

What is Hydromodification?

When undeveloped land is covered with buildings and pavement, it causes more stormwater runoff to flow into creeks at faster rates. This may result in creek channel erosion, as well as flooding, habitat loss, and, in some cases, property damage. These development-induced changes to the natural flow of stormwater and creeks are called hydromodification.



Example of creek bank erosion.

In the past, creek bank erosion was addressed by constructing engineered channels. But this created new problems for salmon and other migratory fish, and in some locations resulted in excessive sedimentation in the channels, requiring costly maintenance.



Example of an engineered channel.

What is Hydromodification Management (HM)?

New hydromodification management (HM) techniques focus on retaining, detaining or infiltrating runoff and matching post-project flows and durations to pre-project patterns for a specified range of smaller, more frequent rain events, to prevent increases in channel erosion downstream. Since 2007 HM has been required in susceptible areas across the Bay Area.

Does My Project Need HM?

HM requirements apply if a project creates and/or replaces one acre or more of impervious surface, increases impervious surface over pre-project conditions, AND it is located in a susceptible area (such as hillsides, the east county, and other areas that drain to natural creeks or earthen channels that are not resistant to erosion). The HM control area map is posted on the Program's Development web page (see For More Information). In some areas, projects may be exempt if applicants show that all runoff flows to hardened channels. Projects requiring HM controls typically also require water quality treatment, described in a stormwater quality requirements flyer (reference on back of page).

What Are the HM Requirements?

If the HM requirements apply to your project, you will need to incorporate appropriate HM controls in the project. These controls can be categorized as:

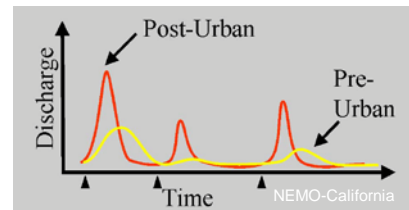
- Hydrologic source controls (site designs) to reduce runoff,
- Flow duration controls to temporarily detain runoff, and
- In-stream measures, or off-site measures, where conditions allow.

Hydrologic Source Controls

Hydrologic source controls are design techniques that minimize and/or slow the rate of stormwater runoff from the site. These techniques may also be called site design measures or low-impact development (LID). Examples include:

- Reduce impervious surfaces,
- Drain rooftop downspouts to pervious areas,
- Use alternatives to standard surfaces, such as pervious paving or green roofs, and
- Rainwater harvesting and use.

Flow Duration Controls



Pre- and post-urban hydrographs show how runoff rates and volumes increase with impervious area.

Flow duration controls are structures designed to detain excess runoff that remains following the use of hydrologic source controls. They have specialized outlets to gradually discharge stormwater to waterways at a level below the "critical flow" that would cause creek channel erosion.

Flow duration controls are generally project-specific on-

site controls. Examples of flow duration controls include:

- Extended detention basins,
- Wet ponds, and
- Underground tanks or vaults.



Detention pond in Pleasanton provides stormwater treatment and hydromodification management.

Flow duration controls are designed so that the post-project stormwater discharge rates and durations match the pre-project rates and durations from 10 percent of the pre-project 2-year peak flow up to the pre-project 10-year flow. Projects that require flow duration controls typically require water quality treatment controls as well (see fact sheet on stormwater quality requirements, referenced below). If feasible, combining flow duration and water quality treatment into one facility can reduce the land area needed for stormwater management.

New Requirements for Low-Impact Development

Starting December 1, 2011, stormwater treatment requirements must be met using evapotranspiration, infiltration, and/or rainwater harvesting and reuse, if feasible. A fact sheet on stormwater quality control is available on the CWP's Development web page (see web link under "For More Information"). Integrating these low impact development (LID) designs into the site plan helps

reduce changes in the site's hydrology. For projects in which it is feasible to meet stormwater treatment requirements with infiltration, evapotranspiration, and/or rainwater harvesting, it may be possible to design smaller flow duration control facilities.

Bay Area Hydrology Model

The design of flow duration controls is based on hydrologic simulation modeling. To help applicants with this, the Program has worked with the Santa Clara Valley Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program to develop the Bay Area Hydrology Model (BAHM). On-site and regional control measures designed appropriately using the BAHM and local requirements will meet the permit's HM requirements. The BAHM and its user manual can be downloaded at www.bavareahydrologymodel.org.



Sculpture collects and stores roof runoff at Mills College in Oakland.

In-Stream Measures

In-stream measures, or a combination of in-stream measures and on-site controls, may be allowed where erosive flows exist and there is excessive sediment, deposition, erosion or a hardened channel. In-stream measures involve modifying the receiving creek channel to reduce the potential for erosion and sedimentation.

Maintaining HM Controls

HM controls and stormwater treatment measures need ongoing maintenance to keep working properly. During project review, applicants must prepare a maintenance plan and enter into an operation and maintenance agreement with the municipality to identify and record the party responsible for long-term maintenance of HM controls and stormwater treatment measures.

For More Information:

- Clean Water Program (CWP): 510/670-5543, www.cleanwaterprogram.org. (for Development webpage, click on "Businesses," then "Development.")
- Contact information for local stormwater programs is available at the CWP's Development web page (click on link to local new development representatives).
- Regional Water Board staff: 510/622-2300 (request Alameda County stormwater program manager.)