Ahead of the Storm
Education and Outreach
Site Evaluation Process

Presented By: Jessica Louisos, MS, PE





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Overview

- Learn about:
  - Engineering Method
  - Developing Stormwater Treatment
  - Site assessment technique
  - Basemapping
  - Data Collection

- Complete:
  - Site assessment
  - Identify problem areas
  - Design concept level Optimal Conservation Practices

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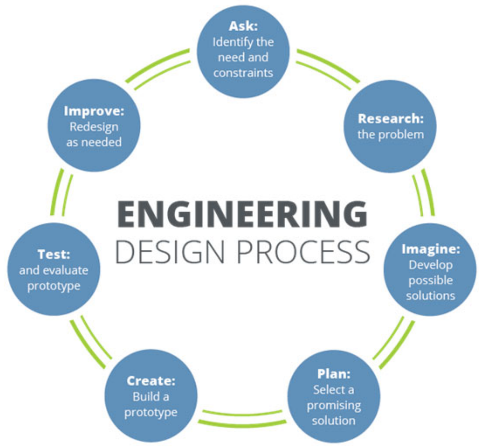
The Engineering Method

- Steps engineers follow to solve a problem
- Iterative



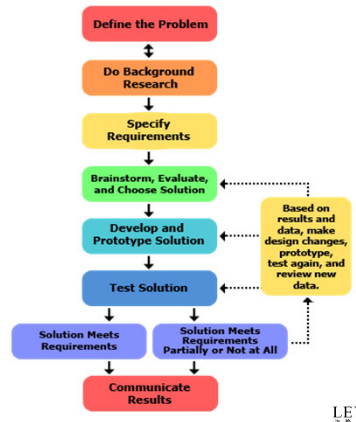


Image from teachengineering.org

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The specific terms used to describe the engineering method may vary, but the concepts are the same.

Identify Problem – Ask

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Define what the problem is. Ask questions. Specify goals for what you will solve.

We may be looking for where dirty water collects or where erosion is occurring.

This may apply to any type of problem. Maybe there is flood issue. Maybe a road that always has traffic jams.

Data Collection – Research

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Collect information that will help solve a problem.

How much water gets to a location.

Are there sensitive natural resources or utilities that need to be avoided.

What are the elevations, slopes, or other data we need.

Alternatives Analysis – Imagine and Plan

Swanton Stormwater Alternatives Analysis Summary Matrix, Outfall #34, Wqvolume = 1.3 ac-ft, 56,6278 ft^3	WQv Treatable in Space Available (ft^3)	WQv Treatable in Space Available (%)	Practice Estimated Sediment Removal	Practice Estimated Phosphorus Removal	TSS Removal from WQv	Phosphorus Removal from WQv	Cost per Treated Volume ($ / FT^3)	Estimated Cost **	Construction Done By Town	Ease of Future Maintenance	Cost of Future Maintenance	Notes
3/28/2016												
PRE-TREATMENT OPTIONS												
Hydrodynamic Separator - Wqflow only, high flow bypassed	56,628	100%	82%	67%	82%	67%	0.7	$ 42,000	YES	+	+	Contech single Vortechs 9000 sized for total WQflow of 8.1 cfs all larger flows bypassed around unit. Designed around average particle size of 50 microns.
Hydrodynamic Separator - Full Flow of Pipe	56,628	100%	89%	67%	89%	67%	2.3	$ 130,000	YES	+	+	Contech Twin Vortech 16000 sized for total WQflow of 8.1 cfs with max flow of 40 cfs. Designed around average particle size of 50 microns.
Hydrodynamic Separator - SiteSaver, Wqflow, 86 microns	56,628	100%	80%	N/R	80%	N/R	1.4	$ 79,000	YES	+	+	SiteSaver SS26-86 sized for Wqflow of 8.1 cfs with max flow of 40 cfs from Brett Hughes from StormTrap. Designed around average particle size of 86 microns.
Hydrodynamic Separator - SiteSaver, Full Flow of Pipe, 100 microns	56,628	100%	80%	N/R	80%	N/R	2.4	$ 134,000	YES	+	+	SiteSaver SS95-100 sized for max flow of 40 cfs from Brett Hughes from StormTrap. Designed around average particle size of 100 microns.
FILTER/ DETE												
Underground Brentwood St (updated con								204,000	NO	+	+	Brentwood StormTanks (2,280 18" Units). A portion of the volume would be filled with groundwater for part of each year. No infiltration expected due to high groundwater.
Stormfilter w Phosphosorb								154,000	YES	o	–	Contech Stormfilter sized to polish 2 cfs for phosphorus removal. 25% (2 cfs of the 8.1 cfs) of the water quality flow would be diverted to this unit after the Vortechs. Every ~3 years exchange cartridges, @ $250/ cartridge = 40 * $250 = $10,000
Jellyfish Filte								126,000	YES	o	–	Contech Jellyfish filter JF 10-11-3 sized to polish 2 cfs for phosphorus removal. 25% (2 cfs of the 8.1 cfs) of the WQflow diverted to this unit after pre-treatment. Every ~5+ years replace cartridges, @ $650/ cartridge = 14 * $650 = $9,100
Jellyfish Filte								182,000	YES	o	–	Contech Jellyfish filter JF12-21-5 sized to polish 4 cfs for phosphorus removal. 50% (4 cfs of the 8.1 cfs) of the Wqflow diverted to this unit after pre-treatment. Every ~5+ years replace cartridges, @ $650/ cartridge = 26 * $650 = $16,900
Kraken Filter,								117,000	YES	o	–	StormTrap Kraken filter KF8-16-60 sized to polish 2.2 cfs for phosphorus removal. 27% (2.2 cfs of the 8.1 cfs) of the water quality flow . Every 5-10 years replace cartridges, @ $150/ cartridge = 114 * $150 = $17,100

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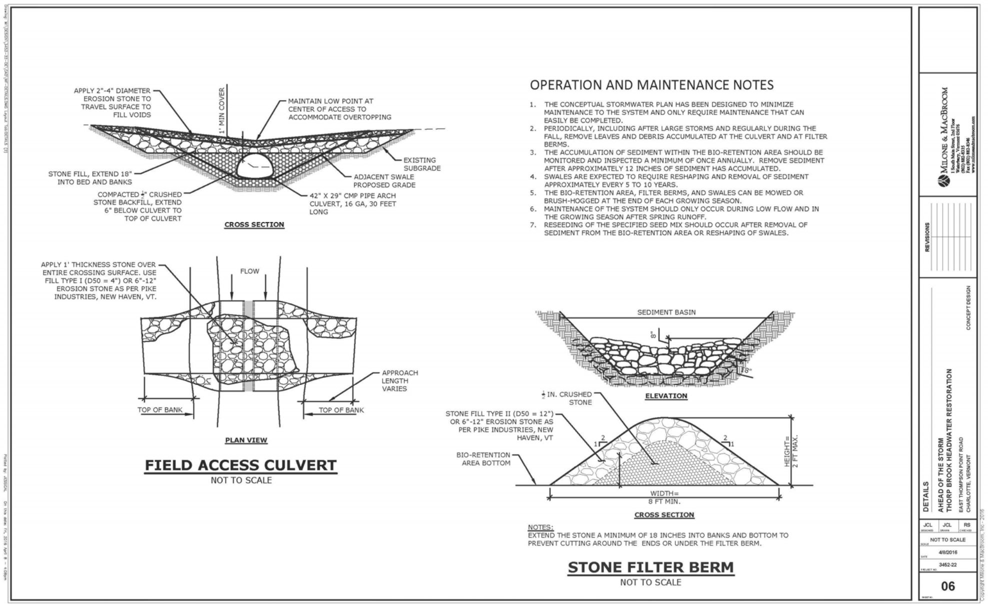
What could be possible solutions?

For each solution how well does it meet our goals?

Goals could be the level of treatment, the reduction in flooding, and factor in cost or other constraints.

Choose a solution that seems to best meet project goals.

Design - Create / Test / Improve



Develop plans that show location, size, materials needed.

Show views from above, cross sections, profiles, and images that give specific details.

Test if the design meets the goals and constraints

Improve if needed – maybe even going back to earlier stages for more data collection or alternatives

Implementation - Construction

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Exciting!

See the final product- your fix- put into action.

As engineers we usually oversee construction to make sure our designs are built correctly.

Design Process

- **See Handout**

Review all the steps

ask students how they might be able to do different parts

Identify which sections engineers may need to do for more complicated projects.

Mapping with ANR Atlas

Floodplains, River Corridor, Wetlands:
http://anrmaps.vermont.gov/websites/anra/

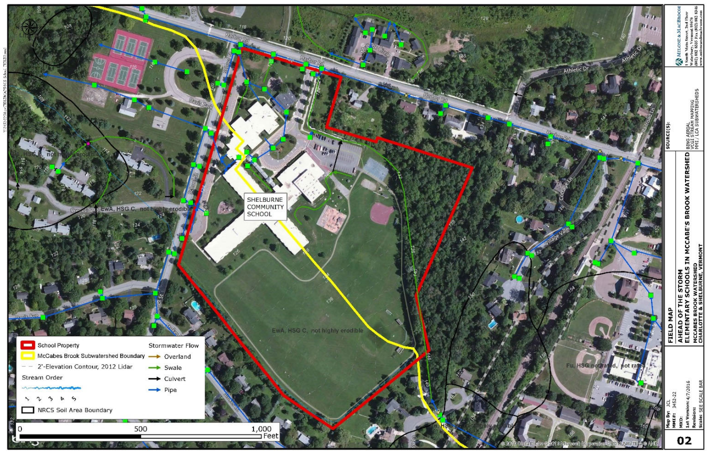
Precipitation:
http://precip.eas.cornell.edu/

- **Show some examples of basemaps and how to get them**

Go to ANR Atlas and click through some of the base map information

Ahead of the Storm – McCabe's Brook Watershed

Site Assessment – Desktop Work - Homework



- Aerial Photograph
- Topography
- Soils
- Wetlands
- Property Lines
  - River Corridor
- Fluvial Erosion Hazard Zone
- FEMA Floodplains, Floodway
- Stormwater Permit?

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Map Exercise

- **Scale**
- **Basemapping**
- **Orientation**

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Using pre-made map of their school have students identify how to read the map

Have them find landmarks they recognize

Turn map to match the orientation of the classroom

Discuss scale, how much smaller the map is from real life

Problem Identification – Point Source

Problem Identification – Non-Point Source

Site Assessment – Fieldwork

- **Review handout**

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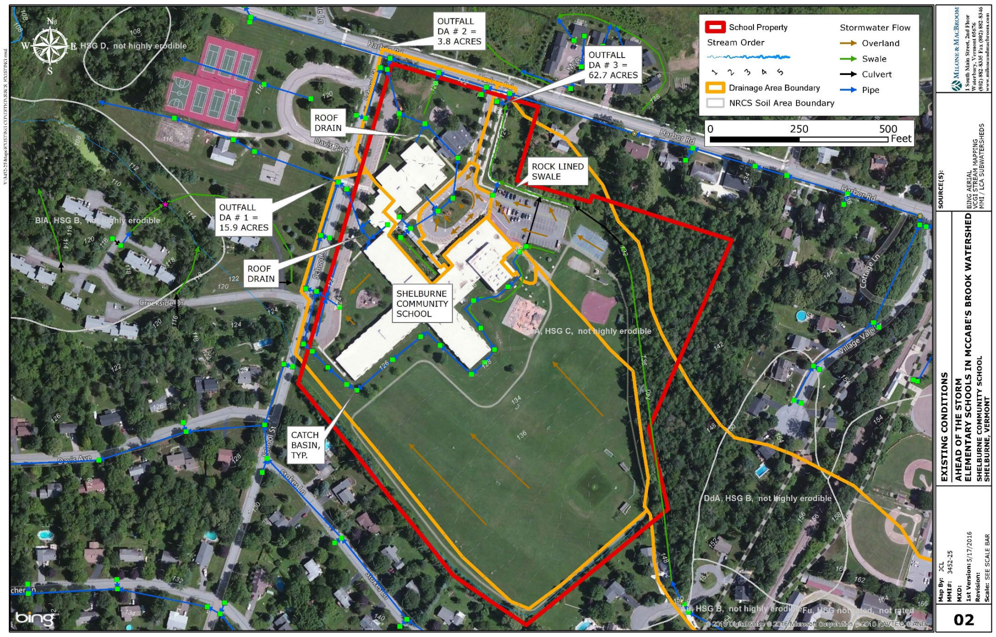
Go back to handout – tell them that the Pre-Project Development and Desktop work have been done and they will be starting with a map

Go through Site Assessment Field work – what they will be looking for and drawing on the maps

Go out and do at least a portion of the site assessment

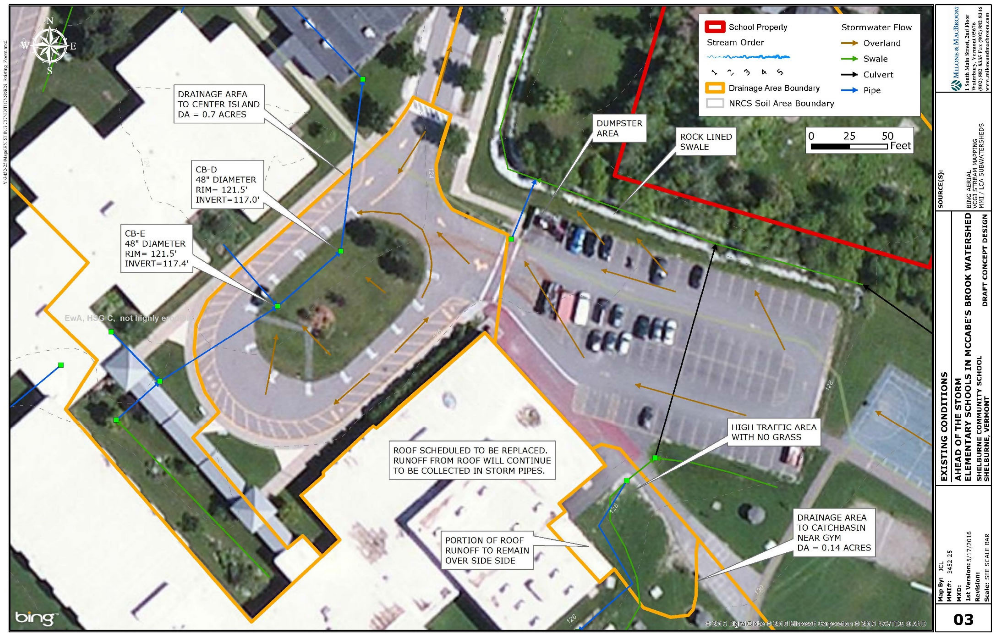
This could be helpful to have a grounds person at the school join in, but not necessary

Site Assessment - Example



This is an example of a completed assessment.

Site Assessment - Example



Zoomed in completed assessment

Ahead of the Storm - Optimal Conservation Practices

The 3 S's….

- **SLOW IT DOWN**
- **SPREAD IT OUT**
- **SOAK IT IN**

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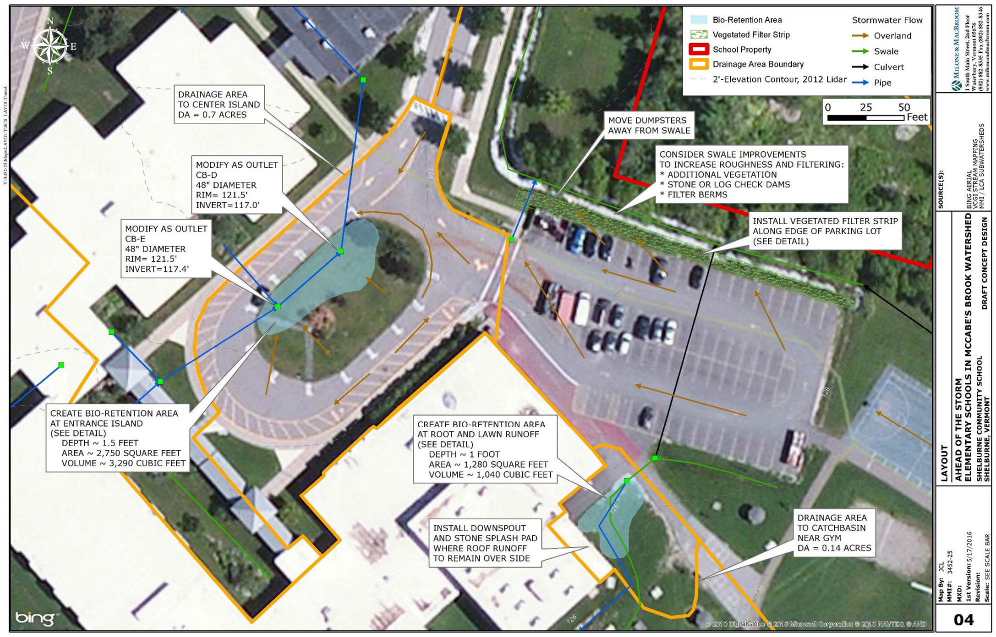
Our goal is to identify locations where water is collected and concentrated or where dirty water is running off impervious surface.

Once identified we will want to consider ways to Slow, Spread, and Soak. Next time we get together we will review specific ways to do that.

For now, just consider if there is space available where the problem exists to try to fix it at that location.

Design Plans - Layout



This is an example of a design plan that shows treatment areas. This will be something we work towards during our next working session.

I wanted you to see it so you can visualize why we are doing the mapping now.

Site Assessment Activity – Today's Goals

- **Orientation to maps**
- **Begin mapping flow paths**
- **Identify problem areas**
- **Start to identify the subwatersheds**
  - **Point Source**
  - **Non-Point Source**
- **Review Site Assessment Goals in Field**
- **Answer questions**

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Maps prepared ahead by engineers/teachers so there is something to use in the field for mapping these items.

Homework – Before next visit together

- **Finish site assessment**
  - **Flow path lines**
  - **Erosion areas**
  - **Existing stormwater infrastructure**
  - **Notes on impervious and landuse**
  - **Think about constraints**
- **Identify problem areas to discuss next time**
- **Review Optimal Conservation Practices Design Principles Handout**

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For older students, there is likely not enough time together for students to fully complete the site assessment. If this is the case, then they will have some homework.

For elementary age this can be adjusted to a shorter site assessment all together.

This ties in the handout given in the AOTS background session.

Site Assessment – Learn from Landowner

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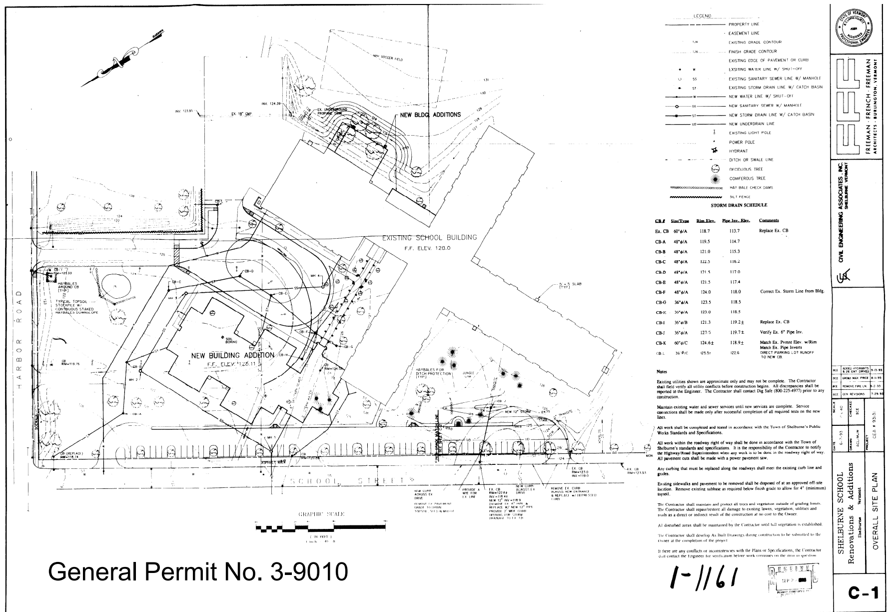
Site Assessment – Request Additional Data



General Permit No. 3-9010

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Site Assessment – Summarize Assessment

Ahead of the Storm
Existing Conditions Site Summary
Shelburne Community School

Site Description

The Shelburne Community School is located on Harbor Road in Shelburne and all runoff from the school goes to the McCabes Brook (Figure 1). Currently stormwater runoff from the roof, parking lots, driveways, playgrounds, and fields is all collected in a series of swales, catchbasins, and pipes and drains to the west to McCabes Brook. In many locations runoff travels directly from an impervious surface to the pipe network with no treatment. This project is to reduce velocity and volume of runoff leaving the site to improve water quality and flood resiliency. Students, teachers, and staff at the schools have contributed their knowledge of the stormwater drainage patterns and constraints at the site to this site assessment.

Drainage Patterns

Water generally flows northwest across the school property, exiting at three different locations.

Drainage area #1 collects water from 15.9 acres and includes runoff from the fields behind the school, the majority of the school building, and a portion of the front of the school. The roof drainage is collected internal to the building and directly enters the stormwater pipe system. This drainage is collected in a series of catch basins and pipes and is discharged through a pipe that travels across the street, past the tennis courts, and out to McCabes Brook.

Drainage Area #2 collects water from 3.8 acres and includes runoff from the front portion of the school and the area out to the corner of School Street and Harbor Road. Runoff from the roofs, driveways, parking, and lawn areas are collected in catch basins and piped out to Harbor Road where it joins a pipe leading to McCabes Brook.

Drainage Area #3 collects water from 62.7 acres, including a large portion of the village between the railroad tracks and Route 7 that drains to a large swale that travels around the east side of the school property. The swale is naturalized along the fields, goes through a culvert near the tennis court, and then is a straight, rock-lined swale out to Harbor Road where it enters a stormwater pipe and travels along Harbor Road to McCabes Brook. This swale also collects water from a portion of the parking areas, dumpster area, tennis courts, and baseball diamond.

No major erosion is visible on the school property. No major drainage issues were identified by the students or staff.

Site Constraints

The school uses a large percentage of the property for educational and recreational uses that should be maintained.

Soils at the site are Enosburg and Whately soils that are not highly erodible. The soils have a Hydrologic Soil Group of C, indicating that infiltration potential is low so runoff is likely to continue and increase with larger storms that is predicted for the area. These soils have shallow groundwater.

Possible Treatment Options Identified

1. Create a bio-retention area in entrance island at front of school. Excavate to create depression, plant, and overflow to existing catchbasins.
2. Improve roof drains near storage at gyms. Install downspout, splash pad, and small bio-retention areas.
3. Install non-mowed vegetated filter strip along parking lot adjacent to swale.
4. Move dumpsters away from swale.
5. Increase roughness in swale by adding filter berms, check dams, and encourage more vegetation.

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Ahead of the Storm
Existing Conditions Photo Documentation Summary
Shelburne Community School

Figure 1: Students and engineers together inspect an existing catchbasin in entrance island at front of school that currently drains through pipes directly to McCabes Brook.

Figure 3: A close-up view of catch basin in the entrance island at front of school that could remain as the overflow from a bio-retention area.

Figure 2: The entrance island at the front of the school has been identified as possible location for a bio-retention area.

Figure 4: The entrance island at the front of the school could be transformed from lawn to a bio-retention area with a variety of plants.

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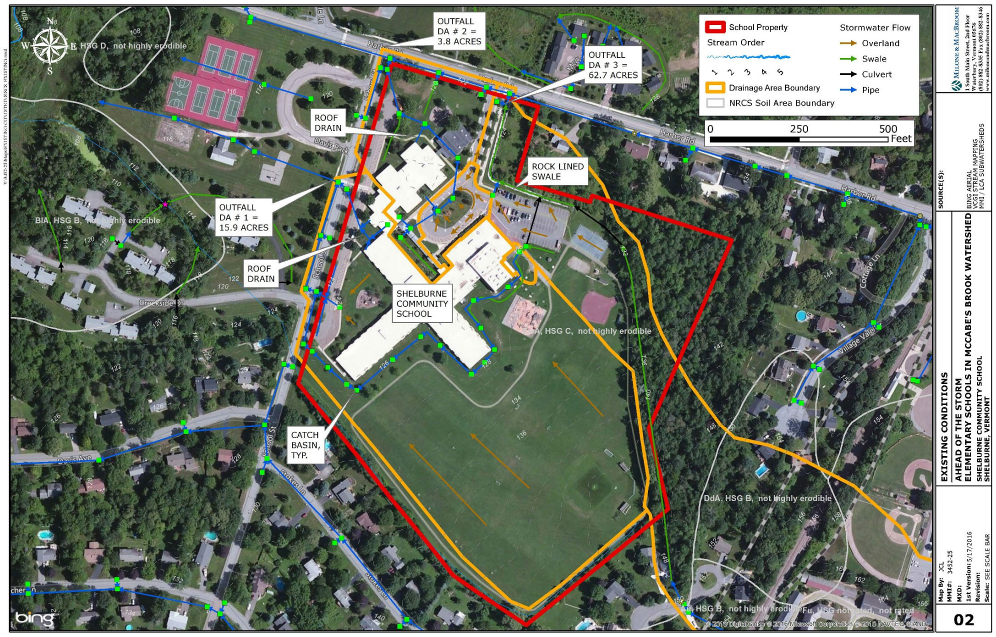
Design Plans - Watershed Map



Design Plans - Existing Conditions