CHAPTER 5
Soil Conservation

Chapter Contributors:
Janny Choy – *Resource Integration Specialist, Tahoe Regional Planning Agency*, Shane Romsos – *Acting Measurement Department Manager, Tahoe Regional Planning Agency*, William ("Woody") Loftis – *Soil Scientist, USDA Natural Resources Conservation Service,* Jarlath O'Neil-Dunne – *Geospatial Analyst, Spatial Analysis Laboratory, University of Vermont*, Paul Nielsen – *Natural Resources Planning Manager, Tahoe Regional Planning Agency,* David Saah, PhD – *Managing Principal, Spatial Informatics Group,* Craig Oehrli – *Hydrologist, U.S. Forest Service - Lake Tahoe Basin Management Unit*

The goal of soil conservation is to prevent soil erosion from the Region's watersheds or soil from becoming chemically altered by overuse, acidification, salinization, or other chemical soil contamination. Soil conservation is a critical element of the *Regional Plan* because of the role soils play in providing a medium for vegetation and their influence on water quality. Key soil functions in the Region include sustaining forest vegetation, water filtration and storage, providing for habitats for wide variety of organisms, and providing a platform for urban development.

The Region includes a wide variety of soil types (Loftis 2007); each soil type encompasses different qualities and abilities to support urban development and vegetation according to Bailey (1974). Land uses in the Lake Tahoe Region over the past 150 years have impacted the Region's soil resources, especially in and around urban areas, and areas influenced by Comstock era logging. Urban development in particular has physically altered and shaped the landscape, resulting in soils being moved, compacted, and eroded. In turn, vegetation communities and the soil's ability to absorb and store water have been altered.

There are two Indicator Reporting Categories in the Soil Conservation Threshold Category, including impervious cover and stream environment zones (SEZ). The primary purpose of this section is to provide an evaluation of the status of indicators relative to the 10 adopted soil conservation targets related to impervious cover and one indicator related to stream environment zones (Table 5-1).

Table 5-1. *Summary of adopted Threshold Standards for the Soil Conservation Threshold Category*

Indicator Reporting Category	Standard	Type of Standard	Indicator
Impervious Cover	Impervious cover shall comply with the *Land-Capability Classification of the Lake Tahoe Basin, California-Nevada, A Guide For Planning*, Bailey, 1974. • Land Capability 1a (1% allowable coverage) • Land Capability 1b (1% allowable coverage) • Land Capability 1c (1% allowable coverage) • Land Capability 2 (1% allowable coverage) • Land Capability 3 (5% allowable coverage) • Land Capability 4 (20% allowable coverage) • Land Capability 5 (25% allowable coverage) • Land Capability 6 (30% allowable coverage) • Land Capability 7 (30% allowable coverage)	Management (with Numerical Targets)	Percent of Impervious Cover within Each Land Capability District (%)
Stream Environment Zone	Preserve existing naturally functioning SEZ lands in their natural hydrologic condition, restore all disturbed SEZ lands in undeveloped, un-subdivided lands, and restore 25 % of the SEZ lands that have been identified as disturbed, developed or subdivided, to attain a 5 % total increase in the area of naturally functioning SEZ lands.	Numerical	Stream Restoration Acres in the Urban and Rural Areas (also expressed as percent of stream environment zone acres restored within the urban and rural context)

Impervious Cover (Land Coverage)

Impervious cover (also referred to as land coverage, impervious surfaces, or impervious coverage) prevents rainfall and snowmelt from infiltrating directly into the soil; instead, it increases the volume of often times pollutant-laden stormwater runoff reaching streams, causing flashier and sporadic stream flow events, creating unstable stream channels, and ultimately impacting the water quality of Lake Tahoe. In 1974, Robert G. Bailey wrote that impervious cover is "*...the most critical element in the land disturbance that has created the basic environmental problems facing the Lake Tahoe basin—water quality degradation, flooding, and soil erosion.*"

Land coverage effectively short-circuits the watershed's sediment and pollutant-removal mechanisms. Coverage also reduces or eliminates aquatic and terrestrial habitat that provide ecological value (Roy et al 2003). For instance, the delivery of sediment, a pollutant of concern identified in the Lake Tahoe TMDL (Lahontan and NDEP 2010), can be created by flashy streams with increasing power to erode as impervious cover increases within a basin (Booth 1990).

Two types of land coverage are defined by TRPA 1) hard coverage and 2) soft coverage. These designations reflect degrees of imperviousness; hard coverage precludes any infiltration of water into the soil, whereas soft coverage may allow up to 25 percent infiltration into the soil. A structure, improvement, or covering is not considered land coverage by TRPA if it permits at least 75 percent of normal precipitation to directly reach the ground, and permits growth of vegetation on the approved species list (TRPA 1987a as amended in March 2012). Hard coverage refers to land that is artificially covered by materials such as buildings, pavement, and concrete. Hard coverage prevents precipitation from reaching the soil and inhibits plant growth. Impervious surfaces affect natural hydrology and water quality by converting potential groundwater to surface runoff. Soft coverage refers to disturbed or degraded soil. This is generally compacted soil, fill, or other compacted areas that have substantially reduced soil water storage capacity, exhibit increased runoff, increased sediment export, and poor nutrient cycling. Soft coverage is not covered by any type of structure or paved surface. Soil compaction reduces pore spaces in the soil, which diminishes the soil's natural abilities to provide nutrients, water, and a medium for plant growth. Vehicles or machinery parking or driving on unpaved areas, and repeated foot traffic over dirt trails, undesignated pathways, and around buildings, are common causes of soil compaction and are examples of the soft land coverage.

The Threshold Standard for impervious surface reads as follows: "*Impervious cover shall comply with the Land-Capability Classification of the Lake Tahoe Basin, California-Nevada, A Guide for Planning, Bailey, 1974.*" The adopted Impervious Cover Threshold Standard is guided by Robert Bailey's land capability classification system for the Lake Tahoe Basin (Bailey 1974).[1] Bailey (1974) assigned units of land throughout the Basin to one of nine land capability classes (1a, 1b, 1c, 2, 3, 4, 5, 6, and 7), from most to least environmentally sensitive, believing that in order to maintain "*environmental balance*," each capability class has a capacity for development, which should not be exceeded (Table 5-2). Factors for determining capability classes included tolerance for developed use, slope percent, relative erosion potential, runoff potential, and disturbance hazards (Bailey 1974). Each land capability class was assigned an allowable percentage of impervious cover, ranging from 1 percent for sensitive lands in classes 1a, 1b, 1c, and 2, to 30 percent for higher tolerance lands in classes 6 and 7. The Impervious Cover Threshold Standard requires compliance with Bailey's allowable impervious cover limits set for each land capability class. This evaluation provides a characterization of the proportion of each land capability class that is covered with impervious surfaces.

[1] *The complete report is available on the TRPA website at* http://www.trpa.org/default.aspx?tabindex=4&tabid=168

Table 5-2. *Basis of land capability classification for Lake Tahoe Basin lands (from Bailey 1974).*

Capability Levels	Tolerance For Use	Slope Percent[2]	Relative Erosion Potential	Runoff Potential[3]	Disturbance Hazards
7	Most	0-5	Slight	Low to Moderately Low	Low Hazard
6		0-16	Slight	Low to Moderately Low	
5		0-16	Slight	Moderately High to High	
4		9-30	Moderate	Low to Moderately Low	Moderate Hazard Lands
3		9-30	Moderate	Moderately High to High	
2		30-50	High	Low to Moderately Low	High Hazard Lands
1a	Least	30+	High	Moderately High to High	
1b	Least	Poor Natural Drainage			
1a	Least	Fragile Flora and Fauna[4]			

To determine Threshold Standard attainment, best available science and technology have been used over time to estimate the quantity of impervious cover within the Lake Tahoe Basin. This is consistent with the spirit of TRPA Goals and Policies for monitoring and evaluation, which promotes the use of data and information that best reflect available scientific knowledge.

For the 2011 Threshold Evaluation, impervious cover (primarily hard coverage) was estimated using high-resolution Light Detection and Ranging (LiDAR) data and multispectral imagery (Worldview 2 Satellite, DigitalGlobe, Inc.) collected in August of 2010. Two iterations of spatial data interpretation have been completed in order to present results in this evaluation. First, specialists from Spatial Informatics Group and the University of Vermont developed a preliminary algorithm (set of rules) to model the remote sensing data and create an automated assessment of land-cover mapping (generally hard impervious surface) using Object-Based Image Analysis (OBIA). This automated procedure systematically interpreted and classified the LiDAR and multispectral imagery data into two generic land cover types based on spectral (color) and landform (topography) information. This automated data interpretation and classification is commonly referred to as "*unsupervised*" because it does not involve human interpretation of the underlying data. The result of the analysis produced a preliminary digital map that displayed: 1) impervious land surfaces and 2) pervious land surfaces (i.e., undeveloped land). This map was then draped ("intersected" with) over an updated land capability map (NRCS 2007) and queried to produce preliminary estimates of hard impervious surface by land capability type at the Lake Tahoe Basin scale. The result of this unsupervised classification of impervious cover was presented in the Draft 2011 Threshold Evaluation.

[2] *Most slopes occur within this range. There may be, however, small areas that fall outside the range given.*
[3] *Low to moderate low-hydrologic soil groups A and B; moderately high to high-hydrologic soil groups C and D.*
[4] *Areas dominated by rocky and stony land.*

As discussed in the Draft 2011 Threshold Evaluation, the land cover map layer that was generated (and associated estimates of impervious cover) was not based on human interpretation – the delineation of impervious surfaces were selected by the automated modeling algorithm that targeted the extraction and mapping of hard coverage landscape features. It was likely that in some instances data was identified as hard cover when it was not (i.e., soft coverage or natural bare ground that met the modeling algorithm criteria were potentially classified as hard impervious cover). In addition, no accuracy assessment accompanied the resulting impervious surface map layer (and associated coverage estimates), so at the time of the release of the Draft 2011 Threshold Evaluation, it was unknown to what extent impervious surfaces identified on the map by the algorithm represented reality on the ground. Nonetheless, the 2011 preliminary coverage estimates from the 2010 data represented the then best available information to account for impervious coverage within the Tahoe Region, and a more complete and accurate regional estimate of land coverage than had been previously available.

Since the release of the preliminary impervious cover estimates utilized in the Draft 2011 Threshold Evaluation, the technical specialist continued working on the classification and accuracy of impervious surface estimates for the Tahoe Region using the same LiDAR and multispectral datasets (collected in 2010), and impervious surface map layer used as the basis for the Draft 2011 Threshold Evaluation. In September 2012, the technical specialists released to TRPA a revised preliminary digital impervious surface map layer. The revised impervious surface map is a result of additional human interpretation (a "supervised" classification) of impervious surface types and refinements to the delineation of impervious surface boundaries – resulting in a more accurate representation of impervious surfaces on the landscape and superior estimates of areal extent of impervious surfaces than could be previously presented. To derive the revised map, consulting map specialists performed a minimum of three iterations of map interpretation and revisions to incrementally improve the accuracy of the resulting impervious surface map. The revised map can now be queried to discriminate hard from soft impervious surfaces and by different and relevant feature types, including: 1) buildings, 2) roads, 3) trails, or 4) other (parking lots/surfaces, driveways, etc.). A preliminary accuracy estimate of the initial classification of hard and soft impervious cover indicated that there is an overall accuracy in the model algorithm (and subsequent human involved classification) for identifying the particular surface type (hard v. soft) of 94% (i.e., accuracy estimate of 90% for "soft" cover, 95% "hard" cover, 94% "pervious" cover). This accuracy assessment was based on a comparison of mapped hard and soft coverage (derived from the algorithm and supervised classification) with aerial photographs rather than a comprehensive on-site verification process. Notably, the overall precision of the impervious coverage estimates is not as precise when the accuracy assessment is scaled from the regional scale down to the parcel scale - consultant experts informally estimate confidence intervals at +/-1% for regional acreage estimates of hard coverage and +/-10% for parcel-level hard coverage acreage estimates. Additional assessment is expected as an element of the final report product due in late December 2012.

The mapping accuracy for some soft land coverage features, in particular, appears uncertain. For example, the algorithm (and subsequent supervised classification) misidentified soft coverage 28% of the time (18% of the time misidentified as pervious). In specific instances, the identification of trails as a unique feature type of soft coverage is estimated to have only a 60% accuracy rating; meaning that about 60% of the time that a trail identified as soft coverage on the ground, would also correspond as a trail on the map. This result is likely a function of the form of trails as narrow and linear features that can be commonly obscured by vegetation, or confused by natural vegetation patterns. Moreover, while LiDAR and multispectral data can accurately identify the components of hard coverage (e.g., rooftops, pavement, etc.), these data and the applied algorithms and supervised classification cannot provide for an indication of the severity or magnitude of soil compaction other than via the absence of

vegetation, non-natural shapes (e.g., linear features like roads, trials, etc.) and the likelihood that the identified structure is compacted (e.g., a dirt road). In sum, the estimates of impervious coverage must be taken as educated approximations based on best available data. TRPA and the consultant specialists are continuing to refine the Agency's estimates of the extent of hard and soft coverage in the basin using advanced remote sensing data. In the meantime, it is likely that the impervious coverage estimates reported here will change as additional analytical refinements and technologies come online.

Updated Soil Survey

An updated soil survey of the entire Tahoe Basin Area was completed by the Natural Resource Conservation Service (NRCS) in 2006, and published in 2007 (Loftis 2007). While too late to be incorporated into the 2006 Threshold Evaluation, the updated soil information was recommended for use in subsequent Threshold Evaluations. The 2010 LiDAR/multispectral-based hard impervious cover estimates for the Basin were used in conjunction with the 2007 updated soil survey to determine the current status of the impervious surface standard for each land capability district defined by Bailey (1974).

This updated soil survey replaced the old soil survey (Rogers 1974) used by Bailey (Bailey 1974), to assign each soil map unit to a land capability class. One substantial change in the updated soil survey was that the mapping resolution nearly doubled. Because this finer resolution provides more detail, a soil map unit that was mapped in one capability class in 1974, may now be separated into several different capability classes.

On a landscape level, the updated soil survey produced acreage changes across all capability classes. Most of the changes occurred outside of the TRPA designated urban boundary, for example, in the Desolation Wilderness (W. Loftis, personal communication, December, 2011). In addition to the finer mapping resolution, some acreage changes could be attributed to better mapping technology. For instance, Global Positioning System (GPS) and Geographic Information Systems (GIS) tools now allow more accurate acreage accounting than was possible four decades ago.

As a previously acknowledged, the land capability concept developed by Bailey (1974) was applied at a regional planning scale. Central to the land capability concept was identifying lands suitable for development, based not only on soil type, but also on landscape position or "geomorphic hazard." Geomorphic hazard is divided into three categories: low, moderate, and high hazard lands (only high hazard lands are considered unsuitable for development). During the land capability analysis and mapping effort, Bailey found instances where pockets of high capability lands (determined by soil type) were fully enveloped within a geomorphic high hazard area. For example, there are small pockets of gently sloping, deep soils within the Desolation Wilderness. While high capability, these pockets are essentially inaccessible from a development standpoint as they are fully surrounded by high hazard areas (e.g. steep, erodible, rocky and stony slopes). Thus, at the time, Bailey reclassified these pockets of high capability soils as low capability lands (i.e. Class 1a, only 1 percent allowable coverage).

The 2007 soil survey did not reclassify land capability classes in this way because it resulted in a misrepresentation of the actual distribution and abundance of land capability classes across Tahoe's landscape. As represented here, land capability classification was based only on soil type, erodability, and slope (Table 5-2). These pockets of high capability land, and commensurate allowable coverage, are incorporated in the impervious coverage analysis depicted in Table 5-3 and Table 5-4. This interpretation accounts for some of the changes to total acreages for each land capability class in the

Basin as a whole. These small pockets of higher capability land are still protected from development through public land ownership and existing regulations. Pockets of higher capability lands were included in the acreage calculation, because they provided the most accurate and science-based representation of the status of regional land capability.

The result of using the new soils survey, in conjunction with the existing land capability system, is that the acreage within each land capability class has changed. Because the allowable impervious coverage within each capability class is a percentage (1-30 percent) of the total area in each land capability class, allowable impervious coverage has therefore also changed.

Estimated impervious coverage estimates from data acquired in 2010 and 2002 were compared with allowable land coverage in each land capability class (as determined from 2007 soil survey data) to determine the attainment status within each land capability class for two evaluation periods (Table 5-3 and Table 5-4). As indicated, land capability class 1b is shown by both the 2010 and the 2002 estimates to exceed the allowable cover for the class. The 2010 data indicated that land capability class 2 is over covered when soft coverage is added to hard coverage. All the other land capability classes are estimated to be below the allowable cover for their respective classes. Region-wide, the 2010 data indicated that there is approximately 7,959 acres (3.9%) of hard and soft coverage, while the 2002 data indicated that there was about 4,269 acres (2.1%) of coverage. Differences in coverage estimates between 2010 and 2002 are most likely a function of higher resolution remote sensing data and more accurate mapping techniques rather than any significant increases in coverage (Figure 5-1). The 2002 impervious cover analysis did not attempt to estimate soft cover and did not include a three-pass supervised classification (as was done to classify data collected in 2010).

Table 5-3. *Estimates of land coverage (includes soft and hard land cover) within the Lake Tahoe Region in 2010, relative to Bailey land capability classes. Land capability class 1b and 2 are shown to be exceeding allowable coverage targets by 670 and 43 acres, respectively. All other land capability classes are within allowable limits. Land capability data are based on 2007 NRCS Soil Survey (NRCS 2007). Impervious cover estimates are interpreted from high-resolution LiDAR and multispectral data collected in August of 2010.*

Land Capability Class	Total Acres Within Class	Allowable Impervious Cover (%)	Acres of Impervious Surface Allowed Within Class	Estimated Acres (%) of Hard Impervious Cover	Estimated Acres (%) of Soft Impervious Cover	Estimated Total Acres (%) of Impervious Cover	Acres Over or Below Allowed Coverage
1a	23,558	1%	236	76 (0.3%)	100 (0.4%)	175 (0.7%)	-60
1b	11,304	1%	113	674 (5.9%)	108 (1.0%)	783 (6.9%)	670
1c	53,957	1%	540	262 (0.5%)	243 (0.4%)	505 (0.9%)	-34
2	23,648	1%	236	135 (0.6%)	145 (0.6%)	279 (1.2%)	43
3	16,920	5%	846	187 (1.1%)	171 (1.0%)	358 (2.1%)	-488
4	32,386	20%	6,477	918 (2.9%)	345 (1.0%)	1,263 (3.9%)	-5,214
5	10,347	25%	2,587	915 (8.8%)	184 (1.8%)	1,099 (10.6%)	-1,488
6	24,308	30%	7,292	1,848 (7.6%)	366 (1.5%)	2,214 (9.1%)	-5,078
7	5,525	30%	1,658	1,161 (21%)	123 (2.2%)	1,283 (23.2%)	-374
Total	**201,953**	**9.9%**	**19,984**	**6,176 (3.0%)**	**1,783(0.9%)**	**7,959 (3.9%)**	**-12,025**

Table 5-4. *Estimates of hard land coverage within the Lake Tahoe Basin relative to land capability classes in 2002 and reported in the 2006 Threshold Evaluation. Land capability class 1b (highlighted) is shown to be exceeding allowable cover by 365 acres. All the other land capability classes are in compliance with coverage limitations. Land capability data were based on updated soil data provided by NRCS (NRCS 2007). Hard land coverage estimates were derived from an interpretation of IKONOS multispectral imagery (2002).[5,6] Note that data are for hard land coverage only, soft land coverage is not included. User's classification error was reported to be 87%.*

Land Capability Class	Total Acres Within Class	Allowable Impervious Cover (%)	Acres of Impervious Cover Allowed Within Class	Estimated Acres of Impervious Cover	Acres Over (+) or Below (-) Allowable Cover
1a	23,558	1%	236	56	-180
1b	11,304	1%	113	478	365
1c	53,957	1%	540	236	-304
2	23,648	1%	236	81	-155
3	16,920	5%	846	120	-726
4	32,386	20%	6,477	538	-5,939
5	10,347	25%	2,587	664	-1,923
6	24,308	30%	7,292	1,222	-6,070
7	5,525	30%	1,658	874	-784
Total	**201,953**	**9.9%**	**19,984**	**4,269**	**-15,716**

New Land Coverage

In addition to total impervious cover estimates for the Basin, *new* land coverage permitted by TRPA between 2006 and 2010 was calculated based on water quality mitigation fees collected for permitted projects in the Basin (Figure 5-1). The *Code of Ordinances* requires that a water quality mitigation fee, currently $1.86 per square foot, be paid for new land coverage created in the Lake Tahoe Basin. The total fees collected were used to estimate the total area of new land coverage created within that same timeframe.

In total, 341 acres of new land coverage has been permitted by TRPA since 1991. There was a 50 percent decrease in the amount of new land coverage created from 2006-2010 (52 acres) when compared to 2001-2005 (103 acres). This decrease may be attributed to the recent economic recession, and/or a reduction in vacant land remaining in the Region that can be developed. New land coverage estimated for the period 1996-2000 was 92 acres. For the period 1991-1995, it was 94 acres. Estimates of new land coverage provided here do not account for transferred or relocated land coverage, nor do they consider decreases in land coverage due to banking coverage or pursuant to excess land coverage mitigation programs. While these factors may shift land coverage within the Basin, they would not result in a net increase of land coverage within the Basin.

[5] Minor, T. and M.E. Cablk. 2004. Estimation of Impervious Cover in the Lake Tahoe Basin Using Remote Sensing and Geographic Information Systems Data Integration. *Journal of Nevada Water Resources Association*. 1(1):58-75.

[6] Cablk, M.E. and T. Minor, 2003. Detecting and discriminating impervious cover with high-resolution IKONOS data using principal component analysis and morphological operators. *International Journal of Remote Sensing* 24(23):4627-4645.

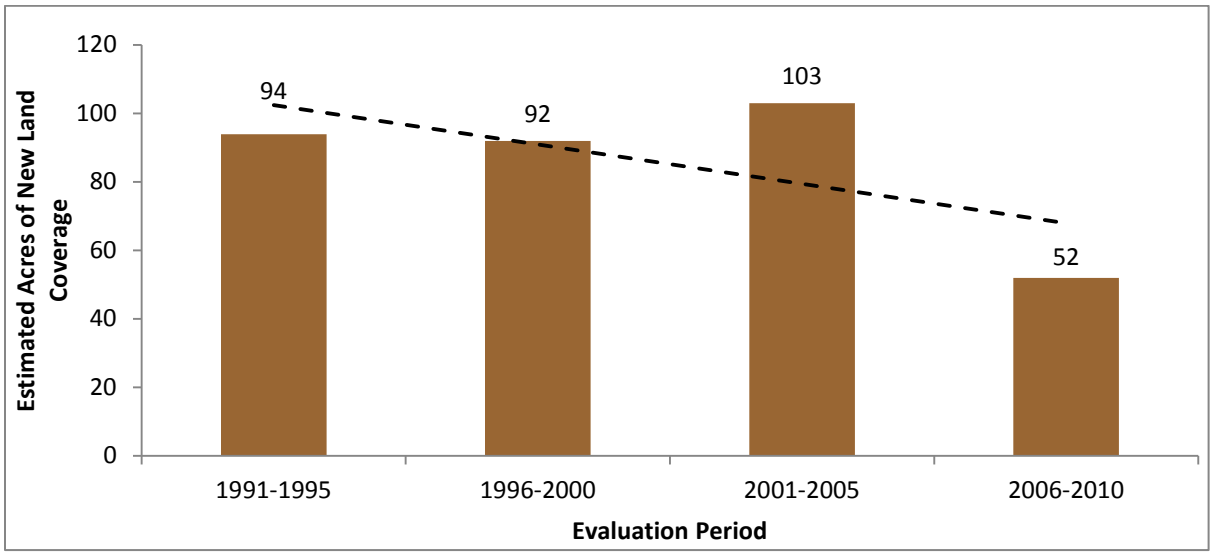


Figure 5-1. *New land coverage estimated for the Lake Tahoe Region, 1991 to 2010. These numbers do not account for land coverage that was transferred, relocated, or banked, nor do they include land coverage in excess land coverage mitigation programs.*

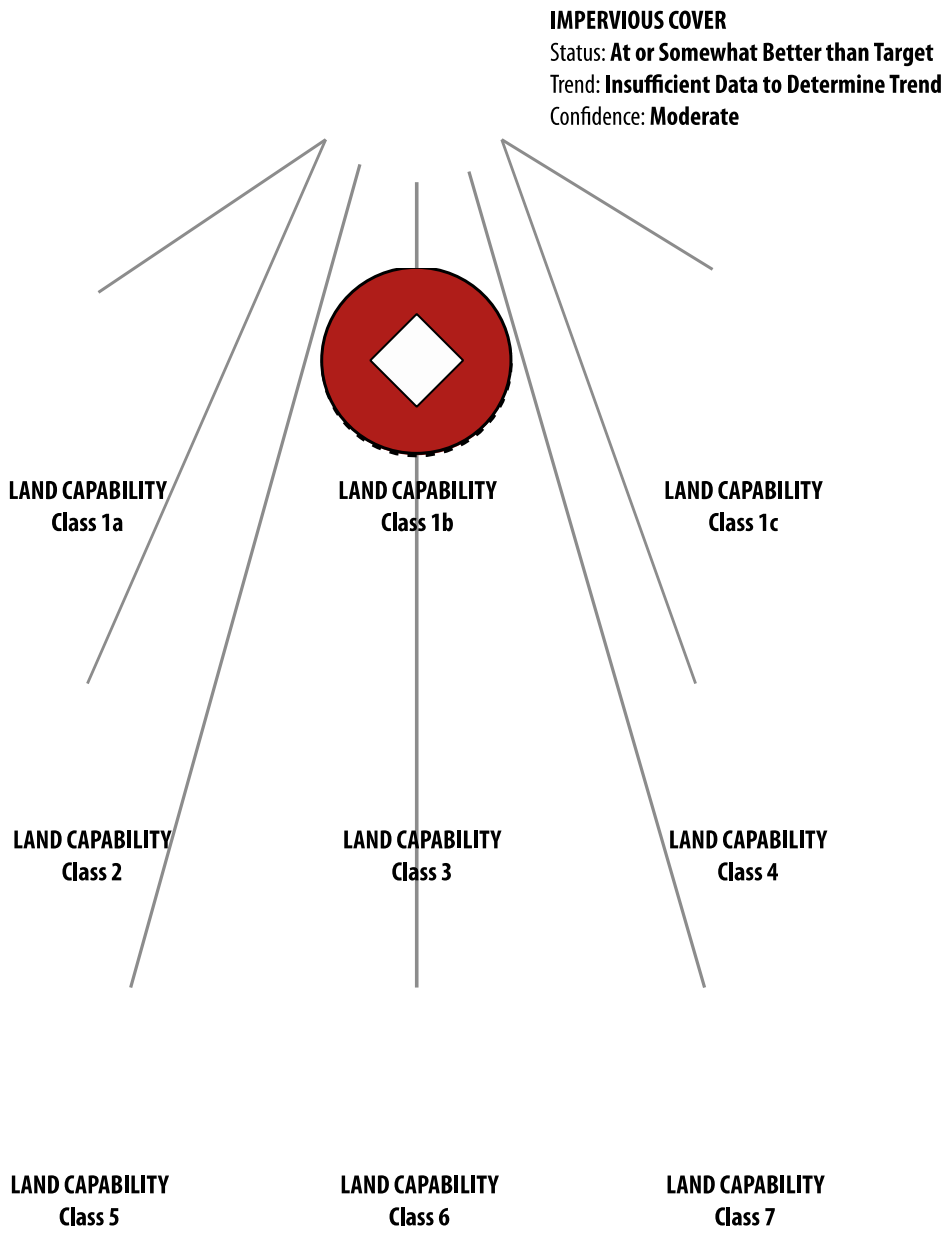


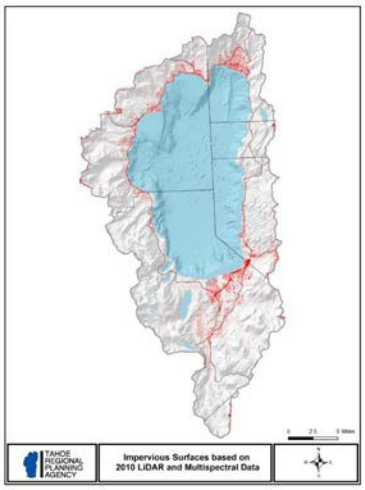
Figure 5-2. *Reporting icons for the nine indicators evaluated in the Impervious Cover Indicator Reporting Category. Results from each of the nine indicators (bottom) were evaluated and aggregated to characterize the overall status of the Impervious Cover Indicator Reporting Category (top).*

Soil Conservation: Percent of Land Coverage within Land Capability Classes

Reporting Icon

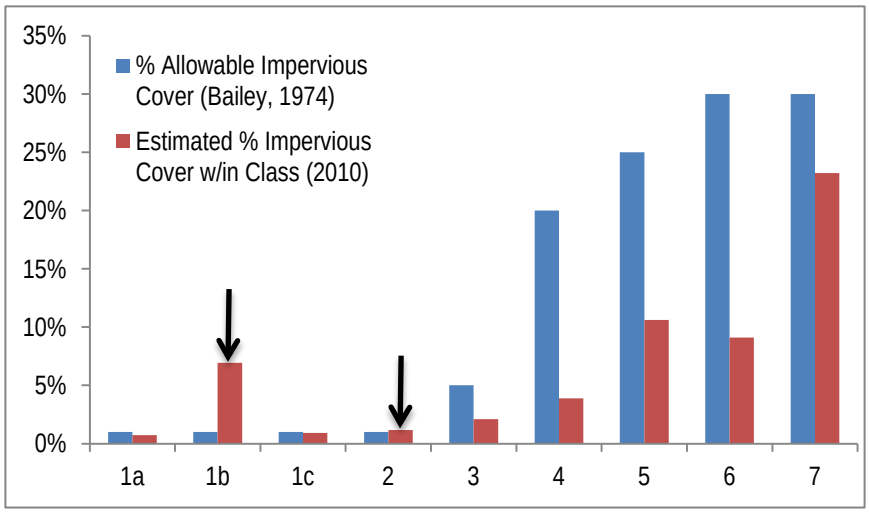
OVERALL LAND COVERAGE
Status: **At or somewhat better than target**
Trend: **Insufficient data to determine trend.**
Confidence: **Moderate**

Map



Distribution of hard impervious cover within the Lake Tahoe Basin in 2010. (Based on interpretation of LiDAR and 8-band multispectral imagery). Data source: Watershed Sciences, LLC, and Digital Globe.

Trend



Percentage of allowable land coverage within each land capability class (as adjusted for new soil survey data) and estimated percentage of land coverage in each land capability class for the Lake Tahoe Basin. Land capability classes 1b and 2 (arrows) as currently estimated exceed the land capability limits prescribed by Bailey (1974). Results are based on an interpretation of 2010 LiDAR and multispectral data, and an updated land capability map that includes current soil survey information developed by Natural Resources Conservation Service (NRCS 2007).

Data Evaluation and Interpretation

Relevance – This indicator measures the percent of land coverage on different land capability classes as described by Bailey (1974) and updated with current soil survey information (NRCS 2007). Impervious cover (land coverage) is a primary indicator of land disturbance. Excessive impervious surface within a watershed can have detrimental effects on water quality, surface hydrology, groundwater, soil health, fisheries, wildlife habitat suitability and vegetation growth. Impervious surfaces include hard coverage, which encompass man-made structures that act as complete barriers to prevent precipitation from infiltrating into the soil; common examples include roads, buildings, driveways, and parking lots; and compacted soil, which prevents most stormwater from infiltrating into the ground.
Threshold Category – Soil Conservation

Indicator Category – Impervious Cover (Land Coverage)

Adopted Standards – Impervious cover shall comply with the *Land-Capability Classification of the Lake Tahoe Basin, California-Nevada, A Guide For Planning*, Bailey, 1974.

Type of Standard – Management Standard with numerical targets

Indicator (Unit of Measure) – Percent impervious cover within each land capability class

Status – When status scores were aggregated according to the methodology section, the overall average aggregated score was = 2.0, resulting in a determination of "at or somewhat better than target." Impervious cover within each capability class as determined by an interpretation of LiDAR/multispectral data indicated existing land coverage (hard impervious cover and compacted land coverage) in Class 1b and 2 exceeds allowable land coverage by 670 acres and 43 acres, respectively. The Region is out of attainment with the land capability class 1b target by 593% ("considerably worse than target") and with land capability class 2 by 18% ("somewhat worse than target"). All other land capability classes are estimated to have fewer existing acres of hard impervious cover than what is allowed under Bailey (1974).

Trend – The trend was determined to be "unknown" due to differences in remote sensing data used and analysis methods. Although TRPA has used the best available science and technology over time to assess the Impervious Cover Threshold Standard, different imagery datasets (4-band IKONOS collected in 2002, LiDAR and 8-band multispectral collected in 2010), variation in the methods used to extract impervious surface features, estimate impervious cover, along with an updated and improved soil survey, make comparison across evaluations inappropriate.

Confidence –

Status – There is "moderate" confidence in the current estimates of impervious cover because an accuracy assessment of the resulting impervious surface layer resulted in an overall accuracy of 94%, ranging by surface type (soft, hard, undisturbed) from a producer's accuracy of 72% to 98%, and an user's accuracy of 90% to 95%.

Overall – There is "moderate" overall confidence base on the accuracy assessment of the impervious surface layer (map).

Interim Target – Land capability classes 1a, 1c, and 3 through 7 are meeting the established targets based on current impervious cover estimates and consequently do not require the establishment of interim targets. Land capability class 1b and 2 are not meeting the established Threshold Standard because land coverage within the class exceeds the allowable one percent. An interim target cannot be reasonably estimated for Class 1b or 2 because it is uncertain at what rate impervious cover can be reasonably removed. To estimate specific interim targets would be purely speculative given uncertainties associated with the economy and public sector investments in restoration and capital improvements. The agency should consider policies that would accelerate the rate of coverage removal in over-covered land capability classes.

Target Attainment Date – The Class 1b target is not expected to be attained in the foreseeable future, given the magnitude of change needed, and current and expected future funding levels, and based on a qualitative review of the historical rate of impervious coverage removal in Class 1b lands (about 17 acres of wetland habitat are restored on average per year). For Class 2 lands, the target could reasonably to be achieved within 15 years if sufficient public funding is provided and sufficient private capital investment occurs and is appropriately focused.

Human and Environmental Drivers – Impervious cover is created through land use conversion from the natural to the built environment. This could be for commercial, residential, recreational, and other activities, and encompasses the spectrum of human uses that involve physical modification of the environment. The economy plays a large role in the housing market and the business environment, which are both historically among the most important drivers of new land coverage in the Basin. The recent economic downturn nationally and regionally may be partly responsible for the substantially lower new land coverage acres in 2006-2010.

Monitoring Approach – An objects-based image analysis (OBIA) system was developed to map land cover from the remotely sensed data. The first OBIA system established the preliminary unsupervised baseline land cover map that was later revised based a supervised classification. The OBIA system algorithm was designed to produce accurate land cover data similar to what a human image analysis would generate, yet yield a clear economic advantage over manual interpretation. Particular attention was paid to insuring that the OBIA system was capable of leveraging data from both active and passive sensors to insure consistent and repeatable output over the entire study area. A second OBIA system will be developed and deployed to identify and quantify change using the original remotely sensed datasets, the base land cover map, and the newly acquired remotely sensed datasets (base map year + five years).

Monitoring Partners – U.S. Geological Survey, Tahoe Regional Planning Agency, University of Vermont, Spatial Informatics Group, LLC., Watershed Sciences, LLC., and DigitalGlobe.

Effectiveness of Programs and Actions – Programs and actions implemented for the impervious cover threshold standard include transfer of development from SEZs, limiting coverage and encroachment in sensitive areas, and the excess coverage mitigation and SEZ restoration programs. Current regulations and measures are not sufficiently facilitating the removal of land coverage from land capability class 1b. The Coverage Study Interim Findings for TRPA and the California Tahoe Conservancy (Environmental Incentives 2011) concluded that coverage in sensitive lands and on over-covered parcels is not being restored at the pace (currently about 1.22 acres/year) necessary to meet Basin-wide objectives, excess coverage mitigation policies are not

able to mitigate excess coverage on a square foot for square foot basis, coverage policies do not incentivize redevelopment or innovative low-impact project designs, and coverage policies and operations are complicated, confusing, and cause barriers to meeting Basin-wide objectives.

Recommendations for Additional Actions – Develop land use policy changes that incentivize removal of land coverage in SEZs and Class 2 lands by providing financial and regulatory incentives for redevelopment in more suitable areas. Create policies that incentivize restoration of sensitive lands and promote compact and infill development using innovative designs. Create policies that promote beneficial redevelopment. According to the 2006 Threshold Evaluation, "In the next 20 years, redevelopment of aging business, homes, and facilities will dramatically increase. Thus, there is an imperative need to have a land capability system that is applicable to both vacant land and redevelopment scenarios. Incentives are needed for over-covered redevelopment to mitigate the impacts of excess impervious cover." Modify excess coverage mitigation (ECM) fee structure to cover the cost of retiring coverage. Remove hydrologic related area restrictions for ECM and barriers that limit the ability to use ECM funds (e.g. foot for foot mitigation requirement). Simplify policies and standardize processes and tools to create more certainty for public and private project proponents. Improve tracking and reporting.

The 2007 NRCS soil survey needs to be reflected in the *Code of Ordinances* Section 53.9. This requires adjustment of the land capability systems, as many of the soil map units described in the Bailey Land Capability system have been replaced or removed, including some SEZ soil map units. The Impervious Cover Threshold Standard language needs to be modified, as it is only possible to achieve the current standard if the old soil survey components used in Bailey's 1974 report remain in place. It is in the public interest to use the best available science, which is the 2007 updated soil survey from NRCS, rather than the outdated 1972 soil survey. One possibility is to reference the Bailey report, but remove it directly from the language of the Threshold Standard itself.

Soft coverage is treated similarly to hard coverage in TRPA coverage policies even though it may have varying effects on erosion potential and water quality. A separate Threshold Standard may need to be developed for soft coverage. Impervious cover estimates historically have solely focused on hard impervious cover due to the difficulty of measuring soft coverage, even when using more contemporary and advanced mapping technologies and analytical methods. The soft coverage analysis and recommendations in this report should continue to be updated as additional analysis findings become available.

Stream Environment Zone

Stream environment zone (SEZ), perhaps more appropriately termed "sensitive" environment zone, is one of two TRPA Indicator Reporting Categories for soil conservation. SEZ is a term used specifically in the Lake Tahoe Basin to describe perennial, intermittent, and ephemeral streams; wet meadows, marshes, and other wetlands; and riparian areas or other areas expressing the presence of surface and ground water.

Stream environment zones are defined by hydrology, hydric soils, and water-associated vegetation. Although SEZ plant communities constitute only a small portion of the Basin's total land area, they are extremely rich and productive. SEZs perform a critical role by providing for fish and wildlife habitat and movement, water treatment, flood attenuation, open space, and scenic and recreational enjoyment, among many other functions and values. Protecting and restoring SEZs is essential for improving and maintaining the environmental amenities of the Lake Tahoe Basin, and for achieving Threshold Standards for water quality, soil conservation, vegetation preservation, and other Threshold Standards. This leads to an enhanced quality of life for residents and a vital economy.

Healthy and functional SEZs are important for soil conservation because these resilient systems are better able to respond to, and recover from, watershed disturbances such as wildfires, insect infestations, and diseases. Functional SEZs help prevent aquatic and terrestrial systems from unraveling, which can lead to widespread erosion and water quality impacts downstream. Sediment in particular can be generated from erosion and carried downstream, ending up in Lake Tahoe where it may impact water clarity.

SEZs have been disturbed in the Lake Tahoe Basin since the 1800s by logging, grazing, stream and river channelization, damming, fire suppression, and other activities, with environmental consequences that are still evident in the landscape today. These legacy issues, and continuing development pressure, have required a comprehensive SEZ program with regulations and policies that limit development and other disturbances in SEZs, and support public acquisition of these sensitive parcels.

Threshold Standard – Preserve existing naturally functioning SEZ lands in their natural hydrologic condition, restore all disturbed SEZ lands in undeveloped, un-subdivided lands, and restore 25 percent of the SEZ lands that have been identified as disturbed, developed, or subdivided, to attain a five percent total increase in the area of naturally functioning SEZ lands.

Preservation has never been defined in the Threshold Standard, but it is commonly interpreted to mean that no new development should occur in naturally functioning SEZs. TRPA regulations are in place to limit new development in SEZs and minimize their disturbance. SEZ land acquisitions by TRPA partner agencies also help achieve this threshold component. No indicator has been developed for the preservation of SEZs. While agencies such as the U.S. Forest Service, California State Parks, or Nevada Division of Environmental Protection may be monitoring naturally functioning SEZs, TRPA currently has no method of tracking this component of the SEZ Threshold Standard Indicator Reporting Category.

"Undeveloped, un-subdivided" lands have been interpreted in past Threshold Evaluations to be those outside the urban boundary or in "rural" areas. There is evidence to suggest that this part of the Threshold Standard was intended to apply to the general forest areas managed by public entities such as the U.S. Forest Service. Restored SEZ habitat in rural areas for 2003-2011 is 84 acres. Vegetation enhancement projects in rural areas total 695 acres over the same period.

There are approximately 21,944 acres of SEZs in the Lake Tahoe Region (TRPA 2001). A total of 4,400 acres of these SEZs are estimated to be "disturbed, developed, or subdivided." The Threshold Standard calls for 25 percent of this 4,400 acres, or 1,100 acres, to be restored. These lands have been interpreted by past Threshold Evaluations to be those within urban (or urbanized) areas, specifically including the residential, tourist, and commercial/public service plan areas, but excluding conservation or recreation plan areas (e.g., Plan Area Statement 100 Truckee Marsh) that are within the urban boundary.

Contrary to recent interpretations of the Threshold Standard that "disturbed, developed, or subdivided" lands applies only to lands within the urban boundary, there is evidence that suggests that the 25 percent restoration Threshold Standard includes SEZ restoration adjacent to, but outside of the urban boundary. Volume 3 of the Water Quality Management Plan (208 Plan) for the SEZ Protection and Restoration Program (TRPA 1988) does not equate "disturbed, developed or subdivided" to the TRPA definition of "urban areas." There is a reference to several completed SEZ projects in the "urbanized portions of the Region," which may be where the interpretation started. However, the list of completed and planned SEZ projects in the 208 Plan (which count toward the 25 percent restoration goal) includes several projects that are located adjacent to, but outside TRPA "urban areas." Therefore, it seems reasonable to conclude that the 25 percent Threshold Standard goal does not have to be attained exclusively within the "urban areas," but does need to be attained adjacent to, or associated with, disturbed, developed, or subdivided lands in the Region.

Accordingly, restoration projects within the urban boundary, and those adjacent to or contiguous with the urban boundary, including conservation and recreation plan areas, would be considered towards the 25 percent restoration goal as long as they are "disturbed, developed, or subdivided." Therefore, a total of 546 acres of SEZ restoration, from 1980 to 2011, was completed in or adjacent to urban areas (Table 5-6). These acres are from stream channel restoration only. An additional 554 acres is needed to achieve the 1,100 acre Restoration Threshold Standard.

Vegetation enhancement projects may improve SEZ biologic and hydrologic functions, but they have not been considered SEZ restoration in the past. These projects have been completed in SEZs throughout the Basin and total 23 acres in or adjacent to urban areas, and 695 acres outside the urban areas (Table 5-2).

Table 5-5. *SEZ restoration projects completed from 2005-2011. Source: EIP database, 2001 and 2006 Threshold Evaluations .*

		SEZ Restoration Acres			
Project	Year Completed	Within Urban Boundary	Adjacent to Urban Boundary	Non-urban ("Rural")	Lead Agency*
Christmas Valley SEZ Restoration	2005	2.5			El Dorado County
Cookhouse Meadow Restoration	2005			20	USFS
Twin Peaks (Nemetz) SEZ Restoration	2006			2	CTC
Blackwood - Phase 2 Barker Pass Bridge	2006			4	USFS
Various Projects	2007			12	NSL
Angora Creek Stream Restoration	2007		4		El Dorado County
Rosewood Creek	2008	2			NSL
Third Creek - Phase 1	2009	2			NSL
Blackwood - Phase 3a Blackwood Channel and Flood Plain Restoration	2009			40	USFS
Diver's Cove	2010			2.5	NSL
Angora Fisheries/SEZ Enhancement	2010		0.5		El Dorado County
Blackwood - Phase 3b Blackwood floodplain berm removal	2010			3	USFS
Upper Truckee River Restoration Middle Reaches 3&4	2011		20		CSLT
Lake Forest SEZ Restoration	2011	40			Placer County
Total (2005-2011)		46.5	24.5	83.5	
Total (2001-2004)		43			
Total (1980-2000)		336	96		
Total (1980-2011)		425.5	120.5	83.5	
Total SEZ acres restored in and around urban boundary (1980-2011)		**546**		629.5	
Total SEZ acres to be restored within Lake Tahoe Basin		Restore 1,100 Acres in and around Urban Boundary		Restore All in Rural	

** USFS = U.S. Forest Service – Lake Tahoe Basin Management Unit; CTC = California Tahoe Conservancy; NSL = Nevada State Lands*

Table 5-6. *Vegetation enhancement acres from 2005 to 2010. Source: EIP database*

		Acres of Vegetation Enhancement within Stream Environment Zones			
Project	Year Completed	Within urban boundary	Adjacent to urban boundary	Non-urban	Lead Agency*
Blackwood Aspen	2005			20	USFS
Cathedral Aspen	2006			88	USFS
Heavenly Creek Demonstration Project	2007		23		USFS
Various Veg Treatment	2007			247	NSL
Riparian Vegetation Enhancement	2009			45	NSL
Forest Restoration III	2010			60	NSL
Big Meadow and Meeks Creek	2010			235	USFS
Total = 718 acres			23	695	

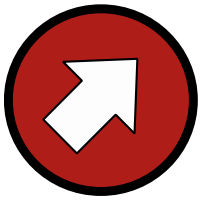
*USFS = U.S. Forest Service – Lake Tahoe Basin Management Unit; NSL = Nevada State Lands

Another source of confusion is the term "disturbed." Disturbance has not been explicitly defined, but activities including filling, grading, draining, encroaching, removing vegetation, altering or blocking drainage, channelizing streams, grazing, and off-road vehicle use are all examples of disturbance presented in the Thresholds Study Report (TRPA 1982b) and the 208 Plan. The 2001 Threshold Evaluation stated that disturbance is defined as including one or more of the following, but the source for this definition is unknown:

1. Impervious surface or compaction
2. Fill or debris in a natural floodplain or other SEZ area
3. Hydrologic blockages or artificial drainage of a SEZ
4. Functional reduction of the floodplain or other SEZ areas adjacent to lake tributaries
5. Increased flows or runoff, whether through diversion of flows, incision, unnatural alignment, or channel gradient
6. Removal and/or degradation of riparian vegetation appropriate to the SEZ area
7. Other restoration activities

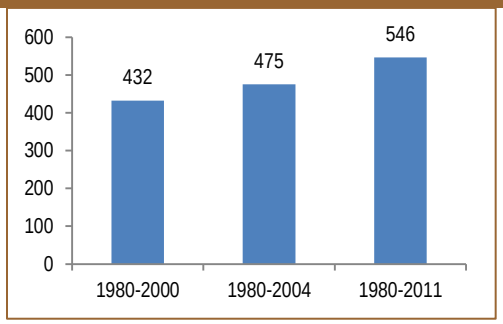
Soil Conservation: Restoration Acres of Naturally Functioning Stream Environment Zones

Reporting Icon



Status: **Considerably Worse than Target**
Trend: **Moderate Improvement**
Confidence: **High (acres restored)**

Trend



Cumulative total acres of SEZ restored within or adjacent to the urban boundary during three different periods in the Lake Tahoe Region. The target is to restore 1,100 acres. Source: 2001 and 2006 TRPA Threshold Evaluations and EIP database.

Map

Locations of SEZ restoration projects completed in the Lake Tahoe Basin, 2005 to 2011.

Data Evaluation and Interpretation

Relevance – This indicator measures the progress made toward the restoration and enhancement of stream environment zones in areas within and adjacent to urban areas, and areas considered more natural or rural. A major importance of SEZs is their ability to provide natural treatment, storage, and conveyance of surface runoff. Encroachment on these areas reduces their potential to filter sediment and nutrients, and also reduces the amount of surface runoff they can effectively treat. Natural SEZs also provide open space, flood flow capacity, riparian vegetation, and fish and wildlife habitat, and buffer urban uses in developed areas. SEZ protection and restoration help achieve all other environmental Threshold Standards, including water quality, wildlife, fisheries, vegetation preservation, recreation, and scenic resources. Even seemingly unrelated Threshold Standards such as air quality and noise are affected by SEZs. For instance, aspen stands in SEZs next to roadways have been shown to help physically block air particulates from spreading to adjacent areas. Such vegetation also help moderate roadway noise.

Threshold Category – Soil Conservation

Indicator Category – Stream Environment Zones

Adopted Standards – Preserve existing naturally functioning SEZ lands in their natural hydrologic condition, restore all disturbed SEZ lands in undeveloped, un-subdivided lands, and restore 25 percent of the SEZ lands that have been identified as disturbed, developed, or subdivided, to attain a five percent total increase in the area of naturally functioning SEZ lands.

Type of Standard – Numerical Standard

Indicator (Unit of Measure) – Acres of restored SEZs in urban and rural areas.

Status – *Preserve existing naturally functioning SEZ lands in their natural hydrologic condition*: This element of the Threshold Standard is a management directive, which cannot be quantified other than to note that TRPA, since the adoption of the 1987 Regional Plan, prohibits the creation of any new coverage in SEZ unless it can be fully mitigated. No indicator has been developed to verify the preservation of naturally functioning SEZs; indeed, preservation has never been defined. However, preservation is commonly interpreted to mean that no new development should occur in naturally functioning SEZs. When interpreted in this way, it could be concluded that the Region is achieving this element of the adopted Threshold Standard. In addition, land acquisition of SEZs by TRPA partner agencies also aids in achieving this element of the Threshold Standard. Basin-wide policies and programs are in place that recognize the myriad critical functions of SEZs, but it is unclear to what extent naturally functioning SEZs are being "preserved" considering that past SEZ mapping efforts were limited to urban and urban influence areas (i.e., did not map SEZ in more remote locations within the Region).

Restore all disturbed SEZ lands in undeveloped, un-subdivided lands: This component of the Threshold Standard in numerical however has not been consistently quantified across Threshold Evaluations. No current estimates for the acres of disturbed SEZs in this category are available. "Undeveloped, un-subdivided" has been interpreted in past Threshold Evaluations to be those lands outside the urban boundary. Many SEZ restoration projects in these areas have occurred, are ongoing, or are being planned, but a comprehensive database for tracking them has not been developed. Acres of restored SEZs for this category for the period 2005-2011 was 83.5 acres. The majority of SEZ projects in "undeveloped, un-subdivided" areas are vegetation enhancement projects, and totaled 695 acres. Because this element of the Threshold Standard is not the focus of the Threshold Standard, no status determination was made.

Restore 25 percent of the SEZ lands that have been identified as disturbed, developed or subdivided, to attain a five percent total increase in the area of naturally functioning SEZ lands: There are approximately 21,944 acres of SEZ in the Lake Tahoe Region, which is about 11 percent of the Basin area (TRPA 2001). A total of 4,400 acres of these SEZs are estimated to be "disturbed, developed, or subdivided." The Threshold Standard calls for 25 percent of this 4,400 acres, or 1,100 acres, to be restored. Total SEZ restoration acreage from 1980 to 2011, for projects completed in, or adjacent to "disturbed, developed or subdivided" areas (i.e. urban boundary or urban areas), is 546 acres. This is about 50 percent of the target achieved; thus, the Threshold Standard status is designated "considerably worse than target." An additional 554 acres is needed to achieve the 1,100 acre Threshold Standard. Restored SEZ acres are from stream channel restoration projects only, recognizing that an addition 801 acres of vegetation enhancement and restoration has been completed outside of the "urban area" (see Table below).

Vegetation enhancement projects may improve SEZ biologic and hydrologic functions, but have not been considered SEZ restoration in the past. These projects have been completed in SEZs throughout the Basin, and total 23 acres in or adjacent to urban areas, and 695 acres outside the urban areas.

The following table provides a summary of SEZ restoration acres and vegetation enhancement acres from 1980-2011. SEZs

restored within or adjacent to "disturbed, developed or subdivided" areas (i.e. urban areas) contribute to the 25 percent SEZ restoration goal. Source: 2001 and 2006 Threshold Evaluations and EIP database.

	Within or Adjacent to Disturbed, Developed or Subdivided Areas	Within Undeveloped, Un-subdivided Areas	Total
Acres of SEZ Restored	546	83.5	629.3
Acres of Vegetation Enhancement in SEZ	23	695	718
Total Acres	569	778.5	1,347.3

Trend – The average restoration rate in or adjacent to urban areas for the period of record 1980-2011 is 17.6 acres per year resulting in a trend determination of "moderate improvement" (1.6 percent SEZ area restored/year).

Confidence –

Status – There is "high" confidence in the current status determination for SEZ restoration acreage because the project information was provided directly from EIP partner agencies and previous Threshold Evaluation reports that documented completed projects. However, the effectiveness of these projects for achieving the restoration objective of restoring "natural hydrologic function" is "unknown" because effectiveness monitoring efforts have not been sufficiently implemented.

Trends – Even though a statistical analysis was not used to test if trends were significant, there is "high" confidence in the cumulative accounting of acres restored because partner agencies regularly track and report project information.

Overall Confidence – Overall, there is "high" confidence in the status and trend information related to acres of SEZ restored. However, there is low confidence in our understanding of the effectiveness of SEZ restoration efforts.

Interim Target – A total of 88 acres of restored SEZs in or adjacent to urban areas should be achieved by the next Threshold Evaluation (2016) based on the average rate of restoration from 1980-2011, if funding for SEZ restoration remains similar to current and past levels.

Target Attainment Date – Based on the trend, attainment of 1,100 acres of SEZ lands restored in or adjacent to urban areas would occur around the year 2043, if the rate of SEZ restoration were to be maintained at around 17.6 acres/year.

Human and Environmental Drivers – SEZs have been disturbed in the Lake Tahoe Basin since the 1800s through logging, grazing, stream and river channelization, damming, fire suppression, and other activities, with environmental consequences that are still evident today. These legacy issues, along with continuing development pressure, have required comprehensive SEZ restoration Basin-wide. These legacy issues have also required regulations and policies that prevent development and limit disturbance in SEZs, and support public acquisition of these sensitive parcels. Restoration efforts by Basin partners are occurring, with the rate driven by available funding, primarily from the federal and state governments.

Monitoring Approach – SEZ restoration projects are tracked by the agencies that implement them. SEZ restoration effectiveness monitoring sometimes occurs on a project-by-project basis. However, because data are often collected for different purposes, analysis of Regional SEZ restoration effectiveness is limited.

Monitoring Partners – California Tahoe Conservancy, U.S. Forest Service, Nevada State Lands, El Dorado County, Placer County, City of South Lake Tahoe and all EIP partners.

Programs and Actions Implemented to Improve Conditions – Currently, the preservation of naturally functioning SEZs is accomplished through TRPA, Lahontan Regional Water Quality Control Board, and Army Corps of Engineer regulations that limit development and other disturbances in these areas. In addition, Nevada State Lands, California Tahoe Conservancy, U.S. Forest Service, CA State Parks, City of Lake Tahoe, and other entities, achieve preservation through strategic acquisition of SEZ parcels. Disturbed SEZs occur in both urban and non-urban environments, and actions to restore these are ongoing. The Environmental Improvement Program, in partnership with CTC, USFS and others, acquires and restores priority environmentally sensitive lands, with a primary focus on protecting and enhancing meadows, wetlands, rivers, streams. Since 1997, more than 3,092 acres have been acquired by state and federal agencies in the Basin (TRPA 2010). An SEZ "Roadmap" was developed by TRPA and partner agencies in 2011, to provide a framework for updating SEZ policies and programs in the Lake Tahoe Basin. This was task was undertaken because it was widely recognized that the initial development of the SEZ program for the Basin in the 1980s missed some fundamental pieces; gaps in SEZ protection and restoration exist, and some technical changes are necessary. This roadmap is based on EPA's Wetland Program core elements to incorporate new scientific information, and to ensure management actions and policies are protective of SEZ functions. This includes developing an SEZ classification system based on desired functions, revising the SEZ technical definition based on the 2007 updated soil survey, and prioritizing SEZ restoration and enhancement actions throughout the Basin. An initial SEZ workshop focused on desired functions and SEZ definitions. TRPA and partners obtained an EPA wetland grant to assist in

implementation of components of the SEZ Roadmap. The grant included assessing the applicability of the California Rapid Assessment Method (CRAM) for riverine systems in the Sierra ecoregion in two pilot watersheds: Upper Truckee River and Third Creek. In addition, Southern Nevada Public Lands Management Act (SNPLMA) Round 12 funding is available to establish a classification system of different SEZ types based on soils, hydro-geomorphology, and vegetation, that is protective of SEZ desired functions.

Effectiveness of Programs and Actions – The SEZ program and policies has been successful in limiting new development in SEZs (Raumann and Cablk 2008). U.S. Forest Service, California Tahoe Conservancy (CTC), and Nevada State Lands acquisition of private parcels in SEZs have also increased contiguous SEZ areas, allowed for restoration, and helped provide buffers to urban development. However, a major obstacle to SEZ restoration in the Basin is addressing the current development and human infrastructure in SEZs, which existed before TRPA regulations. Policies appear to not be sufficiently effective at moving impervious cover out of SEZs, or to incentivize redevelopment onto higher capability lands. The SEZ Roadmap developed by TRPA and partners is an important step forward in building a more scientifically robust SEZ program that supports management options, goals, and policies, for effective and prioritized implementation on the ground.

Recommendations for Additional Actions – Continue to support the restoration of degraded SEZ lands, and review policies to further incentivize the transfer of coverage from SEZ to higher capability lands. Continue to implement the SEZ Roadmap, That is, continue to work with partner agencies and stakeholders to amend the SEZ technical definition and field indicators to be consistent with the updated 2007 NRCS soil survey (the Code is based on the now obsolete 1974 soil survey), define desired functions of SEZs, and classify different types of SEZs. Many restoration projects enhance SEZ functions, but only SEZ restoration in "disturbed, developed or subdivided" areas contribute to the 25 percent restoration goal. "Disturbed" needs to be more precisely defined in order to provide an objective map and evaluation of restoration progress. The SEZ Threshold Standard should be updated to target desired conditions and functions rather than a restoration target. "Undeveloped, un-subdivided lands" has been assumed to be non-urban, and "disturbed, developed or subdivided" has been interpreted to be urban or urban influence zone. "Restoration" and "enhancement" need to be defined. For instance, fire suppression policies have led to white fir encroachment in SEZs. Is vegetation enhancement in SEZs, such as thinning white firs encroaching onto SEZs, considered SEZ restoration? It is currently assumed to be, but a clarification would make future analysis more objective and consistent. The language, "…to attain a five percent total increase in the area of naturally functioning SEZ lands" should be removed from the Threshold Standard language because it is the same as the 25 percent restoration goal in disturbed, developed or subdivided lands (i.e. 1,100 acres), making it redundant. The 25 percent restoration goal for SEZs in disturbed, developed, or subdivided lands does not explicitly address the condition and functions of SEZs. The Stream Environment Zone technical working group is identifying desired conditions and values of SEZs as part of the SEZ Roadmap effort. This information should be used to create target conditions for SEZs that could be used to guide policy and management decisions for SEZs in the future.