Activity 3.4.5 Storm Water Management

Introduction

When a property is developed, it is important to understand that changes to watershed characteristics (i.e., land use, slope, soil type, vegetative cover) will often increase the amount of storm water runoff. When storm water is diverted to a municipal storm water system, increases in volume can require costly infrastructure improvements. In addition, development almost always results in more contamination of the storm water discharge. As a result many municipalities have implemented regulations to restrict the quantity and improve the quality of storm water discharge from developed sites.

Low Impact Development (LID) techniques have been developed to address storm water quantity and quality issues by more closely imitating the natural hydrology of a site. Many communities are now encouraging engineers to incorporate LID techniques in site design to reduce the negative effects of development on the quantity and quality of storm water runoff. In addition, LID often improves visual and sensory aspects of the design by creating a greener design than traditional site design.

In this activity you will estimate the change in peak storm water runoff using the Rational Method as presented in Unit 2. You will then devise a preliminary storm water management plan and further develop the site design for the Keystone Library Renovation project to incorporate LID techniques.

Equipment

Calculator
Journal
Computer with Internet access
Rational Formula Runoff Coefficient table (from Activity 2.3.11 Calculating Property Drainage)
Rational Formula Runoff Coefficient Adjustment Factor table (from Activity 2.3.11 Calculating Property Drainage)

Procedure

For this activity you will need to review the Rational Method for calculating storm water runoff as presented in Activity 2.3.6 Residential Drainage Plan.

The Rational Formula is:

$$Q=C_fCiA$$

Q = Peak runoff rate in cubic feet per second
i = Rainfall intensity in inches per hour (see map)
A = Drainage area in acres
C = Runoff coefficient (see table)

C_f = Runoff coefficient adjustment factor (see table)

Constraints

- Although the Keystone property was previously developed, conservatively assume that the pre-existing condition of the site was a turf meadow.
- Use storm duration of 1 hour for this calculation.
- Stormwater design should meet the requirements of the City of Noblesville Stormwater Technical Standards Manual (STSM) (**http://www.cityofnoblesville.org/egov/docs/1188914102_387664.pdf**) except as follows:
  - Use the design requirements for a drainage area less than or equal to 5 acres in size (although the site is larger than 5 acres) for simplicity.
  - Neglect any stormwater runoff that is generated offsite and diverted to the Keystone site. Assume that the area of the Keystone site is the drainage area for stormwater calculations.

1. Research the storm water requirements for the Keystone Site as regulated in the Noblesville Code of Ordinance (Article 6), the City of Noblesville Stormwater Technical Standards Manual. Answer the following questions.

- Is the Rational Method allowed for drainage areas larger than 5 acres in size?
- Is the Rational Method allowed for drainage areas less than or equal to 5 acres in size?
- Record the runoff coefficients dictated by the STSM that you will need to calculate site runoff.
- On which return period(s) must the stormwater detention design be based?
- What are acceptable detention facilities?
- Can the Rational Method be used to calculate the required volume of stormwater storage for development sites less than or equal to 5 acres?
- Record the rainfall intensity for both a 10-year/1-hour storm and a 100-year/1 hour storm.

2. Calculate the change in site runoff using the Rational Method for both a 10-year/1hour storm and a 100-year/1 hour storm.
3. Estimate the volume of storm water runoff using the rule of thumb from the presentation.
4. Estimate the size of a retention pond for the site. Include the pond on your preliminary site plan sketch from **Activity 3.4.2 Parking Lot Design**.
5. After viewing the Low Impact Development presentation, revise your preliminary site design to include at least one additional Low Impact Development technique.
6. Update your Keystone Library Renovation site plan to include your site design elements.

Conclusion

1. What would happen if a storm water facility that was designed for a 10-year storm was subjected to a 100-year storm?

2. Why is the runoff greater for a 100-year storm than a 10-year storm? Differences in design storm return periods occur among municipalities. Give reasons for using a 10-year design storm to design storm water facilities. Then give reasons to use a 100-year design storm.

3. Why is it important to consider storm water management when laying out a site plan?