Renovate sports turf

AHCTRF305

Overview

By the end of this topic, you should be able to:

- Prepare to renovate turf
- Prepare renovation equipment
- Implement sports turf renovation
- Complete renovation activities

Turfed surfaces

- Even a sports turf area that has been carefully designed and constructed has a finite lifespan – and requires renovation.
  - Ideally, sports turf areas will undergo several modest renovations before complete replacement is necessary
  - Signs that renovation is necessary include:
    - Severe compaction
    - Poor grass cover despite well-intentioned maintenance
    - Loss of organic matter
    - Poor soil structure and inadequate drainage

Source: http://grounds-mag.com/mag/grounds_maintenance_sizing_sports_field/

Turfed surfaces

- Sports turf requires a number of renovation activities, such as:
  - Aeration to promote healthy surface conditions and break up sub-surface compaction
  - Topdressing and fertilisation programs to improve soil structure and fertility
  - Returfing with improved, more tolerant turf varieties
  - Improving irrigation management and drainage

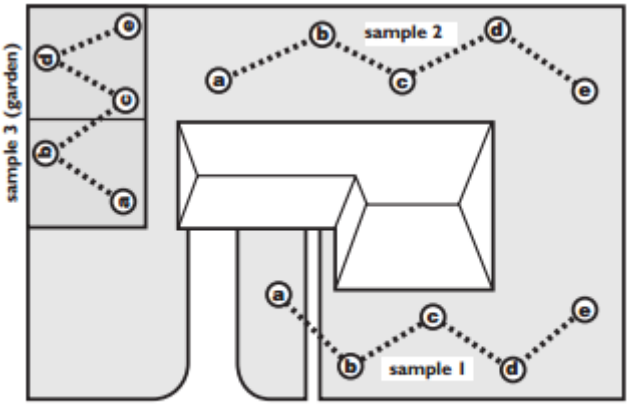
Source: http://grounds-mag.com/mag/grounds_maintenance_sizing_sports_field/

Preparing to renovate turf

- To prepare for turf renovation, you should familiarise yourself with the task requirements
  - Refer to documentation
    - The renovation program will identify the turf renovation site and extent of works, turf type and renovation materials
  - Determine the nature of the soil profile and turf characteristics to identify required improvements
    - Physical characteristics, such as: Soil texture, hardness, traction, smoothness, sward height, water infiltration
    - Chemical characteristics, such as: pH levels, salinity, fertility

Preparing to renovate turf

- When taking soil samples, you should complete the following:
  - Ensure that tools to be used are clean
    - Even a small amount of fertiliser residue on tools can contaminate a soil sample
  - Clear away any weeds and loose organic material to uncover the soil surface
  - Take multiple soil samples at each selected site
    - Ensure that samples are only collected in paper bags if they are lined with plastic
  - Take random samples from the designated area, according to recognised sampling techniques
    - Sample garden and turf areas separately
    - Sample problem areas separately

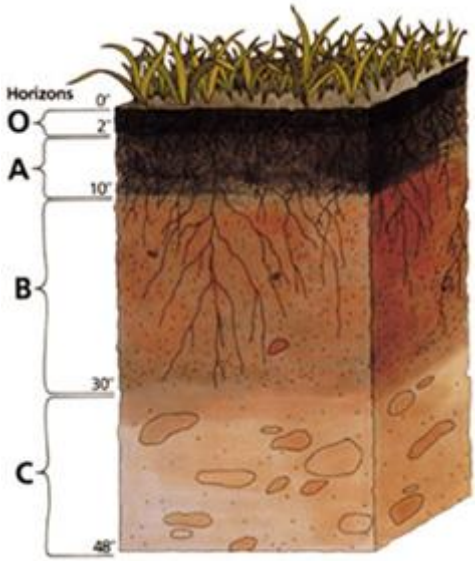


Make a composite sample by collecting small cores from at least five locations.

Source: https://uwlab.soils.wisc.edu/wp-content/uploads/sites/17/2016/01/Soil-Sampling-Instructions-modified.pdf

Physical characteristics

- It is important to understand what exists beneath the surface when taking soil samples
  - The vertical section of soil from the ground surface downwards to where the soil meets the underlying rock is known as the **soil profile**
- The horizons (labelled) represent the following:
  - **Organic (O):** Litter (i.e. dead plants and animal parts)
  - **Surface (A):** Topsoil or mineral horizon
  - **Subsoil (B):** Chemical products of weathering accumulated in the soil
  - **Substratum (C):** Parent material from which soil has formed



Physical characteristics

- There are a range of tests that can be conducted to determine the physical characteristics of the surface, including **soil texture**:

Test	Results	Improvements
Soil texture is an estimate of the relative amounts of sand, silt and clay particles in soil. Soil texture affects the movement and availability of air, nutrients and water in soil. To test soil texture, moisten a small amount and roll it between your hands to try to make a 'sausage' shape.	• **Clay:** Keeps its shape and feels sticky • **Sandy:** Disintegrates and has a gritty feel • **Silt:** Does a bit of both, has a soapy or silky feel	Soil amendments and additives can be used to improve the texture of soil.

Source: https://www.rodalesorganiclife.com/garden/10-easy-soil-tests; http://www.completegardenguide.com/soil_texture.html http://soilquality.org.au/factsheets/soil-texture

Physical characteristics

- There are a range of tests that can be conducted to determine the physical characteristics of the surface, including **hardness**:

Test	Results	Improvements
A device that measures impact absorption is the Clegg Impact Soil Tester (or Clegg Hammer). Surface hardness is measured by determining the 'Gmax' of the playing surface. The higher the value, the harder the surface. Gmax should be tested at various locations, with special attention to high-use locations.	The ability of the surface to absorb impact energy created by a player is its hardness. Playing surface hardness can affect both player performance and safety and should not tend to either extreme. A soft field may create early fatigue, while a hard field can be dangerous in impact situations. Clegg hammer readings should fall between 50 to 120g (3rd drop). Above 150g is high risk.	Off-season: • Use an aerator to remove plugs of soil from the ground, or puncture the ground to give the soil room to decompress. • A quality compost can be spread across the field prior to core cultivation. In-season: • Maintain proper soil moisture • Less aggressive aerification

Source: http://grounds-mag.com/mag/grounds_maintenance_traction_turf/
https://11luuvtufne6f2y33i1nvedi-wpengine.netdna-ssl.com/wp-content/uploads/2017/11/Surface-Hardness-Natural-Turf-Guide.pdf;
https://www.parksleisure.com.au/documents/item/1079

Physical characteristics

- There are a range of tests that can be conducted to determine the physical characteristics of the surface, including **traction**:

Test	Results	Improvements
Mount cleats on a steel disk, weight the disk with barbell weights and rotate it with a torque wrench.	The effect a playing surface has on surface-to-shoe interaction is termed ‘footing’. An sports surface should provide a level of footing that benefits the player's actions without causing excessive stress to joints or ligaments. Too high traction can cause the trapping of players’ boots and contributes to ligament injuries. Test values should fall between 30-50Nm.	The main plant factor determining traction is the stolon and/or rhizome growth on and just within the ground surface. Traction is determined by the combined effects of the grass and the soil medium, both of which can be managed to reduce the effects of traction, if necessary. Traction is also heavily influenced by the choice of footwear, as different studs or cleats can give greater or lesser amounts of grip, irrespective of the grass type or condition.

Source: http://grounds-mag.com/mag/grounds_maintenance_traction_turf/ http://astcs.com.au/documents/Putting%20science%20behind%20traction%20measurement.pdf

Physical characteristics

- There are a range of tests that can be conducted to determine the physical characteristics of the surface, including **smoothness**:

Test	Results	Improvements
Use of 1m straight edge and ruler	These levels affect surface footing or trueness of ball bounce/roll. Ideally, there should be no tufty grass plants >15mm above turf canopy and no divots deeper than 20mm.	Grass should be mowed and divots filled.

Source: https://www.parksleisure.com.au/documents/item/1079

Physical characteristics

- There are a range of tests that can be conducted to determine the physical characteristics of the surface, including **sward height**:

Test	Results	Improvements
Use of a floating disk	Grass height relates to performance in relation to ball bounce and roll, as well as impacting on surface hardness and traction. Sward height will be sport and species/cultivar specific. For example: • Hockey – 8mm to 20mm • Cricket (excluding wicket) – 10mm to 35mm • Soccer – 20mm to 40mm • AFL – 20mm to 50mm • Rugby Union / League: 40mm to 55mm	Grass should be mowed according to requirements.

Source: https://www.parksleisure.com.au/documents/item/1079

- There are a range of tests that can be conducted to determine the physical characteristics of the surface, including **water infiltration**:

Test	Results	Improvements
Observe the duration of ponding after heavy (more than 50mm in 48 hours) rain. Observe the presence of mottles or gleying in surface 100mm.	Slow water infiltration can be a sign of compacted soil, which inhibits root growth and water availability. • First class grounds: Surface should not be squelchy 1 hour after rainfall ceases • Club level grounds: Surface should not be squelchy after 6 hours • General sports field: Surface should not be squelchy after 24 hours	Drainage performance is critical for minimising ground closures and for minimising damage to turf. Options to increase water infiltration rates: • Reducing tillage operations • Increasing the amount of organic materials added to the soil • Decreasing compaction by avoiding the use of machinery, especially when soils are wet • Use a rotary hoe to shatter the crust

Source: https://www.rodalesorganiclife.com/garden/10-easy-soil-tests
http://farmercommunity.incitecpivotfertilisers.com.au/Latest%20News/Horticulture/Measuring%20water%20infiltration;
https://www.parksleisure.com.au/documents/item/1079

- Soil pH is a measure of the acidity or alkalinity in soils
  - You can test soil pH yourself using an over-the-counter kit or meter

1
Most acidic

7
Neutral

14
Most alkaline

- Soil pH affects plant nutrition
  - Having the correct soil pH is important for healthy plant growth
  - Soil pH affects the amount of a particular nutrient that can be taken up by plant roots

- Factors affecting pH include:

Acidic soils (less than 5.5 pH)	Alkaline soils (greater than 7.5 pH)
• Aluminium toxicity • Manganese toxicity • Calcium deficiency • Magnesium deficiency • Low levels of essential plant nutrients (e.g. phosphorus and molybdenum)	• Sodium toxicity (pH greater than 9) • Zinc deficiency • Copper deficiency • Boron deficiency • Manganese deficiency

- You can lower or raise soil pH using a range of products

Lower soil pH	Raise soil pH

• **Acidic fertiliser** (e.g. containing ammonium sufate, or sulphur-coated urea)
• **Elemental sulphur** (Flowers of sulphur), needs to be broken down by soil bacteria to be available for plant uptake
  • Apply at 35g/m^2 on soils with sandy structure
  • Apply at 100g/m^2 on clay soils
• **Manure** (i.e. from poultry, cows, horses and sheep)
	• **Agricultural lime** (Calcium carbonate), a finely ground limestone which is untreated
	• **Hydrated/slaked lime** (Calcium hydroxide), which is more soluble and faster acting than agricultural lime
	• **Dolomite** (Calcium magnesium carbonate), which contains more magnesium than agricultural lime
	• **Quick lime** (Calcium oxide), but not for garden use

Chemical characteristics

- Soil salinity is the salt content in the soil
  - Salinity from irrigation can occur over time wherever irrigation occurs, since almost all water (even natural rainfall) contains some dissolved salts
  - When the plants use the water, the salts are left behind in the soil and eventually begin to accumulate
  - Since soil salinity makes it more difficult for plants to absorb soil moisture, these salts must be leached out of the plant root zone by applying additional water
- Proper irrigation and drainage management can prevent salt accumulation by providing adequate drainage water to leach added salts from the soil

- Salinity is tested in the following way using an EC 1:5 test:
  - Take a soil sample and leave it to dry
  - Crush the dried sample so there are no large clods of soil
  - Add soil to water in a testing container
  - Shake the container to make sure the salts dissolve
  - Allow the solution to settle and place the salinity meter in the solution (but not in the soil at the bottom of the container)
  - Read and record the display once it has stabilised
  - Convert the salinity meter readings to soil salinity (EC_e) by multiplying the value of the Conversion Factor (which is based on the texture of the soil sample)

Chemical characteristics

- To accurately test soil fertility, send your samples to a laboratory
  - This will enable you to determine the appropriate amounts of fertilisers to be added to your garden or turf
- Major and trace nutrients that may be tested for include:

Major	Trace
Nitrogen (N) Phosphorus (P) Potassium (K) Sulfur (S) Calcium (Ca) Magnesium (Mg)	Copper (Cu) Zinc (Zn) Boron (B) Manganese (Mn) Iron (Fe) Chlorine (Cl) Molybdenum (Mo) Sodium (Na) Cobalt (Co) Vanadium (V) Silicon (Si)

Chemical characteristics

- Fertility is determined by whether there is an appropriate balance of nutrients in the soil. Major nutrients found in soil include:

Nutrient	Characteristics

Nitrogen (N)	• Essential for green growth – affects plant colour and lusciousness
	• Affects growth of roots and shoots
	• Provides strength against disease and weather (heat, cold and drought)
	• May be lost from soil:
	  • By leaching through the soil profile
	  • By removing grass clippings
	  • Into the air as ammonia gas (volatilisation) or nitrate gas (denitrification)

Phosphorus (P)	• Essential for root development • Affects the maturation of plants (i.e. avoids stunted growth) • Affects the branching of turf • Deficiency is more prevalent in sandy soils
Potassium (K)	• Affects the ability of plants to withstand wear, drought, disease and stress

Preparing soils

- Soil affects plants in a range of different ways:
  - If a soil has a hard B horizon, roots may have limited depth
  - Large changes in pH at a certain depth may restrict root growth
  - High salinity levels at depth will restrict root growth and/or performance

- To prepare soils for planting or replanting:
  - Improve the physical and chemical characteristics of the garden or lawn area as required
  - Incorporate additional soil, as needed to establish final levels
  - Finish soil level and consolidate as per planting plants and enterprise procedures

Preparing to renovate turf

- To prepare for turf renovating, you should familiarise yourself with the work area
  - Identify any WHS hazards and assess risks
    - Underground services (e.g. telephone lines, gas, electricity, water, cable, sewerage, irrigation, drainage)
      - Refer to site plans or contact Dial Before You Dig
    - Permanent obstacles (e.g. walls, paths, buildings)
    - Movable obstacles (e.g. debris, sporting equipment, portable barricades, hoses)
    - Manual handling injuries
    - Access problems for heavy machinery
  - Identify environmental hazards (e.g. dust, noise, damage to flora/fauna, waste)
- Implement appropriate risk controls for identified issues (e.g. PPE)

- Risk is measured in terms of the seriousness of the possible **consequences** of the hazard and the **likelihood** that those consequences will occur, as in the matrix shown below:

Extreme	High	Medium	Low

Consequences
A: Death or Permanent Disability
B: Serious Injury
C: Lost Time Injury
D: Casualty Treatment
E: First Aid

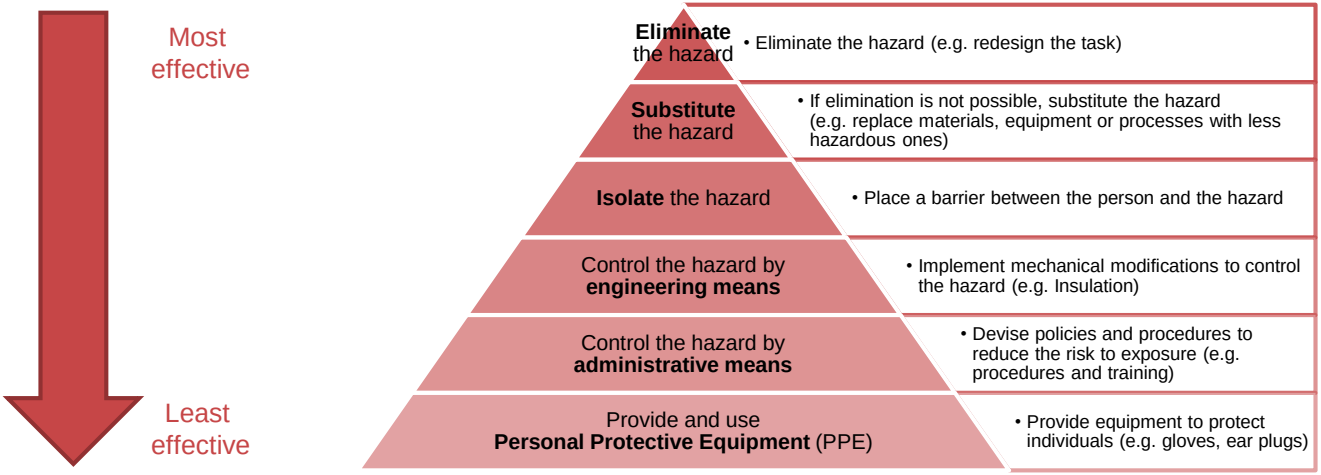
Likelihood

1: Very Likely
2: Likely
3: Possible
4: Unlikely
5: Very Unlikely

Matrix	A	B	C	D	E
1	E	E	H	H	M
2	E	H	H	M	M
3	H	H	M	M	L
4	H	M	M	L	L
5	M	M	L	L	L

Workplace risk control

- The hierarchy of control gives priority to the order in which hazard and risk controls should be implemented.



Preparing to renovate turf

- To prepare for turf renovation, you should organise the required materials, PPE, machinery, tools and equipment
  - Materials may include: Fertiliser, topdressing, chemicals
  - PPE may include: Wide-brimmed hat, safety goggles, dust mask, rubber boots, steel-capped boots, sunglasses, ear muffs, gloves, long pants, long-sleeved shirt, overalls, apron, sunscreen, face shield, respirator
  - Safety equipment may include: Signage and barricades (e.g. witches' hats)
  - Machinery may include: Mower, compactor, edger, turf cutter, fertiliser spreader
  - Tools and equipment may include: Corer, forks, rakes, shovels, brooms, wheelbarrow, irrigation system, hoses, tape measure, marking pegs/flags, spray paint, cord and raddle/chalk, line marker, measuring wheel

Ensure they are appropriately selected, prepared, checked, calibrated and used for the task, following manufacturer's specifications

- Any faulty items should be reported to your supervisor
  - Follow the ‘Stop, Tag, Report, Record’ (STRR) approach:
    - Stop using the equipment
    - Tag the faulty equipment
    - Report the faulty equipment to your supervisor
    - Record the details of the fault
  - Report issues within a timely fashion to avoid issues/injuries

Renovating turf

- To appropriately undertake sports turf renovation, you will likely undertake a range of tasks as per the renovation program, including:
  - Aeration
  - Fertilisation
  - Topdressing
  - Returfing
  - Improving irrigation management and drainage
- Work should be scheduled in a sequential, timely and effective manner

Worksheet 1: Research and document a range of sports turf surfaces – in particular their grasses that may be used for them and their maintenance requirements

Aeration

- Sports turf surfaces become compacted from use
  - This can make the surface hard and potentially dangerous
  - Further, a compacted surface inhibits turf growth

- Regular aeration softens the surface, allows air and moisture movement into the soil and promotes healthy turf growth
  - Provided a field has adequate irrigation, it would be nearly impossible to aerate too often
  - Nevertheless, it is critical to aerate sports turf in spring to encourage spring recovery.

Source: http://www.footballfacilities.com.au/wp-content/uploads/2015/11/Grass-Field-Maintenance.pdf

Fertilisation

- Fertilisation may be required to stimulate regrowth
  - Ideally, fertilisers should be based on controlled release nitrogen which tends to stimulate shoot regrowth, rather than wasteful, excessive leaf growth

- If a sports turf area is intensively used, regular fertilising may be required throughout the entire year to match growth to wear
  - Nevertheless, spring fertilisation can reduce summer fertilisation if good surface recovery occurs

Source: http://www.footballfacilities.com.au/wp-content/uploads/2015/11/Grass-Field-Maintenance.pdf

Fertilisation

- Consult with a specialised soil-testing laboratory to ensure that your amendments are proper in makeup and ratio to meet the requirements of your sports turf area

- Marginal soils can be improved by amendments, but use caution, as the addition of improperly conceived amendments can make a good soil bad – and a bad soil worse

Source: http://grounds-mag.com/mag/grounds_maintenance_sizing_sports_field/

Topdressing and returfing

- When a sports turf surface is used to the extent that its stems are worn away, then the quality and safety of the surface are compromised
  - Depressions begin to appear on the surface
  - Areas devoid of turf become very hard and present safety concerns from physical harm and potential infection of abrasions

- These areas are the slowest to recover, and may require returfing, or topdressing to fill the depressions and restore a flat surface
  - Returfing is not ideal, as it requires more water and fertiliser, takes many weeks to establish and is the most susceptible part of a field to incur damage the following winter

Source: http://www.footballfacilities.com.au/wp-content/uploads/2015/11/Grass-Field-Maintenance.pdf

Drainage

- Many sports fields have a loam to clay loam texture
  - Such profiles are easily compacted and percolation of water through the profile is very slow
  - In such fields, major damage is inflicted by usage after a significant rain event

- Where subgrades are essentially impermeable, you should seriously consider the installation of subsurface drains
  - Drainage systems can be installed in situ that incorporate a cross linked sand/gravel matrix that channel rainwater from the surface to either irrigation tanks or stormwater
    - Removal of surface water allows fields to be in play much more quickly after rainfall events and helps reduce surface damage from playing on a wet surface

Source: http://www.footballfacilities.com.au/wp-content/uploads/2015/11/Grass-Field-Maintenance.pdf

Drainage

- Beware of fields built on poorly drained or over-compacted subgrade
  - These fields, regardless of the quality and nature of the topsoil, will require significant crown to shed excess water – and perhaps an extensive system for removing subsurface water
    - Soils with higher silt and clay contents typically rely exclusively on surface drainage in the from of a crown (1.5-2% minimum) to shed excess water before it enters the soil profile
    - Sandier soils with better infiltration can perform admirably with less of a crown, though anything less than 1% is not recommended.

Source: http://www.footballfacilities.com.au/wp-content/uploads/2015/11/Grass-Field-Maintenance.pdf
http://grounds-mag.com/mag/grounds_maintenance_sizing_sports_field/

Irrigation management

- If your sports turf area is not irrigated, consider the installation of an automatic in-ground system that can delivery water efficiently and evenly across the entire surface
  - Be aware – improperly designed and managed irrigation systems will only exacerbate surface drainage and compaction problems.

- How frequently you irrigate depends on:
  - Soil type
  - Weather conditions
  - Species of grass
  - Mowing height
  - Use of turf
- Water deeply, but infrequently, to encourage a deep root system
  - Overwatering reduces root growth, promotes compaction and decreases overall wear tolerance

Mowing the playing surface

- Mowing may also form part of the renovation activities.

- When mowing the playing surface, you should undertake the following:
  - Mow turf to a pattern, as per enterprise guidelines
    - Mow in a regular pattern, making wide turns so not to cause damage
    - Maintain continuous oversight of mowing activities
  - Assess grass appearance against enterprise guidelines
    - Report changes in appearance

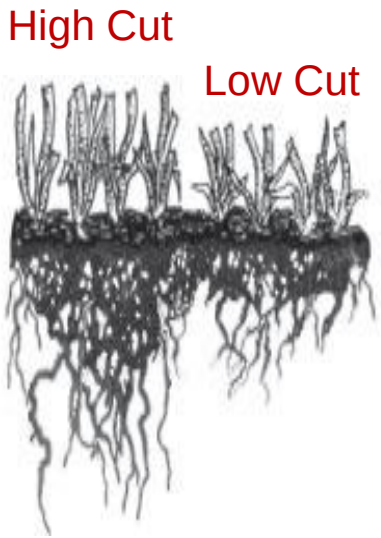
Mowing the playing surface

- Tips for mowing:
  - Trim first
    - The mower will chop the trimmings and reduce the need for raking
  - Mow at the correct height
    - Each grass type has its ideal height range
    - Mow when the grass blades are about one-third taller than the recommended height
    - Only removing one-third of the grass height prevents damage and stress to the turf, reducing the need for fertiliser and pesticides
    - Increased mowing frequency will increase turf density, wear tolerance and decrease weed encroachment

Source: https://garden.org/learn/articles/view/1280/; https://cals.arizona.edu/apmc/docs/Landscape-and-Grounds-Lesson-2.pptx

Mowing the playing surface

- The picture below depicts the effect of mowing height on root growth
- A lower cut produces shorter roots, less stress tolerance and allows more weed invasion



Mowing the playing surface

- Tips for mowing:
  - Mow grass when dry
    - Wet grass cuts unevenly and promotes the growth and spread of diseases
  - Alternate mowing directions each time you mow
    - This will help keep grass growing upright and prevents soil compaction
    - Mow at a 45 or 90 degree angle to your last pattern
  - Keep blades sharp
    - Prevent damage to the grass blades
    - Ragged cuts invite disease and make turf look brown

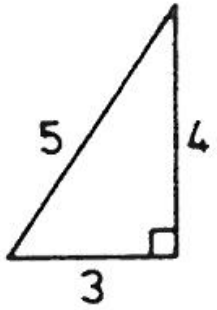
Source: https://garden.org/learn/articles/view/1280/; https://cals.arizona.edu/apmc/docs/Landscape-and-Grounds-Lesson-2.pptx

Final preparations of playing surfaces

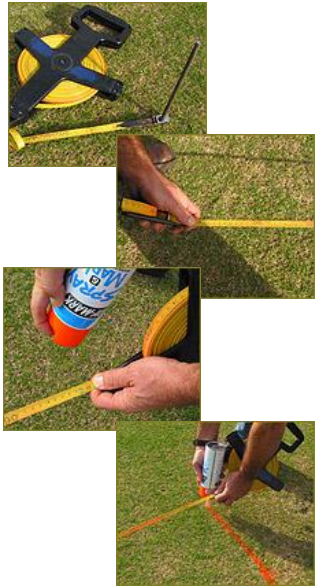
- As part of the final preparations of playing surfaces, you are required to:
  - Measure lengths and angles to locate markers and match play equipment
  - Complete marking out according to the intended playing surface use
  - Place markers and play equipment where necessary

- To mark out a right angled triangle, use one of the following methods:
  - Use a steel square
  - Follow the 3:4:5 rule
    - The triangle's hypotenuse squared will equal the sum of the squares of the other two sides of the triangle

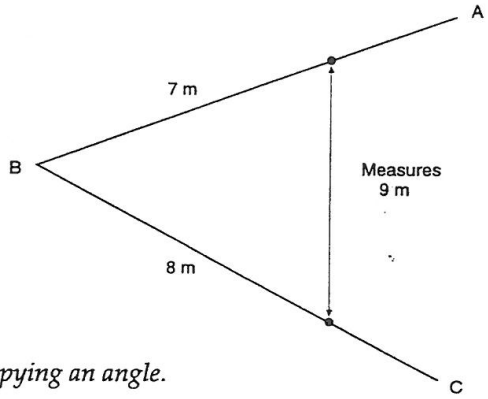
$$3^2 + 4^2 = 5^2$$



- To mark out circles or semi-circles, use the following method:
  - Fix a peg or stake through the D-ring of a tape measure in the centre of the area you would like to draw a circle or semi-circle
  - Use the tape measure to measure out the radius of the circle or semi-circle you would like to mark out
  - Hold the nozzle of the spray can at the point of measurement
  - Pull the tape taut, then depress the nozzle and carefully walk around the peg to mark the arc
    - Walk halfway around the peg to mark out a semi-circle
    - Walk fully around the peg to mark out a full circle



- Where it is necessary to copy an angle, but there is no need to measure the degrees, construct a triangle using the two sides of the angle and measure the distance between the points on each side
  - Measure a convenient distance along BA and BC from B and mark these distances with a peg
  - Measure the distance between the pegs to establish the third side of the triangle
  - The angle ABC can be copied using units of 7, 8 and 9 for the lengths of each side of the triangle



Copying an angle.

Clean up processes

- As part of completing turf renovation, you are required to complete the following practices:
  - Clean up the work area
  - Record and/or report your work outcomes
    - Use appropriate paperwork for reporting to your supervisor
    - Remove safety equipment to notify the public that work is completed
  - Shut down, maintain, clean and store plant, tools and equipment
    - Follow manufacturer's specifications
    - Record faults in the logbook
  - Dispose of materials that cannot be reused or recycled
    - Be environmentally aware and act safely