

**Researching Site Drainage**

It is important to understand how the existing components of a site drainage plan are supposed to operate and interrelate with one another. Maintenance of some of these systems was not necessarily considered at the time of implementation and the project folders are sometimes incomplete so locating and understanding how the systems operate needs to be explored. The documentation of these systems, through drawings, photography and written reports, creates an important baseline of information for future work and understanding.

**Guidelines for Researching Site Drainage**

- Review all reports, documents and plans pertaining to site drainage to understand what one should expect to find at the site.
- Analyze visible elements of site drainage and note their operation, especially during or immediately after heavy rainfall/runoff events.
- Determine if subsurface systems exist and review their effectiveness.
- Note the apparent contours/slopes of the land around the structures, across the whole site and the neighboring properties. Also note the surface treatment (lawn, gravel/paved drives or parking areas, bare soil), land use (residential, commercial, agricultural, etc...), and apparent soil density of those surfaces/areas and how they affect runoff.
- Determine whether local waterways might affect the property during or after heavy rainfall/runoff events and whether the property is in a floodplain.
- Research the average ground water level and the soil types to determine potential issues with basement or site drainage and specifically the effects on subsurface drainage systems.

## Property Care White Papers

### Site Drainage: Research

#### **Technical Information on Site Drainage Research**

*Review all reports and site plans pertaining to site drainage to understand what one should expect to find at the site.*

- Conduct a thorough search of records kept at the Property Care offices, the individual property and at Historic New England's main archives.
- Note the chronology of the documents, type of documents (preliminary/conceptual plans, final design plans, as-built plans/sketches, construction reports, etc...), who prepared the documents (staff, architect, engineer, contractor), and how much of the project was actually installed/completed.
- Make sure that copies of all pertinent documents are kept at all three locations: the archives, Property Care, and at the individual property.

*Analyze visible elements of site drainage and note their operation.*

- It is helpful to review site drainage during or just after a rainstorm. The effectiveness of active systems and existing grading/drainage patterns will be more apparent. This is especially true on flat, relatively flat, and shallow sloped areas.
- Note what portions of the system work in synthesis with natural runoff patterns and what portions work against.
- Trace the routes of gutters, downspouts, discharge points and the various means to move water off the roof and away from a structure and identify any issues or flaws in the system.
- Measure and record cross-sections of gutters and downspouts, and attempt to determine the roof areas that drain to specific downspouts.
- Note the effectiveness of gutters in terms of its ability to capture water from the roof plane. This is particularly important during periods of heavy rain where undersized gutters will allow water to overshoot the edge and free fall adjacent to the building.
- Note which roof areas and gutters have overhanging or nearby trees that would necessitate frequent cleaning of the gutter system.

*Determine if subsurface systems exist and review their effectiveness.*

- Identify any drain or basin systems.
  - French/curtain/foundation drains, drainage channels (ditches or swales), catch basins, drywells, culverts, etc.
- Locate the route of the drains by snaking or using video cameras and document the condition of the drain.
- Locate and document the final discharge point.

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- Evaluate the size, capacity and condition of any subsurface storage or drywell system.
  - DO NOT ENTER ANY UNDERGROUND DRAINAGE STRUCTURES OR CONFINED SPACES. GATHER AS MUCH INFORMATION FROM THE GROUND SURFACE AS IS POSSIBLE.
- Assess the information gathered in the investigation and determine the best course of action to return them to their designed capacity.
- If necessary incorporate the expertise of an engineer or landscape architect to analyze the data and provide recommendations.

Note the apparent contours/slopes of the land around the structures, across the whole site and the neighboring properties. Also note the surface treatment (lawn, gravel/paved drives or parking areas, bare soil), land use (residential, commercial, agricultural, etc...), and apparent soil density of those surfaces/areas and how they affect runoff.

- Determine general drainage patterns and types (sheet flow, shallow concentrated flow, channel flow) both natural and man-made.
- Drainage issues can be a result of adjoining properties. Look for culvert, channel, and drainage system discharges from neighboring properties, in addition to the neighboring surface treatments and land uses noted above.
- Observe the relationship between the site and existing municipal drainage systems.

Determine whether local waterways might affect the property during or after heavy rains and whether the property is in a floodplain.

- Look at the general lay of the land along the waterway and around the adjacent land surface of the property.
  - Is the adjacent land surface elevation close to the elevation of the waterway (broad, flat, wet areas)?
  - Does the adjacent land surface rise up quickly from the edge of the waterway?
  - Are the banks vegetated and stable or are they eroding?
  - Is the waterway shallow and broad, or deep and narrow?
- Look downstream along the waterway for flow restrictions (culverts, man-made dams, beaver dams, fallen trees, accumulated debris, bridges, etc...) that may cause water backups during times of high volume flows in the waterway.
- Check the latest Federal Emergency Management Agency's (FEMA) flood maps for the City/Town to determine whether the property or a portion of the property is in the floodplain or floodway.
  - The flood maps are available at the City/Town Municipal Offices or on the FEMA website (<http://msc.fema.gov/>).

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### Site Drainage: Research

Research the average ground water level and the soil types to determine potential issues with basement or site drainage and specifically the effects on subsurface drainage systems.

- Drainage patterns and groundwater levels are affected by the type, profile, and density of the soils.
- High ground water can affect the operation of drainage systems but be sure there actually is a ground water issue on site.
- The water table changes monthly in relation to the amount of water in the soil.
  - The seasonal high water table (usually occurring in mid to late Spring) can vary from year to year.
  - Groundwater levels can also vary greatly from location to location on a site on any given day.
- The USGS website provides general reference information on soil type monthly averages for groundwater.
- The USDA Natural Resources Conservation Service (NRCS) has a website allowing access to their soil mapping and soil information (<http://websoilsurvey.nrcs.usda.gov/app/>)
- Analyze and understand soil types on the site and how they affect drainage and dispersal patterns.
- Test pits can be used to determine the current water table and the soil type.
  - Old wells adjacent to a structure can serve as a very accurate measure of ground water without the need for a test pit.
  - Note that the installation of test pits may require archaeology.
  - If test pits are excavated on a property, depending upon their locations, consideration should be given to installing a permanent groundwater monitoring pipe in the excavations. These monitors would be invaluable in determining the depth to the groundwater at any time, and more importantly over the long term.
  - If monitors are installed, they should be checked on a regular basis and the groundwater levels recorded. The recorded data would aid in decision making on future below grade structure and utility design and installations.
  - Develop a maintenance and observation schedule with a proper procedure for the recording and delivery of the data.
  - The data would also be useful in determining whether groundwater lowering/diversion measures are needed and what measure would be appropriate, and whether attempting to infiltrate surface runoff into the ground is possible.
  - Buildings with soil floors could also have groundwater monitors installed, as their surfaces are that much closer to the water table and therefore that much more critical.