

1.1 MEASURING IMPERVIOUS SURFACE

This section presents the protocols for measuring impervious surface on a developed parcel that is subject to a prorated SWM fee based on the percentage of impervious surface on the parcel. These protocols standardize the measurement practice and procedure for measuring impervious surface on commercial properties. The protocols are meant to be guidelines that will bring consistency to the process and provide a quality record of the process that can be used to answer present and future questions regarding the property. As each commercial property is different and unique, and the ultimate goal of the process is to accurately measure the impervious area on each property, these are flexible guidelines. The measuring personnel should not feel constrained by these guidelines, however, any deviation from these guidelines should be documented on the map page.

1.1.1 WHAT IS IMPERVIOUS SURFACE?

The definition of impervious surface, as defined in King County Code 9.04.020(P) reads in part "a hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development, and/or a hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development."

1. All paved areas, including porous pavement or other alternative pavements, are considered impervious. Grassed, modular-grid pavement¹, however, may qualify for an "impervious surface reduction credit" if it meets the design specifications for such pavement in Section "SWM Fee Protocols".
2. All compacted gravel areas are considered impervious. The existence of grass or weeds growing in a gravel area does not convert it to pervious area².
3. Dirt (i.e., bare soil) (i.e., bare soil) compacted more than the surrounding native soil is considered impervious. Use the drop penetration test described below to determine if the dirt is compacted more than the surrounding soil.
4. Landscape rock (pea gravel or round washed rock) that deforms when walked on or driven on is not considered impervious unless it is underlain by an impervious surface (such as compacted dirt, plastic, concrete, etc.)
5. Raised decks, coverings, or other structures that are slotted are considered pervious if they do not concentrate runoff at one end or the other and the slots are no wider than 12" on center. While the slotted structure is considered pervious, the ground underneath the structure needs to be evaluated to determine if it is impervious.
6. Portable items, other than sheds and other structures, should not be included in the impervious area calculations unless the ground underneath them is considered

¹ *Modular-grid pavement* is a general term meaning a brick or block surface with large spaces between the brick/blocks that is fill with soil and growing grass.

² In order to convert a compacted gravel area from impervious to pervious, it needs to be rototilled down to the depth of the native soil and then compacted no more than would be done to install grass, and it must not be subject to vehicular use.

impervious. Portable items can included, but are not limited to, such things as picnic tables, cars, stacked lumber, stored plastic, garbage dumpster, etc.

7. Vegetated roofs are considered impervious but may qualify for an "impervious surface reduction credit" as allowed in Section "SWM Fee Protocols".

❑ DROP PENETRATION TEST

The drop penetration test is a simple test that can be used to determine the relative density of two similar soils. For two soils of similar composition, it is generally recognized that a denser (more compact) soil will produce more surface runoff than a less dense soil.

The drop penetration test requires the use of a large steel bar with a pointed end and a tape measure (or graduated markings on the point of the bar). The test is performed as follows:

1. For the area to be tested, find a similar area nearby that appears to be the same type of soil or land cover and would be considered pervious.
2. Hold the bar, pointed end down, at a known height above the ground to be tested. This could be a measured distance (such as three feet) or a height relative to something (even with the top of you knee cap or holding a marked point on the rod even with your eye).
3. Release the bar and let it drop to the ground. If the bar rotates out of being vertical, or if it rubs your hands during the drop, or if the bar hits a solid object in the ground, repeat the drop.
4. Measure how far the point of the bar penetrates the soil.
5. Repeat the drop several times until you are comfortable with the average depth of penetration for the tested area.
6. Repeat the test on the similar, nearby pervious soil area.
7. If the depth of penetration is less in the tested area than in the nearby pervious comparison area, the soil should be considered impervious.

This test can also be helpful in estimating the edge of an impervious area where there is no clear transition line from pervious to impervious.

NOTE: When performing the drop penetration test on gravel or compacted soil areas, eye protection should be worn.

1.1.2 HOW TO MEASURE AND DOCUMENT IMPERVIOUS AREA

The accuracy of the measurement of impervious surface and the documentation of said measurement is as important as the determination of what is impervious surface. The following guidelines will reduce measurement errors and provide consistency among different personnel performing the measurement.

A - MEASUREMENT PROCEDURE

1. Upon arrival at a site, locate the property owner or manager, explain the purpose of your visit, and obtain permission to enter the property.

2. Attempt to identify the boundaries of the property. Get property dimensions from the Assessor's map. Look for surveyed property corners to identify the property boundaries. In the absence of surveyed property corners, look for fences, hedges, or changes in land use or landscaping to help identify the approximate boundaries of the parcel being measured.
3. When occupation (fences, hedges, etc.) do not match the dimension given on the Assessor's map and there are no surveyed property corners, measure the impervious surface for the occupied area and bring the situation to the attention of the supervisor.
4. Note any impervious surface that crosses the apparent property boundary. Count only the impervious area lying on the parcel being measured. Do not count impervious area lying on adjacent properties, including the right-of-way. Mark the approximate property line if necessary with non-permanent means (lumber crayon, sticks, stones, or a line scraped in the surface).
5. Observe the amount and configuration of the impervious surface on the site. Determine whether it is appropriate to measure the impervious area directly or measure the pervious area and subtract it from the total area of the parcel.
6. Break the areas to be measured up into geometrical shapes (square, rectangle, triangle, circle sections, trapezoid, etc.). Mark the edges of each shape, if necessary, with non-permanent means (lumber crayon, sticks, stones, or a line scraped in the surface) to prevent gaps and overlaps.
7. Measure the dimensions of each shape and calculate the area of the shape.
8. Add the area from each shape to determine the total measured area.

B - MEASUREMENT PRACTICE

1. When using a wheel to measure distances, always set the counter to zero and position the wheel so that the wheel will travel a full foot before activating the counter³.
2. At the end of the measurement, round the measurement down to the nearest 1/2 foot based on the position of the counter in relationship to the wheel.
3. All wheel measurements should be taken in a straight line (except when measuring the centerline of a curved road) and on the smoothest surface possible.
4. All measurements should be performed on foot when access to the property is granted.
5. For measurements less than 10 feet, use a steel or rag tape.
6. Use Assessor's Office information for net area for building footprint area.
7. Measure building overhangs perpendicular to the building. Account for the entire length of the overhang (from edge of roof to edge of roof instead of from edge of building to edge of building) but don't double count overhang areas at corners.

³ A measuring wheel should be checked for accuracy at least once per year. The date the wheel is checked can be recorded on the handle of the wheel so no log is required.

8. For curved areas, measured the centerline length of the arc and multiply by the average width of the area. Take at least three width measurements to compute the average width. If one of the width measurements is significantly different from the other two, break the area into more arcs/shapes.
9. Measure horizontal area not slope area. If the potential error between slope distance and horizontal distance is over 0.5 feet (refer to attached chart), then make a correction to the measured distance (*note: inclinometers may be needed for this*).
10. Calculate rate category for each parcel before leaving the site. Re-measure all parcels within 2% of a lower category in reverse order from the original measurement (i.e. if the parcel had seven shapes and they were measured in order from 1-7 the first time, measure them in order 7-1 the second time). If appropriate, measure different legs of each shape (i.e. if the north and west sides of a rectangle were measured the first time, measure the south and east sides on the rectangle on the re-measure).
11. Reconcile any differences in measurement before leaving the site unless it appears that more information is needed to reconcile said differences.

SLOPE % 5 7.5 10 12.5 20 30

HOR.
DIST

SLOPE DISTANCE

25	25.03	25.07	25.12	25.19	25.50	26.10
50	50.06	50.14	50.25	50.39	50.99	52.20
75	75.09	75.21	75.37	75.58	76.49	78.30
100	100.12	100.28	100.50	100.78	101.98	104.40
200	200.25	200.56	201.00	201.56	203.96	208.81
300	300.37	300.84	301.50	302.33	305.94	313.21
500	500.62	501.40	502.49	503.89	509.90	522.02

EXAMPLE: A MEASUREMENT OF 201.00 FEET ON A 10 % SLOPE SHOULD BE CORRECTED TO 200 FEET. FIGURES SHOWN CAN BE INTERPOLATED AND ADDED TO COME UP WITH CORRECTIONS FOR DISTANCES NOT SHOWN.

INTERPOLATION: WHAT IS THE HORIZONTAL DISTANCE OF A 60 FT MEASUREMENT ON A 20% SLOPE? THE DIFFERENCE BETWEEN THE CORRECTION FOR 50.99 FT AND 76.49 FT IS 0.5 FEET (1.49-.99). 60 FEET IS 35 PERCENT OF THE WAY BETWEEN 50.99 AND 76.49 $[(60-50.99)/(76.49-50.99)]$ THE TOTAL CORRECTION IS $0.99 + .35 \times .50 = 1.16'$. THE ACTUAL HORIZONTAL DISTANCE IS $60-1.16=58.8$ FEET.

C - DOCUMENTATION

1. Each property measured should have a site map showing how the property was measured (how the measured area was broken up into different shapes)
2. Each shape on the site map should be numbered for reference to the legend.

3. The legend should identify the parcel by Assessor's tax lot number and address, indicate north, and include notes to document any unusual circumstances on the site or assumptions made during the measurement process.
4. The legend should identify each measured shape by number and indicate the area for the shape and the type of surface (pavement, gravel, dirt, etc.) in the area.
5. Maps need not be to scale but should be roughly proportional.
6. Large parcels may require multiple page maps with match lines.