

# Low Impact Development in the Construction Phase

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Low impact development practices must be implemented with care at each stage of the development. If a facility is properly designed but improperly constructed, the facility is unlikely to perform as intended and many benefits of low impact development will be lost. The facility may even pollute the stormwater further instead of protect it. This fact sheet is intended to provide an overview of general construction considerations for the project team. Construction considerations for specific low impact development practices are presented in the associated individual fact sheets.

## Preventing site disturbance

The contractor should limit disturbance in areas of the site that don't need to be altered. When land is in an undisturbed, well-vegetated condition, the vegetation and soil work together to capture almost all rainfall and “manage” it through infiltration, evaporation, and transpiration. Unnecessarily clearing vegetation and grubbing or disturbing soils will greatly impact this balance and affect the long-term habitat value of downstream waterways and watershed health in general.



Figure 1.—Orange protection fencing at this project is not a sufficient deterrent to stockpiling within the tree canopy.

## STAGING AND STOCKPILING

Limiting site disturbance on building projects by carefully staging equipment and activities and stockpiling materials is critical to protecting vegetation and soils. Here are some common setback recommendations to limit disturbance<sup>1</sup>:

<sup>1</sup> Sustainable Sites Initiative, Credit 4.4: Minimize soil disturbance in design and construction. <http://bit.ly/1jQXceY> [last accessed 6-4-14]

- Forty feet beyond the building perimeter (although as little as 10 feet is often possible)
- Ten feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter
- Fifteen feet beyond primary roadway curbs and main utility branch trenches
- Twenty-five feet beyond areas with permeable surfaces

The contractor should create a staging and stockpiling plan that identifies

- sensitive areas to be protected with fencing if this isn't already shown on the construction documents
- other areas (infiltration facility locations, tree canopy, etc.) to be protected with fencing
- when materials will be delivered, how much space will be needed, and where they'll be stored until used
- the haul road location
- phasing of clearing and construction activities

Fencing off areas can be an effective way to limit disturbance. Orange plastic fencing is often used, but this has not been found to be as successful as cyclone fencing at keeping subcontractors out of areas. If a contractor doesn't want to make this investment, cyclone fencing can usually be rented for a reasonable fee and is considered a more sustainable material than discardable plastic. While jurisdictions often require fencing of sensitive areas such as wetlands and riparian areas, fencing around other important areas such as the location of infiltration facilities and tree canopies is often forgotten.

Stockpiling materials and parking equipment under the canopy of trees to be preserved should be strictly prohibited, as this can compact soils and kill trees. Unfortunately, it usually takes many years for construction impacts to trees to become evident, saddling the landowner with

an unexpected expense, a maintenance hassle, and a loss of land value.

Stockpiling areas, the haul road, and other construction equipment such as site trailers should be located in the footprints of demolished infrastructure or areas of future disturbance. Vehicular traffic, and even foot traffic in some cases, can easily compact soils. If future natural areas are accidentally or intentionally compacted (fill areas), establishing vegetation can be more difficult. For the owner, this means higher maintenance costs for landscaped areas because they'll need more irrigation and will be more susceptible to diseases. For the watershed, this extra irrigation can be an unnatural source of summer stream flows, and it means more pesticides, fertilizers, and herbicides are likely to enter the water system.

Finally, to limit compaction, contractors can make equipment choices that reduce loads transferred through the soil. These include

- using the lightest (usually smallest) piece of equipment possible
- using track equipment
- using equipment with flotation tires

### EROSION PREVENTION

Erosion prevention and sediment control are often thought of as a single activity, when, in fact, they are different. Erosion prevention is defined by the Oregon Department of Environmental Quality (ODEQ) as "any practice that protects the soil surface and prevents the soil particles from being detached by rainfall or wind." Preventing erosion is often thought of as solely the contractor's realm, but everyone on the project



Figure 2.—Track hoe equipment reduces soil compaction.

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team can contribute to this important practice and should consider it during the planning and design phase. For instance, the final grading plan should be as close to existing grades as possible. This may mean stepping the finished floor elevations of long buildings, which will require close coordination throughout the design phase between the civil engineer or landscape architect doing the grading plan and the architect who will step the buildings. See the “Site Planning” fact sheet for more information.

Due to the high negative impact on water quality caused by suspended solids, the ODEQ closely regulates construction sites of one acre or larger through the 1200-C or 1200-CA permit process; however, erosion from several smaller sites can have a cumulative negative impact on water quality and the habitat value of our waterways. “Sediment runoff rates can be up to 20 times greater than agricultural sediment loss rates and 1,000–2,000 times greater than those of forested lands.”<sup>2</sup> Most local jurisdictions regulate erosion from less than one acre. If not, we strongly recommend you follow the guidance of the ODEQ’s *Erosion and Sediment Control Manual* for all construction sites, regardless of size. Be aware that there are a variety of practices available and not all are appropriate for every application. Time of year (hydroseeding to stabilize slopes is effective only if temperatures outside will allow germination) and soil texture (sediment fences are 0–20 percent effective in clay soils<sup>1</sup>) are

<sup>2</sup> <http://bit.ly/1p7h1nK> [LINK BROKEN]

just two important considerations when choosing BMPs.

### Mitigating site disturbance

Complete protection of site resources on a construction site is, of course, impossible. After limiting disturbance to the greatest extent possible, additional measures should be taken to mitigate site disturbance and prevent impacts.

### SEDIMENT CONTROL

The ODEQ defines sediment control as “any practice that traps the soil particles after they have been detached and moved by wind or water.” This means that rather than simply preventing erosion in the first place, one must install, monitor, and maintain sediment control systems. ODEQ’s *Erosion and Sediment Control Manual* provides excellent guidance on how to do this using any one of 12 different approaches, but not all approaches are equally applicable to all sites.

The ODEQ has determined from a literature review of research papers and EPA guidance that properly installed sediment fences are 0–20 percent effective for fine-grained soils (clays and silts).<sup>1</sup> This is because clay and silt particles are much smaller

<sup>3</sup> ODEQ, *Best Management Practices for Storm Water Discharges Associated with Construction Activities*, Feb. 2006. <http://bit.ly/1ng0OMz> [last accessed 6-4-14]



Figure 3.—The presence of beetles and other soil animals indicates healthy soil.

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than the mesh opening of a sediment fence.<sup>2</sup> Alternatives that work well to control sediment from overland (i.e., non-concentrated) flows for any soil type include compost berms, compost socks, and wattles. At the end of the construction phase, compost used for erosion control can be folded into landscape areas.

### SOIL RESTORATION

Healthy soil plays a crucial role in water quality as

- a growing medium for vegetation
- habitat for beneficial microbes that break down pollutants and larger fauna that mechanically loosen the soil and preserve air pockets
- storage medium for rainfall until it can evaporate or infiltrate

Both intentional and unintentional compaction consolidates soil and greatly reduces void space.

<sup>4</sup> <http://bit.ly/1x8BBsF> [last accessed 6-4-14]

Compacted soils can have densities that are almost as high as concrete.<sup>1</sup> This has long-term impacts on water quality and quantity, because these soils

- won't have voids to store water and air for plants, resulting in higher irrigation needs and less-healthy plants—which caretakers may try to maintain with increased fertilizers, herbicides, and pesticides
- generate runoff flows and volumes that are more similar to impervious surfaces than pervious landscapes

Soils disturbed by current or previous activities should be restored with compost amendment. The ODEQ's *Restoring Soil Health to Urban Lands*<sup>2</sup> (July 2001) and similar resources published by Washington State University Extension and Puget Sound Action Team promote compost amendments as an important LID approach. See the Compost Amended Soils fact sheet.

Because soil life may have died due to poor air and water conditions, mycorrhizae (mushrooms) and biological (bacteria) treatments can be added to the soil to enhance its biology, and thus its ability to support plant life. This is likely to speed establishment and reduce water demand during this period.

<sup>5</sup> <http://bit.ly/UcpMCW> [last accessed 6-4-14]

<sup>6</sup> <http://bit.ly/1jRswdz> [last accessed 6-4-14]



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Figure 4.—Fine clay particles exposed to rainfall have re-sorted and clogged this infiltration facility.

### Special considerations for infiltration facilities

If the soils in an infiltration facility are exposed to rain, fine soil particles will be picked up and moved around and may clog the native subgrade soils. In this case, raking the soils may be helpful; however, experience with the Ballard neighborhood rain gardens in Seattle showed that raking soils that are too wet is not helpful. Soils must be allowed to dry before they can be unclogged. Thus, it is important to protect the soils from rainfall in the first place.

Raking may also be beneficial if the rain garden is dug by hand, since foot traffic in the facility area is probably unavoidable. You may also consider covering the surface in mulch immediately upon excavation. If the facility is a future landscape area (not a pavement area), such as a rain garden, the mulch may be left in

place as subsequent layers of rock or soil are placed.

### Regional impacts of construction activities

Because air pollution has been found to compromise water quality,<sup>1</sup> construction activities that can address air quality are an important control for protecting water quality. In addition to protecting the soil from compaction to preserve the air filtering capacity of the soil, practices that reduce emissions from machinery or reduce vehicle miles travelled will also help protect water quality. For example:

- Select materials and products with transport methods that increase fuel efficiency.
- Choose contractors who use biofuels or electric equipment.

<sup>7</sup> <http://1.usa.gov/1uiUMgX> [last accessed 6-4-14]

- Order construction waste pickups when bins are full, instead of on a weekly basis.
- Plan materials purchases and packaging considerations to ensure that only 10 percent (by weight arriving on the site) of total materials delivered to the site are discarded.<sup>2</sup>
- Recycle construction waste.
- Limit transportation mileage by buying local.

### Additional best management practices

A number of other best management practices can be employed during the construction phase for a variety of environmental benefits:

- Use native seed mixes when temporarily stabilizing slopes during construction. This will limit the weed control needed during site maintenance.
- When removing healthy, native vegetation, grind it on site and use as a compost berm or other compost erosion control method. The compost can be spread over garden areas when the landscape is stabilized and erosion control can be removed.
- Use watertight trucks when hauling saturated soils from the site, since polluted water and sediment can easily leak out onto roads during transportation in regular dump trucks.
- Support companies that employ sustainable practices. Buy materials from manufacturers and sup-

pliers that have “green” business operations, especially nurseries.

### Interdisciplinary communication

The team should ask each other questions and continue the collaborative work they began in the planning or design phase. Surveys are an imperfect representation of the real world, and in disputes or disagreements, all parties should come to the table with an open mind and good intent, assuming that others are doing the same. In addition to imperfect surveys, other common difficulties faced by contractors include

**Meeting the specifications.** Finding material to meet the specification can be challenging. The material may be unfamiliar or difficult to source in quantity or at all. Before substituting an alternative, contractors should ask for help in finding suppliers. Someone

on the team may already know, or a quick question sent out to a listserv or social networking group can often yield an answer. If not, relevant team members should work together to find an alternative that provides mechanical and ecological functioning similar to the original material or component. The contractor should be wary of assuming that one product is equivalent to another and substituting it without prior approval.

**Constructability.** Engage the general contractor in the planning and design phases to ensure that creative solutions are actually buildable.

**Buy-in from sub-contractors.** While the general contractor may be on board with the “green” goals of a project, the sub-contractors may not have had as much involvement in the project. Hold



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Figure 5.—Multi-disciplinary collaboration is needed at every phase of the project.

<sup>8</sup> The LAND Code, <http://bit.ly/1p7hUNc> [last accessed 6-4-14]

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a pre-construction meeting with the architect, the site consultants (landscape architect, civil engineer, arborist, wetland scientist, etc.), and the sub-contractors to clarify what exactly are the

“green” goals, their importance, and how the contractor and sub-contractor can specifically contribute to meeting the goals in their everyday operations.

## References and resources

- Oregon Department of Environmental Quality. *Inspector Guidance Booklet for Construction Site Erosion & Sediment Control*. <http://tinyurl.com/phn79pa> [last accessed 6-4-14].
- Construction inspection training: <http://www.cpesc.net/> [last accessed 6-4-14].
- Oregon Department of Environmental Quality. *Erosion and Sediment Control Manual*. <http://www.cicacenter.org/pdf/ORESCManual.pdf> [last accessed 6-4-14].

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