Amend Poor or Damaged Soils with Pumice

Large-area soil structure, balance, and growth-sustaining performance can be improved economically with pumice.

EXECUTIVE SUMMARY

SITUATION: The long-term success of any reclamation project begins with the quality of the soil. Yet, too often, the native soil is poor or has been damaged from construction or industrial activities, especially where the topsoil has been inadvertently mixed with subsoil, a common occurrence at construction and mining sites. Even stockpiled topsoils suffer from mycorrhizae die-off in as little as eight months.

Beyond reclamation efforts, the growing demand to control and filter runoff water from roadways with ecology embankments and other engineered contours benefit greatly from high-functioning soils. High-value crops on limited acreage demand better soil performance. And common soil is rarely up to the relentless, high-performance demands of today's turf-skinned parks, fields and golf courses.

PROBLEM: Poor or damaged native soils must be improved, repaired or replaced. Adding economical, long-lived, predictably-performing conditioners to improve soil capacity and performance is typically the best solution, but the commercial blends of rich organics meant for pots and small garden plots are not economical for such large-scale applications.

SOLUTION: Tilling in a mixture of an organic compost, which jump-starts soil performance, and inorganic, inexpensive pumice, which functions as a long-term conditioner (in terms of improving soil texture for water and nutrient retention, compaction resistance, drainage and runoff filtration) effectively sustains the on-going health of the rebuilt soil. Pumice—and the benefits it adds to the soil—lasts indefinitely.

RESULT: Reconditioned soils stay loose and friable in the root zone, allowing the critical exchange of gases—respiration—to occur freely (a real problem in compacted, high-clay content soils). Because of the improved Cation Exchange Capacity (CEC), nutrients are held and available to crops, turf grasses or native ground cover over a longer span. Drainage is optimized from improved infiltration, mitigating runoff and erosion problems. Watering requirements—duration and frequency—go down. Contaminated runoff water is aggressively filtered. Turf grasses thrive, crop yields increase, and overall vegetative success is improved.

Hess PUMICE
IDAHO USA

Heavy clay soil amended with 1/8 minus pumice to improve water- and nutrient-holding capacity, root-zone respiration, and compaction resistance in this newly-established turf.

NATIVE SOILS AREN'T ALWAYS IDEAL for growing much beyond the native plants that have adapted to thrive in it. Even then, that balance is incredibly delicate. And wrecking that balance is often a problem in large-scale soil-critical projects where topsoil and subsoil are inadvertently mixed.

Those who grow things in containers enjoy a rich bounty when it comes to choosing a growth medium: potting soils. Dark, friable and gloriously rich in organics-infused goodness, these blended soils are ideally formulated for optimum growth. Those engineered growing soils typically contain an inorganic ingredient: vermiculite, perlite, or pumice. They are added to provide biological, chemical and physical stability and functionality to the soil. They work to combat compaction, optimize aeration, and facilitate drainage.

Move beyond the pot or small garden plot, and the bagged magic of potting soil is out of economic reach. Yet, the wide-area need for better soil is still there.

Engineered landscapes—reclamation projects, runoff-filtering ecology embankments, drainage and stormwater controlling contours, constructed wetlands, erosion-mitigating ground covers—demand high-performance soil to optimize effectiveness.

Large-scale turf operations such as urban parks, golf courses or playing fields must not only be vigorous and attractive, but hold up under hard use. Water requirements, fertilizer demands, compaction problems in the root-zone, drainage dynamics…all are greatly affected by the quality of the soil beneath the turf.

Big agriculture relies on quantity and mechanized equipment—putting a horizon-touching number of acres under cultivation. But for those raising small-plot specialized crops in both rural and urban settings, conditioning the soil to amp yield and reduce water requirements makes bottom-line sense.

Pure, natural, abundant pumice can be economically purchased and blending into the native soils in any of these situations to enhance performance and vegetative success.

Soil Reclamation

In an article appearing in the *IECA Newsletter*[1], Peter McRae, of Quattro Environmental, laments the high failure rate of native seeding operations for reclamation projects. He states: "…re-building sterile and imbalanced soil has been empirically shown to be the most critical element in any seeding design." He continues: "Unless accurate soil data is available to enable balancing of soil and buffering for imbalances through accurate use of soil amendments, the project has probably failed before leaving the designer's desk. This has to be Step One in a successful revegetation project."

There is a lot of savvy that goes into revitalizing and rebalancing soil to the point that re-established native plant species can thrive. Pumice is a ideal foundation upon which to build that soil design, providing immediate and lasting benefits as an economical inorganic amendment.

Stockpiled topsoil can be performance-boosted with pumice to enhance drainage and mitigate runoff while supporting vigorous plant cover.

Ecology Embankments

With the Pacific Northwest states leading the way in research and specification development, the science of and need for ecology embankments and similar constructions is firmly established.

Ecology embankments, biofiltration swales, filter strips and similar—are designed and constructed to control and treat pollutants picked up by stormwater running across impermeable surfaces—roads, parking lots and structures—before it enters streams, lakes and aquifers. These stormwater management constructions need to be low-cost and simple to implement, have an economical lifespan, and require minimal maintenance. The construct's filtration properties—a combination of filtration media and structure design—are critical to effective function.

The above criteria is most effectively met with a plant soil system, and that is done by improving the filtration and growth-support ability of the native soil—a simple, long-term, economical choice.

Pumice makes an ideal soil-performance additive for these types of large-scale projects. Inorganic pumice, in combination with an organic compost, amps the ability of the engineered embankment soil to absorb and filter runoff water while also providing the foundation vital to healthy, sustained-growth vegetation.

WHY PUMICE?

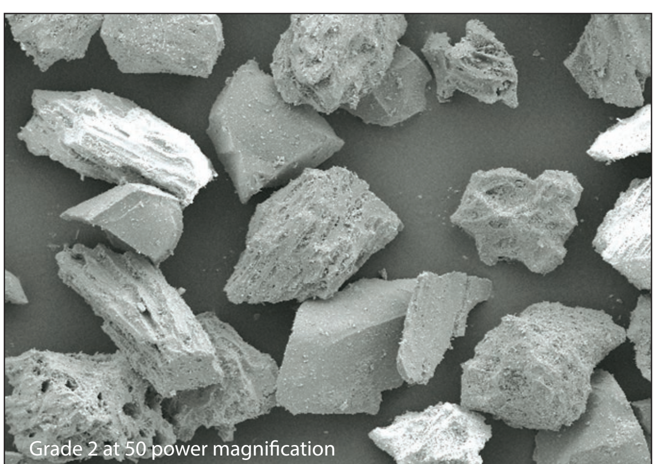
Desirable Characteristics of a Physical Soil Amendment

Physical suitability for an inorganic amendment means the right particle size to thoroughly blend with the soil and provide aeration. Being light of weight is also desirable. As is chemical suitability, which includes factors such as Cation Exchange Capacity, neutral pH, and chemical inertness. Finally, bulk availability at economical costs and consistency in spec and performance load after load. Pumice provides all of those desirable attributes.

Organic conditioners—compost and other manures—are always desirable, even when reintroducing stockpiled topsoils, as the microscopic organisms (mycorrhizae) die out in stockpiles more than 2 feet deep in as little as eight months[2]. Fortunately, much of the benefit provided by expensive organic conditioners (beyond mycorrhizae replacement) can be realized with the addition of pumice. Pumice delivers inexpensive conditioning that enhances root-zone activity, water and nutrient retention, drainage performance, filtration action, and hydric functionality that will help return mycorrhizae to degraded soils. Pumice will both replace a percentage of the expensive organic matter and function consistently and indefinitely as part of the overall blend.

Pumice is a Naturally-Suited Soil Conditioner

Born in the fiery heart of a volcano, pumice is formed when pressurized, super-heated magma (molten stone) reaches the surface and is ejected. The trapped moisture within the magma flashes to steam. The final result: little lightweight pillows of porous glassy stone—remarkably useful in a wide variety of applications and industries. Properly processed to the ideal soil-enhancement grade, these tiny pumice stones, riven with macro and microscopic nooks and crannies, do wonders for soil.



At the ideal soil-enhancement grade (1/8 minus), tiny pumice stones, riven with nooks and crannies, do wonders for the soil.

They grab and hold water and nutrients and then give it all back to the soil and the seeking roots over time. They hold open tight soils, providing the vital soil aeration plants need to thrive. And, via microbial activity, pumice contributes nutrients that plants need.

The aeration problem is especially problematic in the shallow-drained soils found in sports fields, greenhouse benches, roof gardens and other urban landscaped sites. Adding a light, frothy, coarse-textured particle like pumice supplies the needed porosity to either hold onto insufficient water or drain excess water—while still providing adequate aeration.

Heavy clay soils, consisting of a tight matrix of particles, offer a poor growing medium. Adding pumice opens up the dense, sticky soil, improving the soil's ability to breath, absorb and drain water, filter runoff, and support erosion-mitigating plant life.

Beating Compaction

In terms of a soil's resistance to compaction—its ability to stay loose and friable—consider the tasty proof offered by the world-famous Idaho Potato. Those big spuds thrive in the loose, water- and nutrient-holding naturally volcanic soils of the Snake River Plain. Harvest after harvest, decade after decade, the soil stays loose and arable, allowing those potatoes to swell to impressive proportions.

Compaction stomps the moisture characteristics curve, wrecking a soil's crucial porosity balance by reducing total porosity and macroporosity, while increasing microporosity, thus leading to erosion problems. Soil macropores provide drainage and aeration, mesopores supply water conductivity, and micropores retain water. All of these characteristics, in balance, are needed for high quality soils and long-term vegetative success.

Blending pumice into heavy soils susceptible to natural compaction, or with soils subject to compaction forces from mechanical or foot traffic, mitigates the problem by lightening the soil, easing tillage, and helping to lock into place the critical balance between aeration, drainage and water retention.

Pumice and Perlite: Physicochemical Twins

Perlite enjoys a well-deserved reputation as an inorganic soil amendment—it is used widely and has been studied extensively—making a performance comparison between perlite and pumice very useful.

Such study was conducted by the Department of Horticulture at the University of Illinois[3] in 1992, looking specially at pumice as a substitute for perlite. The research found that the physiochemical properties—chemical properties and surface characteristics (important for amendment interaction with water and other soil components)—to be analogous. Bottom line: pumice is equal to petite in behavior and performance as a soil amendment.

Why does it matter? Large-scale economics. To attain its successful soil-enhancing properties, perlite must be expanded (superheated and popped) before being crusted and graded. Pumice, on the other hand, has had its useful lightweight porosity and friability already cooked in by nature.

Such economy in preparation is of interest to soil professionals looking to amend poor soils on a large scale—reclamation projects of disturbed and damaged areas from mining and construction projects, engineered ecology embankments designed to filter polluted runoff water from highways and urban areas, or the hard-used turf skin of sports fields and parks.

Crushed pumice is easily transported, spread, and blended into the soil. For large scale soil improvement projects, pumice is the cost effective performance choice for non-organic, permanent soil conditioning.

Pure Pumice

Not all pumice is created equally by mother nature. The best pumice for soil conditioning comes from naturally pure commercial deposits—pumice that is clean, pH neutral, non-reactive, and free from hazardous properties or toxins that would harm handlers or plant life. The deposit mined by Hess yields such pumice.

Determining Amount of Pumice Needed

The soil-enhancing benefits provided by pumice can be realized with a little as 10% pumice to soil ratio. Up to 1/3 of the needed topsoil can be pumice. A soils technician can run a sieve analysis to determine the appropriate addition rate.

A Grade 2 (1/8-inch minus) is an ideal pumice granule size to mix into soil.

CONCLUSION—Pumice is an ideal foundational amendment upon which to build an effective and economical large-area soil improvement solution, enhancing the long-term ability of poor or damaged soils to support vegetation, mitigate runoff, and function indefinitely as a component in a stormwater filtration embankment.

Contact **Mike Hess Jr.**, Sales Manager at Hess Pumice, to discuss your project and pumice needs.
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CITATIONS & EXPERTS

1 • Western Chapter of IECA Newsletter, Spring 2006: "Shortcomings of Native Seeding Project Implementation."

2 • A comprehensive review and significant contribution was provided by Mike Vice, a Senior Reclamation Specialist with Monsanto Company. He has also worked as a Soil Scientist & Soil Conservationist with the USDA Soil Conservation Service (now the Natural Resource Conservation Service).

3 • Dianne A. Noland, L. Art Spomer & David J. Williams (1992): Evaluation of pumice as a perlite substitute for container soil physical amendment , Communications in Soil Science and Plant Analysis, 23:13-14, 1533-1547

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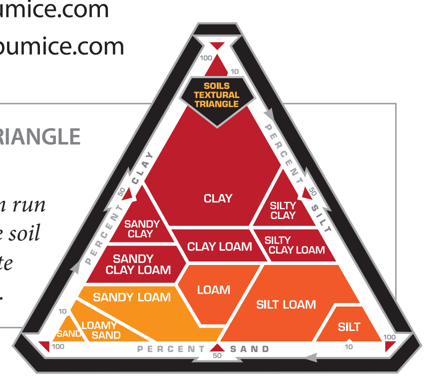

SOILS TEXTURAL TRIANGLE (PAGE 5)

A soils technician can run tests to determine the soil needs and appropriate pumice addition rate.

USE PUMICE TO CONDITION SOIL TO THE IDEAL TEXTURE

- SANDY LOAM TEXTURES: Best for ecology embankments, filtration strips, biofilter swales and engineered wetlands.
- CLAY TEXTURES: Adding pumice breaks up the sticky density of clay soils, mitigating compaction and runoff erosion, enhancing root-zone respiration for healthy ground cover, optimizing drainage and water retention needs.
- SILT LOAM TEXTURES: Unless more aggressive filtering is needed (ecology embankments), soils in these textural range need no additional conditioning with pumice.

The performance target of the soil, combined with a simple test to establish soil texture, will determine if or how much pumice is needed to change the texture and enhance soil function.

Mitigating compaction and runoff and enhancing the ability of the soil to support plant life requires a friable silt loam texture. Engineered ecology embankments, biofiltration swales and roadside filtration strips function best with sandy-loam textured soils. The right amount of pumice will condition the soil to fit the need.