American Samoa
Department of Education

AS DOE

Grounds Maintenance Primer

Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year 2

AMERICAN SAMOA

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ENGINEERING CONSULTANTS

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This Grounds Maintenance Primer is one of a number of "modules" being prepared as part of the "Training and Sustainability Program" focused on building local school facility maintenance capacity.

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GROUNDS MAINTENANCE PRIMER

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PURPOSE

The purpose this primer is to provide facility managers with a reference guide of regular school grounds maintenance tasks, the common problems that result from deferring these tasks, as well as preparation and oversight tips.

METHOD

In preparing this guide, the project team expended more than 280 man hours conducting site visits to the majority of schools in each of the four territories to observe existing conditions and compile recommendations to inform the content of this primer as well as future (to be determined) capital projects or other large scale improvements. This primer also includes reference material for local staff to implement and manage grounds maintenance. Recommendations contained in the body of this report include standards from the U.S. Consumer Product Safety Commission's Public Playground Safety Handbook and recommendations from other published sources.

"As the heart of a community, a school is a reflection of the community it serves and its overall perception of educational quality."

-Insular ABCs (Assessment of Buildings and Classrooms)

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Introduction

WHY IS GROUNDS MAINTENANCE IMPORTANT?

A school's exterior appearance – i.e., landscaping and site maintenance – affects the overall perception of educational quality. As the heart of a community, schools are a reflection of the character and potential of its citizens and leaders. School grounds maintenance is therefore vital to the proper functioning, image and achievement of public schools.

"Appropriate operation and maintenance activities ensure that stormwater practices will continue to function properly and yield expected water quality and environmental benefits, protect public safety, meet legal standards, and protect communities' financial investment." (U.S. EPA, 2017)

School grounds must be properly maintained on a routine basis to preserve the quality of the landscaping and ensure effective site drainage to provide a safe and healthy environment for the student to learn and play in. Grounds maintenance personnel, with the proper training to perform with a wide-ranging knowledge base and skill set, are needed to do work that includes physical challenges as well as equipment operation and maintenance.

This primer provides an overview of basic grounds maintenance needed at all school campuses on a revolving schedule throughout each calendar year.

Grounds maintenance alone will not alleviate all concerns; sometimes capital improvement projects are required. Further design and engineering consultation should be sought when modifying existing grading, subsurface and surface drainage, rain gutters or downspouts at various school campuses.

GROUNDS MAINTENANCE SAVES MONEY

Regularly scheduled grounds maintenance can also help reduce overall long-term operating expenses. Deferring maintenance is more costly because replacing school facilities costs more than repair. Facility management best practices have cautioned that public school budgets cannot afford a "run-it-until-it's-broke" approach to maintenance. According to the National Research Council, every $1 in deferred maintenance, costs an estimated $4 to $5 in capital liability. "Thus an accumulation of deferred investments over the long term may be significantly greater than the short-term savings that public-sector decision makers were initially seeking."[1]

For example, inadequately maintained public school storm drainage facilities have been identified throughout the territories. Clogged drain inlets can lead to extensive damage to school buildings, requiring repair expenditures. Proper grounds maintenance can help reduce the extent of clean up costs, flooring replacement, wood frame wall repairs, electrical damage and mold abatement that can result from flooding.

[1] (NRC, 2004)

With the Zika outbreak, ponding water trapped on the ground or in rain gutters is also a serious health concern. A regularly scheduled grounds maintenance program will expand operating costs in the short-term, but will reduce total expenditures long-term by decreasing the frequency of emergency repair and replacement costs.

FURTHER READING

- NRC. (2004). Investments in Federal Facilities: Asset Management Strategies for the 21st Century. National Research Council, Committee on Business Strategies for Public Capital Investment. Retrieved from https://doi.org/10.17226/11012
- U.S. EPA. (2017). The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure. Retrieved from https://www.epa.gov/sites/production/files/2015-04/documents/green_infrastructure-om_report.pdf
- GAO. (2014). Federal Real Property: Improved Transparency Could Help Efforts to Manage Agencies' Maintenance and Repair Backlogs. U.S. Government Accountability Office. Retrieved from http://www.gao.gov/assets/670/660328.pdf

Chapter 1

Site Inspection Reports for American Samoa

Background

In 2016, the Insular ABCs program civil engineering team conducted site visits to many public school campuses (Appendix A).

Summary of Findings

For the full report, including specific schools visited, see Appendix A. In general, driveways, parking areas, site drainage and landscaping need continuous care and maintenance.

1) Eroded material and debris have taken over play areas, drain inlets, concrete and grass swales and concrete ditches, leading to ponding and flooding.

2) Not enough erosion control measures are in place to control flooding and ponding.

3) Existing onsite drainage inlets and pipes are filled with debris.

4) Trees growing too close to buildings and roots uplifting pavement.

5) Rainwater from building roofs causing ground erosion and flooding.

6) Ponding and flooding is occurring in low spots created by rainwater from building roofs that erodes the ground below, filling drain inlets and swales with debris.

7) More rain gutters need to be installed to reduce erosion and to divert rainwater away from buildings.

Observations

The schools visited in 2016 had drainage issues that require improvements to be implemented through funded design and/or construction projects. The proposed drainage improvements include, but are not limited to:

1) Additional drainage collection systems.

2) Additional roof gutters are needed to reroute stormwater runoff to designated drainage areas.

3) New retention basins are needed to retain and confine onsite stormwater.

4) Addition of concrete and grass swales, gutters and ditches, including sidewalk culverts to route onsite drainage flow to designated flow patterns.

Recommendations

General maintenance should include, but is not limited to:

1) Remove debris (rocks, tree leaves, seeds, fruits and limbs, trash, etc.) by raking and picking up before mowing.

2) Mow, trim and edge grass once every 10 to 14 days. Remove grass clippings.

3) Remove vegetation, dirt and debris from drain inlets and flush drain lines.

4) Prune back tree branches growing over buildings.

5) Tree removal or relocation is recommended if it is growing too close to buildings, utility lines, drainage systems and walkways.

6) Remove vegetation growing along and on perimeter fence lines, causing damage to fencing.

7) Routine general maintenance of the drainage system should be continued at a period of every 3-6 months.

8) Clear and regrade retention basins to remove silt and overgrown plant material and restore basins to its original depth to ensure proper basin function.

9) Regrade surrounding areas to match bottom elevation of culverts and flush culverts to ensure proper culvert function.

10) Clean and regrade existing swales and ditches to ensure proper direction of flow and capacity of drainage routes.

11) Repair and maintain unpaved roads, driveways and designated parking areas by filling in pot holes, re-grading and compacting as needed.

Coordination between the civil engineer and building architect should be conducted for any building additions or improvements. For example, the addition of new temporary or permanent buildings can impede the existing drainage pattern and have potential drainage impacts that should be analyzed by a civil engineer. Site drainage can also be affected by, but not limited to, changes to building roof downspouts, area drains that are part of the building footprint, and roof runoff collection tanks.

Previous 2013-2015 civil engineering assessments provided estimated costs for site improvements and site plans identifying locations of these proposed projects for each campus (See Further Reading). Those civil engineering site plans can help organize ongoing maintenance needs at each individual campus.

At the territorial level, the facilities manager should be responsible to procure funding for projects that cannot be resolved by grounds maintenance staff. For example, capital improvement project or legislative funds may need to be programmed to provide an emergency access route to the school or for potable water system improvements. Table 1 provides a listing of issues in order of magnitude of costs estimated to correct the problems.

Table 1 - Estimated costs to correct grounds issues identified in 2015 dollars

Civil Subsystem	Est costs to correct grounds issues identified in 2015 dollars				
	Am. Samoa ($K)	CNMI ($K)	Guam ($K)	USVI ($K)	Total ($K)
Drainage Swales/Overall Drainage Pattern	$821	$898	$1,308	$774	$3,800
Headwalls, Catch Basins & Drain Inlets	$186	$557	$370	$346	$1,460
Retention/Detention Ponds	$7	$496	$480	$0	$983
Fire Protection Distribution and Storage (Water Supply)	$0	$588	$11	$34	$632
Septic Disposal Systems (Sanitary Sewer)	$108	$68	$0	$16	$192
Potable Water Distribution and Storage (Water Supply)	$45	$75	$26	$36	$182
Piping (Sanitary Sewer)	$8	$11	$13	$47	$79
Fences & Gates (Site Development)	$11	$0	$59	$0	$70
Fire Truck/Emergency Vehicle Access	$0	$46	$0	$0	$46
Pumping Station(s) (Water Supply)	$0	$10	$24	$11	$45
Erosion Control (Earthwork)	$6	$0	$0	$8	$14
Paving & Surfacing (Pedestrian Paving)	$0	$0	$11	$0	$11
Paving & Surfacing (Roadways)	$0	$0	$7	$0	$7
Lift Stations/Emergency Generators (Sanitary Sewer)	$0	$2	$0	$0	$2
Total	**$1,200**	**$2,800**	**$2,400**	**$1,300**	**$7,600**

(Austin Tsutsumi & Associates, 2015)

FURTHER READING

- HHF Planners. (2013-2015). Insular ABCs Initiative: Phase 3 Task 1 - Civil Engineer Assessments:
  - **American Samoa:** http://hhfplanners.com/as.html
  - **CNMI:** http://hhfplanners.com/cnmi.html
  - **Guam:** http://hhfplanners.com/guam.html
  - **USVI:** http://hhfplanners.com/usvi.html

FUTURE CONSIDERATIONS

- Overall site drainage, grass and landscaping need continuous care and maintenance. Is this reflected in your school budget?
- All of the schools visited in 2016 (see full report in Appendix A) had drainage issues that will require additional improvements to be implemented through funded design and construction projects. Are projects that need funding receiving the proper attention?
- If a maintenance situation is urgent, are grounds maintenance staff aware of how to communicate this to school and district administrators for action?
- Is there an adequate mechanism to report, monitor and check that work orders have been resolved in a timely manner?

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Chapter 2
Staffing Levels

The following benchmarks can be used by Facility Managers to serve as a baseline for determining minimum levels of staffing required for grounds maintenance. In this primer, grounds maintenance is focused on addressing stormwater drainage, septic system maintenance, and the general appearance and safety of the outdoor portions of campus. Grounds maintenance does not include janitorial cleaning of building exteriors or interiors, building facility maintenance, campus security or supplies.

Amount of staff required will vary depending on the level of service desired (see Table 2), available equipment and tools, unique conditions of the site (i.e., steep topography, soil conditions, or other accessibility issues that can limit staff's ability to perform work), and supplies available.

Most importantly, grounds maintenance staff need a reliable way to communicate with the Facility Managers and other administrative staff, in order to report emergencies, alert others to deficiencies that are beyond grounds maintenance staff's scope or responsibility (i.e., HVAC or roofing work that should be performed by licensed contractors or large repair projects that should be classified as capital improvements), communicate general concerns, and to initiate and track work orders.

Assuming grounds maintenance crews are provided with proper equipment, protective gear, training, and support, Facility Managers can use campus areas provided in Appendix C with Table 2 to estimate the number of grounds staff needed. These estimates should only serve as a starting point as they fail to consider site-specific topography, existing grounds conditions, or the amount of actual landscaped area. These considerations should be included in work scoping and budget estimate development.

Table 2: Grounds Maintenance Worker Level of Service and Campus Size Benchmarks [2]

Level of Service	Area of Responsibility or Campus Size	Description
High Standard of appearance	1 worker per 3 to 5 acres	• Trim or replace trees as needed • Trim or replace shrubs as needed • Mow grass as needed • Use chemicals as needed • Provide sanitation as needed • Provide extra services
Medium Standard	1 worker per 5 to 15 acres	• Trim trees; selectively replace them every 1 to 3 years • Trim shrubs; selectively replace them every 1 to 3 years • Mow grass as needed • Use chemicals once a year or every two years • Provide sanitation weekly • Limited extra services
Low Standard	1 worker per 15 to 25 acres	• Seldom trim trees with few replacements • Trim shrubs once or twice a year with few replacements • Mow grass as infrequently as possible • Limited use of chemicals (or none) • Monthly sanitation • No extra services

[2] Summarized from Good School Maintenance, Edited by James Fritts, Illinois Assoc of School Boards, 2008.

Grounds maintenance is conducted through different means in each territory, and differently for various tasks (see Table 3). Opportunities to leverage community support, maximize the use of custodian time, and take advantage of contractors services should be evaluated, with obvious consideration of staffing and budget limitations, for all facility management offices.

Table 3 - Grounds Maintenance Strategies Used in Each Territory

Responsible Party	American Samoa	CNMI	Guam	USVI
Central Office		X		X
School Custodians		X		
Mayors	X		X*	

*Guam Mayors outsource grounds maintenance.

FUTURE CONSIDERATIONS

The following questions are intended to guide facility managers' strategic planning.

- Are custodians present at each school, and could they conduct visual surveys and minor clean up each morning?
- Are custodians aware of grounds maintenance issues and able to report concerns to the facility management office?
- Are contractors available for regular simple landscaping services, and would associated costs be cheaper than keeping full time staff and purchasing/maintaining equipment?
- How can village leaders contribute to the care and appearance of schools in their area, and how can they interact with the facility management office in making work or budget requests?
- Who should be responsible for holding workers accountable for the completion of various tasks and how does this oversight impact available staff time?

Table 4: Outdoor and Grounds Care Frequency Chart

DUTIES	Daily	Weekly	Monthly	Annual	As Needed
Pick up trash & debris	X				
Sweep entrances & sidewalks	X				
Inspect play area pavement	X				
Check playground equipment	X				
Rake grounds		X			
Remove leaves		X			
Mow lawn (in season)		X			
Trim around building & walks		X			
Trim along fence lines		X			
Inspect drainage structures and clean storm drains		X			
Pull weeds or apply herbicide			X		
Clean roof drains				X	
Inspect gutters & downspouts				X	
Remove graffiti					X
Trim shrubbery or trees					X
Replace burnt out light bulbs					X

FURTHER READING

- Planning Guide for Maintaining School Facilities. National Forum on Education Statistics and the Association of School Business Officials International (ASBO), sponsored by the National Center for Education Statistics and the National Cooperative Education Statistics System, 2003. https://nces.ed.gov/pubs2003/2003347.pdf
- An Overview of Routine Cleaning and Maintenance for a Healthy School Environment. U.S. Environmental Protection Agency https://www.epa.gov/schools-healthy-buildings/overview-routine-cleaning-and-maintenance-healthy-school-environment

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Chapter 3
Maintaining Drainage Facilities

Generally, the purpose of storm drainage structures is to move rain water away from buildings and prevent site ponding. If water ponds against building foundations, it can cause moisture to seep into the building envelope, damaging walls and in some cases, ponding water causes cracks and foundation settlement. Moisture related problems, such as mold, may also develop. Ponding can limit the use of school grounds, degrade grounds conditions, and may even provide habitat for the propagation of disease-bearing mosquitoes.

The following images show the different types of storm drainage structures on school campuses.

Figure 1: Grass Swale (swales may also be concrete construction)

Figure 2: Trench Drain

Figure 3: Catch Basin

Figure 4: Retention Basin

Figure 5: Drain Pipe Headwall

Figure 6: Sidewalk Culvert

Figure 7: Drainage Channel

FUTURE CONSIDERATIONS

- Some grounds maintenance tasks are best handled by staff in the field. Are grounds maintenance staff consistently performing essential tasks?
- Are staff, parents and other stakeholders satisfied with the general appearance of school grounds? If not, what is the plan to address this?
- Are grounds maintenance staff adequately equipped, trained, and staffed?

TYPICAL STORM DRAINAGE PROBLEMS

Storm drainage structures should be inspected once a month, and especially after a heavy rain. Remove dirt and trash, cut grass, and remove leaves and other debris that can block the flow of water to drain inlets, as well as within the swale or drain.

Removal of vegetation and sediment build-up in trench drains, catch basins, rain gutter, concrete swales, side walk culverts and drain pipes is critical to reduce the ponding and flooding problems on campuses. Maintenance staff will need to use hand tools and wheel barrows to dig out sediment and flush clogged drain pipes. Removal of sediment build-up at the outlet end of drain lines is important to the reduce ponding and flooding upstream.

Blocked Swales

Figure 8: Mud, grass and weeds in concrete and grass swales block the flow of stormwater, causing poor drainage.

Clogged Trench Drains

Figure 9: Trench drains are easily clogged with dirt and vegetation. Periodic inspection and cleaning is needed to prevent flooding.

Re-Grading Needed

Figure 10: These grass swales do not convey water to the drain inlet or away from the sidewalks and need to be re-constructed.

GRASS SWALES

Grass swales are a low-cost and environmentally desirable drainage system that can be easily constructed by simple hand tools such as a pick, shovel and hard hand rake. However, grass swales need periodic maintenance to clear debris or for the re-grading of high points along the swale line that restrict the flow of stormwater to the drain inlet. Grass also needs water (during dry season), fertilizer and periodic mowing.

Grass swales are ideal for areas where water easily percolates into the ground (i.e., not suitable for clay soils) and where the volume and duration of runoff is limited. Grass swales also have environmental benefits: they slow runoff, filter pollutants and allow rainwater to be reabsorbed on-site. This natural form of stormwater management potentially reduces the need for other drainage structures downstream, but some amount of ponding water should be expected. In situations where that is not suitable, a concrete-lined drainage structure may be more appropriate. A concrete drainage structure is often necessary in areas with high foot-traffic or large areas involving a large volume of water or steeply sloped sites. A civil engineer is typically involved in the design.

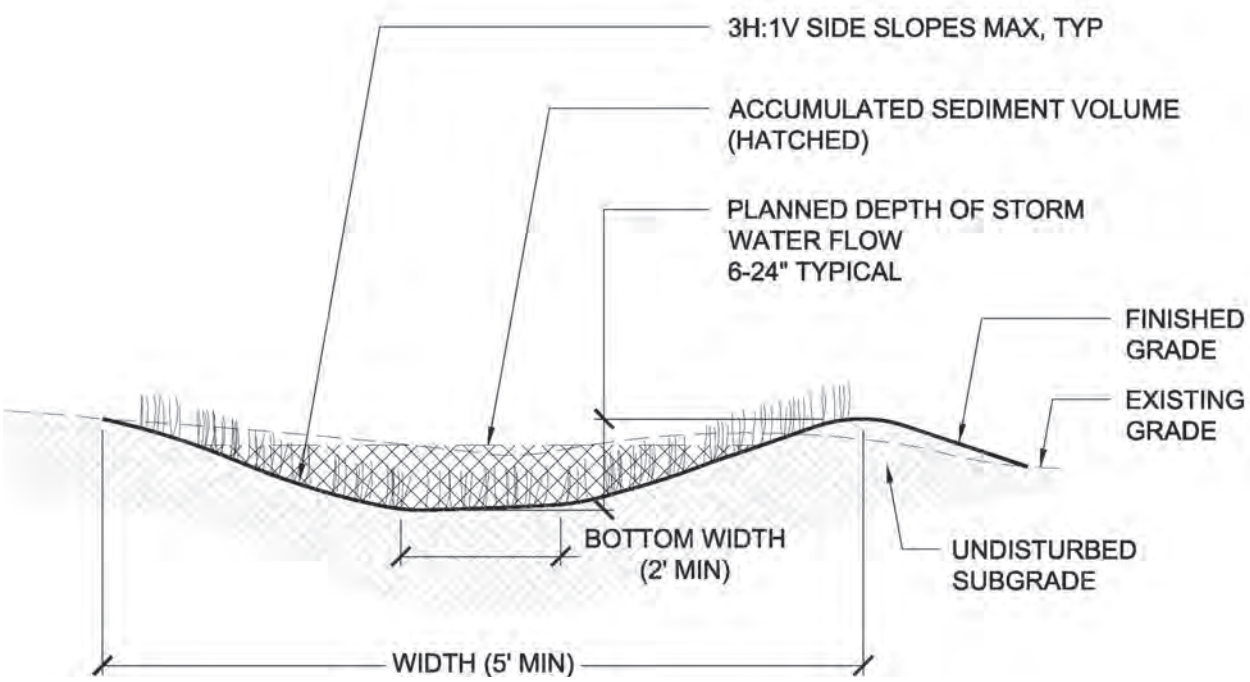

Figure 11: Swale cross section showing planned depth and loss of volume from accumulated sediment. Designed slope is shown as a ratio of horizontal distance (H) to vertical (V).

TIPS FOR CONSTRUCTING A GRASS SWALE

The depth of the grass swale should begin at ground level where standing water occurs, sloping gently lower as one moves further away. The sides of the swale can be graded and smoothed using a hard rake or a flat shovel. No lining material is necessary other than grass to hold soil in place. For considerations on grass selection (i.e., hardiness of species and tolerance to drought) see Appendix G.

To plant grass after the swale is created:

- Fertilize the seedbed. Apply seeds uniformly across swale surface. Add mulch on top of seeds for protection during establishment.
- Overseed, repair bare spots, and apply additional mulch as necessary.

FURTHER READING

- Storm Water Permanent Best Management Practices Manual, State of Hawai'i Department of Transportation Highways Division, 2007. http://hidot.hawaii.gov/wp-content/uploads/2015/05/Appx-E.1-Permanent-BMP-Manual-Feb-2007.pdf
- National Pollutant Discharge Eliminations System (NPDES) Stormwater Maintenance, Environmental Protection Agency. https://www.epa.gov/npdes/stormwater-maintenance
- Save the Swales, St. Lucie County, Florida, Stormwater/Water Quality Division. http://www.stlucieco.gov/home/showdocument?id=188
- Common Lawn Grasses for Hawai'i, University of Hawai'i College of Tropical Agriculture and Human Resources, 2009. https://www.ctahr.hawaii.edu/oc/freepubs/pdf/TM-12.pdf

FUTURE CONSIDERATIONS

- Which parts of campus have drainage problems? (If you need a map of campus—see links at end of Chapter 1)
- Can the drainage problem be solved by simple routine maintenance (i.e., clearing debris?) or are civil engineering design and other improvements/sources of funding needed?
- How are these needs being communicated to school administrators?

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Chapter 4
Septic System Maintenance

INSPECT AND PUMP FREQUENTLY

The typical septic system should be inspected once a year and pumped every 2 to 3 years or when the total depth of the sludge and scum exceeds one third of the liquid depth of the tank (Figure 12). Contracting a service provider to perform routinely scheduled site visits and inspections is one way to ensure adequate maintenance. Septic service providers will inspect for leaks and check scum and sludge levels in the septic tank.

Maintenance staff at each school should be responsible for keeping records of service performed on each septic system (see attached worksheet, Figure 17). It's important to keep track of when the tanks were pumped and the sludge and scum levels. Document any repairs completed; if repairs are needed, notify the facilities maintenance department or appropriate regional office and document the call on the worksheet shown in Figure 17.

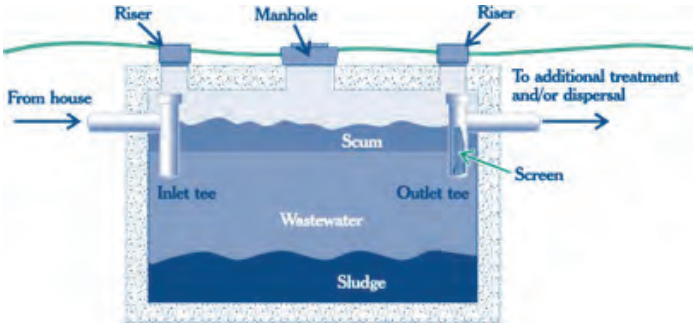

Figure 12: Sludge and scum levels in septic tanks should be routinely monitored.

The Central Office should have as-built drawings or records of every septic system. Ideally, each septic system would be located on a site plan, identifying the location of the septic tank, leach field, sewer lines, and septic tank capacity, manufacturer and model number.

Four major factors affect how frequently a tank must be pumped: number of users, total wastewater generated, volume of solids in the wastewater, and septic tank size. Extreme rainy weather or flooding can also affect the leach field's ability to absorb effluent.

USE WATER EFFICIENTLY

Overburdening the septic system with too much wastewater can cause the system to backup and/or result in more frequent service calls. Reducing the total amount of water use can help reduce the amount of wastewater sent to the septic system. Maintenance staff should routinely be on the lookout for leaking fixtures and immediately fix them.

Figure 13: A leaking toilet wastes 200 gallons of water a day.

High-efficiency plumbing fixtures can also reduce the amount of wastewater generated. In some facilities, older toilets require 3.5 to 5 gallons per flush; newer models use just 1.6 gallons per flush. Adding faucet aerators can also reduce water consumption and cut the volume of water sent to the septic system. Look for Environmental Protection Agency (EPA) labeled WaterSense labeled products when purchasing new fixtures.

Figure 14: The U.S. EPA has partnered with manufacturers to clearly identify low-flow water fixtures (i.e., toilets and sinks)

PROPERLY DISPOSE OF WASTE

To the extent possible, maintenance staff should avoid pouring harsh chemicals such as bleach down any drain connected to a septic system. Figure 18 shows a poster created by the Environmental Protection Agency, to educate users about their septic system. Septic systems used for public schools should be inspected annually and pumped every 2 to 3 years or when the total depth of the sludge and scum exceeds one third of the liquid depth of the tank. Harsh chemicals can kill the collection of living organisms required to digest human waste. Other items that will clog a leach field and should never be flushed:

- Cooking grease or oil
- Flushable wipes
- Photographic solutions
- Feminine hygiene products
- Dental floss
- Diapers
- Cigarette butts
- Coffee grounds
- Paper towels
- Pharmaceuticals
- Chemicals such as gasoline, oil, pesticides, antifreeze, and paint or paint thinners

MAINTAIN YOUR LEACH FIELD

The leach field is the area of underground perforated pipes that allows the earth to slowly absorb wastewater. To properly maintain a functional leach field, avoid the following:

- Parking: unless the leach field is specifically designed for it, never park or drive vehicles over the leach field.

- Plants: avoid planting trees above or near leach fields. The roots will grow into the perforated pipes, which will clog and require replacement. A civil engineer or landscape architect can help determine minimal tree separation distance or specify root barrier material to discourage root intrusion.

- Drainage: to the extent possible, direct site drainage swales, roof downspouts and other site drainage features away from the leach field. Excess water will interfere with the wastewater treatment process.

Figure 15: Avoid planting trees and shrubs above or near leach fields or plumbing lines.

HOW MAINTENANCE SAVES MONEY

Poor maintenance often causes septic systems to fail prematurely. Failing systems are expensive to repair or replace; it is less costly to provide routine inspections and maintenance. Septic systems need to be pumped regularly. Frequency will depend on the size of the system, number of users, weather pattern, as well as health and condition of the system.

PROTECT THE ENVIRONMENT

Another important reason to properly maintain septic systems is that it can help prevent the spread of infection and disease. Fecal matter in septic systems contain disease-causing bacteria and viruses, nitrogen, and phosphorous. Inadequate wastewater treatment can leach into the groundwater and contaminate drinking water (Figure 16).

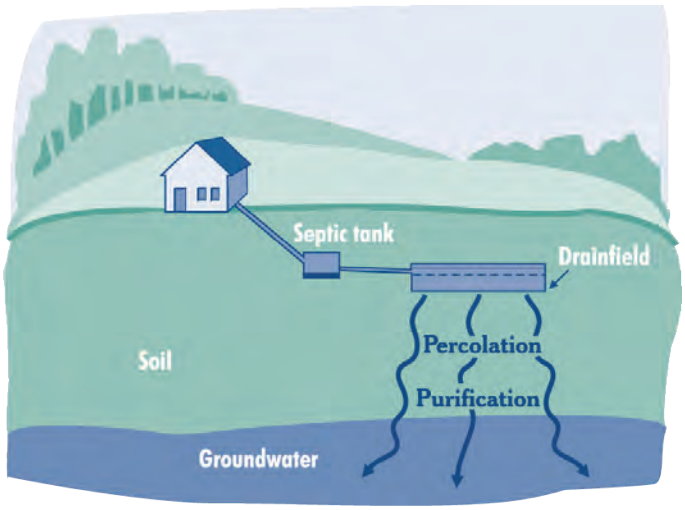

Figure 16: Overloading the leach field can cause contamination of groundwater sources.

FURTHER READING

- Civil Engineering Site plans can be downloaded online, see Chapter 1, Further Reading links.
- U.S. Environmental Protection Agency
  - How to Care for Your Septic System: https://www.epa.gov/septic/how-care-your-septic-system#inspect
  - Your Septic System is Your Responsibility: https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf
  - WaterSense, Water-Saving Products: https://www3.epa.gov/watersense/products/index.html

FUTURE CONSIDERATIONS

- Septic systems that require pumping more often than 2 to 3 times per year, may need a plumber and/or civil engineer to help verify what is wrong and offer suggestions.

School Name:	
(include a Site Plan or describe # and location of septic tank(s), leach fields, and sewer lines)	
Tank Size(s):	
Date of last service:	Description (repairs completed/needed):

Figure 17: Worksheet to be updated by grounds maintenance staff every time the septic system is serviced.

Figure 18: Environmental Protection Agency poster promoting proper septic system maintenance. Public school septic systems should be inspected annually and pumped every 2-3 years or when the total depth of the sludge and scum exceeds one third of the liquid depth of the tank.

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Chapter 5
General Grounds Maintenance

Grounds maintenance workers ensure that the school campus grounds are safe, attractive, orderly, and healthy in order to provide a functional outdoor environment.

Duties consist of keeping school grounds clear of trash, glass, leaves, and other debris; sweeping sidewalks, parking lots, and paved play areas; hosing down sidewalks, steps, and outside entrance areas; maintaining the lawn in a neat and presentable condition by mowing grass, trimming around the buildings, sidewalks, and fence lines; pulling weeds and trimming shrubbery as necessary.

The following general guidelines are provided in response to general observations of school campuses, based on ABCs 2016 site visits. See Appendix A for the full report.

FUTURE CONSIDERATIONS

- Checklists such as Table 4 in Chapter 2, can help ensure maintenance tasks are performed on a consistent basis.
- Such checklists can also serve as the basis for estimating Full-Time-Equivalent staff needed (to adequately provide grounds maintenance services) and key performance indicators to measure staff performance and results.
- If management of grounds maintenance staff is an issue, the district may want to consider outsourcing school grounds maintenance to a private contractor.

1. Keep Campus Clean

General sweeping, raking and picking up leaves, tree litter, foreign debris, trash and garbage, is a daily task to keep the appearance of the campus grounds neat and sanitary. Faculty should remind students to place their trash into a trash container and not on the grounds.

2. Fencing Maintenance

Clear and remove overgrown vegetation along the outside of the perimeter fencing to prevent the chain-link fencing from damage caused by the weight of the vegetation leaning on the fence as well as tree branches falling on the top rail of the fencing. An 8’ to 10' wide clear area on the exterior perimeter of the fence should be maintained on a monthly basis by keeping the vegetation cut down to a manageable height. Keeping the fencing from any obstructions is beneficial for security and maintenance purposes. Fencing repairs will be easier to access and less expensive.

Figure 19: Trash and debris on campus should be cleaned up on a daily basis.

Figure 21: Vegetation has overgrown the existing perimeter chainlink fencing.

Figure 20: Dumping of trash and foreign debris should never be allowed on school grounds.

Figure 22: Fallen trees and overgrown vegetation has damaged section on perimeter chainlink fencing.

3. Remove Nuisance Trees

Removal of plant material that is growing in undesirable locations should be removed as soon as possible. There may be instances where a seed from a tree has germinated and is now growing right next to a building, fencing, drainage swale or sewer leaching field that will cause damage or flooding. Removing vegetation where it should not be growing is essential to reducing this type of maintenance and costly repairs. Do not allow the plant to grow into a tree. It is best to remove it when it is still in its juvenile stage of growth.

Figure 23: Young tree growing along the fence line will eventually damage the fence unless it is removed soon.

Figure 24: Trees growing along the fence also disrupt the drainage swale and should be removed.

4. Limit Vehicle Parking

Cars, trucks and other vehicles should not be allowed to park, drive along, or cross pedestrian walkways, dedicated fire access lanes and drainage ways. Cars and trucks damage both the walkway pavement as well as adjacent grass and landscape areas. Drainage problems and standing water due to deep tire depressions can also breed mosquitoes. Barricades or posting of "NO CARS AND TRUCKS ALLOWED" or "KEEP VEHICLES OFF THE GRASS" may help in deterring people from driving where they should not be driving.

Figure 25: Vehicles parking on grassed areas damages the turf and creates potholes, which degrades site condition, causes erosion, and may create breeding habitat for mosquitoes.

Figure 26: Vehicles parked within a drainage structure damages the planned function of the swale and causes storm water to backup and flood to other areas of campus. These parked cars are also blocking the fire access lane.

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Chapter 6
Turf (Grass) Maintenance

Why Turf Maintenance is Important
Regular turf maintenance is essential in preventing drainage problems, weeds and pest infestations. Turf left uncut for weeks will block surface rain runoff from flowing into drain inlets. An overgrown retention basin can flood other areas. Good turf maintenance practices will promote healthy growth and will benefit the students that are actively using the playfields on a year round basis. Use proper Personal Protective Equipment (PPE) at all times.

Three important mowing safety guidelines shall be followed to prevent accidents and injuries:

a. Walk the site before mowing.
b. Remove debris (rocks, tree limbs, trash, etc.).
c. Locate any hazards or obstacles (i.e., drain pipes, clean outs, manholes, valve boxes).

Selecting the Right Grass
Many factors affect grass selection. Some considerations are: grass species, desired texture, sun exposure, salt tolerance, growth rate and resistance. For example, “No-Mow” bermuda grass requires less mowing and tolerates drought, saline and alkaline soil, but it can be slow to establish, and is susceptible to insects. Appendix G - Common Lawn Grasses for Hawaii is provided as a reference, however, a local nursery or a landscape architect may have additional site-specific recommendations.

Mowing Turf
Turf shall be mowed at a uniform finished height. Mow turf areas to a minimum average height of 2" when average height of grass becomes 3" to 4". The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Vary the mowing pattern (i.e., avoid mowing in the same direction every time) to prevent the turf from growing in one direction. Mowing in the same direction will cause soil compaction and ruts. Varying the mowing pattern will result in more upright growth.

Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and branches on a turf area shall be

FUTURE CONSIDERATIONS

- Selecting the right grass is important. Certain grasses can help reduce the frequency of lawn trimming because they grow slower. Other species may be more salt tolerant or drought resistant. Consult a local specialist.

picked up and disposed. Adjacent paved areas shall be swept and vacuumed clean. Avoid mowing the turf when conditions are wet which will cause an uneven cut and clippings can mat and block sunlight to the grass.

Mowing shall be done on a regular schedule once every 10 to 14 days. Adjust mowing frequency based on the growth rate to remove approximately 1/3 (height) of the grass blade at each mowing.

Mower blades need to be sharp and should be sharpened at least once a week if the mower is being operated on a daily basis.

Turf Edging and Trimming

Clearing and edging grass along paved walkways is an on-going maintenance task. Keeping the walkways and roadways clear and safe is a priority. Use of an edger or weed-eater is recommended as well as a hand pick and shovel. Grass encroaching onto walkways can become a tripping and slipping hazard. The edges of both sides of the walkway shall be visible and shall not drop off suddenly which can cause ankle injuries. General rule of thumb is to maintain the finish grade to be 1/2" from the top of pavement.

Perimeter of turf limits and paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and drain inlets and outlet and to provide a clear cut division line between existing conditions and turf. Edging also is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string-line trimmers is permitted in "soft" areas such as an edge between turf-grass and roadway edges.

Trimming around fences, poles, drain inlets, manholes, cleanouts, valve boxes and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf is mowed.

Chapter 7
Tree, Palm and Shrub Maintenance

OVERVIEW

Tree, palm and shrub maintenance involves proper care to prevent disease and maintain the health of the trees, palms and shrubs which includes watering, pruning, pest control, fertilization and Integrated Pest Management (IPM) practices.

Existing trees and palms shall be inspected every week for dead branches, diseases, weak or heavy limbs and branches that could break and fall to cause injury or death and/or damage building roofs. All school campus trees and palms shall have a tree assessment report conducted by a certified arborist and prune trees according to International Society of Arboriculture (ISA) Pruning Guidelines (ANSI 300 Part 1). Selectively prune trees and palms for health and safety reasons. Removal of large dead trees should be done by a licensed certified arborist.

Figure 27: Example of a large dead tree with branches overhanging a classroom building.

WATERING

Trees, palms and shrubs have specific water requirements. It's best to select plants that are naturally suited to the tropical local conditions of the four U.S Territories to minimize maintenance requirements and use of water.

(a) Do not over-water, which deprives roots of oxygen, stresses the plant and causes roots to become infected. Yellowing of the leaves is also a sign of oxygen starvation and can eventually kill the plant.

(b) Do not under-water the plants. Signs of stress includes wilting and loss of eaves.

(c) Avoid frequent light watering, which will promote the development of shallow surface root systems.

(d) Deep-root watering to a depth of 12 - 18" will help plants develop a deeper root system. Always allow time for the soil to dry partially between waterings.

(e) Water early during the day so the soil will absorb water before it evaporates when the sun is out.

ROOT BARRIER

Root barrier can be used as a retrofit measure when an existing tree has been planted too close to existing buildings or sidewalks (Figure 28). Without a root barrier, the tree's roots may undermine the foundation, resulting in uplift and cracking. When installed properly, root barrier can help manage root expansion by redirecting roots either away from a structure or deeper underground to reduce structural impacts.

Non-chemical root barriers are available as a high density polyethylene (HDPE) roll or panel. The roll root barrier can be draped over utility lines to protect them from root damage. A panel root barrier can be placed along a sidewalk or surrounding a tree well, to minimize uplift and root damage. See the manufacturer's instructions for more information.

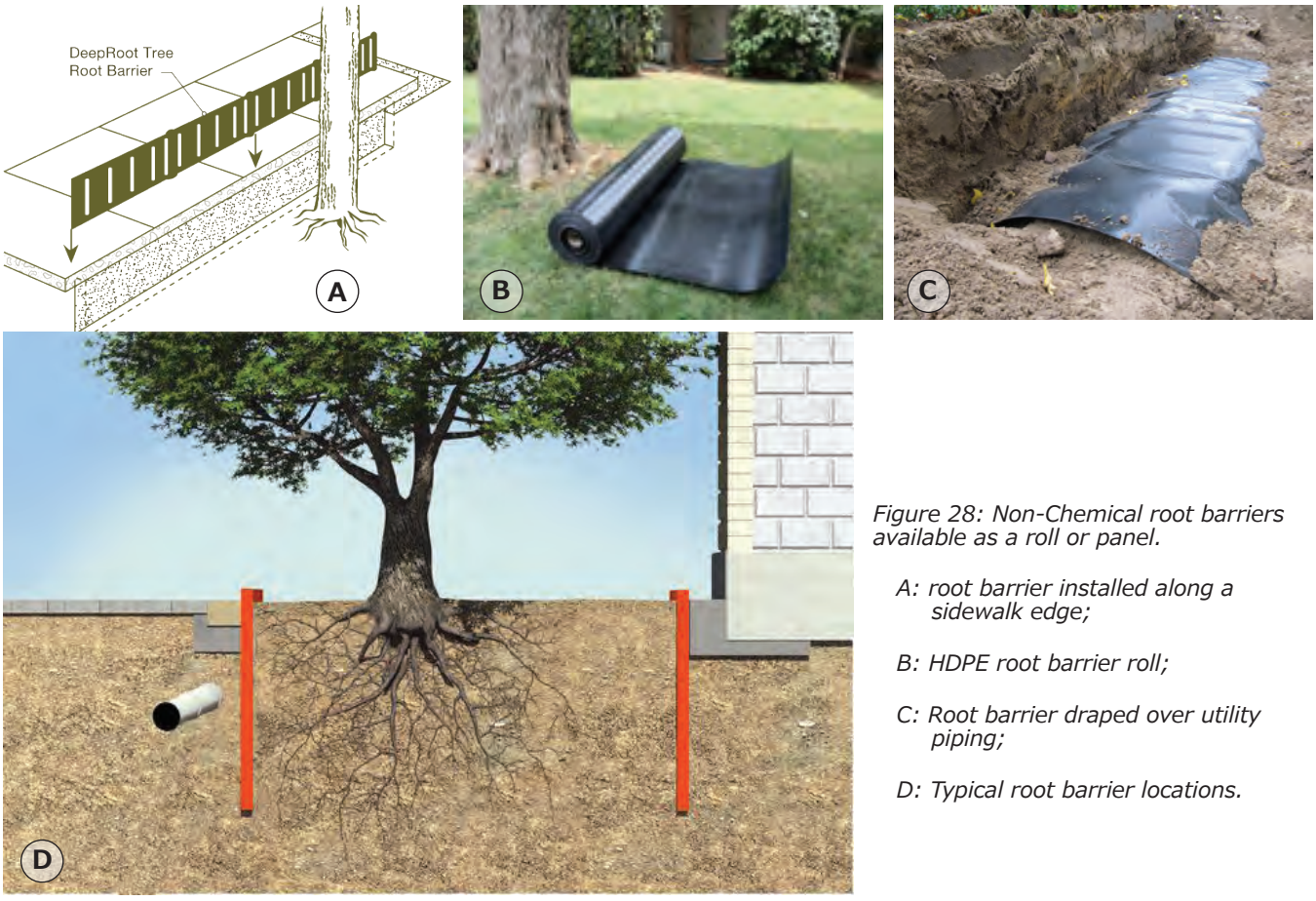

Figure 28: Non-Chemical root barriers available as a roll or panel.

A: root barrier installed along a sidewalk edge;

B: HDPE root barrier roll;

C: Root barrier draped over utility piping;

D: Typical root barrier locations.

PRUNING

Pruning involves the trimming and removal of branches, fronds, and fruits (e.g., coconuts), from trees, palms and shrubs to improve the overall health and appearance and to control or stimulate growth. Pruning is also done to prevent safety hazards, such as falling coconuts.

Tree Pruning: The general rule being "remove no more than 25 to 30 percent of the total crown with each pruning". Removing limbs to balance a tree for appearance sake or to increase time between necessary tree maintenance shall not be done. Most routine pruning such as, removal of weak, diseased or dead limbs can be done any time year round.

There are two primary pruning objectives for trees:

(a) Hazard Reduction Pruning (HRP); the primary objective is to reduce the danger to a specific target caused by visibly defined hazards in a tree such as a dead or damaged branch hanging over utility lines, walkways, roadways or buildings.

(b) Maintenance Pruning (MP); the primary objective is to maintain or improve tree health and structure, and includes hazard reduction pruning.

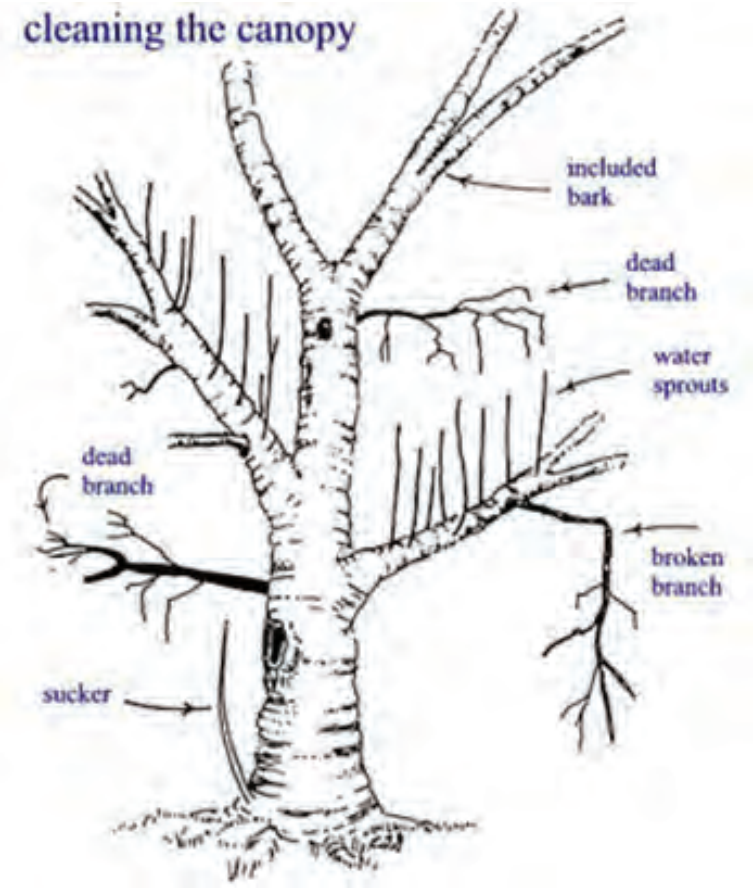

Figure 29: Example of a tree in need of Crown Cleaning.

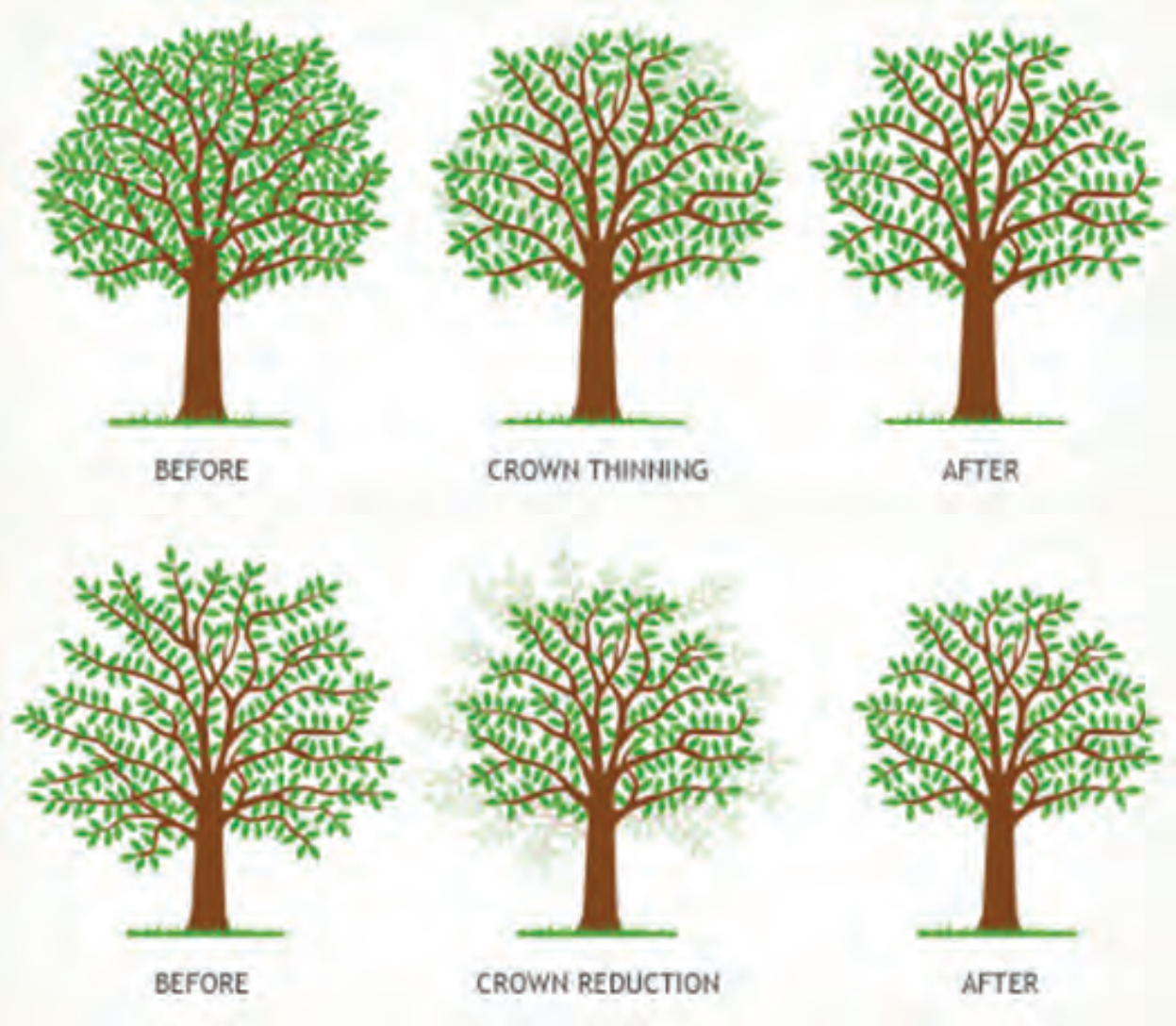

Figure 30: Examples of Crown Thinning and Crown Reduction.

Tree Pruning Types: HRP and MP consist of one or more pruning types.

(a) Crown Cleaning shall consist of the selective removal of one or more of the following items: dead, dying or diseased branches, weak branches, water sprouts and storm damaged growth. ("Water sprouts" are a symptom that too much leaf surface has been removed from a tree; aka, sucker growth)

(b) Crown Thinning shall consist of the selective removal of branches to increase light penetration, air movement and reduce weight. Only perform this pruning type if the health of the tree is declining.

(c) Crown Reduction decreases the height and/or spread of a tree without losing the natural shape/form of the tree.

(d) Crown Restoration improves the structure, form and appearance of trees that have been severely headed or vandalized.

Tree Pruning Guidelines: Follow the guidelines below to prune correctly and safely.

(a) Always cut branches just beyond the branch collar and not flush with the trunk.

(b) Avoid leaving a stub beyond the edge of the branch collar, which can result in decay spreading into the trunk of the tree.

(c) Avoid topping a tree.

(d) Avoid pruning the trunk of a tree, unless the tree is being removed entirely.

(e) Always use sharp tools to make clean cuts.

(f) Always disinfect pruning equipment after pruning, even when moving to other plants in the same area, to prevent the spread of disease organisms.

(g) Always wear appropriate PPE, including eyewear, footwear, head protection and gloves.

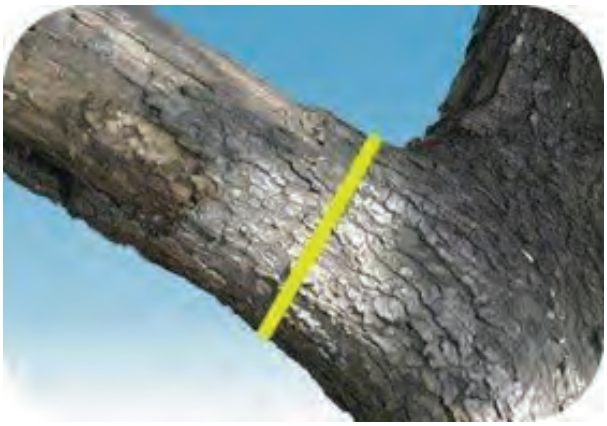

Figure 31: The branch collar is the point where a branch joins the trunk or another branch. This is the area the arborist chooses to make a proper cut.

Figure 32: The wrinkles in the branch collar are the tree's first line of defense against the invasion of micro-organisms. The final cut should be made just outside these wrinkles.

Good

Bad

Figure 33: In good pruning technique, a surgical cut preserves the branch collar, and should be made square to the diameter of the stem. This produces the smallest theoretical wound. If a cut is made on the diagonal, it creates a larger oval sloping cut, which makes it harder for the wound to heal.

Palm Pruning
Prune palms to remove dead, dying, diseased, damaged or unwanted fronds, seed pods and fruit clusters.

Pruning for Coconut Palms
(c) Barricade off area below pruning operation to create a safe pedestrian way.

(d) Remove fronds that are hanging below the horizontal plain.

(e) Remove fruits, seed pods and fruit stalk two times a year or as required to maintain safety of personnel, students and property.

Root Pruning
Have a certified arborist evaluate and perform or oversee tree root pruning. Never cut/remove all of the tree surface roots. Make sure that an arborist is consulted to determine the extent and amount of roots to be removed.

Pruning for Shrubs
(a) Prune shrubs if the branches start to overhang walkways and roadways.

(b) Prune shrubs if the plants are obstructing view of on-coming vehicles and pedestrians.

(c) Cut and remove dead, broken or unhealthy wood back to a healthy part of the plant.

EQUIPMENT

Pruning Equipment
Pruning equipment consists of motorized and hand-operated tools. Select the appropriate tool to the type of pruning and the diameter of the branches being cut. Training and precautions are required for motorized tools and equipment, such as chainsaws and chippers.

Figure 34: Pruning saws are used to cut branches too large for hand pruners or loppers

Figure 35: Use hand pruners to cut branches up to 1/2" in diameter.

Figure 36: Loppers are used to cut branches up to 1-1/2 " in diameter.

Figure 37: Chainsaws are used for cutting large limbs; operating a chainsaw requires training.

Figure 38: Use shears and / or motorized hedge trimmers for trimming hedges.

Figure 39: Chippers reduce branches and leaves into a reusable mulch product, but operating the chipper requires training.

Chapter 8

Playground Equipment Maintenance

Playground equipment should be inspected semi-annually—before school begins in the fall and in the early spring. A July safety inspection allows time for repairs to be made before students return for the first day of school. An early spring inspection (early-March) should also be undertaken.

Periodic inspection of playground equipment are important to determine faulty equipment and minimize risk of injury to students and other community users (Figure 40 and 41). The following checklist (Figure 42) should be used for these semi-annual inspections and should be kept with other preventive maintenance records. For playground equipment, the fall height of a child to a cushioned ground surface should never exceed 8 feet. An Outdoor and Grounds Care Frequency Chart is also included (page 15, Chapter 2, Table 4) to provide a guideline for how often grounds keeping tasks should be performed.

Figure 40: Sand or grass is not a safe surfacing for fall protection; a certified resilient play surface is recommended.

Figure 41: Play structure is compromised by extensive wood rot. Exposed nails are a safety hazard and should be removed immediately. Grass is not a safe surfacing for fall protection; a certified resilient play surface is recommended.

Minor repairs should be made at the school level. Repairs beyond the capability of in-school personnel should be brought to the attention of the district facilities manager.

Whether using factory-manufactured or natural elements, public school playgrounds have specific obligations beyond providing a fun, challenging space. Although budgets have a lot to do with choices, parents and the community members expect playground equipment to be safe.

PLAYGROUND EQUIPMENT SAFETY STANDARDS

Relevant standards for playground facilities include the Americans with Disabilities Act, the U.S. Consumer Product Safety Commission Handbook on Public Playground Safety, American Society for Testing Materials International (ASTM) F1292, F1951 and F1487, and in some cases, State Health and Safety Codes, which may have additional, more stringent accessibility requirements. Playgrounds and protective surfacing are dynamic outdoor environments that are intended to provide safe environments for children. Installing equipment that is non-compliant to the standards or to the bare minimums of the standards invites failure, injury, costly replacements or lawsuits.

Today, ASTM F08.63 and F15.29 Subcommittees have developed the following standards dealing with playground surfacing and playground equipment for public use:

1. F1292 Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment -This specification establishes minimum performance requirements for the impact attenuation of playground surfacing materials installed within the use zone of playground equipment. ASTM F1292 section 4.4.2 states, "When an installed playground surface is tested in accordance with this section, if the impact test scores at any tested location in the use zone of a play structure do not meet the performance criterion, bring the surface into compliance with the requirements of this specification or the play structure shall not be permitted to be used until the playground surface complies."

2. F1951 Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment - This specification is a performance standard to determine the suitability of surfacing for persons with disabilities.

3. F2075 Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment - This specification describes the technical requirements for engineered wood fiber. There are a number of tests performed on the subject material for particle size and distribution, heavy metals, and tramp metal, and sieve analysis.

4. F2479 Guide for Specification, Purchase, Installation and Maintenance of Poured-In-Place Playground Surfacing - This guide covers standards for selecting and specifying surface systems under and around playground equipment. This guide describes how to apply existing ASTM standards to evaluate the impact attenuation, accessibility characteristics, and product characteristics when selecting surfacing systems for use under and around playground equipment.

5. F3012 Standard Specification for Loose-Fill Rubber for Use as a Playground Safety Surface under and around Playground Equipment - This standard defines the technical requirements for loose-fill rubber mulch used in and around playground equipment including performance requirements for size, hazardous metal content, tramp metal content, sharp metal content, and lead content.

6. F1487-11 Standard Consumer Safety Performance Specification for Playground Equipment for Public Use - This consumer safety performance specification provides safety and performance standards for various types of public playground equipment. Its purpose is to reduce life-threatening and debilitating injuries.

Playground Inspection Checklist

School _____ Date _____

Inspected by _____

Inspected	Play Equipment	Describe Repairs Needed	What Repairs Were Made
SLIDES			
	Exposed concrete footing		
	Protruding bolts or hardware		
	Head entrapment areas (between 3" and 9")		
	Metal slide bed separating from equipment base at entrance, exit or joints		
	Loose, bent, sharp, or missing parts		
	Unstable equipment		
	Rough or broken slide bed		
	Finger entrapment areas (between 3/8" and 1")		
	Rust or dry rot on frame		
	Peeling paint or graffiti		
	Obstructions in 8' fall zone		
	Rusty/worn hardware		
	Debris littered steps		
CLIMBERS			
	Exposed concrete footing		
	Protruding bolts or hardware		
	Head entrapment areas (between 3" and 9")		
	Loose, bent, sharp, or missing parts		
	Unstable equipment		
	Peeling paint or graffiti		
	Finger entrapment areas (between 3/8" and 1")		
	Rusty-worn hardware		
	Rust or dry rot on frame		
	Loose railings		
	Obstruction in 8' fall zone		
FOOTBALL/SOCCER FIELDS			
	Goals bent or broken		
	Grounds in poor shape		

Figure 42: Playground Inspection Checklist

Inspected	Play Equipment	Describe Repairs Needed	What Repairs Were Made
PLAY EQUIPMENT			
	Glass or rocks scattered on fields		
	Grounds in need of care (i.e., ground uneven, gullied areas, etc.)		
	Glass, bottles, paper or cans need to be cleaned up		
BASEBALL/SOFTBALL DIAMONDS			
	Backstop fencing bent, torn or broken		
SWINGS			
	Loose/worn chain swivels		
	Badly worn chain links		
	Seats cracked or broken		
	Protruding nuts and bolts		
	Loose concrete footings - unstable equipment		
	Loose, bent or missing parts		
	Excessively/dangerously rusted parts		
SEESAWS			
	Rotted or cracked boards		
	Protruding or exposed nuts or bolts		
	Badly worn pivotal joints		
	Cracked boards or handles		
	Loose concrete footing		
BASKETBALL COURTS/ HOOPS			
	Hoops loose/broken		
	Backstop loose		
	Surface (concrete or blacktop) cracked, loose or pitted		
	Surfaces with broken glass or gravel		
CRAWL TUNNELS			
	Peeling paint		
	Finger entrapment areas (between 3/8" and 1")		
	Cracked or broken areas		
	Obstruction in 8’ fall zone		
	Rough/sharp edges		
	Glass or debris present		

Figure 42: Playground Inspection Checklist

Inspected	Play Equipment	Describe Repairs Needed	What Repairs Were Made
PLAY AREA SURFACE AND BORDERS			
	Glass and/or debris present		
	Play pieces are not at least 8’ apart		
	Surfacing border has rough or cracked concrete, rough boards, or protruding bolts or nails		
	The depth of loose surfacing material is less than 6"		
	Surfacing border is not adequately containing the material		
WOODEN CLIMBING EQUIPMENT			
	Split uprights on wooden equipment		
	Exposed footings		
	Uprights worn/loose		
	Platforms, rungs, railings loose or worn		
	Loose bolts		
SPRING RIDING TOYS			
	Concrete footing loose		
	Exposed bolts and nuts		
	Plastic structure broken or cracked		
Please Note: In no case should the fall height of a child to the cushioned ground surface exceed 8 feet.			
Overall comments on playground:			

Figure 42: Playground Inspection Checklist

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Chapter 9

Resources Cited and Recommended Reading

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Graphic Sources

Chapter 3

Figure 1-10: Okahara & Assoc, 2017 Site Visit.

Chapter 4

Figure 11: Okahara & Assoc.

Figure 12: U.S. EPA. (n.d.). Your Septic System is Your Responsibility. Retrieved Mar 16, 2017, from https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf

Figure 13: http://www.dreamstime.com/royalty-free-stock-image-overflowing-toilet-image-image41425426

Figure 14: U.S. EPA. (n.d.). U.S. Environmental Protection Agency. Retrieved Mar 16, 2017, from Watersense/Products: https://www3.epa.gov/watersense/products/index.html

Figure 15: http://www.vacuumtruckexchange.com/roots-in-sewer-lines.html

Figure 16: U.S. EPA. (n.d.). Your Septic System is Your Responsibility. Retrieved Mar 16, 2017, from https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf

Figure 17: HHF Planners

Figure 18: https://www.epa.gov/sites/production/files/2016-08/documents/septicsmart_infographic_v2_081215.eps_508.pdf

Chapter 5

Figure 19-26: Okahara & Assoc, 2017 Site Visit.

Chapter 7

Figure 27: Okahara & Assoc, 2017 Site Visit.

Figure 28A: http://www.deeproot.com/resources/rootBarrier/supporting/Root_Guide_Tech_Sheet.pdf

Figure 28B, 27C, 27D: http://www.greenmax.eu/nl/rootcontrol/

Figure 29: http://hort.ifas.ufl.edu/woody/cleaning.shtml

Figure 30: http://www.arbortectreecare.co.uk/tree-pruning-and-trimming

Figure 31-33: http://treecarepruningandplanting.com/branch-collar.htm

Figure 34: https://www.stihlusa.com/products/hand-tools/hand-pruning-saws/ps60/

Figure 35: https://www.lowes.com/pd/Fiskars-Bypass-Hand-Pruner/3044767

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Figure 39: https://www.vermeer.com/NA/en/N/equipment/brush_chippers/bc900xl

Chapter 8

Figure 40-41: Okahara & Assoc, 2017 Site Visit.

Appendix A
Site Inspection Reports

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

December 27, 2016

CONFIRMATION NOTICE NO. 02

SITE INSPECTION REPORT

Project : Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year Two
Contract number W9128A-11-D-0004

Territory: American Samoa

Dates of Site Inspections: November 15, 16, 17 and 18, 2016

Inspection Participants:
Irvin Higashi, Okahara and Associates (Day 1, 2, 3 & 4)
Alan Nishimura, Okahara and Associates (Day 1, 2, 3 & 4)
Monty Chin, (HHF) (Day 1, 2, 3 & 4)
Pili Masaniai, (DPW) Midwest District Coordinator (Day 1 & Partial 4)
Malaki Togiola, (DPW) Midwest District Asst. Coordinator (Day 1 & Partial 4)
Puaauuli Ioane, (DPW) East District Coordinator (Day 2)
Leasau Samuelu Tuitoelau, (DPW) Central District Coordinator (Day 3)
Albert Joe Atuatasi, (DPW) Central District Asst. Coordinator (Day 3)
Fiavivini Atofau, (DPW) West District Coordinator (Day 1 - Partial & 4)
Sosaiete Matai, (DPW) West District Asst. Coordinator (Day 4)

Day 1: November 15, 2016
1. Tafuna High School
2. Nu'uuli Vocational/Technical High School
3. Manulele Elementary School
4. Pavaia'i Elementary School
5. Siliaga Elementary School

Day 2: November 16, 2016
6. Alofau Elementary School
7. Matatula Elementary School
8. Olomoana Elementary School
9. Faga'itua High School

Day 3: November 17, 2016
10. Matafao Elementary School
11. Samoana High School
12. Coleman Elementary School
13. Le'atele Elementary School
14. Aua Elementary School

Day 4: November 18, 2016

15. Alataua II Elementary School
16. Leone Midkiff Elementary School
17. Leone High School
18. Lupelele Elementary School

Between November 15, 2016 and November 18, 2016, Okahara and Associates, Inc. (OAI) conducted and completed grounds site assessments for 18 schools on the island of Tutuila of American Samoa the U.S. territory focusing on general condition of the campus grounds maintenance and drainage issues. The extent of the drainage system and grass maintenance should be made consistent to improve the overall campus appearance and drainage systems.

DPW/DOE needs to consider the implementation of a proactive routine maintenance program for all campuses.

The following is a summary of our observations with photos and comments at the various schools campuses visited.

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1) The existing school campus grounds needs to have a regular routine maintenance of the campus exterior grounds to keep up with repairing and maintaining driveways, parking areas, site drainage system and the landscape.

    a. Eroded material and debris has taken over play areas, drain inlets, concrete and grass swales and concrete ditches that leads to ponding and flooding where water cannot flow properly.
    b. Not enough erosion control measures to control flooding and ponding.
    c. Existing onsite drainage inlets and pipes are filled with debris.
    d. Trees growing too close to buildings and roots uplifting pavement.
    e. Rainwater from building roofs causing ground erosion and flooding..
    f. Ponding and flooding is occurring in low spots created by rainwater from building roofs that erodes the ground below and carries loose material fill drain inlets and swales.
    g. More rain gutters needs to be installed to reduce the erosion and to divert the rainwater away from buildings.

2) General maintenance should include, but is not limited to:

    a. Remove debris (rocks, tree leaves, seeds, fruits and limbs, trash, etc.) by racking and picking up before mowing.
    b. Mow, trim and edge grass once every 10 to 14 days. Remove grass clippings.
    c. Removal of vegetation, dirt and debris from the drain inlets and flushing of drain lines.
    d. Tree branches growing over buildings needs to be removed and pruned back.
    e. Tree removal or relocation is recommended if it is growing too close to buildings, utility lines, drainage systems and walkways.
    f. Removal of vegetation growing along and on perimeter fence lines, causing damage to fencing.

g. Routine general maintenance of the drainage system should be continued at a period of every 3-6 months.
h. Cleaning and regrading of existing swales and ditches to ensure proper direction of flow and capacity of drainage routes.
i. Repairing and maintaining unpaved roads, driveways and designated parking areas by filling in pot holes, re-grading and compacting as needed.

3) All of the schools visited has drainage issues that will require additional improvements to be implemented through funded design and construction projects. The proposed drainage improvements include, but are not limited to:

a. Addition of roof gutters to reroute drainage roof runoff to designated drainage areas.
b. Addition of new drainage collection systems to allow the drainage of ponding and flooded areas.
c. Addition of retention basins to retain and confine onsite runoff and reduce onsite ponding.
d. Addition of concrete and grass swales, gutter and ditches, including sidewalk culverts to route onsite drainage flow to designated flow patterns.

4) Examples of landscape and drainage issues at various school campuses.

a. Overgrown grass, weeds and vegetation due to in-frequent maintenance.


Grass needs to be cut every 10 to 14 days and remove overgrown vegetation growing next to buildings and fences.

b. Overgrown grass, weeds and vegetation covering and clogging drain inlets and swales.


Remove overgrown grass / weeds covering major drain inlets and remove dirt and debris inside the drain inlets and flush drain lines.

c. Partial buried drain pipes crossing under walkway pavements.

Remove dirt and debris blocking drain pipe under the pavement and re-grade the existing swale to ensure proper direction of flow and capacity of drainage routes.

d. Remove trees that are a health and safety concern.

(Left Photo) Remove large mango tree growing close to building.

(Right Photo) Remove ficus trees where roots are uplifting pavements and have poor branch structures that can fail.

e. Drainage swales filled with debris and sediment will restrict flow through drain inlets, drain pipes and culverts.

Remove built-up sediment and vegetation blocking drain swale to ensure proper direction of flow and capacity of drainage culverts.


Remove trash and overgrown vegetation and re-grade the existing swale to ensure proper direction of flow and capacity of drain swales and inlets.

f) Drain inlets are filled with sediment, trash and debris.




(All of the above) Remove all dirt and debris from the drain inlets and water flush to clear drain lines.

g) Sediment and weeds have filled up the trench drains causing ponding and flooding of surrounding areas.


Removal of dirt and debris from the trench drain grates and inside channel. Water flush trench drains to restore full drainage flow.

h) Rain runoff from roofs causing flooding and erosion to ground below.




(All of the above) Add new rain gutters and downspouts where applicable to prevent flooding and reduce erosion by redirecting rainwater.

i) Concrete drainage ditches and swales are filled with dirt, trash and overgrown vegetation.


Remove dirt, grass and weeds growing in concrete lined ditches and swales that is blocking the flow.


Remove mud, trash and debris that has filled the concrete drainage ditch.

j) Correct swales that does not drain properly.


Re-construct swale to flow freely towards the drainage ways.


(Left Photo) Re-construct flat concrete swale to flow freely towards the grass swale beyond.

(Right Photo) Re-construct concrete sidewalks and swales to flow towards the designated drainage area.

k) Remove dead trees, branches, weal limbs and coconut seeds.


Remove dead branches from trees and coconut seed clusters from coconut palms to prevent injury from falling branches and coconuts.


Remove dead trees, stumps and all exposed surface roots.

l) Erosion in roadways and parking areas.






(All of the above) Re-construct driveways and parking areas with suitable all weather material and divert runoff whenever possible to avoid erosion from occurring. Permanent paving, or the inclusion of geotech cell mats or formed grass blocks below the topping material for use in the parking and access aisle pavement sections would help limit erosion and formation of potholes.

m) Grass areas have been eroded to subgrade material.


Restore grass lost by erosion by adding topsoil and reseed with locally suitable grass seeds.


Add rain gutters to roof eaves and restore grass lost by erosion by adding topsoil and reseed with locally available grass seeds.

n) More grass areas to replace loose gravel surfaces and restrict vehicle parking, will help with reducing erosion, ponding and flooding. Students will have more grass play areas for outdoor physical education activities.






(All of the above) Examples of schools where grass can be planted in lieu of a unsuitable loose cinder / gravel based surface.

o) Addition of new drainage structures to alleviate flooding in flat low lying areas.


Addition of new drainage collection systems needs to be designed to allow the drainage of ponding and flood prone areas.


Re-construction of concrete walkway and swales to route onsite drainage flow to away from buildings to designated flow areas.

p) No dumping of trash and rubbish near the ocean shoreline and nearby streams should be allowed.


Remove trash and debris in designated trash bins and containers or haul away to a designated refuse site.

Keep trash and foreign objects out of drainage ways or streams.

q) Overgrown vegetation causes damage to chain link fencing.

Remove overgrown trees, shrubs and vines growing on the chain link fencing and repair any damage as necessary. Maintain a clear buffer zone to minimize the build-up of vegetative growth on either side of the fence.

End of Site Visit Report

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

December 27, 2016

CONFIRMATION NOTICE No. 01

SUMMARY REPORT OF IN-BRIEF MEETING

Project : Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year Two, Contract number W9128A-11-D-0004
Territory: American Samoa

The purpose of the In-Brief Meeting was for the consultants to begin the school site visits and to meet the Department of Public Works (DPW) staff.

The In-Brief Meeting was held at 8:00 a.m., Tuesday, November 15, 2016, in the DPW Office 2nd floor Conference Room. The attendees were:

DPW	Faleosina Voigt, Director
	Kanape Aumavae, DOE FM Manager
	Don McMullin
HHF Planners	Monty Chin (Insular ABCs Program Manager)
	Gala Ualita (Insular ABCs Construction Specialist)
Okahara and Associates	Irvin Higashi, Landscape Architect
	Alan Nishimura, Civil Engineer

SUMMARY OF MEETING

1. Introductions and Purpose of Site Visits

Introductions and greeting were made and Irvin started off the meeting by stating the intent of Okahara's site visit meeting.

The site assessment plans previously prepared by Austin, Tsutsumi and Associates are the basis for conducting the site visits for each school to verify the deficiencies and recommendations noted. We will note and record as we see any other deficiencies or problems within the grounds and provide recommendations and updates to changes that may have occurred after the previous site assessment reports for each school campus visited. Photographs will be taken and documented to help in identifying each specific items being addressed. General grounds maintenance items will be noted as well.

"Landscape Training Manual for Maintenance Technicians", published by the National Association of Landscape Professionals, was presented and passed around to the

group. This training manual can be used as an essential how-to resource for the current grounds maintenance staff and also as guidance for training future new hires and in-coming maintenance personnel.

Sina Voigt stated there are schools that have had buildings removed as well as new buildings that was completed within the past year.

2. Site Visits Schedule

Site visits will be performed during November 15 through November 18, 2016.

A. Tuesday, November 15, 2016
Monty Chin (HHF) will accompany Irvin and Alan

1. Tafuna High School
2. Nu'uuli Vocational/Technical High School
3. Manulele Elementary School
4. Pavaia'i Elementary School
5. Siliaga Elementary School

B. Wednesday, November 16, 2016
Monty Chin (HHF) will accompany Irvin and Alan.

6. Alofau Elementary School
7. Matatula Elementary School
8. Olomoana Elementary School
9. Faga'itua High School

C. Thursday, November 17, 2016
Monty Chin will accompany Irvin and Alan.

10. Matafao Elementary School
11. Samoana High School
12. Coleman Elementary School
13. Le'atele Elementary School
14. Aua Elementary School

D. Friday, November 18, 2016
Monty Chin will accompany Irvin and Alan.

15. Alataua II Elementary School
16. Leone Midkiff Elementary School
17. Leone High School
18. Lupelele Elementary School
19.

3. Next Meeting
The out-brief meeting will be held on Friday, November 18, 2016, at 4:00 pm at the DPW / HHF 2nd floor office.

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

December 27, 2016

CONFIRMATION NOTICE No. 02

SUMMARY REPORT OF OUT-BRIEF MEETING

Project : Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year Two
Contract number W9128A-11-D-0004
Territory: American Samoa

The purpose of the Out-Brief Meeting was for the consultants to summarize the school site visits with the Department of Public Works (DPW) staff.

The Out-Brief Meeting was held at 3:00 p.m., Friday, November 18, 2016, in the DPW Office 2nd floor Conference Room. The attendees were:

DPW	Kanape Aumavae, DOE FM Manager
	Don McMullin,
HHF Planners	Monty Chin, Insular ABCs Program Manager
	Gala Ualita, Insular ABCs Construction Specialist
Okahara and Associates	Irvin Higashi, Landscape Architect
	Alan Nishimura, Civil Engineer

SUMMARY OF MEETING

1. School Site Visits

1.1 Assessment of Existing Conditions:

a. Based on the site visits to 18 schools, there are significant concerns with erosion, overgrown vegetation, covered drain inlets and trench drains, drainage ditches, swales, and culverts, which contributed to flooding and ponding areas.

b. Most of the schools have un-paved parking lots made up of a cinder type material that does not compact as well as basalt or coral type gravel. Erosion and/or the movement of the loose cinder material creates high and low areas that results in ponding and flooding.

c. More grass needs to be established for play areas and to reduce erosion.

1.2 General maintenance should include:

a. Removal of dirt and debris from the drain inlets and flushing of drain lines.

b. Regrading of surrounding areas to match bottom elevation of culverts and flushing of culverts to ensure proper culvert function.

c. Cleaning and regrading of existing swales and ditches to ensure proper direction of flow and capacity of drainage routes.

2. Recommendations

2.1 Civil Engineering

a. The majority of schools visited will require civil engineering design plans to construct new grading for parking lots and driveways, additional drainage features such as fencing, rain gutters, downspouts, drain inlets, concrete swales, trench drains, reconstruction of sidewalks, ramps, and curbs, and proposed retention basins. Topographic surveys will need to be provided.

3. Schedule: The draft civil maintenance primer for American Samoa to be submitted for USACE for review and comment in early March 2017.

End of meeting.

Appendix B

Downspout Water Drainage System

Building roof eaves needs to have rain gutters installed along the roof eaves to prevent eroding the ground below. Downspouts will also need to be installed at the ends of the roof eaves and along the vertical exterior wall of the building. A subsurface corrugated drain pipe shall be connected to the downspout and extend to a location where the rainwater will flow in a direction as to not cause any flooding problems. A pop-up drain emitter to be attached at the end of the corrugated drain line to allow the water to flow out during rain. (See Step 3: Install Pop-Up Emitter))

List of Tools Needed, Shopping List, and Installation Instructions

Tools Needed


Duct Tape


Hammer


Saw


Level


Measuring Tape


Pick


PVC Glue


Shovel


Plastic or Tarp


Phillips Screwdriver


Wheel Barrow
Optional


Trenching Machine
Optional

Shopping List

Quantity needed of each part will vary based on several factors specific to your project including system length, rainfall intensity, and number of problem areas. Pipe and fittings are offered in two sizes: 3" and 4". Size availability will vary based on region and store. Ensure that component sizes are consistent throughout your drainage system.

NDS (or equivalent) Part Number	Description
321 or 421	3” or 4” Pop-up Emitter with Elbow
3P02 or 4P02	3” or 4” Sewer and Drain Elbow
101	Spee-D Basin (or equivalent)
80	6” Atrium Grate
Generic	3” or 4” Drain Pipe

Installation Instructions

Note Before You Dig
Prior to installation, have your local utility companies locate and mark the location of existing utilities. Lay out your drainage system and mark the location of trenches and individual parts to be installed with marking paint before digging. Carefully remove grass or plants that are located where the trench will be dug so they can be replanted after installation. Trenches should be dug such that they slope a minimum of 1% away from your house. Place all excavated dirt on a tarp so that it can be used later to backfill.

To speed up installation, a trenching machine can be used to dig all trenches, especially in areas with particularly hard soil. NDS drainage products have been designed to be installed in any soil type. Due to the variety of pipe types and sizes, double check that all pipe connection points are the correct size. Please follow all installation directions included with the individual parts of your drainage system. To create watertight connections between products, apply a bead of waterproof silicone to both parts and connect.

This system requires that the elevation of the Pop-Up Emitter be lower than the elevation of the area drain or the system will not drain.

Step 1: Lay out system, dig trenches and holes

Dig holes and trench for pipe and catch basins. Dry fit (no glue) the entire drainage system from the catch basin to the pop-up emitter. Measure and cut all pipe to necessary lengths. After completing each step, glue parts together. TIP: If installing the drain in an existing concrete area, a wet concrete saw will be required to cut the concrete prior installation.

Step 2: Install Spee-D Basin (or equivalent) beneath downspout

Before beginning your installation, check if your downspout has a downspout elbow connected. If not, connect a downspout elbow to your downspout. The Spee-D Basin (or equivalent) should be installed in the ground directly beneath the downspout elbow to catch all water draining from the downspout. Connect the drain pipe to the Spee-D Basin. The Spee-D Basin can be used to clean out any debris that may enter the system and also serves as an inlet for surface water. Once installation is complete, place the atrium grate on the Spee-D Basin. A 6" SDR-35 drain pipe can be inserted into the Spee-D basin to raise the elevation of the atrium grate. The Atrium grate will also fit into the "bell" or "hub" end of the pipe or on a 6" sewer and drain coupler.

TIP: Dig the hole for the basin an additional 6" deeper than needed. Place 6" of gravel in the bottom of the hole. Drill small holes in the bottom of the basin to prevent standing water in the bottom of the basin.

Step 3: Install Pop-Up Emitter

Using a Corrugated Pipe Adapter, connect the EZ-Drain to an elbow with a weep hole. The elbow should be installed with the weep hole on the horizontal side of the elbow. Slide the Pop-up Emitter onto the elbow. An additional length of pipe can be used to bring Pop-up emitter to the surface.

TIP: To avoid damaging your Pop-Up Emitter with your lawn mower, raise the cutting level of the blades or avoid passing the mower over the Pop-Up Emitter

Step 4: Backfill and Replant

Backfill and replace any grass or plants that were removed.

TIP: DO NOT BACKFILL WITH SOIL WITH HIGH CLAY CONTENT. Water must be able to easily pass through the backfilled soil.

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Appendix C

Approximate Campus Lot Areas

Insular Area	School Name	Campus Area (acres)
American Samoa	A.P. Lutali Elementary	0.56
American Samoa	Afonotele Elementary	0.60
American Samoa	Alataua II Elementary	1.48
American Samoa	Alofau Elementary	1.17
American Samoa	Aua Elementary	1.38
American Samoa	Coleman Elementary	2.47
American Samoa	Faga'itua High	2.16
American Samoa	Faleasao Elementary	0.80
American Samoa	Fitiuta Elementary	0.75
American Samoa	Lauli'i Elementary	0.76
American Samoa	Le'atele Elementary	0.70
American Samoa	Leone High	3.87
American Samoa	Leone Midkiff Elementary	2.32
American Samoa	Lupelele Elementary	2.38
American Samoa	Manu'a High	2.01
American Samoa	Manulele Elementary	2.11
American Samoa	Masefau Elementary	0.61
American Samoa	Matafao Elementary	2.21
American Samoa	Matatula Elementary	0.88
American Samoa	Mt. Alava Elementary	0.55
American Samoa	Nu'uuli Polytech High	1.77
American Samoa	Olomoana Elementary	0.78
American Samoa	Olosega Elementary	0.80
American Samoa	Pavaia'i Elementary	3.04
American Samoa	Samoana High	4.02
American Samoa	Siliaga Elementary	0.66
American Samoa	Tafuna Elementary	3.70
American Samoa	Tafuna High	5.71
American Samoa	Tapu Tapu Elementary	0.00

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Appendix D

Safety and First Aid

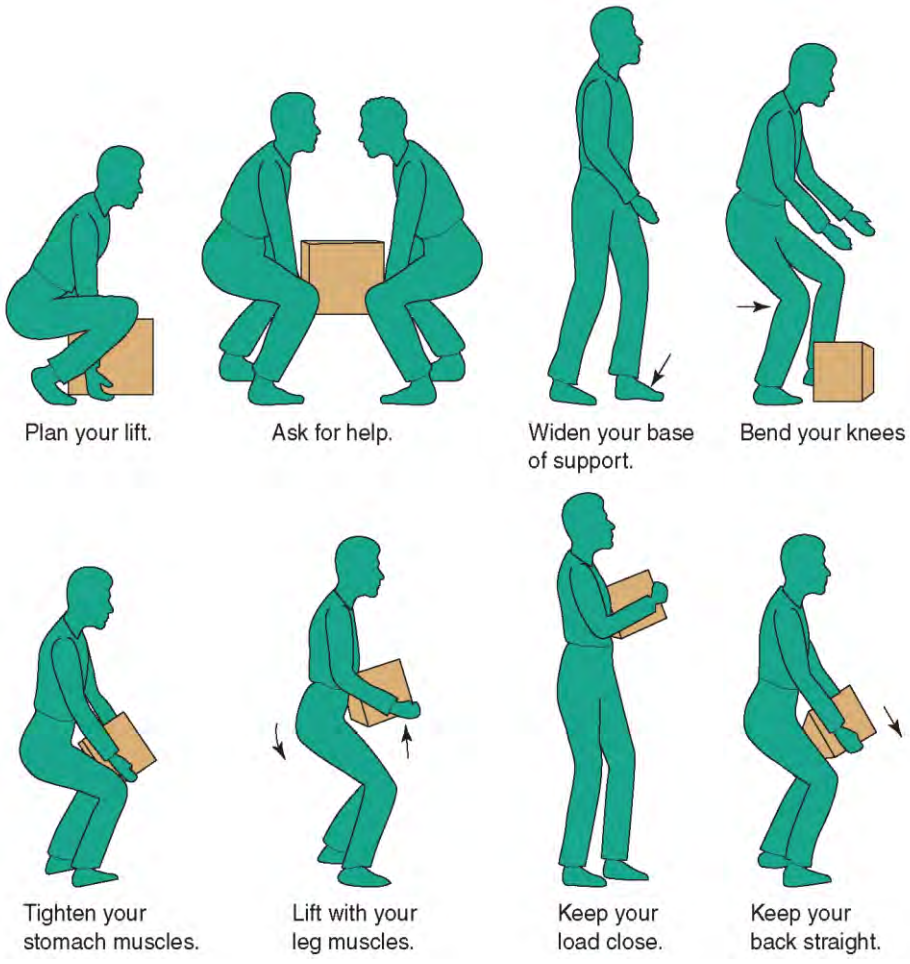
On the job accident prevention is the responsibility of all the employees. It is the further responsibility of each employee to correct or report any unsafe condition or practice that he or she may observe.

Each supervisor is responsible for prevention of accidents to employees working under his/her supervision. It is the supervisor's responsibility to train these employees to enable them to work safely and efficiently.

A. General Safety Rules:

The following are some important general safety rules that each employee is required to follow, regardless of work assignments.

1. Lifting improperly is a major factor of the tremendous number of claims for back injuries. The following procedures should be followed:



a) Size up the load; make sure it is stable and balanced. Test the weight to ensure you can lift it yourself.
b) Plan the job. Ensure that your path of travel is clear and that you have identified the location where you will place the load.
c) Establish a good base of support. Use a wide balanced stance with one foot ahead of the other.
d) Bend your knees and get as close to the object as possible. Lift with your legs and not your back.
e) Get a good grip on the object to be lifted. Make sure you can maintain your hold throughout the lift and won't have to adjust your hands later.
f) Lift gradually, don't jerk, but use a slow steady movement.
g) Keep the load close while carrying; this prevents you from arching your back and adding additional stress to your back.
h) Pivot; don't twist when you need to change directions. Move your feet in the direction of the lift. Twisting is especially harmful for your back.
i) If the load is too heavy either enlist another helper or use a mechanical device.

2. All employees shall keep tools, equipment, and work areas clean and orderly.
3. Keep aisles stairways and exits clear of boxes and other tripping hazards. Do not obstruct exits.
4. Clean spills immediately. Mark the spill if you must leave to retrieve assistance or additional supplies.
5. Each employee should know the location of fire extinguishers in their work area. The area in front of a fire extinguisher should be kept clear for ready access. Employees should not fight fires that are beyond their fire training and limitations of the available fire-fighting equipment. When in doubt, call 911 and evacuate to a safe area.
6. Gasoline will not be used as a washing or cleaning fluid. When cleaning solvent is required, use an approved cleaning solvent.
7. Any employee, while on duty or on district property, who possesses, sells, or receives any illegal drug or who is under the influence of drugs or alcohol, will be discharged and, in appropriate situations, referred to law enforcement authorities.
8. Smoking will not be allowed within any school campus property.
9. Use caution when opening doors which serve two-way pedestrian traffic.
10. Use a stepladder or a step stool for reaching above shoulder height. Never stand on the cap of a ladder.
11. While in a district vehicle, seat belts are required to be worn at all times. Do not disable airbags unless you have written permission from your Supervisor.
12. Material will be stored in a safe and orderly fashion. Flammable liquids should be stored in an approved Flammable Storage Cabinet.
13. Do not operate machinery that you are not familiar with and have not been trained to use.
14. Inspect all tools and equipment prior to use to ensure they are in working order and do not present a hazard.
15. After use put all tools/or equipment back in their proper place.

16. Disconnect all electrical cords by grasping the plug and carefully disengaging; never yank by the cord. If an electrical cord is frayed or wires are exposed remove it from service.
17. Use handrails when using the stairways. Never take more than one stair at a time.
18. Only qualified, designated employees should work on electrical wiring and equipment.
19. Horseplay or practical jokes will not be tolerated.
20. Material Safety Data Sheets must be available, at the point of use, to any person who requests this information.

21. Report all accidents to your supervisor.
22. Report all unsafe or broken tools and equipment to your supervisor. Mark the tool or equipment so that no one else will use.
23. Observe all warning signs, safety bulletins and posters.
24. Do not do any job that appears unsafe; ask your supervisor for guidance.

B. First Aid Training

Appropriate training and equipment shall be made available to employees to respond to an emergency to include first aid, CPR (cardiopulmonary resuscitation), AED (automated external defibrillator) if available, mobile phone, and fully stocked first aid kit.

Arrange for qualified training sessions (The Red Cross) for employees is important for accident prevention and response during emergency situation when accidents or medical conditions occur on or off campus.

C. Preventive Measures

To be incorporated into the program shall include the following:

1. Barricading or securing the work area or hazardous situations as they occur.

2. Proper clothing and personal protective equipment (PPE) for employees. Appropriate PPE for the job being performed shall be required. Protective equipment shall include, proper gloves, hardhat, goggles or safety glasses, earplugs, safety vest, steel toe shoes or boots and respirators. No shorts and slippers shall be acceptable.

3. Driving safely and vehicle safety to and from the work site will reduce chances of getting in an accident. Obey all traffic laws, signs and speed limits. Use of cell phones while driving is not allowed unless a hands-free device is used.

Appendix E

Hand Tools and Truck Safety and Maintenance

A. Hand Tools Safety and Maintenance:

1. Hand tools, such as shovels, rakes, picks, wheel barrows, etc. require maintenance to keep the metal parts free from rust and keep wooden handles from splitting and splintering.
   a) Sharpen tools (shovels, sickles, hand saws, machetes and picks) as they become dull with a flat file.
   b) Always clean and rinse tools to remove dirt and mud and dry before storing to prevent rust from occurring.
   c) Remove rust from metal with a wire brush and machine oil.
   d) Fine sand wooden handles and apply linseed oil to prevent cracking or splintering.
   e) Check tire pressure for the wheel barrow before using.
   f) Store tools in a neat and orderly location.

B. Truck Safety and Maintenance:

1. Trucks are used on a daily basis to transport workers, tools and supplies to the school campuses and they must be maintained regularly and operated with care and skill. Daily truck maintenance shall include checking the following items for proper operation, adjustments or levels:
   a) Head, brake, backup and tail lights
   b) Front and rear turn signals
   c) Hazard lights
   d) Seat belts
   e) Tires (proper inflation and tire wear)
   f) Engine fluids (proper levels)
   g) Hoses and belts
   h) Brakes
   i) Horn
   j) Mirrors
2. The following are ten safe driving practices that can significantly reduce the risks faced by employees that drive on the job.

   a) **Inspect the Vehicle**

   Driver safety begins before turning the ignition key. Employees should be trained to inspect the vehicle before heading out. This includes checking the lights, gauges, tires, and fluid levels and adjusting the steering wheel, seat, and mirrors. The employee should also perform a visual inspection to look for damage. In addition, he or she should ensure that the vehicle has emergency supplies, such as a first-aid kit, flashlight, blankets, emergency phone numbers, and any other items that may be helpful if the employee becomes stranded.

   b) **Secure Cargo**

   Any sudden crash or driving maneuver can cause loose personal items or cargo to slide around or fly off a vehicle, injuring the driver, passengers, or other road users. For that reason, employers should train their employees to secure loads, equipment, and other objects that could become a hazard while being transported.

   It is not uncommon to see tools, building materials or other objects lying alongside the highway. While other drivers don't always secure cargo properly, employers can make a difference with their own employees by training them to do so.

   c) **Use a Seat Belt**

   According to the National Highway Traffic Safety Administration (NHTSA), seat belts are the single most effective means of reducing deaths and serious injuries in traffic crashes. Research has found that the risk of death is cut by 45 percent for those wearing a seat belt while riding in cars. For light-truck occupants, that risk is reduced by 60 percent.

   Yet about 16 percent of Americans fail to buckle up. Anyone not wearing a seat belt during a crash may slam into the steering wheel, windshield, or other parts of the interior, or even be ejected from the vehicle. Total ejection occurs over a quarter of the time for unrestrained occupants.

   In addition to urging employees to use a seat belt at all times when operating or riding in a motor vehicle, employers may also want to develop a seat belt use policy.

d) **Drive Defensively**

Each time employees get behind the wheel, they should have a defensive driving mind-set. That means employers should train employees to incorporate the following habits:

- Check the driving conditions before heading out.
- Avoid driving in severe / bad weather.
- Clear mud and dirt from the vehicle, including all windows and lights.
- Activate the low-beam headlights during the day.
- Keep a safe following distance.
- Don't speed, and slow down in poor driving conditions.
- Use caution at intersections and interchanges.
- Look ahead in traffic for situations requiring quick action.

e) **Avoid Distractions**

According to police-reported crash data, about 17 percent of all crashes involve some form of distraction. Although cell phone use and text messaging have received much attention recently, NHTSA databases include other types of distraction as well, such as talking with occupants; dropping objects; pets and insects; adjusting the radio or controls; eating, drinking, or smoking; watching events on the roadside; and daydreaming.

Countless distractions and pressure to multi-task often tempt drivers to forget that safe driving is their primary responsibility. Employers should remind employees that driving requires their full attention, and they should avoid distractions.

In fact, OSHA says employers should also prohibit texting while driving. The agency explains that employers who require texting while driving or make it necessary are violating the Occupational Safety and Health Act. Moreover, it should be noted that many state and federal laws and regulations prohibit texting or cell phone use while driving. These provisions and their penalty amounts may be worth sharing with employees.

f) **Avoid Impairment**

There's no question that alcohol, certain prescription and over-the-counter medications, and illegal drugs can affect an employee's ability to drive safely. These substances can decrease alertness, concentration, coordination and reaction time. Because a driver makes numerous decisions per mile, it's critical that a driver make the decision to drive alert before getting behind the wheel. Therefore, employers should instruct employees not to drive if they are impaired.

g) **Avoid Drowsy Driving**

Drowsy driving can affect anyone, and many adults surveyed by the National Sleep Foundation have reported falling asleep while driving. Moreover, the government estimates that, nationwide, about 83,000 crashes are caused each year by drowsy drivers, so it's important for employees to be well rested before driving. Employers should train employees who drive to do the following:

- Get a full night of rest before driving.
- Set realistic goals for daily distances.
- Switch drivers if possible.
- Avoid medications that cause drowsiness.

h) **Avoid Aggressive Driving**

Traffic congestion — just saying the phrase may bring frustration to an employee who travels on business. According to the Department of Transportation (DOT), the number of drivers

increased by 87.5 percent since 1970, while the roadway system increased only by about 9.5 percent. It's no wonder millions of crashes each year are pinned on aggressive driving. This type of driving includes not only tailgating, rude gestures, and honking the horn but also speeding, failing to signal, passing on the shoulder, and running a red light.

Employers should encourage their employees to limit the dangers of aggressive driving with these tips:

- Be patient with other drivers.
- Plan routes to avoid congestion and construction zones.
- Allow plenty of time to reach the destination.
- Accept lateness, especially when it is beyond the driver's control.
- Avoid aggressive behaviors.
- Move out of an aggressive driver's way.

i) **Take Security Measures**

In-transit security is also important to ensure the physical safety of the driver and to reduce and prevent vehicle and cargo theft and damage. Employers may wish to cover the following simple precautions with their drivers to lower the risks:

- Locking vehicle doors and keeping windows rolled up
- Avoiding secluded, poorly lit parking lots
- Staying alert when walking to the vehicle
- Applying cargo seals or locks
- Carrying vehicle information at all times

j) **Properly Handle Hazardous Materials**

Any material that is "capable of posing an unreasonable risk to health, safety, and property when transported in commerce" must be properly packaged, labeled, placarded, and marked as required by the DOT Hazardous Materials (Hazmat) Regulations. These regulated materials even include common solvents, adhesives, paint, and fuel, with some exceptions. Paperwork may also need to accompany the material to identify it as hazardous and outline what to do in the event of a spill.

If an employee will be transporting hazardous materials, training will be required in accordance with DOT regulations. However, some basic hazmat safety training topics might include always securing the package so it won't shift, never smoking in or near the vehicle, protecting a package from extreme heat, and inspecting a package for damage and tampering.

Appendix F

Turf Equipment Safety and Maintenance

A. Turf Equipment Safety:

1. Turf maintenance equipment are classified into the following three general categories:
   a) Motorized hand-operated equipment

   b) Equipment powered by gas engines

   c) Equipment powered by electric motors

2 Wear proper personal protective equipment (PPE) to protect your skin by using sunscreen, your eyes with safety glasses or goggles, head by wearing a construction hard hat, hearing by wearing earplugs, hands and feet with appropriate work gloves and boots (steel-toed).

3. Safety Guidelines for Motorized Turf Equipment:
   a) Always read the operator's manual for all equipment and be familiar with safe operation and maintenance procedures as specified by the manufacturer.

   b) Dress appropriately for the equipment you are using. Wear snug fitting clothes to prevent getting caught while operating equipment.

   c) Wear appropriate personnel protective equipment.

   d) Know how to stop the engine quickly.

   e) Shut off hand-held equipment when changing locations.

   f) Be sure students and other bystanders are a safe distance from the work area.

   g) Turn off equipment when making adjustments or performing maintenance.

   h) Turn off equipment when leaving it unattended.

   i) Avoid putting hands or feet near rotating parts, cutters, belts, pulleys and gears.

4. Safety Guidelines for Gas Engines:
   a) Disconnect spark plug before performing any maintenance.

   b) Turn off the engine and let cool before refueling.

   c) Fuel equipment in a ventilated area and on a hard surface.

d) Avoid spilling gasoline on a hot engine, which can start a fire.

e) Properly clean up any fuel spills that may occur.

f) No smoking while operating or fueling.

g) Avoid refueling or performing equipment maintenance in a grass or landscape area.

h) Operate engines only in well-ventilated areas.

5. Safety Guidelines for Electric Motors:
   a) Check power cord regularly for nicks and cuts. Replace if the insulation is worn or damaged.

   b) Extension cords must be UL approved and appropriate to carry the power load of the equipment being used.

   c) Keep power cords away from sharp objects, intense heat, oil and solvents, all of which can damage the insulation.

   d) Always know where the cord is when operating an electric device. If the cord become severed, shock or electrocution can result.

   e) Avoid using electric equipment in wet areas unless manufacturer states such use is permitted.

6) Safety Guidelines for Battery-Operated (Cordless) Tools:
   a) Use only the kind of battery that the tool manufacturer specifies for the battery-powered tool you are using.

   b) Recharge a battery-powered tool only with a charger that is specifically intended for the battery in the tool.

   c) Ensure that the tool is switched off or removed the battery from the tool before changing accessories, making adjustments, or storing the tool.

   d) Store the battery pack safely so that no metal parts, nail, screws, wrenches, etc. can come in contact with the battery terminals. This could cause shorting of the battery and possibly sparks, fires or burns.

   e) Dispose of batteries only as recommended by the manufacturer.

B. Types of Motorized Lawn Maintenance Equipment:

1. Mowers:
   a) Walk-behind self propelled rotary mowers are the most popular type.

b) Standing mowers are similar to walk-behind mowers except that the operator stands on a platform to operate the equipment.

c) Riding mowers have a seat and steering mechanism, which allows the operator to ride on top of the mower.

2. String *Trimmers* are used for trimming grass, weeds and light brush.


3. Edgers are used to create a clean edge where lawn meet curbs, driveways or walkways. Operate edgers with special care as they can damage concrete, brick, asphalt and wood.


4. *Blowers* are used to clean up leaves, grass clippings and other debris by moving these materials with forced air.


C. Guidelines for Turf Equipment Operation:

1. Guidelines for Mower Operation:
   a) Always read the operator's manual before operating the mower.

   b) Before mowing, walk the site to pick up trash and other debris. Avoid mowing over debris. Flying debris is dangerous and can leave an unattractive mess. Debris can also cause mower and/or property damage, as well as injuries from flying objects.

   c) Turn off mower to remove foreign objects in front or next to it.

   d) Turn off engine before removing or attaching the clippings bag.

   e) Avoid operating a mower in wet grass. Slippery conditions can be dangerous and wet grass can clog the discharge chute of the mower.

   f) The operator should be the only person on a riding mower.

   g) Work from side to side on sloping terrain, rather than up and down, to avoid rollover. On steeper slopes, an intermediate walk-behind mower may be safer than a riding mower.

   h) Do not operate a mower without a deflector or a clippings bag.

   i) Maintain solid and firm footing while operating a walk-behind mower.

2. Guidelines for string trimmer operation:
   a) Always read the operator's manual before operating the string trimmer.

   b) Wear eye and ear protection, long pants and government recommended safety standards footwear.

   c) Inspect string shield and shut-off switches before starting. Check the surrounding area to be sure there are no people or vehicles nearby.

   d) Keep hands, face and feet clear of rotating trimming lines at all times.

   e) Place yourself in a proper starting position with stable footing and the trimmer on the ground before pulling the starting rope.

   f) Grip trimmer firmly by both handles while operating. Avoid over-reaching and maintain good balance at all times.

   g) Immediately turn trimmer off and check for damage if it strikes a foreign object or becomes entangled. Make repairs before restarting.

   h) Stop operating when the hub or spool is broken.

   i) Avoid extending trimming line beyond the length stated in the operator's manual as this can cause injury or damage to the engine.

3. Guidelines for edger operation:
   a) Always read the operator's manual before operating the edger.

   b) Wear eye and ear protection, long pants and government recommended safety standards footwear.

   c) Always operate an edger with guards and other safety devices intact and keep it on the ground while starting.

   d) Remove rocks or other debris from the work area to reduce the potential for damage to vehicles, buildings, etc. or injury to pedestrians.

4. Guidelines for blower operation:
   a) Wear eye and ear protection, long pants and government recommended safety standards footwear.

   b) Make sure debris is blown into an appropriate area. Avoid blowing into drain inlets, streets, neighboring properties, vehicles, windows or towards people.

   c) Keep the air stream close to the ground by extending the nozzle.

   d) Be aware of creating a dusty situation in dry conditions.

Appendix G

Cooperative Extension Service
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Turf Management
Mar. 2009
TM-12*

Common Lawn Grasses for Hawaii

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Department of Tropical Plant and Soil Sciences

Notes

Mowing height: Reel mowers are preferred for cutting turfgrasses at heights less than 1 inch. Rotary mowers are preferred for heights greater than 1 inch.

Propagation: 2-inch square plugs planted 12 inches on center require 30 ft^2 of sod per 1000 ft^2 of lawn area planted. 2-inch square plugs planted 6 inches on center require 110 ft^2 of sod per 1000 ft^2 of lawn area planted.

Nitrogen fertilizer: Amounts given in table refer to quick-release N, such as urea, ammonium sulfate, and some mixed formulations, unless otherwise noted. In windward locations during winter months, reduce fertilizer amounts or omit applications because the grass grows slowly and cannot use the nutrients.

Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft^2)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft^2)
Common bermudagrass (*Cynodon dactylon*)	Gray-green; medium texture; long internodes.	Resists wear; has deep root system, low moisture requirement; tolerates saline, alkaline, and moderately acid soils; tolerates many herbicides.	Vigorous, often invading where not wanted; frequent seed head formation; susceptible to some lawn insects; builds thatch;	Sun	Seed (hulled): 1–2 lb Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–1	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'No-Mow' bermudagrass ('Green Velvet') (*Cynodon dactylon*)	Dark blue-green; medium texture; creeping growth; usually not more than 3 inches high.	Resists some wear; tolerates saline and alkaline soil, some compaction, and drought; requires less mowing.	Susceptible to several insects and diseases; builds thatch; slow to establish.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–1	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'Tifgreen' bermudagrass (Tifton 328) (*C. dactylon x transvaalensis*)	Dark green; fine texture with prostrate growth; shorter internodes than common bermudagrass; soft leaves.	Resists wear; tolerates saline and alkaline soils; stands moderate acidity; produces few seed heads. Under proper management can be a beautiful lawn.	Vigorous grower; very susceptible to some lawn insects; builds thatch; injured by some herbicides. A very high-maintenance grass.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.

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Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft²)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft²)
'Tifway' bermudagrass (Tifton 419) (*C. dactylon x transvaalensis*)	Dark green; fine texture; dense sod; stiff leaves.	Resists wear; tolerates saline and alkaline soils; very rapid recovery; good weed resistance; high quality turf; produces few seed heads. Moderate maintenance	Susceptible to insects; builds heavy thatch.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'Tifdwarf' bermudagrass (*C. dactylon x transvaalensis*)	Dark green; dense mat; fine texture; shorter blades and internodes than 'Tifgreen'.	Resists wear; tolerates saline, moderately acid, and alkaline soils; produces few seed heads. Denser sod than 'Tifgreen'; requires less frequent mowing.	Susceptible to grass webworms and also to other insects and diseases; builds thatch; slow to cover. A very high-maintenance grass.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1– 2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'Sunturf' bermudagrass (*C. magennisii*)	Dark green; fine texture; low-growing.	Resists wear; tolerates saline and alkaline soils; drought resistant; rapid recovery from scalping; produces few seed heads.	Vigorous grower; slightly slow to establish, but rapid growth thereafter; susceptible to insect injury; builds thatch.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
Manilagrass (*Zoysia matrella*)	Deep green; medium texture; blades flat and shorter than templegrass; blades stiff; fewer mounds than templegrass	Resists wear; shade tolerant; tolerates salinity, drought, and mild soil acidity; dense growth resists weeds when established; tolerates most herbicides.	Attacked by billbugs and rust fungus; builds thatch; slow to establish; forms some mounds; requires good drainage; requires heavy-duty mower.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
Templegrass; koreangrass; velvetgrass (*Zoysia tenuifolia*)	Medium green; fine texture; blades stiff with sharp points; pronounced mounds or humps.	Resists wear; shade tolerant; may be left unmowed as a groundcover; seldom flowers; tolerates many herbicides.	Badly attacked by billbugs and some other insects and diseases; builds thatch. Slowest of the zoysias to establish; forms mounds that are difficult to mow; requires reel mower; requires good drainage; high water user.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	As desired or 3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
'Emerald' zoysiagrass (*Z. japonica x tenuifolia* 'Emerald')	Deep green; medium texture; blades shorter than manilagrass; blades not stiff; not as mounding as templegrass.	Resists wear; shade tolerant; tolerates salinity, drought, and mild soil acidity; spreads faster than manilagrass; keeps out weeds when well established; tolerates most herbicides.	Attacked by billbugs and possibly by rust fungus; builds thatch; forms some mounds; requires reel mower; requires good drainage; leaves stiff; many seed heads.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.

Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft²)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft²)
'Meyer Z-52' zoysiagrass (*Zoysia japonica* 'Meyer')	Light green; medium texture; leaves stiff, prickly, and longer than 'Emerald'.	Resists wear; shade tolerant; tolerates salinity and mild soil acidity; produces no mounds; keeps weeds out when well established; tolerates most herbicides.	Attacked by some insects and diseases; builds thatch; requires heavy-duty mower; needs good drainage; leaves stiff; produces seed heads.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
'El Toro' zoysiagrass (*Zoysia japonica* 'El Toro')	Light green; fine to medium texture; stiff leaves.	Resists normal wear; tolerates shade, drought, and salinity; deep root system. Produces a quality turf with proper management.	Does not tolerate excessive traffic; recovers slowly. Does not like poorly drained soils.	Sun or light shade	Plugs: 6–12" apart Stolons: 5–10 bu Sprigs: 1–2 bu	1/2–2	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
'Z-3' zoysiagrass (*Zoysia matrella x japonica*)	Medium green; medium-fine texture; short, soft leaves; inconspicuous seed heads.	Establishes more quickly than most zoysias. Forms a dense stand; tolerates drought; resists wear; recovers well. Produces a quality turf with proper management.	Can invade other plantings; forms some thatch. Should be mowed to low heights to keep it attractive. Verticut once a year and/or lightly topdress.	Sun or light shade	Plugs: 6–12" apart Stolons: 5–10 bu Sprigs: 1–2 bu	1/2–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
St. Augustinegrass (*Stenotaphrum secundatum*)	Light green; coarse texture; stiff, wide blades and stems; no underground stems; leaves upright; shallow-rooted.	Resists moderate wear; very shade tolerant; tolerates a range of soils and climates but prefers well-drained, fertile soil; low maintenance; easy to establish. There are variegated varieties for ornamental purposes and dwarf lawn cultivars.	Attacked by grass webworms, chinch bugs and other insects and diseases; produces thick thatch; requires heavy-duty mower; susceptible to certain herbicides. Does not tolerate drought well. Difficult to start with stolons.	Sun or shade	Stolons: 3–5 bu Plugs: 6–12" apart	2–3	1 lb preferably slow-release N every 60–90 days or as determined by color. Iron may be necessary to improve color in soils with low iron or alkaline pH.
Centipedegrass (hunangrass) (*Eremochloa ophiuroides*)	Medium green; medium texture; leaves long and narrow; many stolons; shallow-rooted.	Tolerates some shade; does well in coarse, heavy, low-fertility, or acid soils; makes dense, weed-free sod; best for moist areas; few insect or disease problems; very low maintenance requirement. 'Au Centennial' is a dwarf selection.	Becomes chlorotic under alkaline soil conditions; does not tolerate heavy traffic or poorly drained soil; susceptible to certain herbicides and salt spray. Not drought tolerant.	Sun or light shade	Seed: 2–4 lb Plugs: 6–12" apart Sprigs: 1–2 bu	1–2	1–6 lb per year (slow-release N preferred) depending on desired quality and maintenance levels. Do not apply more than 2 lb quick-release N per application. Iron may be needed on alkaline soils.

Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft²)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft²)
Carpetgrass, Australian carpetgrass (*Axonopus affinis* or *A. compressus*)	Light green; coarse texture; creeping growth habit; blunt, rounded leaf tips; produces seed heads primarily in summer.	Produces a dense stand; tolerates wet and shady conditions, poorly drained soils; prefers acid soils; low maintenance. Somewhat resembles centipedegrass. Commonly used in pastures and for erosion control.	Not drought or salt tolerant; not suitable for a quality lawn; poor traffic tolerance; shallow root system; must be irrigated frequently in drought conditions; may be chlorotic under alkaline conditions.	Sun or shade	Seed: 5 lb Sprigs: 1–2 bu	1–2	Does not need or like a lot of N. Apply $^1/_2$–1 lb every 6 months.
Seashore paspalum (*Paspalum vaginatum*)	Medium to dark green; fine textured; very soft leaves; Y-shaped seed heads.	Tolerates saline conditions; seen growing directly into brackish ponds and streams; tolerates brackish irrigation. Tolerates drought and wear. Will show moisture stress but recovers quickly.	Affected by armyworms, webworms. Scalping can be a problem in shade. Produces very heavy thatch; few herbicides available; requires regular maintenance to maintain quality	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	$^3/_4$–1$^1/_2$ Best mowed at 1" or less.	$^1/_2$ lb per month or 1–2 lb of slow-release N every 60–90 days.
Hilograss (*Paspalum conjugatum*)	Medium to dark green; coarse texture; wide, pointed blade tip; Y-shaped seed heads.	Easily takes over lawn or bare ground. Tolerates acidic, wet, and low-fertility soils; establishes easily and grows fast. Does well in high rainfall areas. Makes a satisfactory lawn grass with some maintenance.	An invader in most cases. May cause an allergic rash to sensitive skin. Does not tolerate drought and heat well. Needs to be mowed frequently to control unsightly seed heads and upright growth.	Sun or light shade	May not be commercially available. Seed: 4–6 lb Stolons: 5–10 bu Plugs 6–12" apart Sprigs: 1–2 bu	1–2	Does well with little or no fertilizer. Apply $^1/_2$–1 lb every 6 months.

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