Weed Free Aggregates for Quarry Managers

Introduction

Johnson Grass. *NPS Photo*

Non-native invasive plants displace native plants and crops, deplete water, increase wildfire severity and frequency, decrease visibility along right-of-ways, degrade pastures, decrease timber yields, degrade wildlife habitat, and inhibit recreation. Land managers control invasive plants to reduce the environmental and economic damage that invasive plants cause. Treating invasive plants over a large area is expensive and often impossible. However, prevention of invasive plant introduction and establishment is the most cost-effective alternative.

Aggregate quarries are high quality habitat for invasive plants and are the source for many invasive plant infestations, especially in transportation corridors and construction sites. When contaminated aggregate is used, invasive plant propagules transplant from one high quality disturbed habitat to the next. Land managers can save thousands of dollars on treatment by preventing the introduction of invasive plants by buying weed-free aggregate. Weed-free aggregate is material purchased from a quarry that has been inspected and certified weed-free. An inspector examines the quarry to determine the likelihood that saleable material leaving the quarry does not contain invasive plant propagules. Upon successful inspection, the inspector issues a weed-free aggregate certificate.

This document provides guidance for land managers interested in starting a weed-free aggregate inspection program. Currently, California does not have a statewide inspection program although several public agencies (e.g. Yosemite National Park, Sequoia-Kings National Park, US Forest Service – Lake Tahoe Basin Management Unit) do inspect nearby aggregate pits and issue weed-free aggregate certificates. These certificates are shared between land managers.

As more land managers join the program, it reduces the cost of inspections. Additionally, the certificate increases product visibility and demand and becomes a marketable tool that highlights the “value-added” to the product.

The demand for weed-free aggregate will increase as land managers realize the cost-savings of purchasing weed-free aggregate as opposed to incurring the cost of treatment. The voluntary collaboration of land management agencies and quarries creates a market driven solution to invasive plants management problems.

Quarries have financial incentive to participate in an inspection program, but they may not have the financial resources or knowledge base to develop an effective invasive plant abatement program. Therefore, the inspector serves dual roles as both inspector and educator. The success of this program hinges on the collaboration between inspectors and quarry managers to develop an integrated pest management program for each quarry. Inspectors work with quarry managers to develop invasive plants identification skills, and provide educational materials to guide managers to develop a successful program.

Klamath NF-- Dyers Woad on Gravel. *USFS Photo*

Case Studies

•At Great Smoky Mountains National Park in Tennessee, park staff began suspecting aggregate as an invasive plant source after seeing weedy white sweet clover and coltsfoot growing out of stockpiled winter sand. The winter sand was used on the highway and the next year new infestations of white sweet clover and coltsfoot were found scattered along miles of highway. Land managers discovered the highly invasive plant, dyers woad, growing along five miles of road in Klamath National Forest in northern California. Staff manually treated the infestation, but it continues to spread despite all efforts.

•Aggregate from gravel pit infested with black henbane was used to resurface a road in Sublette County, Wyoming on natural gas field roads. New henbane infestations soon popped up along the roads and spread through the region.

•Staff at Golden Spike National Historic Site in Utah, noticed new infestations of dyer's woad growing along miles of railroad grade after the park accidentally imported contaminated gravel to shore up the railroad grade. They had to bring in a specialized National Park Service weed treatment team to treat the problem.

•Emergency repairs for several miles of roadway required the import of fill dirt to stabilize the road edge, after a large flood in Yosemite National Park washed away the road. The fill dirt was contaminated and the following season many new invasive plant infestations sprung up. Yosemite spent hundreds of thousands of dollars to clean up the worst of the most invasive plant species, but many of the highly flammable annual grasses and other weeds remain today.

Sublette County (WY), Great Smoky Mountain National Park (TN), and Yosemite National Park (CA) now inspect aggregate before importing it to prevent paying for the costly treatments that followed these simple mishaps. Agencies across the West have instituted gravel pit inspections in the past fifteen years. The North American Weed Management Association (NAWMA) developed inspections standards in 2007. The U.S. Forest Service (USFS) Lake Tahoe Basin Management Unit has been inspecting gravel pits since 2003, and annually provides each operator with a letter authorizing or denying use of their products for Forest Service projects in the Tahoe Basin. Yellowstone National Park has been inspecting pits since 2003 and now inspects over 50 pits. This program builds upon those programs and provides the resources necessary to land managers and quarry managers looking to start their own program.

Coltsfoot in gravel. *NPS Photo*

Best Management Practices

Quarry managers can take an active hand in invasive plant management that goes beyond treatment. By using Best Management Practices (BMP's), quarry managers can greatly reduce the risk of contaminating material with invasive plants. Below are practices (•), rationale (o), and additional actions (*) that quarry managers can take to prevent spreading invasive plants. Many do not require herbicides.

- Don't leave stockpiles for a long time
  - o The longer a stockpile sits, the higher the chances that invasive plants can contaminate the stocked aggregate. If material is not moving...
    - * Treat invasive plants as they appear on the stockpiles
    - * Move the oldest material off first to prevent establishment
- Create a buffer between stockpiles and any vegetation
  - o Buffers reduce the risk of stockpile contamination
    - * Locate stockpiles in areas away from all vegetation
    - * Treat all invasive plants growing near stockpiles
- Treat invasive plants growing on the perimeter of the active pit
  - o Invasive plant seeds can easily blow into the active pit
- Treat invasive plants growing on the sides of access roads
  - o Invasive plants seeds can easily blow into dump trucks
- Completely clean all material while it is being sorted and crushed
  - o Properly cleaned material is less likely to have invasive plants
    - * Use filters that separate out organic material
- Ensure that overburden material and aggregate remain well separated.
  - o Overburden is highly likely to have invasive plants growing on them
    - * Scrape off all overburden before mining aggregate
    - * Keep overburden piles away from stockpiles, active pit, conveyors, and weigh house. If overburden piles are close to active areas, treat the invasive plants on them
- Equipment and vehicles transport invasive plants not only within a quarry, but from quarry to quarry. When contaminated equipment comes from a weedy quarry, it can easily carry and subsequently spread invasive plant seed. This happens when seeds fall off the vehicle, or especially when contaminated aggregate or fill is transferred between quarries. Washing equipment greatly reduces the probability of equipment spreading seeds. Also monitoring all outsourced material for invasive plants will reduce the risk of the them spreading on the property.

Frequently Asked Questions

Why are quarries weedy?

Quarries are highly disturbed areas due to the nature of the site. Disturbed areas are high quality habitat for many invasive plants. Invasive plant seeds blow around the quarry and infest recently mined material, which is then transplanted to roadsides and construction sites.

Why should we participate?

Increased marketability In a tight economy land managers are looking to cut costs, and weed-free aggregate is one of the most cost-effective prevention measures versus treating invasive plants. As more land managers join the weed-free aggregate buying consortium, those suppliers that provide weed-free aggregate will have a competitive edge into this market.

Quality product

Weedy aggregate is low quality aggregate. Certified weed-free aggregate adds a layer of product quality.

Stewardship

Supplying weed-free aggregate contributes to healthy native ecosystems and public safety. Invasive plants outcompete native vegetation, reduce visibility along roadsides and create fire hazards in right-of-ways.

Reclamation

Well established invasive plants seriously impair the establishment of desired species during reclamation of quarries. Desired vegetation are more likely to establish by treating invasive plant populations while actively mining and well before reclamation begins. The success of reclamation projects are judged in part by the success of the revegetation component. To prevent invasive plants from hindering reclamation efforts the California Surface Mining and Reclamation Act (Article 9 Section 3705) states that "Noxious weeds shall be managed: (1) when they threaten the success of the proposed revegetation; (2) to prevent spreading to nearby areas; and (3) to eliminate fire hazard."

How much will the inspection, certificate, and educational materials cost?

Nothing. The inspection, certification, help with the weed-management plan and any educational materials provided by the inspector are provided for free.

How much does it cost to treat invasive plants?

It varies, but treatment costs increase when invasive plant populations are large, difficult to access, or when there are large varieties of species. Costs tend to decrease by treating in-house versus using contractor services. Reduce costs by treating invasive plant populations before they get large and by treating invasive plants every year rather than treating every few years. Talk to your county agricultural commissioner for assistance assessing treatment costs.

What areas in the quarry are most likely to have invasive plants?

- access roads
- perimeter
- stock piles
- standing water
- overburden storage
- equipment and vehicle parking

What areas in the quarry are most likely to contaminate the aggregate?

- access roads
- active mining areas
- stock piles
- standing water

What other factors could also contaminate aggregate?

- neighbors
- water source
- prevailing wind
- stockpiling aggregate outside the quarry

For more information about invasive plant treatment and prevention, visit www.cal-ipc.org

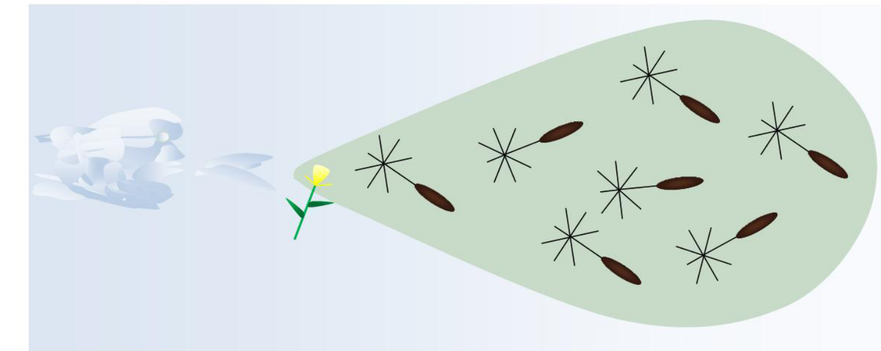
Seed Dispersal

Most invasive plant seeds fall close to the parent plant, some of the seeds disperse further from the plant, and a few seeds fall very far from the parent plant. Seed dispersal can be either 1) directional, or 2) evenly distributed around the parent plant.

1) Directional distribution occurs when wind blows seeds away from the parent plant.

- Seeds spread within a cone away from the parent plant instead of a circle.
- Plants on a slope spread their seeds further because gravity pulls them down.
- Humans pick up seeds and disperse them along roads, trails, or developed areas.
- Animals drop seeds along a corridor

2) Seeds spread evenly in a circle away from the parent plant when outside factors do not influence seed distribution directionally. For example, lupine seeds burst out of the pods in random directions and distribute close to the parent plant.



Wind disperses seeds away from the parent plant and can contaminate large areas with seed.

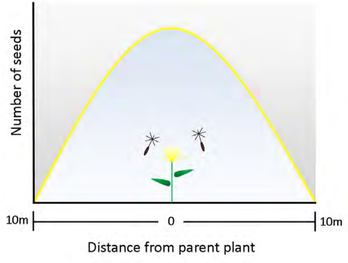
Multiple factors can combine to increase the dispersal distance of a seed. If the seed has a pappus, it travels further than a seed lacking a pappus. The distribution may increase again if the plant is at the top of a slope, and so the dispersal circle increases.

Seed characteristics that increase seed dispersal distance:

- •Hooks, spines, burs
  cling to animal fur or clothing (e.g. cheat grass)
- •Edible
  animals eat then spread seeds (e.g. blackberry)
- •Pappus, wings
  parachute-like structure helps seeds catch the wind (e.g. dandelion)

When parent plants go to seed, any seeds that do not germinate form a seedbank and contaminate a site for years. It usually takes years of treatment before a site is no longer contaminated.

Equipment and vehicles transport invasive plants not only within a quarry, but from quarry to quarry. When contaminated equipment comes from a weedy quarry, it can easily carry and subsequently spread invasive plant seed. This happens when seeds fall off the vehicle, or especially when contaminated aggregate or fill is transferred between quarries. Washing equipment greatly reduces the probability of equipment spreading seeds. Also monitoring all outsourced material for invasive plants will reduce the risk of them spreading on the property.



Most seeds disperse close to the parent plant, but some can travel long distances based on outside factors.

Probablity of Invasive Plant Occurrence

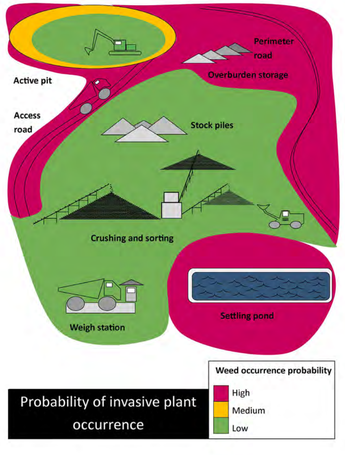
The diagrams on the following pages represent aggregate quarries and show:

1) The probability of invasive plant occurrence
2) The probability of contamination
3) The areas most likely to be contaminated

Each diagram illustrates probability as being either high (red), medium (yellow), or low (green). These hypothetical models of quarries should help guide inspections and treatments. However, quarries and their invasive plant problems differ, and these models will not exactly fit any quarry.

The probability of invasive plant occurrence diagram displays the likelihood of finding invasive plants at a quarry. Disturbance levels and site history dictate invasive plant occurrence at many aggregate pits. The probabilities of invasive occurrence are:

HIGH	MEDIUM	LOW
•Around active pit •Road between pit and crushing/ sorting area •Stock piles •Perimeter roads •Stock piles (inactive)	•Inside pit perimeter •Settling pond	•Stock piles (active) •Crushing/sorting area •Weigh station

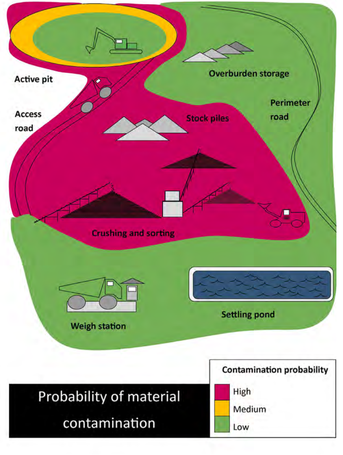


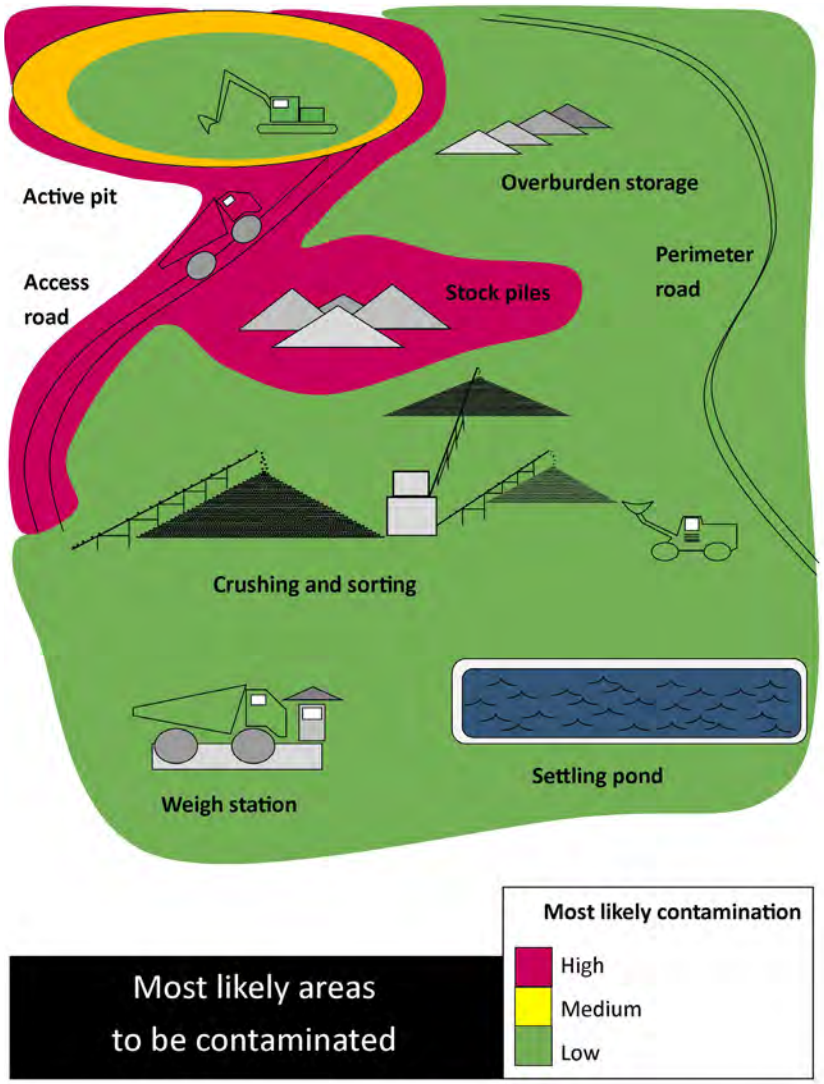
Probability of Contamination

The probability of contamination diagram shows the likelihood that invasive plants, if present, will contaminate exported material. While the probability can be high, if there are no invasive plants, then the contamination is less likely. High probable areas are sites where nearby sources could contaminate exposed aggregate. The probabilities of contamination if invasive plants are present are:

HIGH	MEDIUM	LOW
•Around active pit •Road between pit and crushing/sorting area •Stock piles	•Just inside active pit	•Center of active pit •Perimeter roads •Settling ponds •Overburden storage

The highest probability areas for contamination are relatively small, but are the most important to monitor and treat for invasive plants. The most likely areas of invasive plant contamination are when the highest probability of occurrence overlaps with the highest probability of contamination. When these areas overlap, quarry managers must take precautions to ensure that aggregate is not contaminated. Quarry managers should prioritize treatments in areas where the probability of contamination is high and invasive plants are present. The areas that are most likely to contaminate material include access roads and the area around pit perimeter. *See diagram, next page.*





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