National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Erosion - Sheet and Rill	Detachment and transport of soil particles caused by rainfall splash and runoff degrade soil quality.	Sheet and rill erosion does not exceed Soil Loss Tolerance "T"	Erosion does not exceed "T" for planned rotation and agronomic feasibility and soil resource base is sustained. *Rangeland:* score of moderate or better for rills (ref. (1), p. 28).	Tons/Acre/Year – average annual tons of erosion reduced per acre for the field or planning area/unit	• Current water erosion tool for cropland: RUSLE2 (16) • Rangeland: Interpreting Indicators of Rangeland Health, p. 28 (1) • Water Erosion Prediction Project (WEPP) for forestland • Soil Quality Information Sheets (4) • Soil Quality Test Kit (5)
Soil Erosion - Wind	Detachment and transport of soil particles caused by wind degrade soil quality and/or damage plants.	Wind erosion does not exceed the Soil Loss Tolerance "T" or, for plant damage, does not exceed Crop Damage Tolerances.	Erosion does not exceed "T" for planned rotation and agronomic feasibility and soil resource base is sustained. *Rangeland:* score of moderate or better for wind scoured, blowout and/or depositional areas (ref. (1), p. 30).	Tons/Acre/Year – average annual tons of erosion reduced per acre for the field or planning area/unit	• Current erosion prediction tool, i.e., Wind Erosion Equation (WEQ) or Wind Erosion Prediction System (WEPS) (16) • Rangeland: Interpreting Indicators of Rangeland Health, p. 30 (1)
Soil Erosion - Ephemeral Gully	Small channels caused by surface water runoff degrade soil quality and tend to increase in size. On cropland, they can be obscured by heavy tillage.	Surface water runoff is controlled sufficiently to stabilize the small channels and prevent reoccurrence of new channels.	No excessive erosion and concentrated flow channels are absent or old ones are blunted and muted features. *Rangeland:* score of moderate or better for water flow patterns (ref. (1), p. 30).	Tons/Year – average annual tons of erosion reduced for the field or planning area/unit	• Visual assessment • Interpretation of aerial photographs • Rangeland: Interpreting Indicators of Rangeland Health, p. 30 (1) • Direct Volume Method (14)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Erosion – Classic Gully	Deep, permanent channels caused by the convergence of surface runoff degrade soil quality. They enlarge progressively by head cutting and lateral widening.	Surface water runoff is controlled sufficiently to stop progression of headcutting and widening.	*Rangeland:* score of moderate or better for gullies (ref. (1), p. 30).	Tons/Year – average annual tons of erosion reduced for the field or planning area/unit	• Visual assessment • Direct volume method (14) • Interpretation of aerial photographs • Rangeland: Interpreting Indicators of Rangeland Health, p. 30 (1)
Soil Erosion - Streambank	Accelerated loss of streambank soils restricts land and water use and management.	Accelerated streambank soil loss does not exceed a level commensurate with upstream land use and normal geomorphological processes on site.	*Rangeland:* score of 7 or better for channel condition and 4 or better for bank stability (ref. (2)).	Tons/Year – average annual tons of erosion reduced for the field or planning area/unit	• Visual assessment • Direct Volume Method (14) • Lateral Recession Estimate • Interpretation of Aerial Photographs • Rangeland: Visual Assessment of Riparian Health (2)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Erosion - Shoreline	Soil is eroded along shorelines by wind and water action, causing physical damage to vegetation, limiting land use, or creating a safety hazard.	Shoreline erosion is stabilized to a level that does not restrict the use or management of adjacent land, water, or structures.	Same as National	Tons/Year – average annual tons of erosion reduced for the field or planning area/unit	• Visual assessment • Aerial photo analysis • Volume analysis
Soil Erosion – Irrigation-Induced	Improper irrigation water application and equipment operation are causing soil erosion that degrades soil quality.	Irrigation-induced erosion does not exceed the Soil Loss Tolerance "T"	Erosion does not exceed "T" and any runoff entering receiving waters is at or below state standards.	Tons/Acre/Year – average annual tons of erosion reduced per acre for the field or planning area/unit	• Imhoff Cone or other acceptable method used to quantify sediment in irrigation runoff water. (17) • Surface Irrigation Models (i.e., Furrow4 or FUSED-if calibrated) • NRCS Irrigation Water Management Guides • Direct volume method
Soil Erosion - Mass Movement	Soil slippage, landslides, or slope failures, normally on hillsides, result in large volumes of soil and rock movement	Shallow slumps, slides, or slips are prevented or minimized so that the mass movement of earth material does not exceed naturally occurring rates	Toeslopes are not undercut and tops of slopes are not overloaded.	Tons/Year – average annual tons of erosion reduced for the field or planning area/unit	• Visual assessment • Geologic Investigation

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Erosion – Road, Roadsides and Construction Sites	Soil loss occurs on areas left unprotected during or after road building and/or construction activities.	Sites are adequately protected from soil loss during and after road building and construction activities.	Roadbanks and scoured areas are stable and not eroding. Sediment is not leaving the site in runoff water.	Tons/Year – average annual tons of erosion reduced for the field or planning area/unit	• Visual assessment • Current water and wind erosion prediction tools (RUSLE2 and WEQ)(15) • Direct volume calculation • Soil Quality – Urban Technical Note 1 (18)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition - Organic Matter Depletion	Soil organic matter has lowered or will diminish to a level that degrades soil quality.	Soil Conditioning Index is positive.	Soil Conditioning Index is 0 or positive and soil crust is absent and there is an adequate percent of water stable aggregates. Use an appropriate sampling method when testing soil. *Rangeland:* score of moderate or better for Soil Surface Loss or Degradation (ref. (1), p. 33)	Soil Conditioning Index Improvement – positive improvement in index for the field or planning area/unit	• Soil Conditioning Index (3) • Soil Quality Kit: Measure thickness and strength of soil crust (4) Measure soil aggregate stability, (5) Earthworm Test (5) Respiration Test (5) Soil Quality Information Sheets (21, 22) • Rangeland: Interpreting Indicators of Rangeland Health, p. 33 (1) • Soil Sampling Method (12)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition – Rangeland Site Stability	The capacity to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water.	Indicators of Rangeland Health Attribute rating for Soil/Site Stability show Slight to Moderate or less departure from Ecological Reference Sheet (ESD).	Same as National.	Departure from Ecological Reference Sheet (ESD) categories – amount of departure, by numeric value, from Ecological Reference Sheet for the field or planning area/unit. 1=None to Slight, 2=Slight to Moderate, 3=Moderate, 4=Moderate to Extreme, or 5=Extreme.	• Rangeland: Interpreting Indicators of Rangeland Health, p. 33 (1)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition - Compaction	Compressed soil particles and aggregates caused by mechanical compaction adversely affect plant-soil-moisture relationships.	Mechanically compacted soils are renovated sufficiently to restore plant root growth and/or water movement.	Use an appropriate sampling method when testing soil. *Rangeland:* score of mod. or better for Compaction Layer (ref. (1), p. 35)	Non Measurable	• Soil Quality Test Kit: Bulk Density Test (5) • Observation of plant roots • Penetrometer (11) • Rangeland: Interpreting Indicators of Rangeland Health, p. 35 (1) • Soil Quality Information Sheet: Compaction (23) • Soil Sampling Method (12)
Soil Condition – Subsidence	Loss of volume and depth of organic soils due to oxidation caused by above normal microbial activity resulting from excessive drainage or extended drought.	The timing and regime of soil moisture is managed to attain acceptable subsidence rates.	Same as National	Inches/Acre/Year – average annual inches of subsidence reduced per acre for the field or planning area/unit	• Visual assessment • Inventory of volume and depth • Soil probes and witness poles

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition – Contaminants: Salts and Other Chemicals	Inorganic chemical elements and compounds such as salts, selenium, boron, and heavy metals restrict the desired use of the soil or exceed the soil buffering capacity	Salinity levels cause less than a 10% decrease in plant yield. Other contaminants do not exceed plant tolerances or are below toxic levels for plants or animals.	Use an appropriate sampling method when testing soil.	Electroconductivity (EC) – average reduction in EC for the field or planning area/unit	• Laboratory test for chemical contaminants. • Background Concentrations of Trace and Major Elements in California Soils (6) • Soil Quality Test Kit: Electrical Conductivity Test (5) • Effects of Salinity, Boron, Sodium, and Chloride on Crop Yields (7) • Soil Quality Information Sheet: Salinization (24) • Soil Sampling Method (12)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition – Contaminants: Animal Waste and Other Organics - N	Nitrogen nutrient levels from applied animal waste and other organics restrict desired use of the land.	Nitrogen nutrient application levels do not exceed soil storage/plant uptake capacities based on soil test recommendations and risk analysis results.	Use an appropriate sampling method when testing soil.	Pounds/Acre/Year – average annual pounds of nitrogen (N) reduced per acre for the field or planning area/unit	• Nitrogen Quick Test (9) • Soil laboratory testing. • Plant tissue testing. • Application records. • Reference for nutrient requirements of crops (10) • Soil Sampling Method (12)
Soil Condition – Contaminants: Animal Waste and Other Organics - P	Phosphorus nutrient levels from applied animal waste and other organics restrict desired use of the land.	Phosphorus nutrient application levels do not exceed soil storage/plant uptake capacities based on soil test recommendations and risk analysis results.	Use an appropriate sampling method when testing soil.	Pounds/Acre/Year – average annual pounds of phosphorus (P) reduced per acre for the field or planning area/unit	• Soil laboratory testing. • Plant tissue testing. • Application records. • Reference for nutrient requirements of crops (10) • Soil Sampling Method (12)
Soil Condition – Contaminants: Animal Waste and Other Organics - K	Potassium nutrient levels from applied animal waste and other organics restrict desired use of the land.	Potassium nutrient application levels do not exceed soil storage/plant uptake capacities based on soil test recommendations and risk analysis results.	Use an appropriate sampling method when testing soil.	Pounds/Acre/Year – average annual pounds of potassium (K) reduced per acre for the field or planning area/unit	• Soil laboratory testing. • Plant tissue testing. • Application records. • Reference for nutrient requirements of crops (10) • Soil Sampling Method (12)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition – Contaminants: Commercial Fertilizer - N	Over application of nitrogen degrades plant health and vigor or exceeds the soil capacity to retain nutrients.	Soil nutrient levels of nitrogen do not exceed crop needs based on realistic yield goals and appropriate pH levels are maintained.	Use an appropriate sampling method when testing soil.	Pounds/Acre/Year – average annual pounds of nitrogen (N) reduced per acre for the field or planning area/unit.	• Nitrogen Quick Test (9) • Soil laboratory testing. • Reference for nutrient requirements of crops (10) • Soil Sampling Method (12) • Soil Quality Test Kit: pH meter (5)
Soil Condition – Contaminants: Commercial Fertilizer - P	Over application of phosphorus degrades plant health and vigor or exceeds the soil capacity to retain nutrients.	Soil nutrient levels of phosphorus do not exceed crop needs based on realistic yield goals and appropriate pH levels are maintained.	Use an appropriate sampling method when testing soil.	Pounds/Acre/Year – average annual pounds of phosphorus (P) reduced per acre for the field or planning area/unit.	• Soil laboratory testing. • Reference for nutrient requirements of crops (10) • Soil Sampling Method (12) • Soil Quality Test Kit: pH meter (5)
Soil Condition – Contaminants: Commercial Fertilizer - K	Over application of potassium degrades plant health and vigor or exceeds the soil capacity to retain nutrients.	Soil nutrient levels of potassium do not exceed crop needs based on realistic yield goals and appropriate pH levels are maintained.	Use an appropriate sampling method when testing soil.	Pounds/Acre/Year – average annual pounds of potassium (K) reduced per acre for the field or planning area/unit.	• Soil laboratory testing. • Reference for nutrient requirements of crops (10) • Soil Sampling Method (12) • Soil Quality Test Kit: pH meter (5)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					
Soil Condition – Contaminants: Residual Pesticides	Residual pesticides in the soil have an adverse effect on non-targeted plants and animals.	Pesticides are applied, stored, handled, and disposed of so that residues in the soil do not adversely affect non-target plants and animals.	The pesticides chosen are compatible with the soil and are not subject to loss by leaching or runoff. Use an appropriate sampling method when testing soil.	Non Measurable	• Visual observation • Pesticide Screening Tool WIN-PST (13) • Laboratory testing of soil for excess pesticides. • Soil Sampling Method (12) • Soil Quality Information Sheet: Pesticides (19)
Soil Condition – Damage from Sediment Deposition	Sediment deposition damages or restricts land use/management or adversely affects ecological processes.	Soil deposition is sufficiently reduced to maintain desired land use/management and ecological processes.	Includes onsite and offsite sediment. Human health and/or safety are not put at risk from airborne dust or particulate matter. *Rangeland:* score of moderate or better for Wind-scoured, Blowouts, and/or Deposition Areas (ref. (1), p. 30).	Acres/Year – average annual acres of sediment deposition reduced for the field or planning area/unit	• Visual assessment • Volume calculation • Current water and wind erosion prediction tools (RUSLE2 and WEQ) (16) coupled with sediment delivery ratios. • Plant and animal community assessment • Rangeland: Interpreting Indicators of Rangeland Health, p. 30 (1) • Soil Quality Information Sheet: Sediment Deposition on Cropland (20)

National and State Resource Concerns and Quality Criteria					
Natural Resource Concern	**Description of Concern**	**National Quality Criteria**	**California State Quality Criteria**	**Measurement Units**	**Assessment Tools for Quality Criteria Evaluation**
SOIL					

(1) USDI and USDA. Interpreting Indicators of Rangeland Health, version 4, Technical Reference 1734-6, 2005.
http://www.glti.nrcs.usda.gov/technical/publications/index.html#range-health-indicate Also refer to the Ecological Site Descriptions.
(2) Ward, Tate and Atwill. Visual Assessment of Riparian Health. University of California Division of Agricultural Resources, Rangeland Monitoring Series Publication 8089. http://californiarangeland.ucdavis.edu/Publications%20pdf/8089HR.pdf
(3) The currently available Soil Conditioning Index may need revision for use in California. See http://soils.usda.gov/sqi/management/files/sq_atn_16.pdf.
(4) http://soils.usda.gov/sqi/index.html
(5) USDA-SQI. Soil Quality Test Kit (August 1999). http://soils.usda.gov/sqi/assessment/test_kit.html
(6) Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996. http://www.envisci.ucr.edu/downloads/chang/kearney/kearneytext.html
(7) Hansen and Gratten. Agricultural Salinity and Drainage. University of California Agricultural & Natural Resources Publication 3375.
http://anrcatalog.ucdavis.edu
(9) Hartz, Tim. Efficient Nitrogen Management for Cool-Season Vegetables. http://vric.ucdavis.edu/veginfo/topics/fertilizer/nitmanagement.pdf
(10) We need to find a reference giving nutrient needs of individual crops.
(11) Jones, Dickey, Eisenhauer and Wiese. Identification of Soil Compaction and Its Limitations to Root Growth, NebGuide G-87-831A
NRCS Soil Quality Information Sheet on Compaction http://anrcatalog.ucdavis.edu
(12) EC 628 Soil Sampling for Home Gardens and Small Acreages http://extension.oregonstate.edu/catalog/html/ec/ec628/
(13) http://www.wsi.nrcs.usda.gov/products/W2Q/pest/winpst.html
(14) (Width (ft) * Depth (ft) * Length(ft) * average bulk density * 62.4)/2000 = Tons. An average bulk density is 1.5 gm/cm^3.
(15) Soil Quality Institute Urban Technical Note Series – Note 1: Erosion and Sedimentation on Construction Sites
http://soils.usda.gov/sqi/management/files/sq_utn_1.pdf
(16) Erosion Tools http://www.wcc.nrcs.usda.gov/water/quality/common/erosion/erosiontools.html Renard, Foster, Weesies, McCool, Yoder. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, handbook No. 703, 404 pp.
http://efotg.nrcs.usda.gov/references/public/WA/Revised_Universal_Soil_Loss_Equation_(RUSLE).htm Official website for RUSLE2:
http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm Website for WEQ and WEPS: http://www.weru.ksu.edu/weps.html
(17) Use the fact sheet developed by Terry Hall of the Hollister Service Center for Imhoff Cone. Terry Hall's fact sheet is attached. HACH Water Analysis Handbook http://www.hach.com/hc/browse.product.documentation/FILCAT_PROC_WAH_MAIN/NewLinkLabel=Hach+Water+Analysis+Handbook+Procedures
(18) http://soils.usda.gov/sqi/publications/publications.html#sq_tn
(19) Soil Quality Information Sheet: Pesticides http://soils.usda.gov/sqi/publications/files/Pesticides.pdf
(20) Soil Quality Information Sheet: Sediment Deposition on Cropland http://soils.usda.gov/sqi/publications/files/sq_fiv_1.pdf
(21) Soil Quality Information Sheet: Aggregate Stability http://soils.usda.gov/sqi/publications/files/sq_eig_1.pdf
(22) Soil Quality Information Sheet: Soil Crusts http://soils.usda.gov/sqi/publications/files/sq_sev_1.pdf
(23) Soil Quality Information Sheet: Compaction http://soils.usda.gov/sqi/publications/files/sq_nin_1.pdf
(24) Soil Quality Information Sheet: Salinization http://soils.usda.gov/sqi/publications/files/Salinzation.pdf