by MARC. This includes the production of 105,000 brochures for distribution. The summer 2005 brochure is very colorful and informative, including straight-forward instructions on how to disconnect your downspouts, the environmental benefits from adopting this behavior and ideas for how to create a rain-friendly yard (see Appendix C).⁹⁰ Private FM stations ran 100 twenty-second public radio sponsorships and 440 sixty-second advertisements. There have also been quarterly news releases sent to over 90 area media outlets. MARC has distributed native wildflower seeds, rain barrels and approximately 10,000 rain garden instructional brochures to local municipalities, nonprofit organizations, garden/lawn stores and state/federal agencies. Finally, staff have displayed educational materials at applicable regional festivals and shows. MARC also funds regional water cleanups.

MARC works with a budget of about \$115,000 USD, paid for by 18 contributing local governments.⁹¹

Downspout Disconnection Pilot

The disconnection program in Portland has been demonstrated to be very effective in encouraging households to disconnect their downspouts. Rather than suggest a unique program, the recommendations below are intended to enhance what is already an effective initiative.

To summarize the Portland program, city staff select neighborhoods to be targeted based upon which areas have the largest number of properties connected to a combined storm/sanitary system. Staff then canvass the area seeking voluntary agreements from homeowners to disconnect their downspouts. Residents are provided with a financial incentive to disconnect the downspout themselves or can agree to have

a volunteer organization or contractor do the disconnect for them — with the organization or contractor receiving a per-household payment. Following these disconnections, city staff conduct inspections to ensure that the work has been done properly.

This program can be enhanced in several ways. First, when a resident agrees to disconnect their downspout, the behavior is “invisible” in the neighborhood. That is, without walking directly up to the home, it is impossible for other residents to ascertain whether a household has disconnected their downspouts. Since downspout disconnection is not being readily visible from the street, there is a reduced likelihood that other residents will feel social pressure to disconnect their downspouts. Asking residents if temporary signs can be placed on their front lawns indicating that the household has disconnected its downspout can facilitate the development of social norms and the fostering of social diffusion. A simple message, such as “To protect our water, we’ve disconnected our downspout,” can be utilized to facilitate others being more receptive to disconnecting their own downspouts. The text on these lawn signs should be clearly visible to those driving or walking through the neighborhood. Finally, residents should be asked to allow the signs to be displayed for the period of time that the neighborhood is being canvassed. Once the canvassing is completed, the organization or contractor that is conducting the disconnections collects the signs.

Second, the Portland program involves city staff canvassing a neighborhood and then arranging for an organization or contractor to disconnect the downspout. Following the disconnection, city staff conduct an inspection to ensure that the work was done properly. As a consequence, each household is visited three times. It may be more time and cost-efficient to have only one visit in which the request is made and disconnection and inspection occurs. Prior to committing to *three visits* or *one visit*, their relative costs should be evaluated.

Third, when households agree to have their downspout disconnected, they should be asked if they would like information about other actions they can take to protect the local watershed. If they agree, strategies to reduce pesticide and fertilizer use can be utilized.

Pilot Evaluation

Evaluation of this project is simple. The percentage of households who agree to disconnect their own downspouts or have their downspouts disconnected for them is recorded. In addition, the amount of water diverted from the CSO in a normal rain year is calculated. Finally, the return of investment is calculated by comparing the cost per household for the two forms of disconnection (by householder or by organization/contractor) versus the costs associated with stormwater overflows.

Endnotes

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- ² Ibid.
- ³ Ibid.
- ⁴ Mid-America Regional Council (MARC). (2005). Watershed tips brochures: Redirect or disconnect your downspout. <http://www.marc.org/Environment/Water/publications.htm>.
- ⁵ City of Toronto. (1998-2006). *Protecting water quality: Toronto downspout disconnection*. http://www.toronto.ca/water/protecting_quality/downspout.htm
- ⁶ MARC. (2005).
- ⁷ Ibid.
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- ¹¹ Environment Canada. (2001).
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- ¹⁴ Ibid.
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- ¹⁶ J.F. Sabourin & Associates Inc. (1999); cited in: MARC (2005).
- ¹⁷ Environment Canada (2001).
- ¹⁸ MARC, 2005.
- ¹⁹ Rouge River National Wet Weather Demonstration Project Brochure. (Undated). Pg.5.
- ²⁰ MARC, 2005.
- ²¹ Ibid.
- ²² Ibid.
- ²³ Ask GREG
- ²⁴ Boston Metropolitan Area Planning Council (MAPC). (2003). Low impact development factsheet: Cisterns and rain barrels. Massachusetts Low Impact Development Toolkit. http://www.mapc.org/regional_planning/LID/cisterns_barrels.html.
- ²⁵ Ibid.
- ²⁶ Ibid.
- ²⁷ Ibid.
- ²⁸ Hottenroth, D. (Undated?). pg.187. Using incentives and other actions to reduce watershed impacts from existing development. City of Portland Bureau of Environmental Services, 181-190.
- ²⁹ Boston MAPC, (2003).
- ³⁰ Ibid.
- ³¹ Ibid.
- ³² MARC, (2005).
- ³³ City of Toronto, (1998-2006).

³⁴ **Program Contact:** Chance Berthiaume, Cooperative Approach to CSO Reduction Project Coordinator, 3027 Olympus Drive, Bremerton, WA 98310. (Phone) (360) 473-5929, (E-mail) cs0@ci.bremerton.wa.us, (Web site) www.cityofbremerton.com.

³⁵ Stelling, S., Pater, D., Cahall, K., & Berthiaume, C. (2003). Pg.3.

³⁶ Ibid. pg.1

³⁷ Ibid. pg.1

³⁸ Ibid. pg.6

³⁹ Ibid. pg.8

⁴⁰ Ibid. pg.8

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⁴² Ibid. pg.8

⁴³ Ibid. pg.8

⁴⁴ Ibid. pg.6

⁴⁵ Ibid. pg.9

⁴⁶ Ibid. pg.9

⁴⁷ Ibid. pg.1

⁴⁸ Ibid. pg.1

⁴⁹ Ibid. pg.6

⁵⁰ Ibid. pg.5

⁵¹ Ibid. pg.1&10

⁵² Ibid. pg.6

⁵³ Ibid. pg.11

⁵⁴ Ibid. pg.10

⁵⁵ Ibid. pg.12

⁵⁶ Ibid. pg.11

⁵⁷ Ibid. pg.11

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⁵⁹ Ibid. pg.11

⁶⁰ Ibid. pg.11

⁶¹ Ibid. pg.11

⁶² **Program Contact:** Access Toronto, (Phone) (416) 338-0338, (E-mail) acessto@toronto.ca.

⁶³ All information in this section taken from: City of Toronto. (1998-2006). Downspout disconnection program. Protecting Water Quality. http://www.toronto.ca/water/protecting_quality/downspout.htm

⁶⁴ **Program Contact:** Anne Peterson, BES & ONI. 1221 SW Fourth Avenue, Suite 110, Portland, OR 97204. (Phone) (503) 823-3086, (E-mail) anne.peterson@bes.ci.portland.or.us.

⁶⁵ Hottenroth, D. (Undated?). pg.183.

⁶⁶ Ibid. pg.181.

⁶⁷ Ibid. pg.181

⁶⁸ Ibid. pg.181

⁶⁹ Ibid. pg.182

⁷⁰ Ibid. pg.183

⁷¹ Ibid. pg.183

⁷² Ibid. pg.186

⁷³ Ibid. pg.187

⁷⁴ Ibid. pg.187

⁷⁵ Ibid. pg.187

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⁷⁷ Ibid. pg.187

⁷⁸ Ibid. pg.187

⁷⁹ Ibid. pg.187

⁸⁰ Portland Bureau of Environmental Services. (2006). Downspout Disconnection Program. <http://www.portlandonline.com/bes/index.cfm?c=43081>.

⁸¹ Hottenroth, D. (Undated?) pg.187

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⁸⁵ Ibid. pg.187

⁸⁶ Portland Bureau of Environmental Services. (2006).

⁸⁷ Ibid.

⁸⁸ Hottenroth, D. (Undated?) pg.187

⁸⁹ **Program Contact:** Mid-America Regional Council, 600 Broadway, Suite 300, Kansas City, MO 64105-1554. (*Phone*) (816)474-4240, (*Fax*) (816) 421-7758, (*E-mail*) Chris Vukas, Environmental Planner-Watershed Management: cvukas@marc.org.

⁹⁰ Mid-America Regional Council (MARC). (2005). Watershed tips brochures: Redirect or disconnect your downspout. <http://www.marc.org/Environment/Water/publications.htm>.

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Appendix A



Appendix B



Appendix C

Instructional Portion of Brochure

Why disconnect your downspout?

Downspouts that connect directly to sewer pipes increase the risk of sewer overflow and flooding. Disconnecting your downspout from a sewer intake pipe (standpipe), then redirecting the flow of water to a grassy area or garden is a simple process that makes a big difference to the environment.

Supplies

- Hacksaw
- Cordless drill
- Tape measure
- Pliers
- Sheet metal screws
- Downspout elbow
- Downspout extension
- Standpipe cap

There are different types, lengths and sizes, of standpipe caps, so be sure to take measurements before shopping. Capping the standpipe prevents water from going in while keeping pests (such as rodents) from entering/exiting the pipe.

Instructions

1. Cut the existing downspout approximately 9 inches above the sewer standpipe with a hacksaw.
2. Cap the sewer standpipe.
3. Attach elbow by crimping the downspout with pliers to ensure a good fit. Connect elbow to downspout using sheet metal screws. It may be necessary to pre drill holes.
4. Attach the elbow INTO the extension and secure with sheet metal screws. Water should drain at least five feet away from the house, so direct the extension accordingly. A splash block may help direct water further away from the house.

The diagrams illustrate the installation process in three stages: 1. A downspout is shown connected directly to a standpipe. 2. The standpipe is capped, and the downspout is cut above the cap. 3. An elbow is attached to the cut end of the downspout, and a downspout extension is attached to the elbow, directing water away from the house.

A close-up photograph showing a person's hands using pliers to crimp a metal elbow onto the end of a downspout. The elbow is being secured to the downspout with sheet metal screws.

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