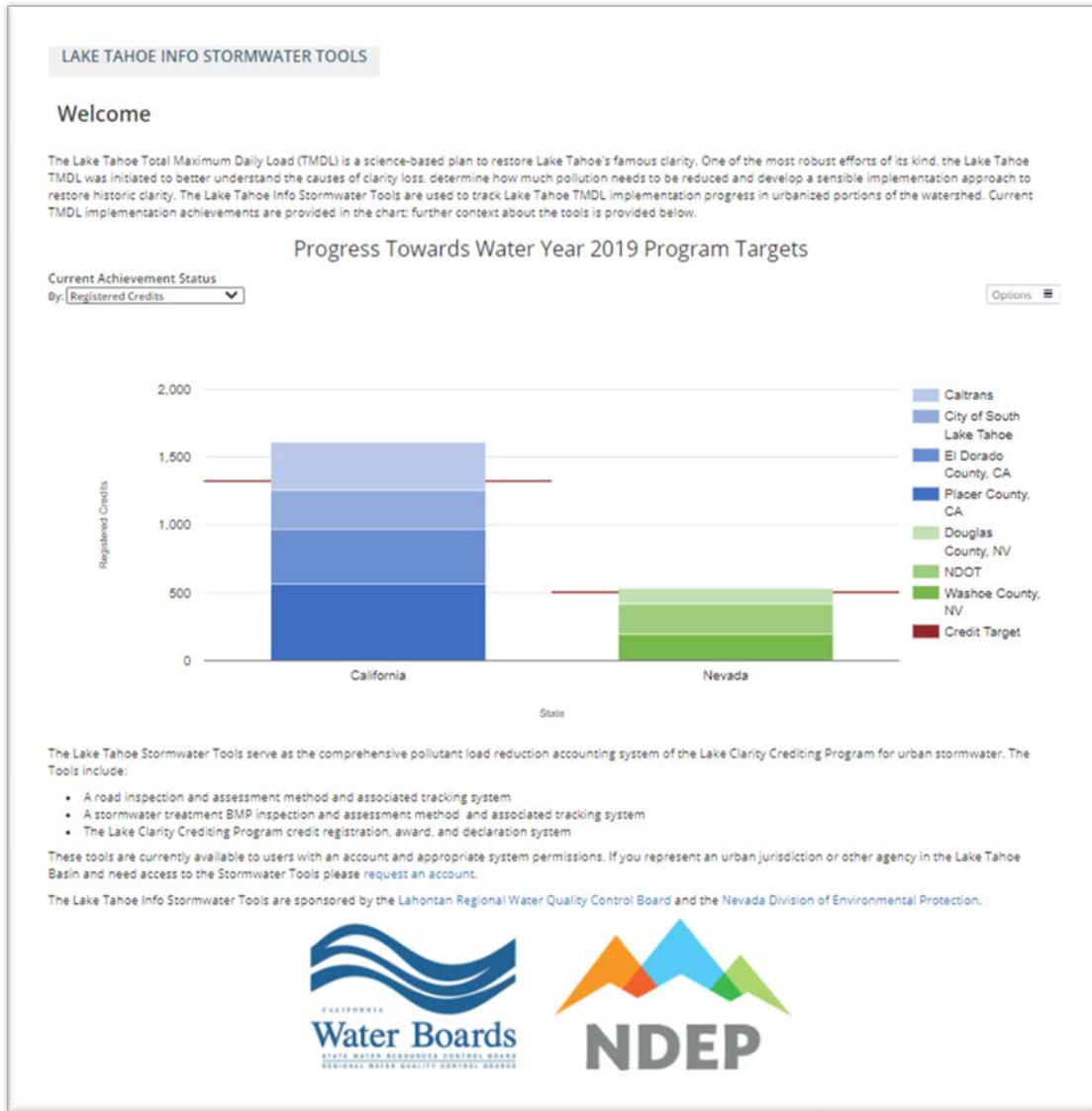


Stormwater Tools Phase 3 Improvements Project Final Report



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1. BACKGROUND

The Lake Tahoe Total Maximum Daily Load (TMDL) Program (www.clarity.laketahoeinfo.org) seeks to effectively guide efforts to restore historic clarity within Lake Tahoe so that people may once again be able to see to depths of nearly 100 feet. Science upon which the TMDL restoration plan is based indicates lake clarity restoration ultimately hinges on achieving fine sediment particle load (FSP) reductions in the Urban Upland Source Category. The urban uplands are both the largest source of FSP loadings to the lake and hold greatest opportunity to achieve needed reductions.

To motivate effective actions to reduce Urban Upland Source Category pollutant loads to Lake Tahoe, the Nevada Division of Environmental Protection (NDEP) and Lahontan Regional Water Quality Control Board (Lahontan Water Board), together the TMDL Agencies, developed and jointly administer the Lake Clarity Crediting Program (LCCP). The LCCP defines a process that connects on-the-ground actions to achieving the milestones set by the Lake Tahoe TMDL. Pollutant controls implemented to reduce fine sediment particles, nitrogen and phosphorus loads from urban stormwater are quantified, tracked, verified and reported through an online data management and reporting system known as the [Stormwater Tools \(SW Tools; stormwater.laketahoeinfo.org\)](http://stormwater.laketahoeinfo.org). The SW Tools is a component of the Lake Tahoe Info (LT Info) System, which is identified as LT INFO Program Oversight and Tracking System, Environmental Improvement Project (EIP) #06.01.02.0009.

2. PURPOSE

The LT Info Stormwater Tools are a vastly improved system from the initial LCCP tools and accounting system, which were developed independently and without consideration of future integration into a comprehensive systematic platform. Attainment of the TMDL's first five-year Urban Upland Source Category milestone highlights the success of the revamped data management and reporting system. While the LCCP registration process was greatly simplified and streamlined during the process of migrating to LT Info, a number of desirable enhancements identified jointly by Urban Implementers and the TMDL Management Agencies remained outstanding at the beginning of this project. Furthermore, several programmatic policy adjustments occurred in 2017 and 2018 that necessitated this project to update the SW Tools. The purpose of this proposed project was to accomplish the highest priority refinements and adjustments to the LT Info SW Tools.

4. ACCOMPLISHMENTS

Below is a summary of the improvements that were made to the LT Info SW Tools over the course of the project.

Properly account for distributed credits in annual credit accounting

To properly display the correct number of credits Urban Implementing Partners are awarded each water year, on the SW Tools' All Declarations page, a new grid of "Secured Credits" shows all awarded declarations and distributions. Each distribution appears once as a positive and once as a negative value to properly account for how distributed credits count towards a jurisdiction's secured credits needed to meet the annual credit target.

On the Lake Clarity Tracker's Urban Upland results page, the performance measure "Lake Clarity Credits Awarded" was renamed to "Lake Clarity Credits Secured". The logic for how the credits are aggregated per jurisdiction per water year was updated to: a jurisdiction's credits secured in a water year is equal to

the sum of credits awarded plus the sum of credits distributed TO the jurisdiction in that water year minus the sum of credits distributed FROM the jurisdiction in that water year.

Changing the other performance measures (Fine Sediment Load and Nutrients) to be proportionate with credit distributions was not in scope. Text was added to the webpage to make it clear that those charts do not take into account distributions between jurisdictions.

Highway RAM assessment protocol incorporation

Users adding road assessments can now input an assessment using either the previously existing Road Rapid Assessment Method (RAM) protocol or the relatively new Highway RAM protocol. From the Assessment Information page, the appropriate protocol can be selected from a new Assessment Protocol dropdown. Selecting the Highway RAM Protocol will trigger the additional field “Number of Lanes,” required for the new highway score calculation. Outside of these two new fields users will proceed through the same workflow as the Road RAM Protocol. This change did not affect existing road inspection scores or future Road RAM protocol score calculations.

Several bugs were identified and corrected once fixed regarding the Highway RAM was implemented. The first related to incorrectly allowing calculated Highway RAM scores to exceed the maximum of 4.8. A 0.2 deduction now applies to scores greater than 0 and less than or equal to 5.0. Valid Highway RAM scores are between 0.0 and 4.8. A second bug was fixed that was incorrectly accounting for Highway RAM scores in the seasonal score calculation. For road segments assessed with Highway RAM protocol, the adjusted score (taking 0.2 off the final calculated score) is now transformed into an effective FSP concentration before averaging in the seasonal score.

Road observation seasons and weighting-percentages adjustment

Road Registration declarations were updated to include a table with Road Class scores calculated using the new Observation Seasons and weightings outlined in the [LCCP 2018 Policy Update](#). Each Road Class included in the water year 2019 road declarations show two tables: Score (old method) and Score (new method). The Score (old method) is the same seasons and weighting as used in previous water years. The Score (new method) table uses the updated “Observation Seasons” outlined in the policy document. These changes do not affect any past declarations and only apply for the 2019 water year and future years. For water year 2019, the “achieves expected conditions” check that determines if credits are available to declare is based on the old method. For water year 2020 and future years, credit declarations are calculated based on the new method.

Modified road class score calculation workflow

Road Registration declarations for water year 2019 and on were updated to make changes to which assessments and road segments are used to calculate the Road Class score. The following changes were made:

- Only Road Segments that are included in the Registration are used to calculate the Road Class score. A jurisdiction can include alternate sites in the Registration, which are then pre-approved assessment sites if the primary sites cannot be assessed.
- All assessments completed for all Road Segments included in a Registration are used to calculate the Road Class Score. That means that even if a segment was only assessed one time in January,

that assessment is used in the water year Road Class Score calculation. Note that only “public” assessments are included in the calculation. “Private” assessments should be used for testing purposes.

- Removed the section of the Road Registration Declaration that shows a list of proposed Road Segments that do not have the required number of assessments. This no longer applies because a Road Segment does not have to be assessed 4 times throughout the year to be included in the Road Class Score calculation.
- Removed the “Reason for Assessing Alternative Segment” rationale field. This field no longer applies because alternate segments are included in the Registration.

The changes above only apply to Road Registration Declarations for water year 2019 and on. All past year declarations are “locked down” after credits were awarded.

Enter Observation Periods for road assessments

Under the Explore menu, there is a new page for “Observation Periods”. Urban Implementers and Administrators can create an observation period with a start date, end date, name, description, and road class. The Observation Period detail page will display a map and grid of road assessments that were completed during the Observation Period.

The screenshot shows a web interface for creating a new observation period. At the top, there are navigation tabs: 'ROAD', 'OBSERVATION PERIODS', and 'NEW OBSERVATION PERIOD'. The main form area contains the following fields:

- Road Assessment Observation Period Name ***: A text input field.
- Road Class ***: A dropdown menu with 'Choose one' selected.
- StartDate ***: A date picker field.
- EndDate ***: A date picker field.
- Description**: A large text area with a 'Characters Remaining: 1000' indicator at the bottom right.

At the bottom right of the form, there are two buttons: 'Save' and 'Cancel'.

Calculate and flag standard deviation for road assessment Observation Periods

Once an Observation Period is added, all assessments that occurred in that time frame will be averaged and the standard deviation calculated. On the Observation Period detail page users can view an average score and standard deviation for road assessments performed during that observation period. An informational flag will appear if the standard deviation is greater than 1.0.

There is also a new Observation Period section on the Road Registration Credit Declaration that shows all Observation Periods that occurred in that water year and the standard deviation of each period.

Added flexible treatment BMP assessment protocols and Observation Types

Replaced the hard-coded BMP types with a new flexible schema that allows Administrators/Regulators to create new observation types and BMP types without support from Sitka developers. The functionality was ported from the Orange County Stormwater Tools. Most of the BMP types used in the Tahoe Basin were re-created using the new administrative editors. This new functionality will allow Administrators/Regulators to work with Urban Implementors to add new observation protocols to the system, such as a new method to support Perf Pipes. Note: None of these changes have affected the “Modeled as” types or PLRM Functionality in the system.

All Treatment BMPs in the system were migrated from the hard-coded types to the new flexible types. Urban Implementors provided a list of how their jurisdictions observes infiltration rate, and new BMP protocols were added to support the different methods, including CASQA Drawdown:

- Dry Basin (using CHP)
- Dry Basin (using user-defined Infiltration Rate method)
- Infiltration Basin (using CHP)
- Infiltration Basin (using User-Defined Infiltration Rate method)
- Infiltration Basin (using CASQA Drawdown)
- Bed Filter (using CHP)

Below is a description of how this change does and does not affect functionality in the Stormwater Tools:

- Each Treatment BMP’s “Assessed as Type” was updated to a corresponding new type
- E.g. if the BMP was assessed as a Dry Basin, it is still assessed as a Dry Basin, but behind the scenes the code is different
- Each Treatment BMP now has at least one archived version, documenting the old assessment protocol and the update version
- The benchmark and thresholds were migrated, so there is nothing for Urban Implementors to do except verify that the data was migrated correctly
- All existing assessments are still available to view
- Assessing a Treatment BMP of any type will be slightly different:
- Standing water observations are now on two steps of the assessment (initial observation and second observation)
- Conveyance observations are now needed for the outlets and inlets on two separate steps of the assessment
- Infiltration rates are now entered based on the method used by each jurisdiction
- CHP infiltration rate is now calculated correctly
- If there are draft or returned BMP Registrations, Urban Implementors may have to fill out the “Register Treatment BMPs” page again before submittal. Hopefully this is a minor inconvenience that only takes a minute to do.
- There are no changes to approved Treatment BMP/Parcel BMP Registrations or declared/awarded Declarations.

As part of migrating the BMPs to use new assessment protocols, the benchmark and threshold values from the old hard-coded BMP types were migrated to the new flexible database for all BMPs in the

system. Urban Implementers can double check these values were moved correctly by comparing the current version of the BMP with the archived version. They can also edit these values if needed before performing any new assessments.

New treatment BMP assessment types added

Two new BMP assessment protocols were added to the system:

- Underground Perf Pipe, Sediment Can and Swale - A series of distributed inline trenches that contain underground perforated pipe in a matrix of drain rock that captures and treats stormwater flow from adjacent roadways.
- Underground Infiltration Gallery - Centralized facility or aggregation of facilities to which concentrated runoff is conveyed; consisting of a diversion/bypass, an inlet sediment trap, an infiltration chamber of underground perforated pipe in a drain rock filled sump, and terminal sediment trap.

New Treatment BMP Type detail pages

Each BMP type now has a “View Details” button where users can view the BMP type description, related observation type protocols with scoring details, and a grid of BMPs assigned to the type.

TREATMENT BMP TYPE
BED FILTER (USING CHP)

BASICS

Name	Bed Filter (using CHP)
Description	A flow-through structure that uses granular media (e.g. sand or activated alumina) to actively filter stormwater to remove stormwater pollutants. Filtration is controlled by the flow rate through the media and discharge via an underdrain or outlet. Little to no volume loss occurs. May be confined space but not always. Pollutant load reductions achieved by reduced concentrations in effluent. No stormwater volume reduction occurs. Typically, moderate sized centralized BMPs but can be small decentralized BMPs treating small areas of imperviousness.

APPLICABLE OBSERVATION TYPES

Observation Name	Collection Method	Default Benchmark Value	Default Threshold Value	Assessment Score Weight	Alternative Observation
Infiltration Rate - Constant Head Permeameter (CHP)	Rate-based Observation	-	20 % decline from benchmark	100%	Infiltration Rate - Calculated Off-System
Conveyance - Inlet Condition	Pass/Fail Observation	n/a	n/a	pass/fail	-
Conveyance - Outlet Condition	Pass/Fail Observation	n/a	n/a	pass/fail	-

New Treatment BMP Observation Type detail pages

Each Observation type name on the Treatment BMP type page is a hyperlink that leads to an Observation type detail page. This page lists the description, details, and configuration settings for each observation type.

Support treatment BMP rate-based Observation Types

Infiltration rate was one of the few hard-coded observation types that was very complicated (6 different ways to enter values) and not completely supported in the new flexible schema. Given the number of BMP Types in the Stormwater Tools that are assessed by observing the infiltration rate, supporting rate-based observations in a flexible way was prioritized. The new rate-based configuration supports collecting time/value data pairs that can be labeled flexibly. The rate is calculated automatically. Infiltrometer and User-defined protocol collection methods for Infiltration Rate were set up using this functionality.

Support use of an alternate treatment BMP observation method

Sometimes it is not possible to use a preferred observation protocol due to weather (e.g. CHP when the basin is saturated with water) or other circumstances. An Administrator can now configure a pre-approved “Alternate Observation Method” for any observation type. If set, an Urban Implementer will see a check box on the page in the assessment workflow “Use Alternative Observation”. When they check the box, the data entry form will change to the alternative type. For example, “Infiltration Rate – CHP” has an alternate type called “Infiltration Rate – Calculated Off System” and a user can simply enter one value for the rate instead of entering time/value pairs.

Add images and documents to a Treatment BMP

Users can now add multiple images and documents to a Treatment BMP detail page. Detail Pages with multiple images will feature a carousel format that cycles through all included images. Documents can be uploaded with short descriptions to provide additional context for users accessing the detail page.

Ability to add images to a treatment BMP assessment

Users now have the option to attach images taken during an assessment directly in the Treatment BMP Assessment workflow or on their BMP Assessment Detail page.

Add catchment layer as a geospatial web service

On the Web Services page, there is a new service called All Stormwater Catchments available under the Geospatial Services Section. The All Stormwater Catchments serves as a conveniently accessible system of record for the latest Stormwater Tools catchment layers.

Visually distinguish catchments that are registered

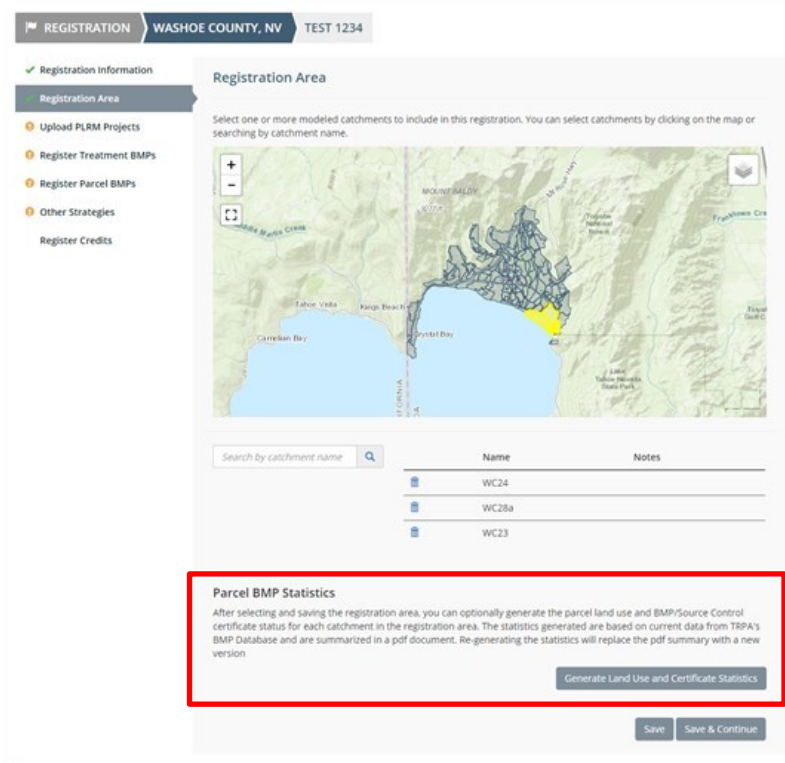
A new Catchments map layer has been added that color codes catchments that are registered. Map views through the Stormwater Tools will default to the new layer to allow for quick distinction of registered catchments.

Display reason for updating a registration

When a user updates a registration, they are prompted to enter in a reason for the update request. Update request comments now display in the Archive section of a registration detail page in addition to being included in email notifications to regulators.

Parcel BMP updates

In the BMP Registration workflow on the Registration Area page, there is now an optional section for Parcel BMP Statistics where users can generate a PDF document with the parcel land use and cert status per catchment.



Users can re-generate the pdf whenever needed. For example, if TRPA updates land use in the BMP Database, a user can come back the next day and click the “Generate” button again for updated statistics. The pdf document will remain as a file attachment on the Registration Area page and on the BMP Registration “detail page” in the Parcel BMPs section. The PDF contains the statistics for the overall registration area (all catchments) on the first page, and subsequent pages show the same information per catchment. No changes were made to how the statistics are generated (uses the same calculations as a Parcel BMP Assessment) and the values generate through the Parcel BMP Assessment are the same as the values on the PDF. Percent values of Parcel BMP section of BMP Registration Detail pages were updated to display one decimal place, to match the significant digits displayed in the Land Use and Certificate Statistics PDF.

The BMP Registration workflow was updated to automatically calculate the Water Quality Importance (WQI) of Parcel BMPs based on the FSP pollutant load (lbs/yr) values for SFR, MFR, and CICU areas. The WQI calculation outlined in the Credit Accounting Platform (CAP) Technical Document is displayed on the Register Parcel BMP of the registration. The WQI is determined based on how many potential credits the parcel BMPs provide:

- Credits ≥ 10 : Essential
- $3 \leq$ Credits ≤ 9 : Key
- $2 \geq$ Credits: Supporting

Calculation Field	Value
Baseline Scenario	2718.9
<i>Parcel Land Use FSP Loading (lbs/yr)</i>	
Expected Scenario	1618.8
<i>Parcel Land Use FSP Loading (lbs/yr)</i>	
FSP Load Reduction (lbs/year)	1100.1
<i>Baseline Scenario - Expected Scenario</i>	
Credits	5
Water Quality Importance	Key

A bug was fixed that was incorrectly showing that a parcel in Douglas County was not BMP certified when a change was made in the BMP Database.

Release Notes

The system now has a dedicated page (this page!) for capturing and sharing release notes. An administrator can add release notes, which are visible to all other users.

Release notes were populated going back to the start of Phase 3 (August 2019). Sitka will update the Release Notes page after every release to document the new functionality in the Stormwater Tools. Administrators can also use Release Notes to announce when new BMP assessment protocols are added.

Launch Pad reorganization, link updates, and action items

Reordered the cards on the Launch Pad to be in line with the sections of the LCCP process as described in the LCCP Handbook. Cards include: Jurisdictions, Inventory, Credits, and Assess. Under the Inventory section "new road segment" and "new road class" are new link options. Under the Assess section for roads, a user now has links to add an observation period and view all observation periods.

The Launchpad now includes a list of action items that require attention. For example, a regulator will see action items when registrations and declarations are submitted for review. Urban implementors will see an action item if a registration or declaration is returned, and when credits are available to declare.

Archive registration details when an update occurs

There is a new section at the bottom of the registration detail page called "Archived Resources". After a regulator approves a request to update a registration, a PDF snapshot of the registration details at the time the update was requested is saved in this section along with a copy of the PLRM Zip file.

Improved readability of notes in Declaration grid

Minor tweak to expand the Declarations grid on the Registration detail pages to be full width. This makes it easier to read the 'reason for Overriding Credit Potential' explanations in the grid.

PLRM Summary Report enhancement

The PLRM Summary Report was updated to show values for all scenarios in the PLRM model. For example, if a registration has baseline, road operations, and BMP scenarios, the model values for all scenarios now show in the report. Previously, only baseline and expected scenario model values were displayed.

The PLRM Summary Report was updated to flag BMPs that are “pre-2004” (i.e. the BMP appears in both the baseline and expected PLRM scenario). The BMP credit potential field for pre-2004 BMPs that is shown in the Summary Report was also updated to accurately calculate and reflect there is no credit potential associated with these BMPs.

Include review comments on registration and declaration approval notifications

When a registration is approved, or credits are awarded for a declaration, any review comments left by the reviewer are now included in the email notification that is sent to the jurisdiction’s urban implementors. Previously, comments were only included in email notifications for returned registrations or declarations.

Miscellaneous additional improvements and corrections

For the BMP Registration Credit Declaration, the system was updated to check for the latest assessment in the water year, regardless of the assessment protocol used. This handles the case where the "assessed as" type (the assessment protocol) is changes mid-year.

In the BMP Assessment, the system was improved to remove validation that constrained the assessment date to be after 11/22/19. Users can now enter assessments with dates prior to the effective date of the BMP version.

Dust cloud instructions in the Road and Highway RAM were corrected to: “If any part of your fingerprint is not visible, answer NO”.

A stormwater user no longer has the ability to edit a Road Class that is included in a Road Registration with the status: Submitted, Approved, Updated Requested, or Withdrawal Requested.

The names of the SW Tools roles were changed from Administrator to Regulator and from Normal User to Urban Implementer.

The term “Catchment” was changed to “Urban Catchment” throughout the SW Tools, except where repeating the word "urban" would have been redundant.

The option to Set Credit Targets from Urban Implementers who do not have permissions to view that page was hidden.

Minor bug fix for Road Registration Credit Declarations that was using the wrong method for “achieves expecting conditions” and could give the wrong answer in some limited cases.

Corrected the update Registration workflow where certain text fields were deleted if a user removed their PLRM zip file. Now all of the text fields will remain and users can edit them if needed before submitting the updated registration.

4. CONCLUSIONS

As can be seen from the extensive list of accomplishments, the project was successful in meeting the intended purpose. Many of the improvements were completed that were not identified in the proposal, but through the project itself. The Project Advisory Committee was critical to guide the project, test and provide feedback on the improvements, resulting in an enhanced LCCP registration system that stakeholders and the TMDL agencies are very happy with.

The successful outcome of this project is largely due to the funding support provided through the Lake Tahoe License Plate Grant administered by the Nevada Division of State Lands. Improvements to the LT Info Stormwater Tools benefits the entire Lake Tahoe basin by increasing the efficiency of the registration process, enabling stormwater program managers to focus greater attention toward planning and implementation of pollutant controls. Moreover, these improvements provide for expanded program transparency and accountability, a key to retaining decision-maker support for the use of public funds to implement and maintain water quality improvements.