TRPA GUIDANCE FOR INCORPORATING THE PLRM AND PRIVATE PROPERTY BMPS INTO THE ECAM PROCESS - FINAL

For the Tahoe Regional Planning Agency
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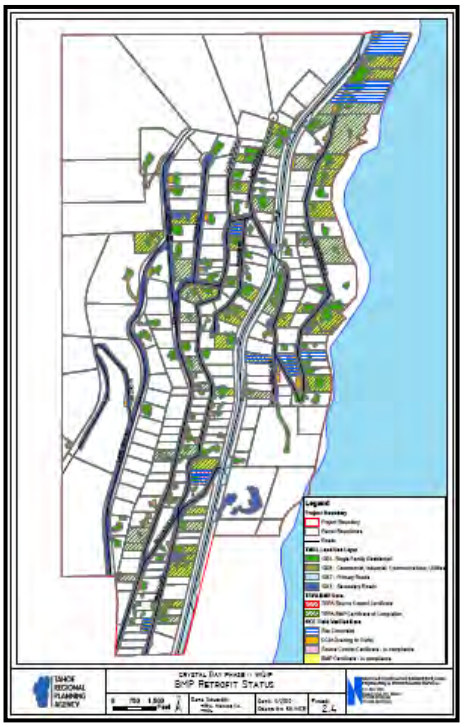

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APPENDICES

1.0 INTRODUCTION, BACKGROUND, AND PURPOSE

The planning process for water quality improvement projects (WQIPs) in the Lake Tahoe Basin relies upon the Storm Water Quality Improvement Committee's (SWQIC) Project Delivery Process (PDP). One of the fundamental elements of the PDP is the procedure outlined in the Formulating and Evaluating Alternatives (FEA) document to develop and analyze project conditions, opportunities, and constraints. The initial product from the FEA is termed the Existing Conditions Analysis Memorandum (ECAM), which serves as the foundation for formulating and evaluating project alternatives by characterizing existing conditions relevant to water quality and identifying opportunities and constraints for the WQIP area.

The guidance documents prepared for the PDP, including the FEA and ECAM, were released in July 2004. Since that time stormwater science and Basin Policy has progressed substantially. Although, an Interim Guidance Paper for the FEA was released in November 2008, it focused on clarifying questions from the 2004 documents and did not address new science associated with the Lake Tahoe TMDL which in 2008 had not yet been adopted. The result of the TMDL science and new policy direction has lead to programmatic shifts which places greater emphasis an applying a Watershed Approach, originally proposed in the FEA Guidance Document, to managing stormwater and addressing all major sources of pollutant loading from a catchment regardless of land ownership. Some examples of the programmatic shifts include:

1. In the TMDL, pollutant loading from private property is considered part of an urban jurisdictions baseline load, and also part of their opportunities and potential credits for achieving load reduction allocations.
2. Technical Advisory Committee (TAC) agencies are increasingly requesting that private BMPs be addressed as part of the public WQIPs they fund. There have been some discussions that this could turn into a grant requirement.
3. TRPA's Regional Plan Update is exploring ways to strengthen code language to guide more comprehensive solutions for water quality improvement for proposed projects.

Currently the PDP and its associated guidance documents provide limited or no guidance on how to integrate the TMDL and its associated tools into the PDP. There is also limited focus and sparse direction for integrating private property into the FEA and ECAM documents. As a result, more guidance is needed to integrate the evaluation of private property BMPs into the ECAM Process and identify the specific data needs of the PLRM for the ECAM.

The Purpose of this document is to provide guidance on integrating private property BMPs into the ECAM and identifying the specific PLRM data collection efforts necessary to fully develop an ECAM in light of the new science and policy direction in the Basin. This document recognizes that the information presented on the following pages should be integrated with a full update to the PDP documents in the future.

The Goals of this project are:

1. Present why private property BMPs are important considerations in WQIP planning
2. Note what information should be collected during the ECAM process to effectively use the PLRM and integrate private property

3. Describe how to collect data and introduce the tools to assist with data collection
4. Present potential options for analyzing PLRM and private property data
5. Describe where to present PLRM and private property data in the ECAM
6. Provide preliminary guidance for assessing the effect of fire defensible space practices on water quality (**Appendix A**)

2.0 INCORPORATING PLRM ANALYSIS INTO THE ECAM PROCESS

The Pollutant Load Reduction Model (PLRM) was developed to assist the WQIP TAC to select and justify a recommended alternative based on a quantitative comparison of pollutant loads and runoff volumes. Because the PLRM is a new storm water quality assessment tool for the Lake Tahoe Basin, guidance for applying the PLRM to the FEA process has not been integrated into FEA guidance documents. Interim guidance provided in this document is intended to assist the TAC when applying the PLRM during the existing conditions analysis portion of the FEA. This section:

- Identifies and summarizes PLRM inputs necessary to estimate pollutant loading
- Directs the reader to additional guidance for developing each PLRM input
- Highlights how use of the PLRM may affect data collection and analysis in comparison to ECAM practices undertaken prior to development of the PLRM
- Suggests methods for summarizing PLRM inputs for submittal to the TAC with an ECAM
- Suggests PLRM output to provide with an ECAM, as well as how to interpret the output

2.1 SUMMARY OF PLRM INPUTS

Table 2.1 describes each PLRM input and directs the reader to specific locations in the PLRM User's Manual (December 2009 version) and the PLRM Applications Guide (October 2010 version) where additional guidance on each input parameter is provided.

TABLE 2.1 – DESCRIPTION OF PLRM INPUTS AND LOCATIONS FOR ADDITIONAL GUIDANCE

PLRM Input	Brief Description of PLRM Input	User's Manual (Dec 2009)	Applications Guide (Oct 2010)
WQIP Area and Location	The WQIP area is the physical boundary of the WQIP. WQIP location is specified using the PLRM meteorological grid.	Section 3.1	Not Included
Catchment Delineations	The term "catchment" is used in PLRM to define a discrete drainage area within a WQIP area where pollutant loading will be evaluated. Most input parameters for a PLRM analysis are developed by catchment. A WQIP area may have multiple catchments.	Section 5.1	Section 1.3
Average Catchment Slope	The average slope for the developed portions of the catchment.	Section 5.1	Section 2.1
Land Use Distribution	The distribution of land uses within a catchment is input as a percentage of the catchment area. Selectable land uses in PLRM have been pre-populated using the TMDL Land Use GIS Layer.	Section 5.2	Section 2.2

PLRM Input	Brief Description of PLRM Input	User's Manual (Dec 2009)	Applications Guide (Oct 2010)
Impervious Area by Land Use	The impervious area of each land use is input as a percentage of the land use area within a catchment.	Section 5.2	Section 2.2
Soils Distribution	The distribution of soils within a catchment is input as a percentage of the catchment area. The PLRM is pre-populated with a list of all soil Map Units defined in the 2006 Tahoe Basin Soil Survey and their key hydrologic properties for water quality calculations.	Section 5.3	Section 2.3
Road Risk Distribution	Road Risk is a PLRM parameter that bounds the range of pollutant concentrations generated from a road in a specific condition. The distribution of Road Risk is input as a percentage of the road area within a catchment using categories of High Risk, Moderate Risk, and Low Risk.	Section 6.1.1	Section 3.1
Road Shoulder Conditions for Pollutant Generation	Road shoulder conditions are defined using the following terms described in the PLRM User's Manual: 1) Erodible; 2) Protected; 3) Stable; and 4) Stable and Protected. For each catchment, road shoulder conditions are input by Road Risk category. Inputs for road shoulder conditions are combined with road sanding and sweeping inputs to estimate the characteristic runoff concentrations (CRCs) from roads by Road Risk category.	Section 6.1.2	Section 3.2
Road Sanding and Sweeping Practices	Road sanding and sweeping practices are defined in PLRM by the: 1) relative amount of road abrasives applied; 2) frequency of street sweeping; and 3) type of street sweeper used. For each catchment, inputs are entered by Road Risk category. Inputs for road sanding and sweeping practices are combined with road shoulder condition inputs to estimate the characteristic runoff concentrations (CRCs) from roads by Road Risk category.	Section 6.1.2	Not Included
Private Property BMP Implementation	BMP implementation is input as the percentage of area with BMPs for each private property land use in a catchment. Where private property land uses are single family residential, multi-family residential, CICU, and vegetated turf. Two types of BMP implementation can be specified based on TRPA definitions for: Source Control Certificates and BMP Retrofit Certificates.	Section 6.2	Not Included
Impervious Area Connectivity by Land Use	The amount of impervious area directly connected to a drainage system is input as a percentage of the total impervious area for each land use within a catchment.	Section 7.2	Section 3.2

PLRM Input	Brief Description of PLRM Input	User's Manual (Dec 2009)	Applications Guide (Oct 2010)
Existing Infiltration Facility Locations and Design Attributes	Infiltration facilities are small features distributed throughout a catchment (e.g. open-bottom sediment traps) that store and infiltrate distributed storm water runoff from public land uses (e.g., road runoff). Identifying the location of existing infiltration facilities is necessary to estimate the drainage area to the facilities. Inputs for design attributes are used to specify storage capacity and infiltration rates.	Section 7.1 and Section 7.3	Not Included
Existing SWT Facility Locations and Design Attributes	Storm water treatment (SWT) facilities are large centralized BMPs that remove pollutants of concern after they have entered concentrated storm water runoff flow paths. In PLRM, SWT facilities are external objects to catchments. One or more catchments can route runoff to an SWT facility. Inputs for design attributes are used to specify treatment performance.	Section 8	Not Included

2.2 Development of PLRM Inputs and Suggested Methods for Presenting in an ECAM

Table 2.2 discusses PLRM inputs relevant to ECAM development, and highlights how use of the PLRM may affect data collection and analysis in comparison to ECAM practices undertaken prior to development of the PLRM. For this purpose, PLRM input requirements are compared to previous practice by grouping them into three categories, which are illustrated in **Table 2.2** using the following symbols:

=	Little or no difference in data collection effort or format is required for application of PLRM.
↔	PLRM requires data to be collected or organized in a specific format that may be different from past practice, but little change in overall level of effort is anticipated once the user becomes familiar with the PLRM concept or data format.
↑	PLRM introduces new parameters or analyses and these require increased level of effort for data collection and development.

The reader should note that ECAM complexity varies according to the nature of the WQIP area and proposed improvements, the practices of individual jurisdictions, and regulatory needs specific to the WQIP. The complexity of PLRM modeling for an existing conditions analysis will also vary dependent upon these factors. **Table 2.2** can therefore only provide general comparisons – the approach and level of effort for a specific ECAM must be defined by individual jurisdictions according to WQIP needs.

A general note regarding PLRM inputs is that the model is based on land uses, as defined by the TMDL Land Use GIS Layer. Therefore, input for PLRM must generally be developed by land use within each catchment. In the TMDL Land Use Layer, Primary and Secondary Roads are defined as specific land uses rather than being lumped with adjacent land uses. Much of the effort involved in developing PLRM inputs is to define conditions associated with these land uses that affect pollutant loading.

Table 2.2 also provides a column that suggests methods and submittals to demonstrate in an ECAM how PLRM inputs were developed for the TAC. An important aspect of the FEA process is communicating key information and assumptions to the TAC and regulators. Concise and consistent summaries of PLRM input parameters will facilitate this objective. The table frequently references the use of the PLRM Input Template to document many of the PLRM inputs. The PLRM Input Template is a Microsoft Excel file that can be used to summarize all PLRM inputs in an easily reviewable format. The template can be downloaded from the PLRM sub-site on the TIIMS website (tiims.org). Instructions for populating the template are provided in the first worksheet of the template. An example PLRM Input Template is provided as **Appendix B** to this document.

TABLE 2.2 – PLRM INPUT AND SUGGESTED SUBMITTALS TO SUPPORT AN ECAM

PLRM Input		Notes on PLRM Input Development for ECAM Process	Suggested Methods for Presenting PLRM Inputs in an ECAM
WQIP Area and Location	=	WQIP area and location are simply defined. PLRM requires location as part of input to define meteorological characteristics.	1. WQIP area map. 2. WQIP location can be specified in the PLRM Input Template.
Catchment Delineations	↔	Many WQIPs incorporate drainage design improvements that require fine-scale drainage delineations to assess localized flooding and conveyance issues. If catchments have been delineated to support drainage design, it may be worthwhile to aggregate these fine-scale drainage delineations into larger catchments to streamline the development of PLRM input parameters.	1. Map displaying PLRM catchment delineations used to develop inputs for the water quality analysis in PLRM.
Average Catchment Slope	↔	Topographic information collected during the ECAM process may be used to calculate the average slope of the **developed portion** of each catchment. This PLRM input may differ from the average slope of the overall catchment.	1. Can be specified in the PLRM Input Template.

PLRM Input		Notes on PLRM Input Development for ECAM Process	Suggested Methods for Presenting PLRM Inputs in an ECAM
Land Use Distribution	=	The distribution of land uses by catchment is based on the TMDL Land Use layer.	1. Land use map with PLRM catchment delineation overlayed. 2. Distribution by catchment can be specified in the PLRM Input Template.
Impervious Area by Land Use	↑	The amount of impervious area must be estimated for each land use within a catchment. The TMDL Land Use layer identifies impervious land uses.	1. Impervious area map with PLRM catchment delineations overlayed. 2. Distribution of impervious area by land use and catchment can be specified in the PLRM Input Template.
Impervious Area Connectivity by Land Use	↑	The PLRM requires an estimate of impervious connectivity for each land use within a catchment.	1. Map displaying impervious area connectivity with PLRM catchment delineations overlayed. 2. Distribution by land use can be specified in the PLRM Input Template.
Soils Distribution	=	The distribution of soils by catchment is defined using the 2006 Tahoe Basin Soils Survey.	1. Soils map with PLRM catchment delineations overlayed. 2. Distribution by catchment can be specified in the PLRM Input Template
Road Risk Distribution	↑	Road Risk is a unique PLRM parameter used to support the PLRM's Road Methodology. A default Road Risk GIS layer is available from the TIIMS website (tiims.org); the user can accept or override the default categories.	1. Map displaying Road Risk categories with PLRM catchment delineations overlayed. 2. Distribution by catchment can be specified in the PLRM Input Template.

PLRM Input		Notes on PLRM Input Development for ECAM Process	Suggested Methods for Presenting PLRM Inputs in an ECAM
Road Shoulder Conditions for Pollutant Generation		The PLRM definition of road shoulder conditions is new, and requires that all road shoulder conditions be defined using the specific terms and concepts developed for the PLRM. A default 2010 road conditions GIS layer will be available for download from the TIIMS website (tiims.org) by January 2011. Identifying erosional hot spots and existing drainage problems on roads may be a useful component of an ECAM; however, this process is not sufficient to develop the PLRM inputs that define road shoulder conditions.	1. Map displaying road shoulder conditions (using PLRM terms and concepts) with PLRM catchment delineations overlayed. 2. Distribution by catchment can be specified in the PLRM Input Template
Road Sanding and Sweeping Practices		Information on road abrasive applications and street sweeping, or estimation of these maintenance practices, is needed as a PLRM input by road type (Primary or Secondary Road) and Road Risk category for a catchment.	1. Can be specified in the PLRM Input Template.
Private Property BMP Implementation		The PLRM requires an estimate of the level of BMP implementation by private property land use as a percentage of the land use area. Two categories of BMP implementation are provided as input choices.	1. Map displaying parcels with BMPs implemented with PLRM catchment delineations overlayed. 2. Distribution by land use and catchment can be specified in the PLRM Input Template.
Existing Infiltration Facility Locations and Design Attributes		The PLRM requires information on the total drainage area to distributed infiltration facilities by catchment, as well as an estimate of the total storage capacity for the distributed infiltration facilities and characteristic infiltration rate.	1. Map displaying locations of existing infiltration facilities with PLRM catchment delineations overlayed. 2. Drainage area and design attributes can be specified in the PLRM Input Template.
Existing SWT Facility Locations and Design Attributes		The PLRM requires information on catchment routing to SWTs, where catchments must be defined based on SWT locations. Additionally, estimates of the specific water quality design attributes for each SWT facility are needed. PLRM defines different water quality design attributes based on the type of SWT facility.	1. Map displaying locations of existing SWT facilities with PLRM catchment delineations overlayed. 2. Catchment routing to existing SWT facilities and design attributes can be specified in the PLRM Input Template.

2.3 Providing and Interpreting PLRM Output in an ECAM Submittal

To support a water quality analysis using the PLRM, the PLRM Recommended Range Report and the Scenario Output Report should be submitted as a part of the existing conditions analysis. Additionally, some basic interpretation of the results of both reports should be completed.

Note to Reader: Please note the process described in Section 3 of this document would be completed prior to running a PLRM scenario as described below.

2.3.1 Recommended Range Report

The Recommended Range Report is generated as an HTML file when a PLRM simulation is initiated. This file can be saved, printed, or converted to a PDF after initiating a PLRM simulation.

The Recommended Range Report flags any value entered by the user outside the recommended range for key input parameters. A value flagged by the Recommended Range Report does not necessarily mean the value entered by the user is incorrect. Two common descriptions are used to categorize values entered by the user that have been flagged.

1. Note: An action is not likely required as values outside the recommended range commonly occur for the input parameter. However, given the sensitivity of the input parameter, a value outside the recommended range is flagged for review purposes. WQIP designers typically do not need to justify values flagged in this category to the TAC but some discussion may be warranted.

2. Warning: An action is likely required as values outside the recommended range are not typical for the input parameter. In certain instances values outside the recommended range are allowable. However, in these instances the Warning message signifies that WQIP designers should provide a rationale/justification to the TAC for the value outside the recommended range.

2.3.2 Scenario Output Report

After a PLRM run has completed, a Scenario Output Report can be exported from the PLRM. The Scenario Output Report generates estimates of pollutant loading and surface runoff for all catchments in an existing conditions analysis, as well as the treatment performance of existing SWT facilities.

WQIP designers and the TAC should review Section 9.1 of the PLRM User's Manual to become familiar with the format and information provided in the Scenario Output Report in order to correctly interpret the output.

Interpreting Catchment Output
The Scenario Output Report can be used to identify catchments with significant pollutant loads, which may highlight opportunities for load reduction. WQIP designers and reviewers are

encouraged to review and interpret the following in the "Catchments" section of the Scenario Output Report:

- Among the catchments modeled, which catchments have the largest surface runoff and fine sediment particle (FSP) loading per unit of area? Does the result make sense? In other words, do these catchments have a significant amount of impervious area or a notable amount of higher loading land uses (e.g., roads and CICU), etc.?
- Are there opportunities or constraints for implementing improvements in the catchments with the highest pollutant loads identified?

Interpreting Storm Water Treatment Facility Output

The Scenario Output Report can be used to review existing performance of Storm Water Treatment (SWT) facilities, which may highlight opportunities to improve or maintain pollutant load reductions achieved by an SWT facility. WQIP designers and reviewers are encouraged to review and interpret the following in the "Storm Water Treatment" section of the Scenario Output Report:

- Review the value reported in the "% Capture (1- Bypass/Influent)" row of the output.
    - A typical volume-based SWT facility (e.g., dry basin, wet basin, infiltration basin) sized to retain 1-inch of runoff from the tributary impervious area will capture between 85%-95% of average annual runoff.
        - How does the SWT facility perform relative to this standard?
        - Note that due to site constraints, it may be impossible or at least not cost-effective to achieve this standard.
    - Critically assess values reported at 100%, which may:
        - Indicate an input error for the facility or catchment;
        - Indicate that the SWT facility is oversized and is not cost-effective; or,
        - For a flow based SWT facility (e.g. treatment vault), indicate that an excessively high treatment flow rate was input into the PLRM that may be inappropriate for treated the pollutants of concern.
- Check that values reported in the "Volume/Load Removed" row of the output.
    - Do the pollutant loads removed and retained by the SWT facility on an average annual basis appear reasonable?
    - Are the results supportable based on available information (e.g. clean-out records) or visual observations of the existing SWT facility?

2.3.3 Potential Sensitivity Tests

Sensitivity tests can be performed using the PLRM to assess the significance of private property contributions to pollutant loading, as well as the influence that some key PLRM input assumptions may have on pollutant loading. The following outlines the general process for performing a sensitivity test in PLRM, as it is beyond the scope of this document to provide step-by-step instructions. Additional guidance can be found in the PLRM User's Manual and Applications Guide (available at tiims.org). A future version of the PLRM Applications Guide may include a chapter detailing specific approaches to perform sensitivity tests.

- As a sensitivity test, the PLRM modeler could quickly complete the following steps to estimate and report to WQIP reviewers the relative loading that private property contributes in each catchment:
    - Copy the existing conditions PLRM Scenario
    - In the copied Scenario set all private property land uses to the maximum percentage of BMP certificates deemed feasible for that land use in the Land Use Editor of the PLRM (i.e. 100% minus constrained parcels).
    - Run the PLRM for the hypothetical 100% BMP Scenario
    - Manually compare the Scenario Output Reports for the existing conditions Scenario and the hypothetical 100% BMP Scenario.
    - Assess whether pollutant loading in any catchment markedly changed. If so, this result signifies that private property land uses contribute significantly to the overall pollutant load generated in the catchment.
- Additional sensitivity tests could be performed by the PLRM modeler following the process outlined above for BMP implementation to gain a better understanding on the range of probable loads from the WQIP area. Where the most sensitive input parameters that require interpretation could be varied and changes in loading assessed:
    - Road Risk Distribution
    - Road Shoulder Conditions for Pollutant Generation
    - Impervious Area Connectivity
    - Characteristic Infiltration Rates

3.0 INTEGRATING PRIVATE PROPERTY BMPS INTO THE ECAM PROCESS

3.1 OVERVIEW

Application of a Watershed Approach, discussed in detail in the 2008 FEA Interim Guidance Paper, establishes a wider scale of reference for designing WQIPs and encourages designers to consider all lands within a WQIP's watershed, sub-watershed, or catchment rather than just the public roads and rights of way. A key portion of this land is private property and its associated hydrology. A Watershed Approach recognizes that hydrologic processes are fundamental to the generation and transport of pollutants and that private property can have a dramatic affect on other portions of the watershed (FEA Interim Guidance Paper, 2008). The largest source of fine sediment particles to Lake Tahoe is urban stormwater runoff, comprising 72 percent of the total fine sediment particle load to Lake Tahoe (TMDL report, 2009). The urban landscape in the Lake Tahoe Basin includes a significant amount of private, developed lands. By including more detailed information about the pollutant loading coming from private property within a WQIP area, four benefits can be realized

- WQIP designers and TACs will have a better understanding of the pollutant generation and transport from private property within a WQIP
- Data inputs into the PLRM will be more accurate
- The TRPA and Conservation Districts will be able to identify priority areas for focused enforcement and technical assistance
- May identify the need for a comprehensive approach to water quality improvements that include public and private BMPs

The guidance presented in this section is intended to assist WQIP designers with a comprehensive evaluation of private property within their WQIP. For linear projects the process may require expanding the project boundary or the area of investigation to include adjacent private parcels. The Rapid Assessment Checklist (**Appendix C**) provides a simple and repeatable method for field observation and data management to assess the state of private property BMPs and the degree of connectivity of private impervious areas in a WQIP. The level of effort to complete this process varies depending on the size and complexity of the WQIP. Based on the work conducted as a part of this project it is likely to take an experienced field and GIS technician 1-2 days in the field and 2-3 days of map making and data analysis.

3.1.1 Critical Private Property Data to Include in ECAM

There are three critical private property data which should be included in an ECAM. They include:

- The presence or absence of BMPs on a property
- Constraints that prevent the implementation of BMPs on a property
- Connectivity of impervious areas

Currently all of the private property BMP information collected for the ECAM and input into the PLRM comes from the TRPA's BMP database and is based on BMP Certificates of Completion and Source Control Certificates that have been issued in the WQIP area. BMP Certificates of Completion are issued to properties that have completed pollutant source control (PSC) (all pervious areas of the property are stabilized) and hydrologic source control (HSC) (runoff from impervious areas is conveyed to infiltration systems sized to the standard 20 year storm). As an update to the ECAM, the Rapid Assessment Checklist can be used to field verify the BMP status of each private parcel in the WQIP. The BMP status of a property can change over time due to property alternation or lack of maintenance thus, field verification of BMP status more accurately portrays the number of private parcels that have complete and functioning BMPs. For example, when this process was used on a WQIP in Washoe County, the TRPA database lists 56 parcels (39%) as having a BMP Certificate of Completion but during the Rapid Assessment Process only 29 parcels (20%) were found to be in compliance with their BMP Certificate (**Appendix D: Crystal Bay Phase II WQIP ECAM Addendum**).

Source Control Certificates are issued to properties that have completed PSC but are not able to install HSC to the TRPA standard due to recognized constraints. Site constraints that prevent the implementation of HSC BMPs include but are not limited too seasonal high water tables/ stream environment zones, slow soils (Ksat ≤ 1"/hr), rocky soils or bedrock near grade, utility placement, retaining structures, steep slopes/ cut and fill slopes, property boundaries, underground heating units, and structures located with no/minimal setback to the public right of way. Site constraints restrict the total number of private parcels in the WQIP area that can meet the standards for a BMP Certificate of Completion. As with BMP Certificates, the source control status of a property can change over time due to property alternation or lack of maintenance thus, field verification of source control status more accurately portrays the number of private parcels that have complete and functioning source control. For example, when this process was used on a WQIP in Washoe County, the TRPA database lists 2 parcels (1%) as having a Source Control Certificate but neither parcel (0%) was field verified to be in compliance with their Source Control Certificate.

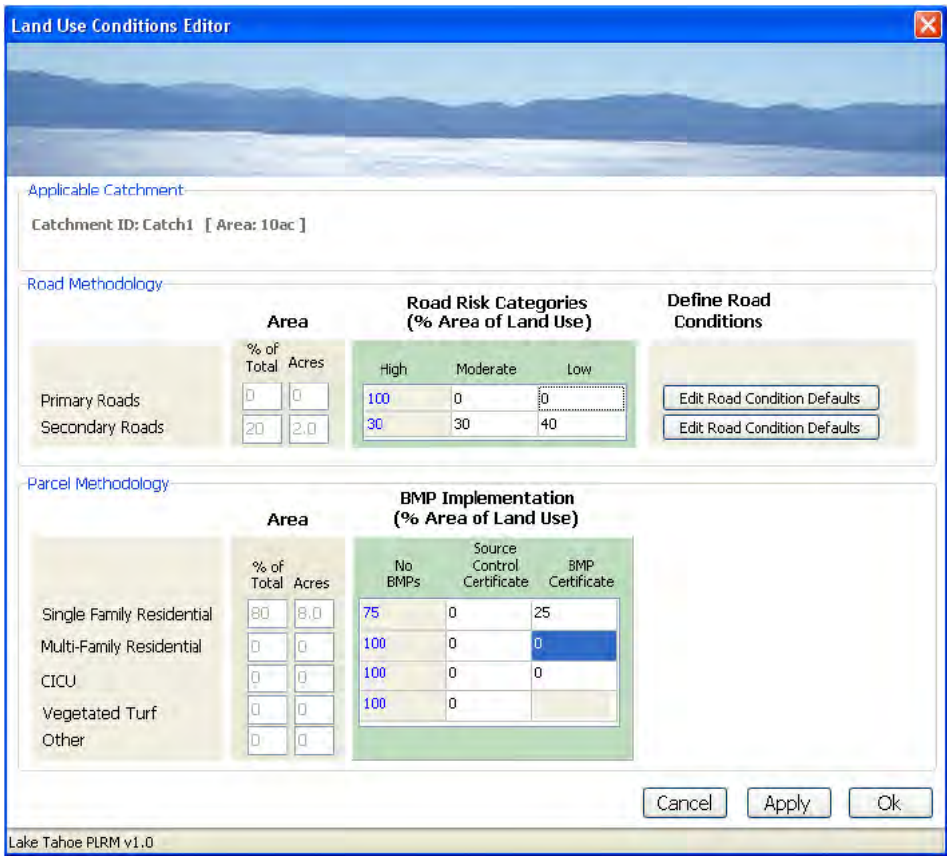
The directly connected impervious area (%DCIA) in a WQIP can be used to determine the quantity of stormwater that will flow into the public WQIP from private property, which then can be accounted for in the WQIP design. This data can be used to determine the reduction in pollutant loads with increased private property BMP implementation and thus, the most cost effective BMP solutions. Using the Checklist process described here, the DCIA can be accurately delineated in the field and then measured and analyzed using GIS software.

3.1.2 Private Property BMP data in the PLRM

Private property information for the PLRM is input in two Editors, the Land Use Conditions Editor and the Drainage Conditions Editor. The Land Use Conditions Editor (**Figure 3.1**) defines the amount of private property BMP implementation for each private property land use (Single Family Residential, Multi Family Residential, Commercial, etc.) and collects data about BMP implementation in three categories: No BMPs, Source Control Certificate, and BMP Certificate. The Source Control Certificate and BMP Certificate designations signify that PSC has been completed for a portion of a particular private property land use and adjusts the characteristic runoff concentrations for that portion of land use in the PLRM accordingly. Additionally, the

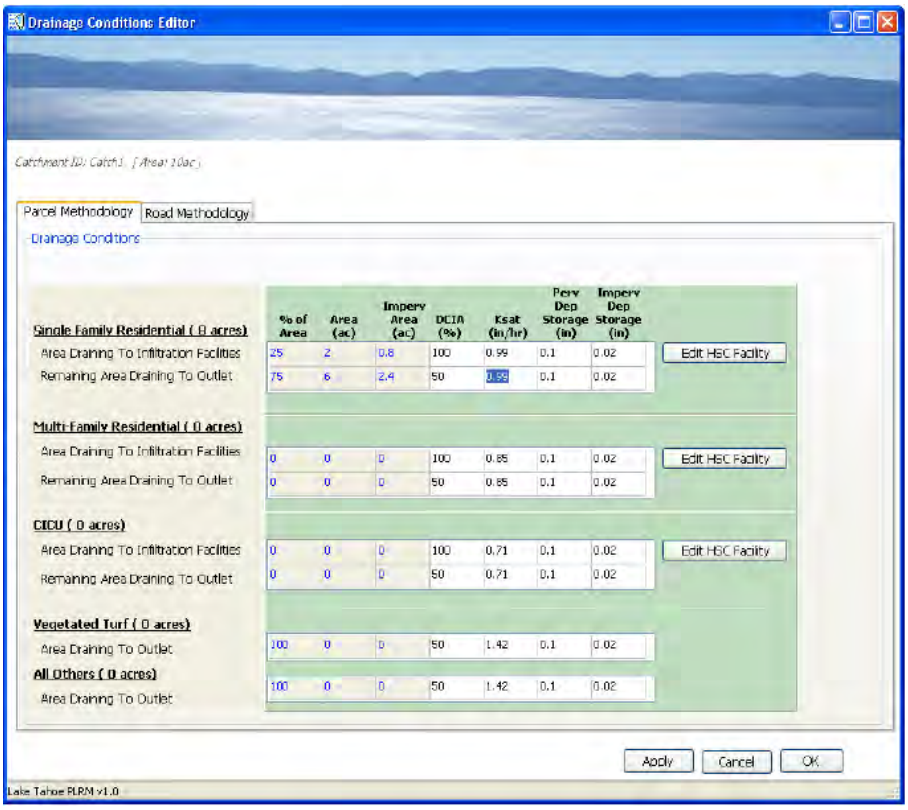
BMP Certificate designation also routes runoff from the impervious area to an infiltration facility sized to the 1-inch storm thus reducing the quantity of runoff in the WQIP. This information is collected per catchment in the WQIP area in order to guide the WQIP design process.

FIGURE 3.1 - LAND USE CONDITIONS EDITOR



Connectivity of private property impervious area is specified per catchment in the PLRM by quantifying the percentage of impervious area that is Directly Connected Impervious Area (%DCIA). Two inputs for private property DCIA are used in the PLRM Drainage Conditions Editor (**Figure 3.2**) to characterize drainage conditions for each private property land use: 1) %DCIA to infiltration facilities (i.e. BMPs); and 2) %DCIA to the outlet. Typically, the %DCIA to infiltration facilities is assigned at 100%, since impervious area in this condition is directly routed to infiltration facilities (i.e. compliance with a BMP Certificate of Completion). The %DCIA draining to outlet is assessed for all impervious area within a private property land use that is not routed to infiltration facilities (i.e. functional BMPs). The percentage of impervious area that is directly connected can significantly affect runoff volumes and pollutant loading in the PLRM (PLRM Manual).

FIGURE 3.2 - DRAINAGE CONDITIONS EDITOR



Utilizing the Rapid Assessment Checklist presented in this section, the necessary private property data for the PLRM can be more accurately collected. The BMP and Source Control Status of a property can be field verified for input into the Land Use Conditions Editor. The DCIA can be accurately delineated in the field for input into the Drainage Conditions Editor.

3.2 GUIDANCE FOR DATA COLLECTION

3.2.1 Introduction

The Rapid Assessment Checklist is intended to be used in the field to rapidly determine if a property has functioning BMPs, if the site has obvious site constraints, and to map out the connectivity of the private impervious areas in a WQIP area. The technicians performing this work should have knowledge of BMPs and the TRPA's BMP Retrofit Program. They should also be experienced (or work with someone who is experienced) with GIS software and map making. It should also be noted that the data collected in this assessment is not intended to substitute for a BMP Certificate of Completion or Source Control Certificate. The TRPA is the only agency that can issue these Certificates.

3.2.2 Presence/Absence of BMPs

The Checklist is intended to be used from the public right of way and only addresses BMPs that are visible from this location which generally includes the largest contributors to stormwater runoff (impervious areas such as driveways, roofs, etc.) and pollutant loading (erosion of bare or compacted soil). The Checklist also guides assessment of the function and ongoing maintenance of the BMPs (**Figure 3.3; Appendix C**).

FIGURE 3.3 - THE RAPID ASSESSMENT CHECKLIST

Rapid Assessment Checklist to determine private property BMP status for the ECAM

Answer each question and follow directions in italics at each private property. Next delineate the impervious area following the directions in bold.

1. Are all pervious areas of the property stabilized from wind and/or water erosion? (i.e. None of the following conditions exist: eroding bare or compacted soil, off pavement vehicular access, poorly vegetated slopes, or eroding bare soil under elevated structures)	Y N
2. Do the impervious areas (roofs, driveways, walkways) have appropriate conveyance and/or infiltration systems to capture necessary stormwater runoff?	Y N
3. Do the BMPs appear to be free of debris and other obvious impediments to their functionality?	Y N

Use this key to determine the property designation based on the answers for questions 1-3.

1.No	1. No	1. No	1. Yes	1. Yes	1. Yes
2.No	2. Yes	2. Yes	2. Yes	2. No	2. Yes
3.No	3. No	3. Yes	3. No	3. No	3. Yes
No BMPs	No BMPs	No BMPs	S. C. Cert.	S.C.Cert.	BMP Cert.

- ***No BMPs*** *should be marked with a red x on the map.*
- ***Source Control Certificate (S.C. Cert.)*** *should be marked with a blue check mark on the map.*
- ***BMP Certificate*** *should be marked with a green check mark on the map.*

4. Do any of the following site characteristics make BMP Retrofit very difficult? Seasonal High Water Table/ Stream Environment Zone (hwt/sez) Slow Soils (Ksat ≤ 1"/hr) (ss) Rocky Soils or Bedrock (rock) Utility Location (util) Retaining wall (rw) Steep Slopes/Cut and Fill Slopes (slope) Property Boundaries (bound) Underground Heating Unit (heat) Other	Y N

- *If yes, note the site constraint abbreviation on map.*

Delineate the connected impervious areas (include compacted bare soil) that are not BMPed by drawing a continuous red line on the Parcel Map and include arrow(s) showing the direction the water is flowing from private properties. The line marks the boundary of the non-BMPed impervious area that drains directly to the right of way. If property drains away from the ROW, draw the line at the ROW.

The input parameters for the PLRM for the presence/absence of BMPs are titled 'No BMPs', 'Source Control Certificate', and 'BMP Certificate' (**Figure 3.1 – Land Use Conditions Editor**). A definition for each category is listed below.

> **No BMPs**: Represents properties that have no, partial, or non-functioning HSC implementation and/or PSC implementation. The property does not infiltrate the 20 year, 1 hour storm event (ie. No, partial, or non-functioning dripline, driveway, walkway, or deck treatments). The property contributes to wind and/or water erosion (ie. bare or compacted soil, off pavement vehicle access, poorly vegetated slopes, bare soil under elevated structures.). It should be noted that a property with this designation could have a BMP Certificate of Completion or Source Control Certificate but have altered or not maintained their BMPs.
>
> **Source Control Certificate**: Represents properties that have completed PSC (all pervious areas of the property are stabilized) but the HSC is not complete due to recognized site constraints (ie. the runoff from the driveway is not infiltrated). These properties have been issued a Source Control Certificate by the TRPA. This is discussed further in Section 3.2.3.
>
> **BMP Certificate**: Represents properties that have fully functioning PSC and HSC implementation to the 20 year, 1 inch per hour standard. All BMPs have been maintained. These properties have been issued a BMP Certificate of Completion from the TRPA.

Proposed updates to the ECAM regarding the presence/absence of private property BMPs include field verifying the presence and functionality of BMPs using the Rapid Assessment Checklist.

3.2.3 Constrained Sites

TRPA Code requires that all property owners implement Best Management Practices (BMPs), including controlling erosion and infiltrating the volume of a 20 year/one hour storm (design storm) on-site. A property may be considered site constrained where physical site characteristics make it impractical or impossible to infiltrate the design storm within the property boundaries. Properties that are considered constrained are still required to implement erosion control BMPs and obtain a Source Control Certificate. Site constraints apply only to small residential scale properties. Recognized constraints are listed in section 3.1.1 and are determined by a qualified BMP site evaluator. When site constraints affect a private property, it is necessary to formulate alternatives to ensure the effectiveness of stormwater treatment facilities. One future alternative may be to work with the TRPA to manage their storm water with an in-lieu fee (**Appendix E**).

During the rapid field assessment of private properties presented in this section as an update to the ECAM process, only some of the causes of the site constraints will be identifiable. An evaluator can typically determine from the right of way if a property is constrained by retaining structures, steep slopes/cut and fill slopes, structures located with no/minimal setback to the public right of way and in some cases it is possible to identify seasonal high water tables/ stream

environment zones, rocky soils or bedrock near grade, and property boundaries. During a rapid assessment from the right of way, without access to the private property or the homeowner, it may not be possible to determine if there are site constraints due to underground heating units, slow soils, bedrock near grade, utility placement, or property boundaries. Therefore, a site constrained property can only be accurately determined by a BMP site evaluator who has access to the private property and the homeowner during a complete site evaluation.

A property that has completed pollutant source control (PSC) (ie. pervious areas of the property are stabilized) but has recognized constraints that do not allow for hydrologic source control (HSC) implementation to meet the standard 20 year storm is issued a Source Control Certificate by the TRPA. These properties may not infiltrate the required stormwater but do reduce characteristic runoff concentrations (CRCs) generated from the property.

If the site constraint is obvious, this updated process records the reason for the specific constraint to assist the WQIP TAC. If the property has completed all of the PSC (no bare soil, driplines infiltrated, etc.) but does not infiltrate the driveway (likely due to the site constraint) and has a Source Control Certificate from the TRPA, the property is given a 'Source Control Complete' designation. If the property does not have PSC measures in place or has not maintained the PSC measures, the property is given a 'No BMPs' designation.

3.2.4 Impervious Area Connectivity

Directly connected impervious area is defined as impervious area draining to conveyance systems via a hydraulic connection. The hydraulic connectivity of impervious area in both the public right of way and on private property contributes to drainage flows and pollutant loads in WQIPs. The implementation of BMPs on private property may have a significant effect on runoff flows and volumes that can be expected to reach public drainage systems and treatment facilities. The percent of area directly connected to the drainage system is the most sensitive input parameter in the PLRM Drainage Conditions Editor and can significantly influence the outputs of the PLRM.

The Checklist (**Figure 3.3**) process enables measurement of the connectivity of impervious areas without BMPs in a WQIP area by using a parcel map with the TMDL Land Use Layer to delineate which sections of impervious areas on private property do not have BMPs and are draining toward the ROW. The properties with functioning HSC implementation should not be included in the connected impervious area assessment because the stormwater is routed to an infiltration system. The delineated map produced through this process can be used to create an accurate GIS map layer to quantify impervious area that does not have functional BMPs in place and is connected with the right of way.

3.2.5 Data Collection Process

Pollutant loads in stormwater are highly variable and difficult to predict with absolute accuracy at particular locations and times. The focus of the PLRM is to make use of the best available Lake Tahoe water quality information to compare the relative performance of WQIP alternatives over the long term. The amount of time allocated for the Rapid Assessment Checklist process should be limited to the time needed to gain confidence that the estimated value is reasonably accurate. Based on NCE's work completed as part of this project, this assessment takes 1-3

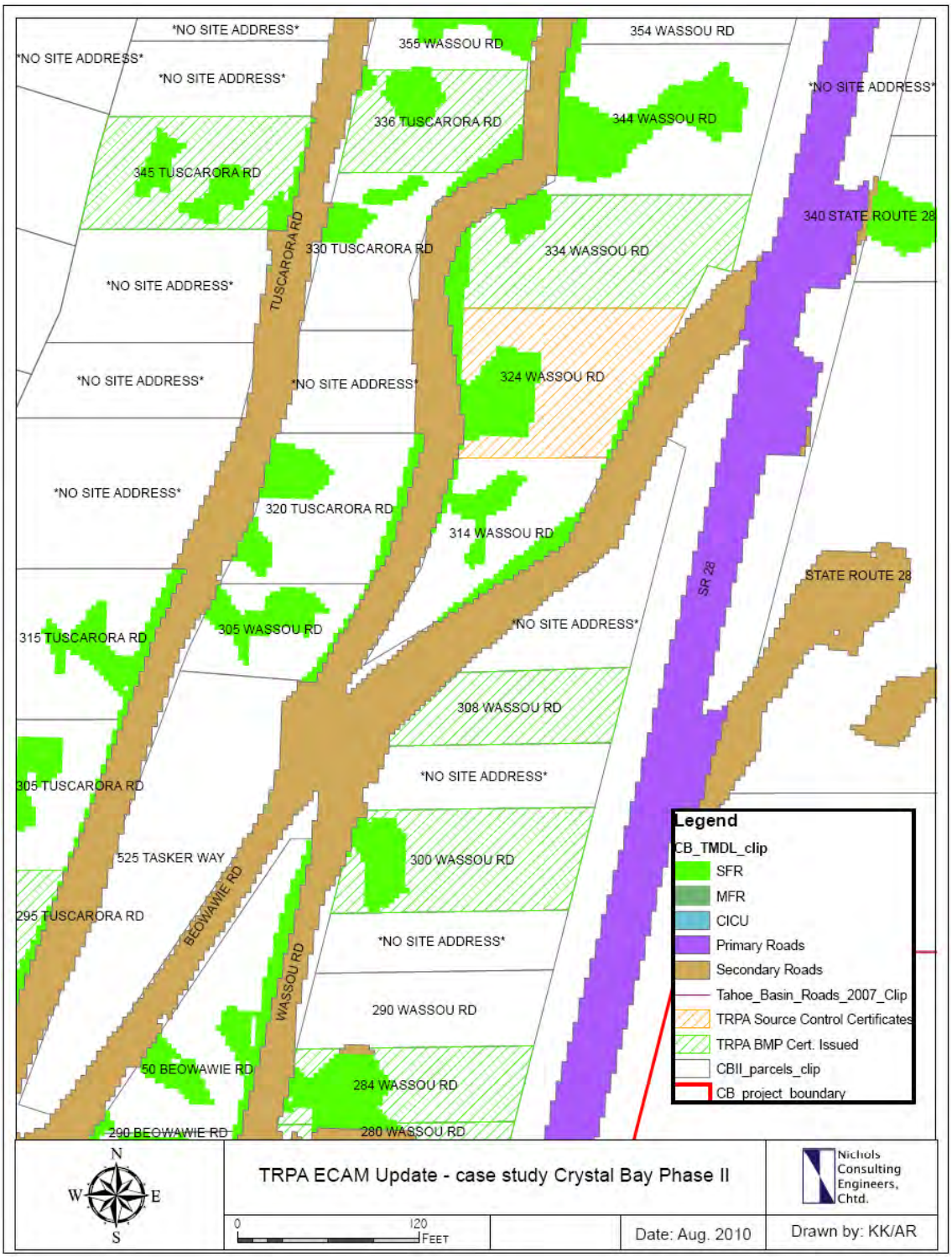
minutes per property. It should be noted that this assessment should be done at the same time as the data collection that is already done for the ECAM in order to save time and money. It is difficult to accurately predict the cost of collecting this data as each WQIP differs in size, parcel density, and the technician's wage. As an example, it took a technician 7.5 hours to collect the field portion of the private property data (independently from the other data collected for the ECAM) in a WQIP area that has 267 parcels (146 built parcels). This equates to 1.7 minutes per parcel (3.1 minutes per built parcel) (**Appendix D**).

The procedure listed below should be followed to prepare for the field work. Once all of the GIS layers are obtained, this process should take less than a day.

OFFICE TASKS

1. Create a GIS map of the WQIP area with the TMDL Land Use Layer and Parcel information layer clipped to the WQIP area. The TMDL Land Use Layer is acquired from the Lahontan website http://www.swrcb.ca.gov/rwqcb6/water_issues/programs/tmdl/lake_tahoe/index.shtml and the parcel layer should be obtained from the County in which the WQIP is located. Label each parcel with the street address. Be sure to use the latest LIDAR remote sensing data.
2. Determine if there are any soils in the WQIP area that would constrain the implementation of BMPs (high groundwater, slow soil, rocky soil, steep slopes, etc.) and include those areas on the map. This information can be obtained through the NRCS Soil Survey at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm .
3. The GIS map should also show which parcels have BMP Certificates of Completion and BMP Source Control Certificates. Contact the TRPA representative for the WQIP to obtain the shape file from their GIS department. Ask for the following fields in the shape file: APN, Cert_Issu1, and dsubstanti. Also request that the Source Control data includes the Site Constraints information check boxes. Allow ample time (minimum of 2-4 weeks) to obtain this shape file. This information may become publicly available through the TRPA website. Once you have received this information, you should create a layer that shows properties with BMP Certificates of Completion and properties that have been issued Source Control Certificates.
4. The map should be printed in color at a scale of around 1:1100. An example field map is shown in **Figure 3.4**. Bring a clip board, camera, red pen, green pen, and blue pen into the field.

FIGURE 3.4 - THE FIELD MAP



FIELD TASKS

1. Walk each road in the WQIP area and look at each developed parcel. Utilize the Checklist (**Figure 3.3**) at each property to determine if the property has functioning BMPs and to determine if the BMPs have been maintained.
2. Use a red pen to mark the parcel with an 'x' if the parcel received a 'no BMPs' designation. Use a blue pen to mark the parcel with a 'v' if the parcel received a 'Source Control Certificate' designation. Use the green pen to mark the parcel with a 'v' if the parcel received a 'BMP Certificate' designation.
3. Use a blue pen to note the type of site constraint on properties that have obvious site constraints. Use the abbreviations listed on the Checklist to identify the type of site constraint (ie. hwt.= high water table, sez = stream environment zone, ss = slow soil, rocky = rocky soil or bedrock near grade, util = utility, rw = retaining wall, slope = steep slope or cut and fill slope, bound. = property boundary).
4. Use a red pen to outline the impervious area of each property without BMPs that drains toward the right of way. Use the Land Use layer to help delineate this area. This is only applicable to properties that have impervious area that does not have functional BMPs in place.

Field Considerations

There are many situations when it is difficult to determine from the right of way if BMPs are in place and functioning on a property. These situations include if the property boundary is difficult to distinguish or if the property is not visible from the right of way. In order to avoid over estimating the baseline pollutant loading from private property, it is recommended that if the technicians can not confirm the BMP status of a property, they give a 'No BMPs' designation to a property that does not have a BMP Certificate of Completion but give a 'BMP Certificate' designation to any property that does have a BMP Certificate of Completion. Additionally, if it is difficult to determine if the impervious area draining toward the ROW has BMPs, the technician should only include the impervious area in the estimate of DCIA if the property does not have a BMP Certificate of Completion.

3.3 DATA ANALYSIS

Note to Reader: This section contains detailed GIS information and is intended for the technician who is preparing the maps and analyzing the data.

In order to determine existing private property BMP conditions in the WQIP area, the BMP presence/absence, source control presence/absence, and site constraint information collected in the field should be used to classify each developed parcel into one of the three categories; No BMPs, Source Control Certificate, and BMP Certificate. This information will be used to create a map that shows the BMP status of the private property in the WQIP area and to calculate the BMP Implementation (% Area of Land Use) for the Land Use Conditions Editor. The impervious area without BMPs delineated in the field that is draining toward the right of way will be used to calculate the %DCIA for the Remaining Area Draining to Outlet for the Drainage Conditions Editor. This process involves knowledge of GIS software and it will likely take a technician a

roughly two days to analyze and write up the data and to create the map and data tables for an average size area and average complexity WQIP.

In order to provide the PLRM with the most useful information, this data needs to be analyzed per catchment in the WQIP area. Catchments are based on topography and represent the area draining into common outlet. It is necessary to clip the private property information to each catchment and run the following data analysis for each catchment. The PLRM will be run for each catchment in order to determine the best WQIP alternatives. In the example used here, the Crystal Bay Phase II WQIP, there is only one catchment (Appendix D).

1. Create a map showing the BMP status of each parcel and calculate the % Area of Land Use

The first step in the data analysis process is to create an accurate GIS layer for the existing field map that shows the field determined BMP classification of each property tied to the APN of the Parcel. To do this, add three fields to the attribute table of the Parcel Layer for the WQIP, 'BMP Status', 'Source Control Status', and 'Site Constraint Type'. Edit the attribute table and input a 'Y' into the BMP Status column of all the properties that were field verified to have functioning BMPs. Do the same for the Source Control Status field. Enter the abbreviation for the site constraint type into the 'Site Constraint Type' field. Using this data, you can create shapefiles that will show which properties in the WQIP area fall under each category. By running the statistics function for each land use (SFR, MFR, CICU, etc.), the total area of the parcels that have BMPs as well as the total area of all that land use within the parcel layer is calculated. By dividing the area that has BMPs complete for each land use by the total area of that land use, the % Area of Land Use for the PLRM Land Use Conditions Editor is determined (**Figure 3.1**). The area that has no BMPs is automatically calculated in the Land Use Conditions editor after the BMP Certificate and the Source Control Certificate percentages are entered.

2. Calculate the impervious area without BMPs draining to right of way

Create a new GIS shapefile to show the area without BMPs draining to the right of way (ROW) using the data collected in the field. Using the field map showing the area draining to the ROW, draw a polygon on the map for the impervious area of each parcel without BMPs that drains toward the ROW. Tie each polygon to the APN of the parcel by adding an APN field in the attributes table. By summarizing the area of each polygon that drains to the ROW, the total acres draining to the ROW can be calculated.

Note that the PLRM requires input of impervious area draining to the catchment outlet, and not the ROW. The intermediate step outlined above is recommended because the ROW is commonly the conveyance system for private property runoff to the catchment outlet. Furthermore, a WQIP may modify or create drainage systems in the ROW, which can influence the runoff characteristics of private property after a WQIP is constructed. The next step describes how to estimate the impervious area connectivity of a private property land use to the catchment outlet based on the connectivity of the ROW to the outlet.

3. Calculate the Directly Connected Impervious Area (%DCIA)

The %DCIA draining to outlet is calculated by summing the delineated impervious private property without BMPs that is connected to the ROW (calculated in the previous step) and then

summing the total impervious area of each private property land use from the TMDL land use layer. This area can be calculated by clipping the TMDL land use layer to the parcel layer in the WQIP area. In the attribute table of the clipped TMDL land use layer, add a new field titled 'area' and calculate the geometry of the TMDL land use layer. Summarize the land use with the area field and this provides the total impervious area within private property. The land use layer is not completely accurate as it is difficult to delineate impervious area from aerial photographs and infrared technology. Additionally, in some cases, land use is misclassified (ie. a SFR is classified as a secondary road, etc.) and new construction is not included. By including the impervious secondary road area with each impervious land use area measurement within a parcel boundary, a more accurate total private impervious area is obtained.

In order to calculate the %DCIA draining to infiltration facilities, use the shapefile that shows which parcels have field verified BMPs complete and clip the TMDL Land Use layer to these parcels. Add an 'area' field to the attribute table of this shapefile and calculate the geometry of the impervious area within parcel boundaries. Summarize the land use field with the area field to obtain the impervious area with BMPs for each land use.

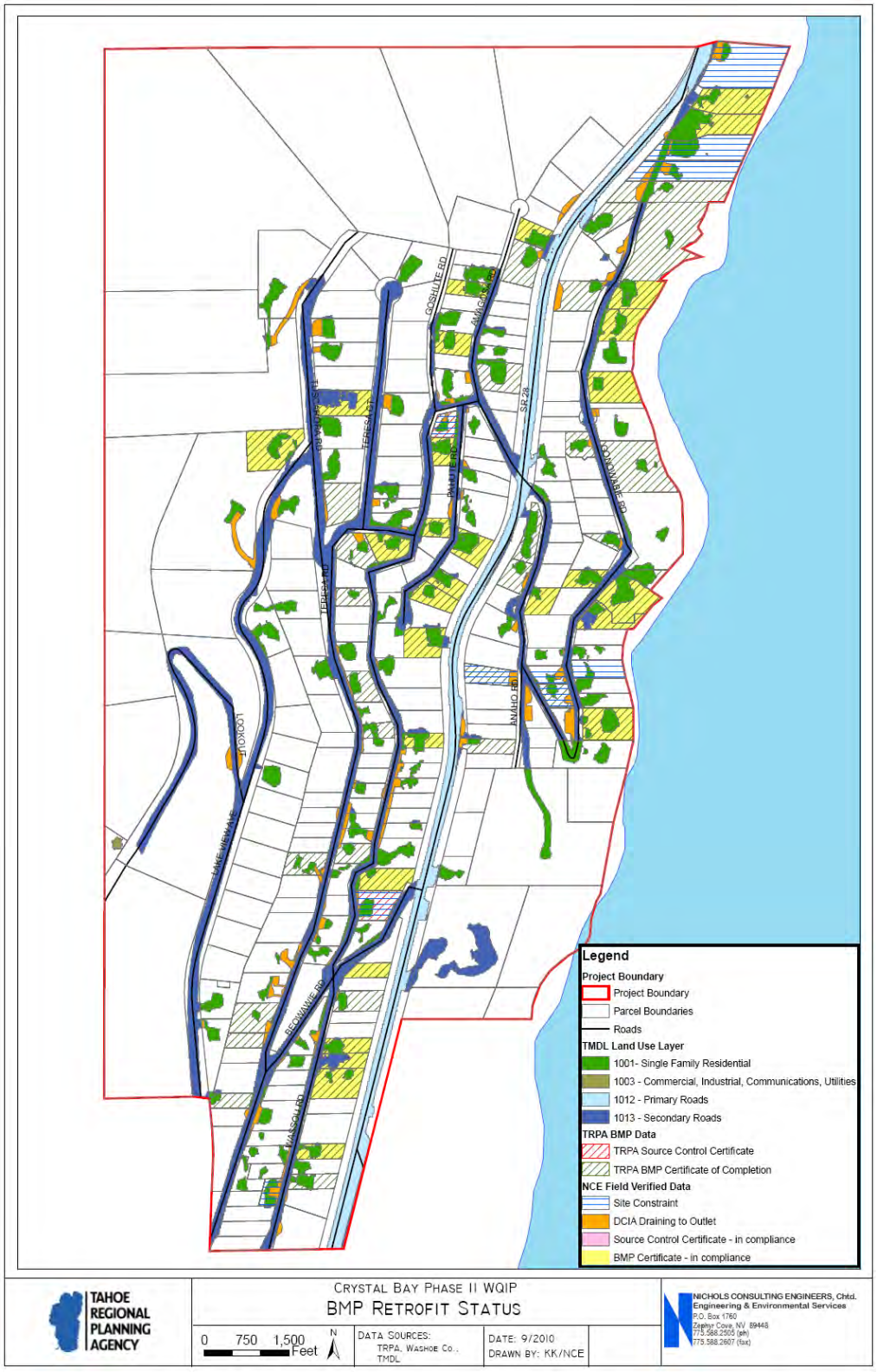
The %DCIA Draining to Infiltration Facilities is 100% for properties with BMPs because by definition, all stormwater from these properties is already directed to an existing infiltration system. For the Crystal Bay example shown in **Figure 3.5**, there are 2.1 acres of impervious area with BMPs (this includes all secondary road impervious area) within parcel boundaries and 100% of this area is directed to an existing infiltration system.

The %DCIA draining to outlet is calculated by subtracting the total impervious area already routed to infiltration facilities (ie. area with BMPs) from the total impervious area within that land use. This result is the denominator for the %DCIA draining to outlet. The %DCIA is the impervious area without BMPs draining to ROW (delineated in the field) divided by total impervious area less the area with BMP Certificates. This estimate is then multiplied by the estimate of impervious area connectivity for the ROW in the catchment (%DCIA of ROW) to estimate the %DCIA of the land use to the catchment outlet.

$$\%\text{DCIA to outlet} = \frac{\text{DCIA Draining to ROW}}{\text{Impervious Area} - \text{Impervious Area Routed to Infiltration Facilities}} \times \%\text{DCIA of ROW}$$

In the Crystal Bay Phase II WQIP example shown in **Figure 3.5**, there are 10.3 total impervious SFR acres and 2.1 of the acres have a BMP Certificate designation (are already routed to infiltration facilities). By subtracting 2.1 from 10.3, the denominator (8.2 acres) for the %DCIA draining to outlet is calculated. There are 1.55 acres of impervious, private property without BMPs (orange polygons) that drain toward the ROW (this includes all secondary road impervious area within parcel boundaries). The ROW receiving the SFR runoff is considered directly connected to the outlet in this example (i.e. %DCIA of ROW = 1.0). There may be portions of the SFR runoff which is indirectly connected to the outlet but given the relatively low amount of DCIA in the project area and to be conservative for this example it is all considered directly connected. Therefore, by dividing 1.55 by 8.2, the %DCIA draining to outlet is calculated as 19% for this WQIP area. The remaining 81% drains away from the right of way and is considered indirectly connected.

FIGURE 3.5 - FINAL MAP



4.) Create Data Tables

The last step in the data analysis process is to summarize the private property BMP data for the ECAM. This information can be shown by creating five data tables titled WQIP Parcel and Area Overview (**Table 3.1**), Private Property BMP and Source Control Data (**Table 3.2**), Private Property BMP Site Constraint Data (**Table 3.3**), Private Property Connectivity Data (**Table 3.4**), and PLRM Parcel Methodology Inputs (**Table 3.5**). These tables provide the TAC with consistent and easy access to the raw data to aid in their decision making process.

The WQIP Parcel and Area Overview Table shows the number of parcels for each land use in the WQIP area as well as the total area for each land use. The number and size of each catchment is also shown. An example is shown in **Table 3.1- WQIP Parcel and Area Overview**. This information is determined using GIS.

Note to Reader: The following tables are suggested templates to ensure consistent presentation of the data. The template will be provided with the TRPA Guidance Document so each user does not have to recreate them and will be publicly available on the TRPA website.

TABLE 3.1 - WQIP PARCEL AND AREA OVERVIEW

Description	Number	Area (Acres)
Project Area		145
Total Parcels	267	131.3
Developed Parcels	146	53.3
Single Family Residential Parcels	*144*	*53*
Multi Family Residential Parcels	*0*	*0*
Commercial, Industrial, Communications, Utilities Parcels	*2*	*0.3*
Undeveloped (Vacant) Parcels	101	78
County Right of Way		13.7
Number of Catchments in Project Area	1	145

The second table includes all of the private property BMP and Source Control Data for each land use (See example in **Table 3.2 - Private Property BMP and Source Control Data**). This table shows the number and area of developed parcels, the number and area of built parcels with field verified BMPs complete, the number and area of parcels with a TRPA BMP Certificate of Completion (in compliance and out of compliance), the number and area of properties without a BMP Certificate of Completion, the PLRM Land Use Editor inputs, the number and area of Source Control Certificates from the TRPA database (in compliance and out of compliance), and the PLRM Land Use Editor inputs for Source Control Certificates. This table should be created for each catchment in the WQIP area.

TABLE 3.2 - PRIVATE PROPERTY BMP AND SOURCE CONTROL DATA

SFR - Single Family Residential	Parcels	% Developed Parcels	Area (Acres)	% Area (Acres)
Developed Parcels	144	100%	53	100%
TRPA BMP Certificates of Completion (Database)	56	39%	15.8	30%
TRPA BMP Certificates of Completion - In Compliance (Field)	*29*	*20%*	*7.9*	*15%*
TRPA BMP Certificates of Completion - Out of Compliance (Field)	*27*	*19%*	*7.9*	*15%*
No TRPA BMP Certificate of Completion	88	61%	37.2	70%
PLRM Input - Land Use Editor (BMP Certificate)	**-**	**-**	**7.9**	**15%**
PLRM Input - Land Use Editor (No BMPs)	**-**	**-**	**45.1**	**85%**
TRPA Source Control Certificates (Database)	2	1.40%	0.4	0.80%
TRPA Source Control Certificates - In Compliance (Field)	*0*	*0%*	*0%*	*0.00%*
TRPA Source Control Certificates - Out of Compliance (Field)	*2*	*1.40%*	*0.4*	*0.80%*
PLRM Input - Land Use Editor (Source Control Certificate)	**-**	**-**	**0%**	**0.00%**

MFR - Multi Family Residential	Parcels	% Developed Parcels	Area (Acres)	% Area (Acres)
Developed Parcels	0	100%	0.00	100%
TRPA BMP Certificates of Completion (Database)	0	0%	-	-
TRPA BMP Certificates of Completion - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA BMP Certificates of Completion - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
No TRPA BMP Certificate of Completion	0	0%	0	0%
PLRM Input - Land Use Editor (BMP Certificate)	**-**	**-**	**0**	**0%**
PLRM Input - Land Use Editor (No BMPs)	**-**	**-**	**0**	**0%**
TRPA Source Control Certificates (Database)	0	0%	0	0%
TRPA Source Control Certificates - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA Source Control Certificates - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
PLRM Input - Land Use Editor (Source Control Certificate)	**-**	**-**	**0**	**0%**

CICU - Commercial, Industrial, Communications, Utilities	Parcels	Developed Parcels	Area (Acres)	% Area (Acres)
Developed Parcels	2	100%	0.3	100%
TRPA BMP Certificates of Completion (Database)	0	0%	-	-
TRPA BMP Certificates of Completion - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA BMP Certificates of Completion - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
No TRPA BMP Certificate of Completion	2	100%	0.3	100%
PLRM Input - Land Use Editor (BMP Certificate)	**-**	**-**	**0**	**0%**
PLRM Input - Land Use Editor (No BMPs)	**-**	**-**	**0.3**	**100%**
TRPA Source Control Certificates (Database)	0	0%	0	0%
TRPA Source Control Certificates - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA Source Control Certificates - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
PLRM Input - Land Use Editor (Source Control Certificate)	**-**	**-**	**0**	**0%**

A table should also be created to show all of the site constraint information in the WQIP area (**Table 3.3 - Private Property BMP Site Constraint Data**). This table includes a total number of site constrained parcels as well as the totals for each type of site constraint.

TABLE 3.3 - PRIVATE PROPERTY BMP SITE CONSTRAINT DATA

Site Constraint Type	Parcels
Property Boundary	1
Retaining Wall and Slope	2
Retaining Wall, Slope, and Rocky Soil	1
Slope	2
Slope and Utility Placement	1
Slope and Rocky Soil	1
Other - TRPA Determined, Type Not Noted	2
Total Parcels with a Site Constraint	**10**

The fourth table (**Table 3.4 - Private Property Connectivity Data**) includes data for each land use on the total acres of impervious area within built parcels, total acres of impervious area within built parcels with BMPs, total acres of impervious area directly connected to the ROW without BMPs, total acres of impervious area not directly connected without BMPs, %DCIA Area Draining to Infiltration Facilities, and %DCIA Remaining Area Draining to Outlet. This table should also be created per catchment.

TABLE 3.4 - PRIVATE PROPERTY CONNECTIVITY DATA

SFR - Single Family Residential	Area (Acres)	% Area (Acres)
TMDL Impervious Area	10.3	100%
TMDL Impervious Area - BMP Certificate of Completion (Draining to Infiltration Facilities)	2.1	20%
TMDL Impervious Area - No BMPs (Connected - Draining to Outlet)	1.55	15%
TMDL Impervious Area - No BMPs (Not Connected)	6.65	65%
PLRM Input - Drainage Conditions Editor - %DCIA (Draining to Infiltration Facilities)	**2.1**	**100%**
PLRM Input - Drainage Conditions Editor - %DCIA (Draining to Outlet)	**1.55**	**19%**
%DCIA (Not Draining to Outlet)	**6.65**	**81%**

MFR - Multi Family Residential	Area (Acres)	% Area (Acres)
TMDL Impervious Area	0	0%
TMDL Impervious Area - BMP Certificate of Completion (Draining to Infiltration Facilities)	0	0%
TMDL Impervious Area - No BMPs (Connected - Draining to Outlet)	0	0%
TMDL Impervious Area - No BMPs (Not Connected)	0	0%
PLRM Input - Drainage Conditions Editor - %DCIA (Draining to Infiltration Facilities)	**0**	**0%**
PLRM Input - Drainage Conditions Editor - %DCIA (Draining to Outlet)	**0**	**0%**
%DCIA (Not Draining to Outlet)	**0**	**0%**

CICU - Commercial, Industrial, Communications, Utilities	Area (Acres)	% Area (Acres)
TMDL Impervious Area	0.086	100%
TMDL Impervious Area - BMP Certificate of Completion (Draining to Infiltration Facilities)	0	0%
TMDL Impervious Area - No BMPs (Connected - Draining to Outlet)	0.06	70%
TMDL Impervious Area - No BMPs (Not Connected)	0.026	30%
PLRM Input - Drainage Conditions Editor - %DCIA (Draining to Infiltration Facilities)	**0**	**0%**
PLRM Input - Drainage Conditions Editor - %DCIA (Draining to Outlet)	**0.06**	**70%**
%DCIA (Not Draining to Outlet)	**0.026**	**30%**

The final table summarizes all of the private property PLRM inputs for the technician running the PLRM (**Table 3.5 - PLRM Parcel Methodology Inputs**). Table 3.5 contains the PLRM parcel methodology data from Tables 3.1 and 3.4 for direct input into the Land Use Conditions Editor and the Drainage Conditions Editor.

TABLE 3.5 - PLRM PARCEL METHODOLOGY INPUTS

LAND USE CONDITIONS EDITOR – BMP IMPLEMENTATION (% AREA OF LAND USE)

Parcel Type	No BMPs	Source Control Certificate	BMP Certificate
Single Family Residential	85%	0%	15%
Multi Family Residential	0%	0%	0%
CICU	100%	0%	0%

DRAINAGE CONDITIONS EDITOR – %DCIA

Single Family Residential	
Area Draining to Infiltration Facilities	100%
Remaining Area Draining to Outlet	19%
Multi Family Residential	
Area Draining to Infiltration Facilities	0%
Remaining Area Draining to Outlet	0%
CICU	
Area Draining to Infiltration Facilities	0%
Remaining Area Draining to Outlet	70%

Note to Reader: The information presented in Table 3.5 is intended as a quick reference tool for the PLRM modeler.

3.4 PLRM DATA ANALYSIS

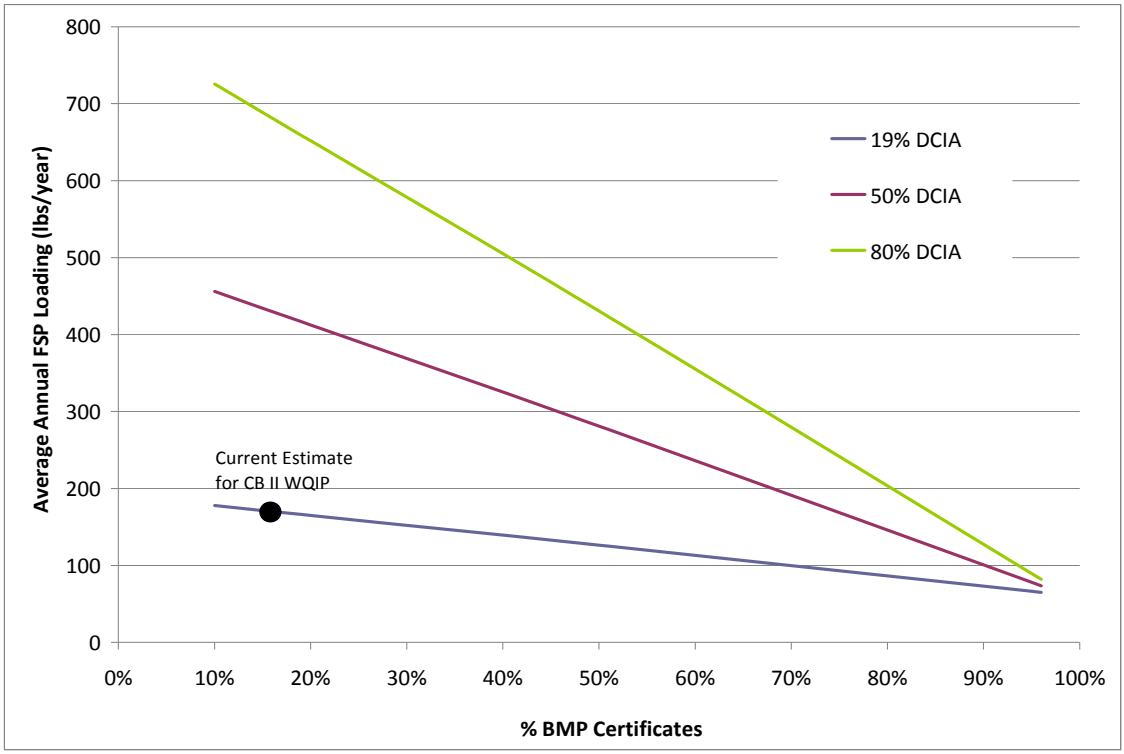
Figure 3.6 illustrates the benefits of utilizing the Rapid Assessment process described in this section to collect private property BMP information. The more accurate BMP data allows for more accurate assessment of pollutant loading in PLRM and this information can help determine the best use of limited WQIP resources**. Figure 3.6** displays the PLRM output for Fine Sediment Particle loading (lbs/year) for a Single Family Residential land use. The FSP loading varies based on the % of BMP Certificates (% land use area) for three different conditions of %DCIA. **Figure 3.6** is based on the impervious area for the Single Family Residential land use in the Crystal Bay Phase II WQIP Area, and results shown in **Figure 3.6** would be different for other WQIP areas.

Note to Reader: The following narrative is only applicable to the Crystal Bay Phase II WQIP and should not be used to make any assumptions about private property BMPs in other WQIP areas.

The amount of impervious area which is directly connected within the Single Family Residential land use in Crystal Bay Phase II is estimated at 19%. As shown in the figure, if 10% of the SFR land use was in compliance with their BMP Certificates, the Average Annual Fine Sediment Pollutant (FSP) Load would be roughly 180 lbs/yr. If 96% of the SFR land use was in compliance

with their BMP Certificates, the Average Annual Fine Sediment Pollutant Load is projected to be roughly 65 lbs/yr. For Crystal Bay Phase II, the 115 lbs/yr load reduction with an 86% increase in BMP Certificates is marginal due to the low %DCIA (19%) and low overall impervious area within the WQIP. A TAC may conclude that this WQIP area may not be a cost effective area to target private property BMP Compliance. If this area had a higher %DCIA, the load reduction would be more considerable with increasing BMP Compliance. For example, if the %DCIA was 50% there would be an average annual FSP load reduction of 382 lbs/yr if the area went from 10% to 96% BMP Compliance. Furthermore, if the %DCIA was 80% there would be an average annual FSP load reduction of 644 lbs/yr if the area went from 10% to 96% BMP Compliance. This evaluation demonstrates how assessments of private property conditions and BMP compliance in a WQIP area can be used to inform the TAC and to identify the significance of pollutant sources within a WQIP.

FIGURE 3.6 - AVERAGE ANNUAL FINE SEDIMENT POLLUTANT LOADING BY % BMP CERTIFICATES FOR 19%, 50%, AND 80% DCIA IN CRYSTAL BAY PHASE II WQIP



3.5 PRESENTING THE DATA

The proposed updates to the ECAM for private property BMPs include:

- BMP presence/absence and functionality as well as Source Control presence/absence will be field verified using the Rapid Assessment Checklist vs. based on TRPA issued BMP Certificates of Completion and Source Control Certificates which over time may no longer represent functioning BMPs due to alteration and lack of maintenance. This data should be obtained during routine ECAM data collection for cost effectiveness.

- The location and reason for obviously constrained properties will be presented in the ECAM because stormwater and pollutants from these properties will not be able to be infiltrated on the property.
- Private property BMP information will be presented per catchment to provide the TAC with data specific to each WQIP treatment.
- The directly connected impervious area draining to outlet will be delineated in the field and will accurately represent those properties without BMPs and draining toward the right of way.
- It is recommended that the ECAM include five data tables per catchment presenting the private property BMP information. These include a WQIP Parcel and Area Overview Table, a Private Property BMP and Source Control Data Table, a Private Property BMP Site Constraint Data Table, a Private Property Connectivity Data Table, and a PLRM Parcel Methodology Inputs Table. These tables present all private property BMP data that will be input into the PLRM and will help the TAC to decide on the WQIP design alternatives.
- The data collected though this process will help determine the most efficient way to implement the BMP Retrofit Program by providing accurate inputs to the PLRM to quantify the pollutant load reduction with increasing BMP Certificates. This information will help the TRPA and Conservation Districts determine which areas they should target for BMP implementation. If the WQIP area has low DCIA and a small amount of impervious area, achieving load reductions through BMP implementation will be minimized and a WQIP TAC may determine other strategies are more effective. If the WQIP area has a high DCIA and a lot of impervious area, private property BMP implementation will dramatically reduce pollutant loading and thus the WQIP area should be a target for private property BMP Retrofit compliance.

This information should be incorporated into Section 2.1.4 of the ECAM, Private Property BMP Retrofit Status. Any opportunities and constraints relevant to Private Property BMPs should be incorporated into Section 6 of the ECAM.

4.0 GENERAL GUIDANCE RELATED TO PRIVATE PROPERTY BMPS

Within the FEA process, the identification and development of strong opportunities and constraints is essential to form the basis for formulating alternatives that are specific to the conditions of the project area. Emphasis should be placed on interpreting information collected for private property conditions to inform the TAC on the relative benefit that private property improvements may have on pollutant load reductions within the project area. This private property information may highlight the need for a comprehensive project that incorporates both public and private runoff.

4.0 REFERENCES

California Tahoe Conservancy November 2008. Interim Guidance Paper for Formulating and Evaluating Alternatives Tahoe Basin Water Quality Improvement Programs. California Tahoe Conservancy, South Lake Tahoe, CA.

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APPENDIX A: POLLUTANT LOADING ASSESSMENT FOR FIRE DEFENSIBLE SPACE PRACTICES

POLLUTANT LOADING ASSESSMENT FOR FIRE DEFENSIBLE SPACE PRACTICES

1.0 Background and Purpose

Implementation of fire defensible space practices is recommended for all homeowners in the Lake Tahoe Basin to reduce the potential for wildfire damage in developed areas. Fire defensible space practices are measures that minimize or eliminate flammable material in proximity to a structure. Examples of fire defensible space practices include removal of dead shrubs and trees, removal of pine needles, and preferential planting with less flammable vegetation. Current guidelines for implementing fire defensible space practices (Smith et al., 2008) may be compatible with water quality objectives for parcel-scale BMP implementation (Cobourn, 2008). However, minimal technical research has been conducted in the Tahoe Basin to assess the effect of fire defensible practices on water quality.

The objectives of this document are to: 1) assess the capabilities for the Water Erosion Prediction Project (WEPP) model to estimate pollutant loading from a range of fire defensible space practices at the parcel-scale; 2) outline recommendations for developing this functionality within WEPP to provide a tool for Tahoe Basin resource managers; and 3) develop a set of recommendations outlining the steps to augment the Pollutant Load Reduction Model (PLRM) to estimate pollutant loading from variable land use conditions for pervious areas, including fire defensible space practices.

2.0 Using WEPP to Assess Pollutant Loading for Tahoe Basin Fire Defensible Space Practices

2.1 Tahoe Basin Context

WEPP is a process-based model simulating soil detachment, deposition, transport, and delivery through hillslope, channel, and structural impoundments within a watershed (Flanagan and Nearing, 1995). WEPP can be used to perform continuous simulations to estimate sediment yield for various particle size classes. Given these capabilities, WEPP has been targeted by Tahoe Basin resource managers as a modeling tool to assist with planning and implementation of the Lake Tahoe TMDL. Research is currently being conducted to develop applications of WEPP that can be applied to specific situations and management conditions in forested areas of the Tahoe Basin (Brooks, 2010). There are two primary areas of research and development for WEPP applications specific to the Tahoe Basin:

1. Development of a Tahoe Database for WEPP Windows: WEPP Windows is the complete desktop version of the modeling program, which provides the user with broad flexibility to simulate complicated or unique applications of land surface erosion. The Tahoe Database is a specific set of input files for WEPP Windows, which is under development to provide many of the necessary inputs to run a simulation that represents Tahoe Basin conditions (e.g. Tahoe Basin climate, soils, and vegetation management files).

2. Development of the Tahoe Basin Sediment Model: The Tahoe Basin Sediment Model is a web-based application of the WEPP program developed to model specific forest conditions and forest management actions (e.g., low traffic forest road, high traffic forest road, bare soil, etc.). The Tahoe Basin Sediment Model constrains WEPP inputs accessible to the user to simplify and target the application of the tool. Additionally, the Tahoe Basin Sediment Model has a maximum of two Overland Flow Elements that can be simulated using WEPP. This approach decreases the complexity for performing a simulation, which broadens the potential use of the

tool and also reduces the potential for misapplication. However, this approach also limits the flexibility and applicability of the tool. Research is ongoing to expand the capabilities of the Tahoe Basin Sediment Model to include additional management actions. For example, research is being conducted to develop an application to estimate pollutant loading from various fuels reduction management practices (Traeumer, 2008).

2.2 Informing WEPP to Simulate Fire Defensible Space Practices in the Tahoe Basin

While WEPP was not developed as an urban stormwater tool, its capabilities might be applicable at a parcel-scale to estimate pollutant loading from various land surface conditions in the urban environment, including conditions influenced by fire defensible space practices.

Below is a discussion of key input parameters, or sets of inputs, which would need development and parameterization to simulate fire defensible space practices using WEPP. The discussion is divided between inputs that pertain to the simulation of runoff (hydrology) and sediment yield (water quality). Due to ongoing research and development, some of the key input parameters for WEPP have already been developed for the Tahoe Basin and are not discussed here (e.g., climate files).

1. Hydrology: WEPP uses a form of the Green-Ampt equation to simulate infiltration. Where the most sensitive input parameter for the Green-Ampt equation is effective saturated hydraulic conductivity (Ksat). Presently, minimal research and data exists that links soil conditions modified by development in the Tahoe Basin to Ksat. Because the assessment of fire defensible space practices would analyze developed portions of the Basin, impacts from urbanization could markedly influence and vary hydrologic properties of soil (e.g., effects of soil compaction). To reasonably estimate runoff under variable soil hydrologic conditions in WEPP, which is necessary to reasonably estimate pollutant loading, research would be needed to develop a range of Ksat estimates (or average values) for soil conditions that have been modified by development.

   A secondary input to the Green-Ampt equation influencing estimates of total runoff is depression storage. In some fire defensible space practices, hydrologic soil conditions can be modified significantly (e.g. pine needle duff layer vs. bare soil). This variability will affect estimates of depression storage that are input to the model. Literature sources could be consulted to link depression storage to various hydrologic soil conditions to reasonably inform the Green-Ampt equation.

2. Water Quality: WEPP uses a number of parameters to simulate sediment detachment, transport, and deposition. Most of the parameterization necessary to represent fire defensible space practices for water quality would be developed as specific vegetative management files in WEPP. Vegetative management files would need to be linked to specific definitions of land surface conditions. Additionally, some level of calibration and validation would be recommended at the parcel-scale to refine and calibrate the representation of sediment yield from each fire defensible space practice. This assessment may need to consider the effects of other factors such as soil type and slope.

2.3 Recommendations for Developing a Defensible Space Tool for WEPP

The following provides a set of general recommendations for developing a WEPP-based tool to predict the effects of variable fire defensible space practices in the Tahoe Basin. It should be noted that recommendations have been developed based on a broad overview of the technical capabilities of WEPP. If TRPA or another entity decides to fund the development of a tool for this purpose, WEPP developers should be consulted to refine and improve upon these recommendations to develop a specific scope of work.

1. Define a range of hydrologic soil conditions that have been modified by development in the Tahoe Basin (e.g. highly compacted to undisturbed). Additionally, define the characteristics of each land surface condition as it relates to a specific fire defensible space practice.

2. Conduct research to estimate a range of Ksat values, or an average Ksat, for each hydrologic soil condition modified by development.

3. Develop WEPP soil and vegetation management files to represent each hydrologic soil condition and land surface condition.

4. Using existing rainfall-runoff-sediment yield data, or data collected through additional research, refine WEPP input files to reasonably correlate with monitored results for each hydrologic soil condition and land surface condition.

5. Expand the Tahoe Basin Sediment Model to include prediction of sediment yield and runoff yield at the hillslope scale for specific hydrologic soil conditions and land surface conditions that relate to a particular fire defensible space practice.

3.0 Development of a Defensible Space Algorithm for PLRM

The PLRM is a land use based urban stormwater runoff model for the Lake Tahoe Basin. The PLRM applies process-based algorithms to estimate runoff (Green-Ampt equation) and empirical algorithms for water quality (assigns a characteristic runoff concentration to each land use). Assuming a WEPP tool was developed to estimate sediment yield from various fire defensible space practices, the results of WEPP simulations could be used to develop an algorithm for the PLRM.

Development of an algorithm of fire defensible space practices in PLRM would allow pollutants generated from pervious land surfaces to be routed through urban drainage systems, which could include infiltration facilities or stormwater treatment facilities. This functionality in PLRM allows for an assessment pollutant yield at the outfall of an urban catchment after runoff is routed through an urban drainage system.

The proposed approach would use current PLRM algorithms to simulate hydrology and surface runoff, while relying on WEPP output to estimate characteristic runoff concentrations. The approach below was formulated to represent fire defensible space practices, but it is more broadly applicable as a PLRM algorithm to define and vary any land use conditions for pervious land uses.

1. In PLRM, the Land Use Conditions Editor would be expanded to include a new methodology that allows a user to specify multiple land use conditions for a land use (e.g., Single Family Residential, Multi-Family Residential, and CICU). Land use conditions could include categories for fire defensible space practices, private property BMPs, bare compacted soil, etc.

2. To inform the water quality component of the PLRM algorithm for fire defensible space practices, a range of WEPP outputs for average annual sediment yield and surface runoff could be developed that vary with: 1) Tahoe Basin soil type – potentially generalized to granitic or volcanic, 2) slope, and 3) climate region in the Tahoe Basin.
    a. Sediment yield and surface runoff from WEPP output would be presumed to reach an urban drainage system.

3. The results of #2 above could be integrated as lookup tables in the PLRM database, which would assign a characteristic runoff concentration to the specific land use condition based on: 1) Tahoe Basin soil type – potentially generalized to granitic or volcanic, 2) slope, and 3) climate region in the Tahoe Basin.
    a. The characteristic runoff concentrations would be calculated from WEPP output as sediment yield divided by surface runoff.
    b. Note that PLRM already requires inputs of Tahoe Basin soil type, slope, and climate region.

4. Also in PLRM, the Drainage Conditions Editor would be modified to allow a user to specify the hydrologic soil condition for the land use impacted by development.
    a. Based on the specification by the user of hydrologic soil condition, the same Ksat value and depression storage used by WEPP to calculate surface runoff would be assigned in PLRM for that land use.
    b. Note that both WEPP and PLRM use the Green-Ampt equation to simulate infiltration. Under the proposed approach, the PLRM should simulate infiltration in a very similar manner to WEPP because it would use the same algorithm and the same value for Ksat and depression storage.

5. A PLRM continuous simulation would run to estimate pollutant generation for the land use conditions specified by the user. This approach would allow PLRM to estimate the timing of pollutant load generation and continuously route pollutant loads through an urban drainage system, which can be important for simulation of stormwater treatment performance.

References

Brooks, Erin. 2010. Tahoe WEPP Workshop. Training Workshop Materials for the Application of the WEPP Windows, GeoWEPP and WEPP-UI Watershed Model to the Tahoe Basin. June 16-17, 2010.

Cobourn, John. 2008. Combine Defensible Space and Best Management Practices (BMPs). Fact Sheet 08-26. Prepared by the University of Nevada Cooperative Extension

Flanagan, D.C., and M.A. Nearing. 1995. USDA-Water Erosion Prediction Project: Hillslope Profile and Watershed Model Documentation. NSERL Rep. 10. USDA-ARS Natl. Soil Erosion Res. Lab., West Lafayette, IN.

Smith, E., et al. 2008. Living with Fire: A Guide for the Homeowner. Lake Tahoe Basin. Second Edition. Prepared by the University of Nevada Cooperative Extension.

Traeumer, D., et al. 2008. Nutrient and Sediment Loading Predictions for Prescribed Fire Using an Optimized WEPP Model. Research Proposal submitted for Southern Nevada Public Management Land Act (SNPLMA) funding.

APPENDIX B: PLRM INPUT TEMPLATE

Field	Description
PLRM Project Name:	Coon Drainage
Project Description	Project areas associated with the Kings Beach Watershed Improvement Project
Urban Planning Catchment (UPC):	Placer County #31
Additional UPC in Urban Area?:	No
PLRM Met Grid Number:	532
PLRM Database Version Used:	v15.2
Planning Documents Used:	n/a
Dates of Field Inspections:	August 2009
Initals of inspector(s)	BW, MG
Name of PLRM Scenario:	2004 Existing Coon
Scenario Description:	Baseline conditions PLRM estimate using 2004 as base year
Number of Catchments in Scenario:	1
Number of SWTs in Scenario:	1

Complete a quick schematic of the Scenario here using the available icons below. Copy icons as needed in box that constitutes the Scenario included in this spreadsheet (e.g. multiple catchments).

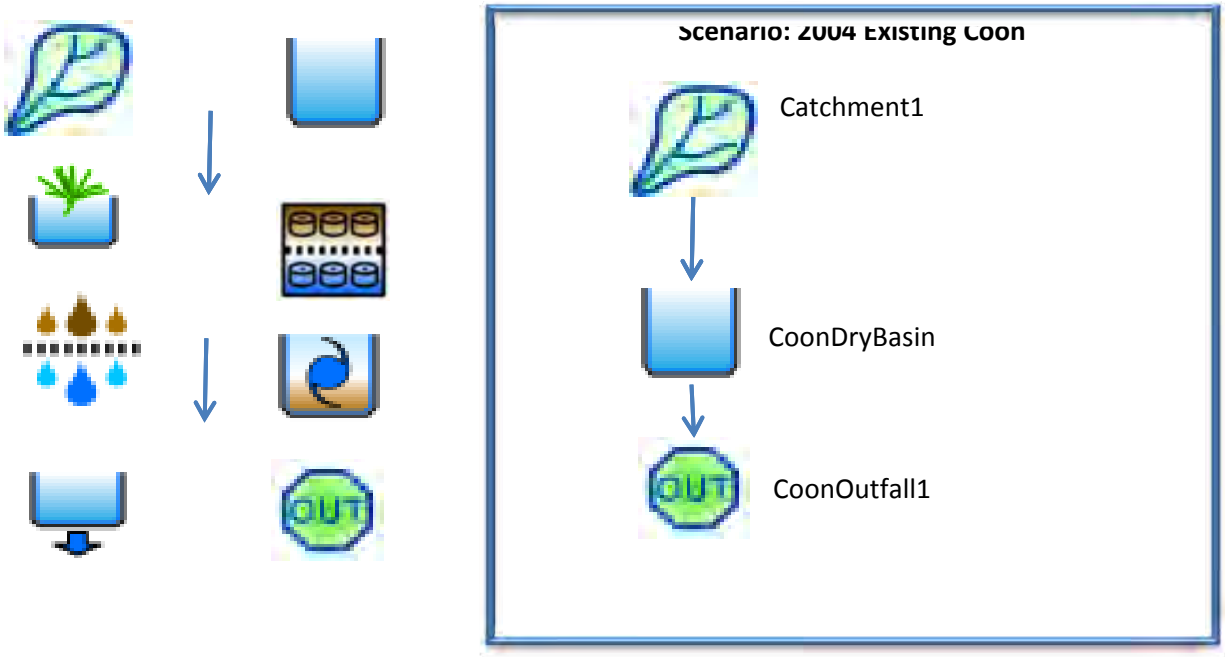


Table 1: Catchment ID and Routing	Description
Name:	Catchment1
Description:	The only catchment in existing conditions
Outfall Name	CoonDryBasin
Type of Outfall (SWT, Outlet, Junction, or Diversion)?	SWT
If SWT, what type?	Dry Basin

Table 2: Catchment Properties	Value
Area (Acres)	20.0
Average Slope (% as whole number)	2%

Table 3: Land Uses Present	% of Catchment	% Impervious for Land Use	Area (acres)
Primary Roads	5%	90%	1.0
Secondary Roads	15%	80%	3.0
Single Family Residential	40%	40%	8.0
Multi Family Residential	20%	50%	4.0
CICU	5%	60%	1.0
Vegetated Turf	5%	0%	1.0
Erosion Potential 1	15%	0%	3.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Check (should be 100%):	100%	n/a	20.0

Table 4: Soils Present (list Map Unit number)	% of Catchment as Whole Number
7462	28%
7533	72%
Check (should be 100%):	100%

Table 5a: Primary Road Conditions	% of Land Use (Whole Number)	Road Abrasive Application Strategy	Road Shoulder Conditions (Percent as whole number)				Type of Sweeper	Sweeping Strategy
			Erodible	Protected Only	Stabilized Only	Protected and Stabilized		
High Road Risk	50%	Moderate	0%			100%	Broom	1-2 times
Moderate Road Risk	50%	Moderate	50%			50%	Broom	1-2 times
Low Road Risk	0%	Moderate	100%				Broom	1-2 times
Check (should be 100%):	100%							

Table 5b: Secondary Road Conditions	% of Land Use (Whole Number)	Road Abrasive Application Strategy	Road Shoulder Conditions (Percent as whole number)				Type of Sweeper	Sweeping Strategy
			Erodible	Protected Only	Stabilized Only	Protected and Stabilized		
High Road Risk	20%	Min	100%				Broom	1-2 times
Moderate Road Risk	35%	Min	100%				Broom	1-2 times
Low Road Risk	45%	None	100%				Broom	1-2 times
Check (should be 100%):	100%							

Table 6: Parcel Methodology (Private BMPs)	BMP Implementation (% Area)			Notes on BMP Implementation Decision
	No BMPs	Source Control Certification	BMP Certification	
Single Family Residential	93%	0%	7%	Standard assumptions for baseline condition
Multi Family Residential	81%	0%	19%	
CICU	95%	0%	5%	
Vegetated Turf	100%	0%	0%	

Table 7: Drainage Area by Land Use	% of Area	Area (acres)	Impervious Area (acres)	DCIA (%)	Ksat of Drainage Area (in/hr)	Ksat of HSC (in/hr)	Notes on Connectivity Decisions
Primary Roads							
To Infiltration Facility		0.0	0.0	100%	default	0.5	
To Pervious Dispersion Area		0.0	0.0	100%	default	default	
To Outlet	100%	1.0	0.9	90%	default	-	
Secondary Roads							
To Infiltration Facility		0.0	0.0	100%	default	0.5	
To Pervious Dispersion Area		0.0	0.0	100%	default	default	
To Outlet	100%	3.0	2.4	90%	default	-	
Single Family Residential							
To Infiltration Facility	7%	0.6	0.2	100%	default	0.5	
To Outlet	93%	7.4	3.0	50%	default	-	
Multi Family Residential							
To Infiltration Facility	19%	0.8	0.4	100%	default	0.5	
To Outlet	81%	3.2	1.6	70%	default	-	
CICU							
To Infiltration Facility	5%	0.1	0.0	100%	default	0.5	
To Outlet	95%	1.0	0.6	70%	default	-	
Vegetated Turf							
To Outlet	100%	1.0	0.0	-	default	-	
All Other Land Uses							
To Outlet	100%	3.0	0.0	-	default	-	

Additional Notes to Reviewer:

First SWT by type

Dry Basin 1	Description
Name:	CoonDryBasin
Description:	Existing dry basin constructed from previous project
Outlet Name	CoonOutfall1
Type of Outlet (SWT, Outfall, Junction, or Diversion)?	Outfall
Is outlet another SWT, if so what type?	
Design Parameters	
Water Quality Volume (CF)	5,000
Footprint (SF)	2,500
Infiltration Rate (in/hr)	0.30
Brim Full Draw Down Time (hrs)	72

APPENDIX C: RAPID ASSESSMENT CHECKLIST

Rapid Assessment Checklist to determine private property BMP status for the ECAM

Answer each question and follow directions in italics at each private property. Next delineate the impervious area following the directions in bold.

1. Are all pervious areas of the property stabilized from wind and/or water erosion? (i.e. None of the following conditions exist: eroding bare or compacted soil, off pavement vehicular access, poorly vegetated slopes, or eroding bare soil under elevated structures)	**Y**☐ **N**☐
2. Do the impervious areas (roofs, driveways, walkways) have appropriate conveyance and/or infiltration systems to capture necessary stormwater runoff?	**Y**☐ **N**☐
3. Do the BMPs appear to be free of debris and other obvious impediments to their functionality?	**Y**☐ **N**☐

Use this key to determine the property designation based on the answers for questions 1-3.

1.No	1. No	1. No	1. Yes	1. Yes	1. Yes
2.No	2. Yes	2. Yes	2. Yes	2. No	2. Yes
3.No	3. No	3. Yes	3. No	3. No	3. Yes
No BMPs	No BMPs	No BMPs	S. C. Cert.	S.C.Cert.	BMP Cert.

- ***No BMPs*** *should be marked with a red x on the map.*
- ***Source Control Certificate (S.C. Cert.)*** *should be marked with a blue check mark on the map.*
- ***BMP Certificate*** *should be marked with a green check mark on the map.*

4. Do any of the following site characteristics make BMP Retrofit very difficult? Seasonal High Water Table/ Stream Environment Zone (hwt/sez) Slow Soils (Ksat ≤ 1"/hr) (ss) Rocky Soils or Bedrock (rock) Utility Location (util) Retaining wall (rw) Steep Slopes/Cut and Fill Slopes (slope) Property Boundaries (bound) Underground Heating Unit (heat) Other	**Y**☐ **N**☐

- *If yes, note the site constraint abbreviation on map.*

Delineate the connected impervious areas (include compacted bare soil) that are not BMPed by drawing a continuous red line on the Parcel Map and include arrow(s) showing the direction the water is flowing from private properties. The line marks the boundary of the non-BMPed impervious area that drains directly to the right of way. If property drains away from the ROW, draw the line at the ROW.

APPENDIX D: CRYSTAL BAY PHASE II WQIP ECAM ADDENDUM

CRYSTAL BAY PHASE II WATER QUALITY IMPROVEMENT PROJECT (WQIP)

2.1.4 PRIVATE PROPERTY

BMP Retrofit Status

The Best Management Practices (BMP) Retrofit Program represents the primary private sector contribution to the Environmental Improvement Program. The TRPA's BMP Retrofit Program requires the implementation of BMPs in order to infiltrate the 20-year, one-hour storm event. All properties within TRPA Priority 1 Watersheds, including the Crystal Bay Phase II WQIP area, were required to implement their BMPs by October 15, 2000. Once BMPs are properly installed, the property receives a BMP Certificate of Completion. Properties that have completed all erosion control measures but have site constraints that make BMP Retrofit very difficult to implement, in terms of stormwater capture and infiltration, receive a TRPA Source Control Certificate. The Crystal Bay Phase II WQIP area contains 267 total parcels and 146 developed parcels made up of 144 single family residential parcels and 2 commercial, industrial, communications, and utilities parcels. There are no multi family residential parcels in this project area. The areas listed in **Table 1 – Project Parcel and Area Overview** differ slightly from the areas listed previously in the Crystal Bay Phase II WQIP ECAM since parcels have been developed, ownership has changed, and parcel boundaries have been adjusted during the past 3 years.

Table 1 – Project Parcel and Area Overview

Description	Number	Area (Acres)
Project Area		145
Total Parcels	267	131.3
Developed Parcels	146	53.3
Single Family Residential Parcels	*144*	*53*
Multi Family Residential Parcels	*0*	*0*
Commercial, Industrial, Communications, Utilities Parcels	*2*	*0.3*
Undeveloped (Vacant) Parcels	101	78
County Right of Way		13.7

According to the TRPA BMP Database as of September 2010, 56 (39%) of the 144 developed single family residential parcels within the project area have received a BMP Certificate of Completion and 2 (1%) of the 144 developed single family residential parcels within the project area have received a Source Control Certificate. According to the TRPA BMP Database as of September 2010, 0 (0%) of the 2 developed commercial parcels within the project area have received a BMP Certificate of Completion or a Source Control Certificate.

Private property BMP data is collected per catchment in order to provide the most useful data for the Pollutant Load Reduction Model (PLRM). The Crystal Bay Phase II WQIP area, for the purposes of this effort, consists of one PLRM catchment. The condition of the private property BMPs is determined through visual field inspections conducted from the County right of way. The condition of the BMPs varies throughout the catchment from functioning properly and well maintained to not functioning.

During the NCE field investigation on September 13, 2010, 29 of the 56 parcels with BMP Certificates of Completion were identified as being in compliance with their BMP Certificates of Completion (15% of the area comprising developed single family residential parcels in the

catchment) and no parcels were identified as being in compliance with their Source Control Certificates **(Table 2 - Private Property BMP and Source Control Data and Figure 2.4 – BMP Retrofit Status)**. It should be noted that the TRPA is the only agency that can issue or revoke a BMP Certificate of Completion or Source Control Certificate.

Table 2 - Private Property BMP and Source Control Data

SFR - Single Family Residential	Parcels	% Developed Parcels	Area (Acres)	% Area (Acres)
Developed Parcels	144	100%	53	100%
TRPA BMP Certificates of Completion (Database)	56	39%	15.8	30%
TRPA BMP Certificates of Completion - In Compliance (Field)	*29*	*20%*	*7.9*	*15%*
TRPA BMP Certificates of Completion - Out of Compliance (Field)	*27*	*19%*	*7.9*	*15%*
No TRPA BMP Certificate of Completion	88	61%	37.2	70%
PLRM Input - Land Use Editor (BMP Certificate)	**-**	**-**	**7.9**	**15%**
PLRM Input - Land Use Editor (No BMPs)	**-**	**-**	**45.1**	**85%**
TRPA Source Control Certificates (Database)	2	1.40%	0.4	0.80%
TRPA Source Control Certificates - In Compliance (Field)	*0*	*0%*	*0%*	*0.00%*
TRPA Source Control Certificates - Out of Compliance (Field)	*2*	*1.40%*	*0.4*	*0.80%*
PLRM Input - Land Use Editor (Source Control Certificate)	**-**	**-**	**0%**	**0.00%**

MFR - Multi Family Residential	Parcels	% Developed Parcels	Area (Acres)	% Area (Acres)
Developed Parcels	0	100%	0.00	100%
TRPA BMP Certificates of Completion (Database)	0	0%	-	-
TRPA BMP Certificates of Completion - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA BMP Certificates of Completion - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
No TRPA BMP Certificate of Completion	0	0%	0	0%
PLRM Input - Land Use Editor (BMP Certificate)	**-**	**-**	**0**	**0%**
PLRM Input - Land Use Editor (No BMPs)	**-**	**-**	**0**	**0%**
TRPA Source Control Certificates (Database)	0	0%	0	0%
TRPA Source Control Certificates - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA Source Control Certificates - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
PLRM Input - Land Use Editor (Source Control Certificate)	**-**	**-**	**0**	**0%**

CICU - Commercial, Industrial, Communications, Utilities	Parcels	% Developed Parcels	Area (Acres)	% Area (Acres)
Developed Parcels	2	100%	0.3	100%
TRPA BMP Certificates of Completion (Database)	0	0%	-	-
TRPA BMP Certificates of Completion - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA BMP Certificates of Completion - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
No TRPA BMP Certificate of Completion	2	100%	0.3	100%
PLRM Input - Land Use Editor (BMP Certificate)	**-**	**-**	**0**	**0%**
PLRM Input - Land Use Editor (No BMPs)	**-**	**-**	**0.3**	**100%**
TRPA Source Control Certificates (Database)	0	0%	0	0%
TRPA Source Control Certificates - In Compliance (Field)	*0*	*0%*	*0*	*0%*
TRPA Source Control Certificates - Out of Compliance (Field)	*0*	*0%*	*0*	*0%*
PLRM Input - Land Use Editor (Source Control Certificate)	**-**	**-**	**0**	**0%**

BMP Constrained Sites

Properties that have completed all erosion control measures but have site constraints that make BMP Retrofit very difficult to implement, in terms of stormwater capture and infiltration, receive a TRPA Source Control Certificate. Examples of site constraints include, seasonal high water tables, stream environment zones, slow soils (Ksat ≤ 1"/hr), rocky soils, bedrock near grade, utility placement, retaining structures, steep slopes, cut and fill slopes, property boundaries, underground heating units, and structures located with no/minimal setback to the public right of way.

Ten parcels (8 field identified and 2 from the TRPA BMP Database) were determined to have a site constraint that makes the implementation of BMPs very difficult **(Table 3 - Private Property BMP Site Constraint Data).** There are likely more constrained properties that could not be easily identified from the County right of way. At least 10 parcels within the project area will not be able to fully implement their BMPs due to site constraints; therefore, the highest possible level of private property BMP Retrofit Program compliance is 93% (136 out of 146 developed parcels).

Table 3 - Private Property BMP Site Constraint Data

Site Constraint Type	Parcels
Property Boundary	1
Retaining Wall and Slope	2
Retaining Wall, Slope, and Rocky Soil	1
Slope	2
Slope and Utility Placement	1
Slope and Rocky Soil	1
Other - TRPA Determined, Type Not Noted	2
Total Parcels with a Site Constraint	**10**

Private Property Connectivity

Connectivity of private property impervious area is specified in the PLRM by quantifying the percentage of impervious area that is Directly Connected Impervious Area (%DCIA). Two inputs for private property DCIA are used in the PLRM to characterize drainage conditions for each private property land use: 1) %DCIA to infiltration facilities (i.e. BMPs); and 2) %DCIA to the outlet. Typically, the %DCIA to infiltration facilities is 100%, since impervious area in this condition is directly routed to infiltration facilities (i.e. compliance with a BMP Certificate of Completion). The Directly Connected Impervious Area (DCIA) draining to outlet includes the impervious area within private property land use that does not have BMPs implemented, or functional BMPs, and is directly connected to the County right of way and, assumedly the outlet. This information is summarized in **Table 4 - Private Property Connectivity Data**. The low amount of DCIA will be an important consideration in the development of project alternatives.

The impervious area draining to infiltration facilities was calculated by totaling the TMDL impervious area for all parcels with field verified BMP Certificates of Completion by land use. The %DCIA for the area draining to infiltration facilities is 100%, since the impervious area draining to infiltration facilities equals the total impervious area for the parcels.

The remaining area draining to outlet was calculated by totaling the area delineated in the field of impervious area draining to the right of way where BMPs did not exist, or were not functioning in the field. The %DCIA for the remaining area draining to outlet is calculated using the below equation.

$$\%\text{DCIA to Outlet} = \frac{\text{DCIA Draining to Outlet}}{\text{Impervious Area} - \text{Impervious Area with Field Verified BMP Certificates}}$$

Table 4 - Private Property Connectivity Data

SFR - Single Family Residential	Area (Acres)	% Area (Acres)
TMDL Impervious Area	10.3	100%
TMDL Impervious Area - BMP Certificate of Completion (Draining to Infiltration Facilities)	2.1	20%
TMDL Impervious Area - No BMPs (Connected - Draining to Outlet)	1.55	15%
TMDL Impervious Area - No BMPs (Not Connected)	6.65	65%
PLRM Input - Drainage Conditions Editor - DCIA (Draining to Infiltration Facilities)	**2.1**	**100%**
PLRM Input - Drainage Conditions Editor - DCIA (Draining to Outlet)	**1.55**	**19%**

MFR - Multi Family Residential	Area (Acres)	% Area (Acres)
TMDL Impervious Area	0	0%
TMDL Impervious Area - BMP Certificate of Completion (Draining to Infiltration Facilities)	0	0%
TMDL Impervious Area - No BMPs (Connected - Draining to Outlet)	0	0%
TMDL Impervious Area - No BMPs (Not Connected)	0	0%
PLRM Input - Drainage Conditions Editor - DCIA (Draining to Infiltration Facilities)	**0**	**0%**
PLRM Input - Drainage Conditions Editor - DCIA (Draining to Outlet)	**0**	**0%**

CICU - Commercial, Industrial, Communications, Utilities	Area (Acres)	% Area (Acres)
TMDL Impervious Area	0.086	100%
TMDL Impervious Area - BMP Certificate of Completion (Draining to Infiltration Facilities)	0	0%
TMDL Impervious Area - No BMPs (Connected - Draining to Outlet)	0.06	70%
TMDL Impervious Area - No BMPs (Not Connected)	0.026	30%
PLRM Input - Drainage Conditions Editor - DCIA (Draining to Infiltration Facilities)	**0**	**0%**
PLRM Input - Drainage Conditions Editor - DCIA (Draining to Outlet)	**0.06**	**70%**

PLRM Parcel Methodology Inputs

Table 5 – PLRM Parcel Methodology Inputs lists all of the PLRM parcel methodology inputs for the Land Use Conditions Editor and the Drainage Conditions Editor. This information was presented in the previous tables, but is summarized here for direct inputting.

Table 5 – PLRM Parcel Methodology Inputs

Land Use Conditions Editor – BMP Implementation (% Area of Land Use)

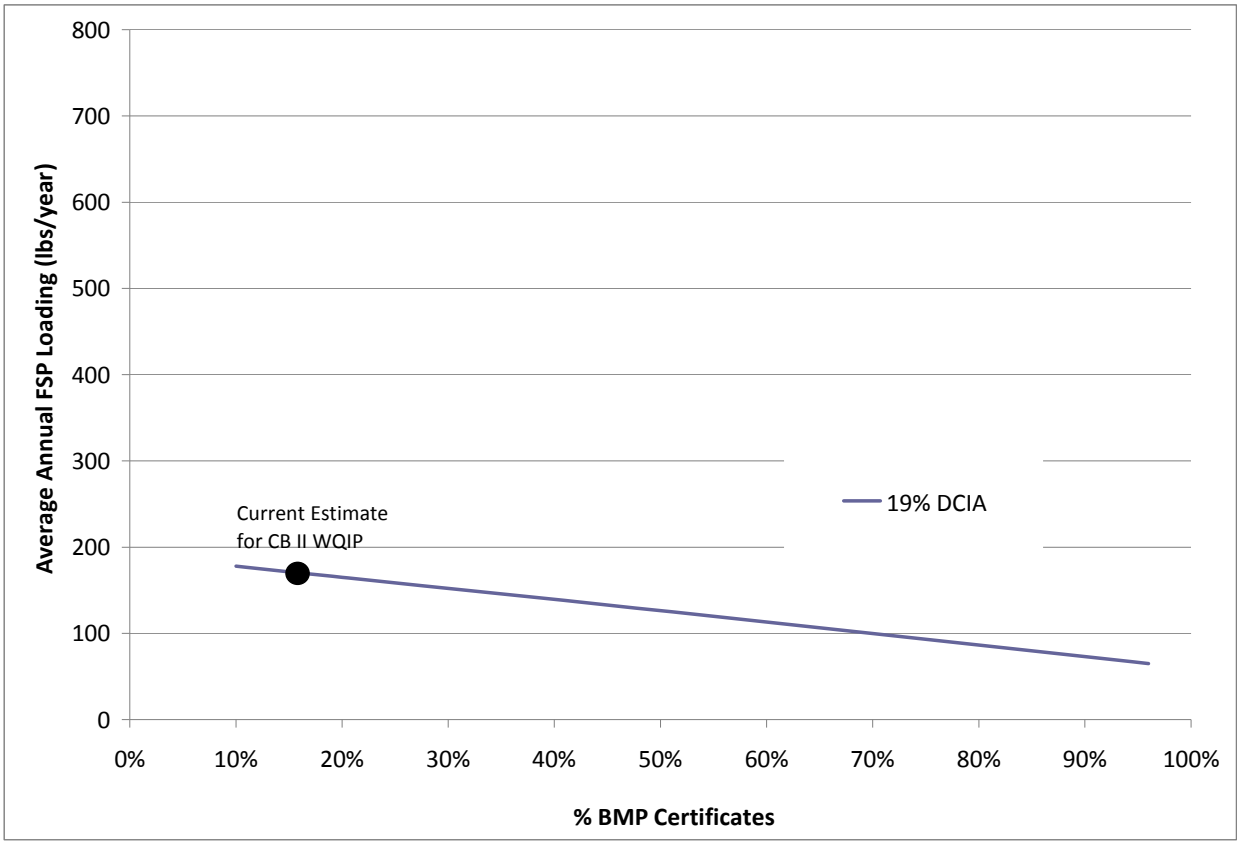
Parcel Type	No BMPs	Source Control Certificate	BMP Certificate
Single Family Residential	85%	0%	15%
Multi Family Residential	0%	0%	0%
CICU	100%	0%	0%

Drainage Conditions Editor – DCIA%

Single Family Residential	
Area Draining to Infiltration Facilities	100%
Remaining Area Draining to Outlet	19%
Multi Family Residential	
Area Draining to Infiltration Facilities	0%
Remaining Area Draining to Outlet	0%
CICU	
Area Draining to Infiltration Facilities	0%
Remaining Area Draining to Outlet	70%

The following graph (Graph 2.4) illustrates the Fine Sediment Pollutant Load (lbs/year) by % BMP Certificates (% land use area) for 19% DCIA as exists in the Crystal Bay Phase II WQIP area. The current estimate of BMP Compliance by % area of land use is 15% which results in an average annual fine sediment pollutant load of 171.3 lbs/year for this project area. If 96% of the single family residential land use was in compliance with their BMP Certificates, the Average Annual Fine Sediment Pollutant (FSP) Load is projected to be 65.04 lbs/yr. This results in a FSP load reduction of only 106.26 lbs/yr for an increase of 81% in BMP Certificate compliance. For Crystal Bay Phase II WQIP, the load reduction that would result in increasing BMP Certificates is minimal because of the low %DCIA (19%) and low impervious area within the project area. This indicates that this project area may not be a cost effective area to target private property BMP compliance.

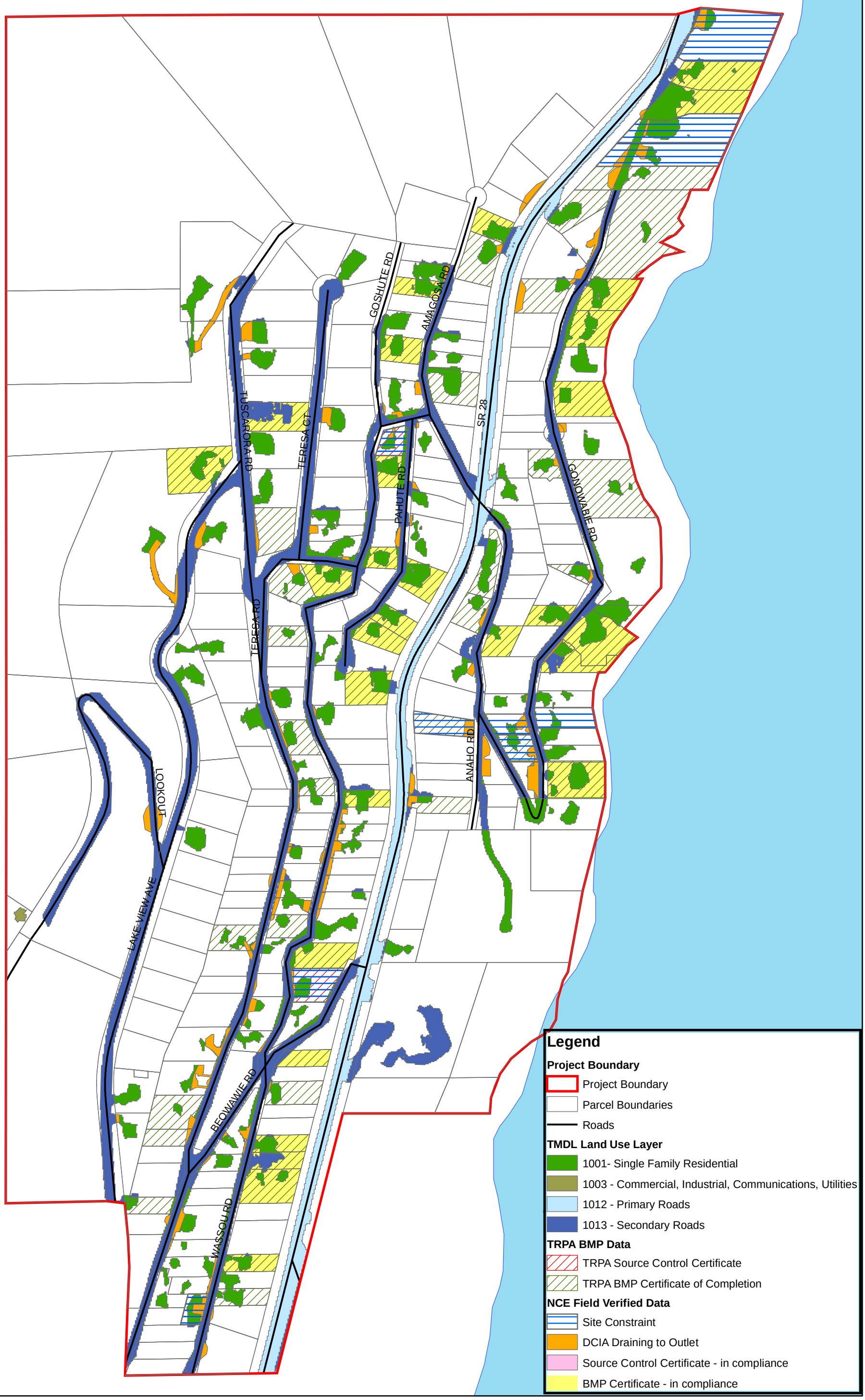
Graph 2.4 - Average Annual Fine Sediment Pollutant Loading by % BMP Certificates for SFR Parcels in the Crystal Bay Phase II WQIP



6.0 OPPORTUNITIES AND CONSTRAINTS

Note: *The below items are additional opportunities and constraints to be included with Section 6.0 of the Crystal Bay Phase II WQIP ECAM.*

- **Private Property Directly Connected Impervious Area -** Of the 53 acres of developed parcels, only 10.3 acres (19%) are impervious area. Only 1.55 acres of the impervious area (15%) and of the developed parcel area (3%) is directly connected to the County right of way.
- **Private Property BMPs** – Only 20% of developed parcels (15% of developed parcel area) have BMP Certificates of Completion that are in compliance per field verification.
- **Private Property Site Constraints** - Only 10 private properties have obvious site constraints making BMP Retrofit very difficult. There are likely more constrained properties in this project area that were not easily identified from the County right of way. Based on the field assessment, at least 10 parcels within the project area will not be able to fully implement their BMPs due to site constraints; therefore, the highest possible level of private property BMP Retrofit Program compliance is 93% (136 out of 146 developed parcels).
- **Pollutant Load Reduction** – Due to the project area having a relatively low total impervious area for the single family residential land use, and relatively low impervious area that is directly connected, the implementation of private property BMPs within the project area may not have a significant impact on reducing pollutant loading (refer to Graph 2.4).



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Crystal Bay Phase II WQIP
BMP Retrofit Status

0 750 1,500 Feet

N

Data Sources: TRPA, Washoe Co., TMDL

Date: 9/2010
Drawn by: KK/NCE

Figure: 2.4

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APPENDIX E: IN-LIEU FEE DEVELOPMENT ALTERNATIVES

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In-Lieu Fee Development Alternatives

Background

Pursuant to Chapter 25 of the TRPA Code of Ordinances ("BMP Retrofit Program"), all developed parcels, both public and privately owned, are required to install Best Management Practices (BMPs) onsite for the protection or restoration of water quality. The standard BMP requirements outlined in Section 25.5 of the TRPA code include achieving a discharge standard as well as a stormwater infiltration requirement.

In order to meet stormwater quality regulations including TMDL requirements, local jurisdictions design and install Water Quality Improvement Projects (WQIPs) for public parcels, roadways and rights-of-way. Many private properties have not yet installed BMPs; stormwater from private parcels without BMPs enters the public system, often substantially adding to the installation and maintenance costs of the WQIP.

TRPA Code of Ordinances (Chapter 25.7) permits the approval of alternative BMPs in special circumstances. Special circumstances may include, but not be limited to, streets, highways, and bike trails, existence of high ground water table, unusual up stream or downstream flow conditions, proximity to drinking water sources, and presence of unusual concentrations of pollutants. The TRPA Code of Ordinances leaves room to analyze local conditions and take a flexible approach to stormwater treatment.

Retrofitting developed properties with erosion and stormwater BMPs occasionally presents design problems. When a site is already developed, the design of BMPs must consider existing conditions and avoid potential problems with existing structures and neighbors. Site constraints that make it difficult to design and install of parcel-level infiltration and treatment BMPs include features such as rock outcrops, engineered retaining walls, high ground water, steep slopes, structures, trees and tree roots, and underground utilities. These situations often render on-site infiltration infeasible or cost prohibitive relative to the water quality benefit.

Local jurisdictions need alternative funding opportunities to meet TMDL targets and to pay for operations and maintenance costs. Installation of stormwater treatment and infiltration BMPs which treat both public and private stormwater and are financed in part through stormwater fees is one alternative that could assist private property owners meet their obligation to meet Chapter 25

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requirements as well as provide a funding source for local jurisdictions looking to maintain their WQIPs.

The purpose of this section is to:

1) Outline issues that need some thought and resolution prior to implementing a project-based user in-lieu fee system, and
2) Provide example calculations in an excel spreadsheet format for generating user fees for private parcels draining to and within a WQIP area in-lieu of on-site BMP implementation.

Addressing Private Parcel Issues

BMP Certificates

The BMP Retrofit Program has been operating since 1998, before any stormwater fee implementation in the Tahoe Basin. Properties with BMP Certificates of Completion are scattered throughout the Tahoe Basin. In the following Excel tables, alternatives are provided that account for properties that have received a BMP Certificate by giving credit for their on-site improvements.

Private Parcel BMP Maintenance

If BMP Certificates of Completion qualify a property for a reduction in a stormwater mitigation fee charges, then maintenance of these on-site water quality improvements is critical. Chapter 25 of the BMP Retrofit ordinance requires BMPs to be maintained. It is the responsibility of the parcel owner to maintain these improvements; however, the local jurisdictions will be obtaining TMDL credits for these pollutant reductions due to private parcel BMPs. An organized system of follow up will be needed to ensure private parcel BMPs are maintained.

BMP Retrofit Enforcement

In areas where a stormwater fee is developed, TRPA BMP Retrofit Program may initiate enforcement activities. Clear communication to the public as to which options are available to them is critical. BMP Retrofit Program enforcement is a tool in stormwater fee areas to encourage landowners to make their choice as to which system they would prefer to participate in.

Capacities of Jurisdictional Projects to Accept and Treat Private Runoff

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Whether or not a WQIP can accept and treat private runoff in addition to right-of-way runoff is important to determine prior to implementing a stormwater fee. County and city public works engineers can verify this with design information and any monitoring data they have for existing projects. For new or proposed projects, the existing conditions analysis will include an evaluation of the projects potential to collect and treat private run-off. The use of the Pollutant Load Reduction Model will also show estimated pollutant load reductions with or without on-site private BMP implementation.

Sediment Source (Erosion) Control on Properties Paying Stormwater Fees

Even though properties may pay into a stormwater fee, these properties still have the opportunity provide water quality benefits by installing erosion/sediment controls onsite per TRPA Code of Ordinances Chapter 25. Infiltration of stormwater may be the only waived requirement under a stormwater fee. This condition should be disclosed to the public during discourse and outreach.

Example Excel Spreadsheets

The following Excel tables are for example purposes and hypothetical only. They provide a rational starting point for developing an in-lieu fee schedule for a project area based on one-time and/or ongoing annual fees for capital and maintenance costs.

The calculation methods and input numbers below are only conceptual and can be updated and modified to suit the specific jurisdiction and project area and to create an equitable fee structure. For example, any necessary administrative fees may be included in the total estimated capital and maintenance costs, or added as a separate item. Private contribution may be calculated by equally distributing all design, construction, materials, mobilization, and other costs among all public and private participants. Alternately, private contribution costs may be calculated based on just the cost of adding additional capacity to a project. This second method reduces costs for the private parcel owner, and places the most of the burden of design, mobilization, etc on the public jurisdiction.

Other more complex methods exist for developing jurisdiction-wide stormwater fees. However, that is not within the scope of this section or document.

A) One Time Capital and Maintenance Fee

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This method results in a one-time capital and one time maintenance fee based on a specified lifecycle (number of years) for a WQIP accepting select private parcel runoff. The fee is generated by calculating the additional sizing costs needed to accommodate and treat private parcels without BMPs. Total estimated maintenance costs for the project are estimated as a yearly cost, summed over the lifecycle of the project, and a present value calculated assuming a 4% discount rate. This gets divided into a single one-time cost per parcel for maintenance.

B) One Time Capital and Annual Maintenance Fee

This method results in a one-time capital and an annual maintenance fee based on a specified lifecycle (number of years) for a WQIP accepting private parcel runoff. The fee is generated by calculating the additional sizing costs needed to accommodate and treat private parcels without BMPs. Total estimated annual maintenance costs for the project are divided between all the parcels.

C) Equivalent Hydrologic Unit Method

This method is based on the amount of impervious area per parcel generating stormwater runoff. A standard chosen amount of impervious area is equal to 1 equivalent hydrologic unit (EHU). This EHU equals a dollar amount monthly fee. Each parcel will have a specific number of EHUs depending on how much impervious coverage exists on the parcel, thereby defining the EHUs and cost per month. This fee accounts for both capital and maintenance costs of the project over time.

Each of the above methods may contain a credit factor for parcels that have installed and maintained BMPs and that have received a BMP Certificate from the TRPA.

While these examples are not the only methods for calculating in-lieu fees, they are examples that can be used as a starting point for developing alternative mechanisms for funding WQIPs per project area. They may also assist in obtaining full private participation in water quality improvements despite site constraints that preclude on-site BMP installation.