Development of Regional Suspended Sediment and Pollutant Load Estimates for San Francisco Bay Area Tributaries using the Regional Watershed Spreadsheet Model (RWSM): Year 2 Progress Report

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Table of Contents

Introduction, context and objectives

The RMP is providing direct support for answering specific Management Questions through multi-year Strategies consisting of coordinated activities centered on particular pollutants of concern (POCs) or processes. The Small Tributaries Loading Strategy (STLS, SFEI, 2009) presented an initial outline of the general strategy and activities to address four key Management Questions:

1. Which Bay tributaries (including stormwater conveyances) contribute most to Bay impairment from POCs;
2. What are the annual loads or concentrations of POCs from tributaries to the Bay;
3. What are the decadal-scale loading or concentration trends of POCs from small tributaries to the Bay; and,
4. What are the projected impacts of management actions (including control measures) on tributaries and where should these management actions be implemented to have the greatest beneficial impact.

Since then, a Multi-Year-Plan (MYP) (STLS, 2011) has been written that provides a more comprehensive description of activities that will be included in the STLS over the next 5-10 years in order to provide information in compliance with the municipal regional stormwater permit (MRP; Water Board 2009). The MYP provides detailed rationale for the methods and locations of proposed activities, including loads monitoring of local tributaries. The MYP, which will be updated at least once a year to reflect evolving information, recommended the development of the Regional Watershed Spreadsheet Model (RWSM) as a tool for estimating regional loads. Point-source loads, though covered in TMDLs or other potential regulatory activities, are not included in this model.

The first phase of the project (Year 1) served to develop a GIS-based regional rainfall-runoff model, calibrate the hydrology, collate land use / source specific concentration data for pollutants of interest, and perform initial forays into sediment and pollutant models (Lent and McKee, 2011). The RWSM Year 1 report concluded that there were concerns with the hydrologic calibration data set and with the underlying land use data set, and that the immediate next steps should be to refine hydrology model by:

- Adding several calibration watersheds to ensure watershed characteristics spanned a wider range of imperviousness including more of the higher %IC character
- Removing any gage records incongruent with land use / impervious data
- Refining land use categories and re-calibrating model

This write-up serves to document these model refinements performed during year 2 of the RWSM development. At the end of year 2, no further hydrologic model refinement was recommended as a priority in year 3; focus should now shift to the sediment and contaminant models. However, development and calibration of a selection of water quality models in year 3 may highlight weaknesses in the hydrological model that may need to be addressed in year 4 in concert with other priorities identified at that time.

Improved calibration data set

The original calibration data set used in the RWSM Y1 model (Lent and McKee, 2011) lacked representation at the high end of the imperviousness range. This was was problematic because highly impervious areas contribute disproportionately to runoff and because San Francisco Bay is ringed by highly developed flatlands. Only one of the original watersheds had greater than 50% impervious surface (Figure 1). To better represent the range of development conditions present in the Bay Area, we added three high imperviousness watersheds to the calibration data set: Ettie Street Pump Station (79% impervious), Victor-Nelo Pump Station (88%) and Laurelwood Pump Station (74%) (Figure 1, right side). In keeping with Bay Area development patterns, all of the high imperviousness watersheds added were in the highly developed lowlands. Additionally, the sites added were all pump stations due to the lack of flow monitoring in highly urban watersheds. The added advantage of including these watersheds is they might also include some of the source areas proposed for structuring the PCB and Hg model components.

The data sets for all of the pump stations were derived from pump run logs, which were converted to estimated flow using the maximum pump capacity for each station. This assumption of instantaneous pump "run-up" and maximum rated capacity introduces errors, but they are likely small relative to the overall magnitude of flow volume passed by the pumps. To check if the pump data logs seemed reasonable, we plotted monthly rainfall versus estimated flow volume using the 5 months of data available for each station (Figure 2). The pump data showed a good correlation with rainfall for the two South Bay pump stations. Based on 41 months of data, Ettie Street pump station records exhibited a strong relationship with rainfall as well ($R^2 = 0.98$, data not shown).

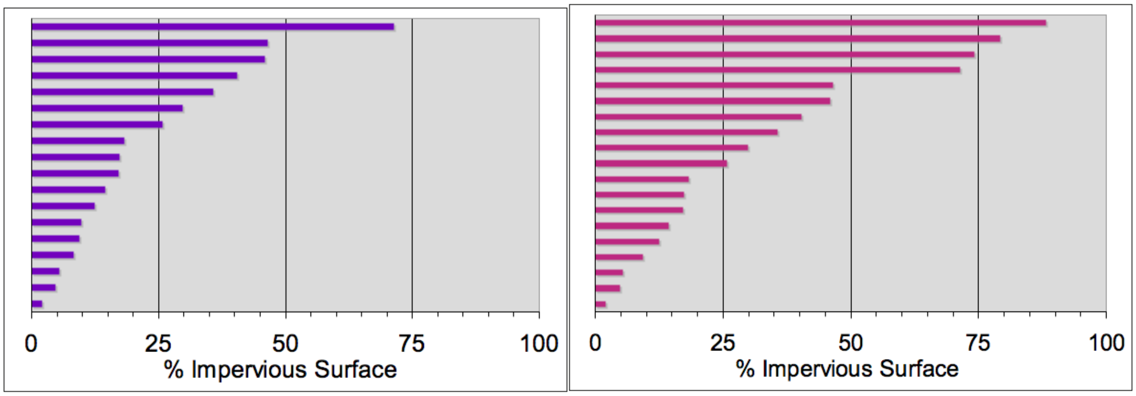

Figure 1 - Percent imperviousness in the original (Left) and updated (Right) calibration watershed data set. The left panel shows the RWSM Y1 calibration data with only one watershed with >50% impervious surface.

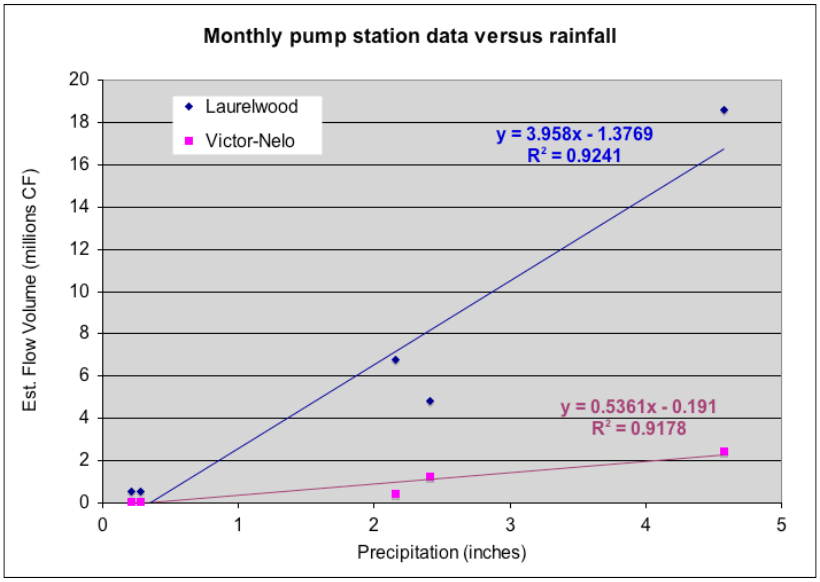

Figure 2 - Correlation between flow obtained by conversion of the pump data logs (using assumptions about pump capacity) and rainfall.

Aside from the lack of representation at the high end of the imperviousness range in the original calibration data set, we were also concerned about potential incongruence between disparate non stationary data that represents differing time periods. Given that we were using a land use and impervious surface data set from the 1990-2000s to estimate runoff coefficients, some of the older gage records potentially were not representative of more recent hydrological behavior in some of the calibration watersheds, especially if significant development had occurred in the watershed between the start of the gage data record and the 1990s. We checked the older (pre-1990s) gage records for watersheds with ≥5% built impervious surface for changes in runoff behavior over time. In some watersheds, a distinct development signal was shown by the increase in runoff coefficient by decade; a prime example is Colma Creek, which underwent massive development over the period of flow monitoring (Figure 3). As a result of this analysis, we removed earlier portions of several gage records (Colma Creek, Matadero Creek, and Walnut Creek). Additionally we completely removed two records which ended too early to properly evaluate hydrologic changes relative to more recent conditions: Arroyo Corte Madera (1966-1986) and Wildcat Creek at Richmond (1965-1975).

Watersheds in our calibration data set span the entire spatial geography of the Bay Area and incorporate watersheds that represent a wide range of imperviousness (Table 1). A flow record actually exists for Sunnyvale East Channel, but unfortunately it is of poor quality (pers. comm., Ken Stumpf, SCVWD), which was apparent when the record was regressed against rainfall ($R^2 = 0.58$). Upon further analysis, based on regression with rainfall data, data quality was found to be good before 2001. This subset of data was initially used in the calibration but Sunnyvale Creek was found to be the worst performer in the model amongst all the calibration watersheds again casting dispersion on data quality. We decided to reject incorporating it at this time but may include it in the future once data generated by SFEI monitoring efforts can be used to verify quality. Our basic check of data quality revealed very

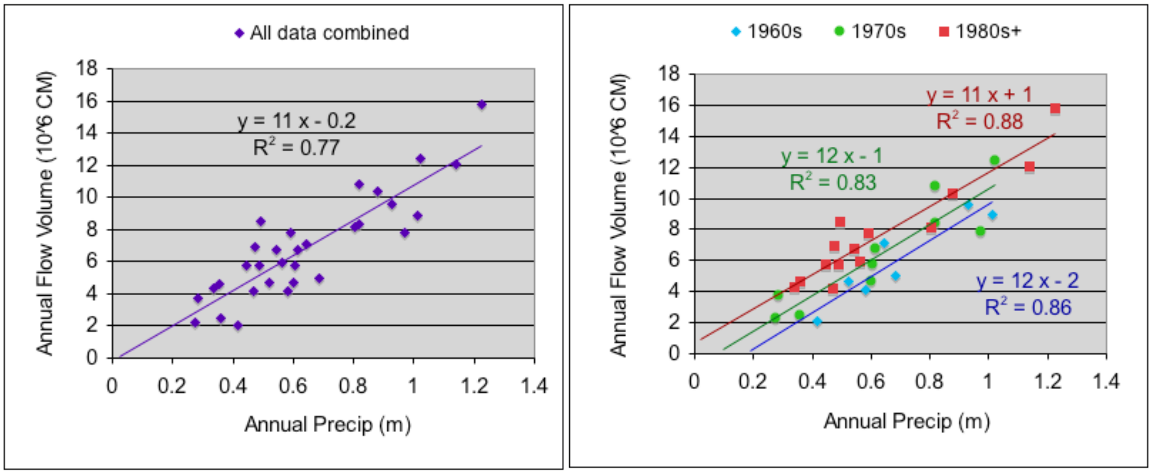

Figure 3 - Colma Creek rainfall-runoff relationship changing over time.

Table 1 - Updated calibration watershed set.

Watershed	County	Agency / Gage ID	Gage Record Used	% Built Imp. c.2000
Canoas Creek	Santa Clara	SCVWD 1485	1995-2007	46
Castro Valley Creek	Alameda	USGS 11181008	1972-2009	46
Colma Creek	San Mateo	USGS 11162720	(REVISED) 1981-1994	38
Dry Creek	Napa	USGS 11458500	1952-1966	0.1
Matadero Creek	Santa Clara	USGS 11166000	(REVISED) 1981-2009	17
Novato Creek	Marin	USGS 11459500	1947-2009	3
Pinole Creek	Contra Costa	USGS 11182100	1940-1977	0.3
Corte Madera Creek	Marin	USGS 11460000	1952-1993	5
Ross Creek	Santa Clara	SCVWD 2058	1995-2007	36
San Ramon Creek	Contra Costa	USGS 11182500	1953-2009	3
San Tomas Creek	Santa Clara	SCVWD 2050	1973-2009	30
Sonoma Creek	Sonoma	USGS 11458500	1956-1981; 2002-2009	2
Upper Napa River	Napa	USGS 11456000	1940-1995; 2001-2009	2
Walnut Creek	Contra Costa	USGS 11183600	(REVISED) 1981--1992	13
Wildcat Creek - Vale	Contra Costa	USGS 11181390	1976-1995	4
Zone 4 Line A Channel	Alameda	SFEI (no ID)	2007-2010	71
San Leandro Creek	Alameda	SFEI (no ID)	To be monitored WY2012	38
Sunnyvale East Channel	Santa Clara	SFEI (no ID)	To be monitored WY2012	59
Victor-Nelo Pump Station	Santa Clara	City of Santa Clara	2009-2010	88
Laurelwood Pump Station	Santa Clara	City of Santa Clara	2009-2010	74
Ettie St. Pump Station	Alameda	ACFCD	2005-2008	79

strong relationships between a local representative rainfall data set and the annual runoff ranging between r^2=0.78 to r^2=0.98 (Table 2).

The model was rerun using the reevaluated watershed calibration data sets that included dropping some watersheds and picking up others (Table 3). Unfortunately, the model performance worsened with the updated calibration data set. The two worst performers in the revised data set were the South Bay pump stations: Laurelwood being under-simulated by 95% and Victor-Nelo being over-simulated by 60%. This may reflect the very short records and the conversion of pump logs to estimated flow not providing an accurate target volume for calibration. But this poor performance may also reflect the model being over-calibrated to the new calibration data set being skewed towards less impervious areas. Without longer, higher quality flow records in highly impervious watersheds, it's hard to know. Ettie Street Pump Station has a longer record (albeit with the pump log-to-flow conversion issues), and is also one of the worst performers (under-simulated by 86%), suggesting that at least part of the problem is over-calibration to a data set lacking representation of high impervious areas.

Table 2 - Rainfall-runoff regression equations for updated calibration set.

Watershed	PRISM Annual Prec. (m)	Rainfall gage	Scale rainfall?	Regression			Est. Annual Volume (10^6 CM)
				Slope	Y-int.	R^2	
Canoas Creek	0.48	Alamitos	No	17	-1.8	0.87	6.6
Castro Valley Creek	0.58	Upper San Leandro	Yes	7.8	-1.4	0.93	3.2
Colma Creek (REVISED time period: WY1981-1994)	0.66	SFO Airport	Yes	11	+0.73	0.88	7.9
Dry Creek	1.05	St. Helena	Yes	34	-19	0.94	17
Matadero Creek (REVISED time period: WY1981-2009)	0.55	Palo Alto	Yes	9.6	-2.2	0.85	3.2
Novato Creek	1.04	Petaluma	Yes	28	-16	0.88	11
Pinole Creek	0.63	Berkeley	Yes	16	-5.7	0.88	4.1
Corte Madera Creek	1.08	San Rafael	Yes	36	-16	0.86	55
Ross Creek	0.59	Johnson Ranch	No	7.5	-0.98	0.87	3.4
San Ramon Creek	0.67	Berkeley	Yes	10	-3.9	0.86	2.9
San Tomas Creek	0.62	Palo Alto	Yes	19	-5.5	0.78	6.4
Sonoma Creek	1.08	Sonoma	Yes	111	-45	0.86	75
Upper Napa River	1.05	St. Helena	Yes	143	-69	0.95	81
Walnut Creek (REVISED time period: WY1981-1992)	0.60	Berkeley	Yes	155	-43	0.94	50
Wildcat Creek - Vale	0.66	Richmond	Yes	13	-3.9	0.92	5.0
Zone 4 Line A Channel	0.49	Hayward 541A	No	1.8	-0.013	0.93	0.86
Victor-Nelo Pump Station	0.38	San Jose	Yes	0.59	-0.0054	0.92	0.22
Laurelwood Pump Station	0.39	San Jose	Yes	4.3	-0.039	0.92	1.6
Ettie St. Pump Station	0.54	Oakland Museum	Yes	10	0.070	0.98	5.7

Table 3 - Model performance (% difference between simulated and observed values).

Calibration set	Mean	Median	Minimum	Maximum
Original	+2%	+3%	-42%	+46%
Updated	+1%	+9%	-95%	+60%

Another possibility is the assumption of linearity in the relationship between imperviousness and the resulting runoff coefficient. For example, in the LA region (even more arid than the Bay Area), a curvilinear function has been applied (Figure 4) (Peter Mangarella, GeoSyntec Consultants, Oakland, personal communication, February 2012). In addition another problem with runoff coefficient modeling method is that contribution from both impervious and pervious areas can vary depending on storm size and season (soil moisture content and evapotranspiration). This has been discussed extensively in science literature and was documented by M.I Budyko in 1974. The “Budyko curve”, as it came to be referred to, describes the relationship between climate, evapotranspiration and runoff (Donohue et al., 2006; Gerrits et al., 2009). The explicit outcome of the curve is that watersheds of differing rainfall and heat should have differing inter-annual rainfall -runoff functions. Thus, the centrality of the medium or mean relative to the runoff extremes in reaction to rainfall extremes will be a function of aridity. This is presently not incorporated into the year 2 version of the RWSM but could be in future versions. This appears consistent with experience in Wisconsin, where runoff coefficients have been defined as a function of both land use and percent connected imperviousness and rainfall depth (Roger Bannerman, personal communication, December 2011).

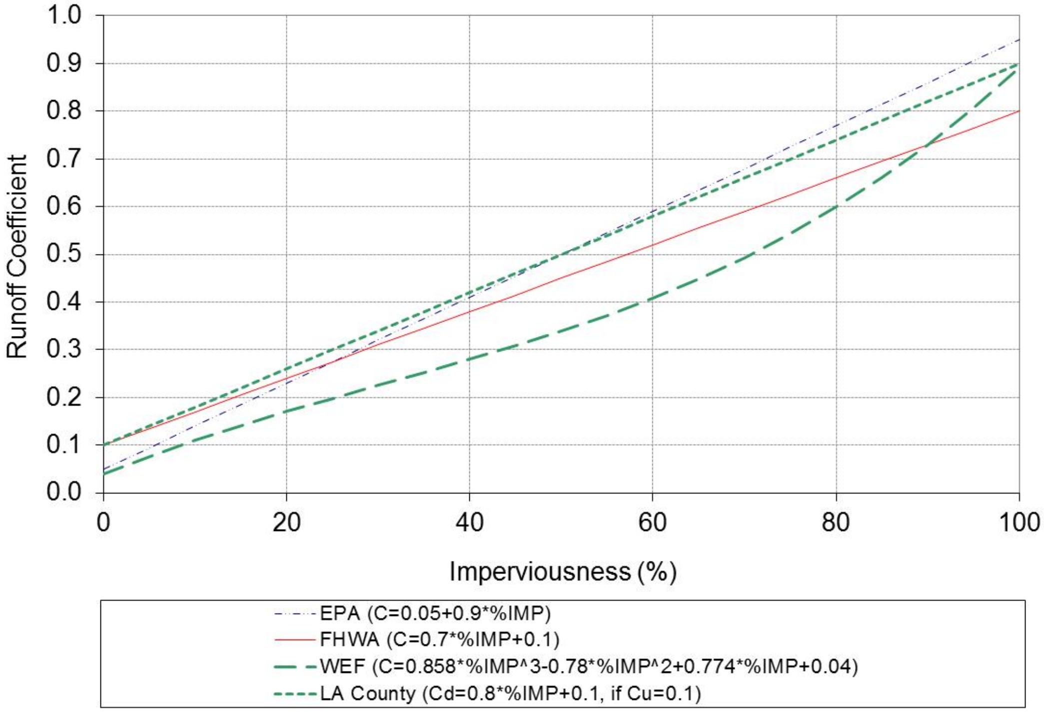

Figure 4. Runoff coefficients as a function of imperviousness. Source: Peter Mangarella, GeoSyntec Consultants, Oakland.

Refined land use input data

During development of the base hydrology model, we noticed that the land use layer (ABAG 2000) contained discrepancies related to transportation land use. Specifically, for Alameda and Santa Clara counties, local roads were not broken out into their own category (Figure 5) as they had been for the other Bay Area counties. Upon close inspection, it was noted that the land use resolution varied dramatically between counties (Figure 6). These discrepancies were corrected in the updated land use layer (ABAG 2005). Accordingly the model was re-developed using the improved ABAG 2005 land use data set.

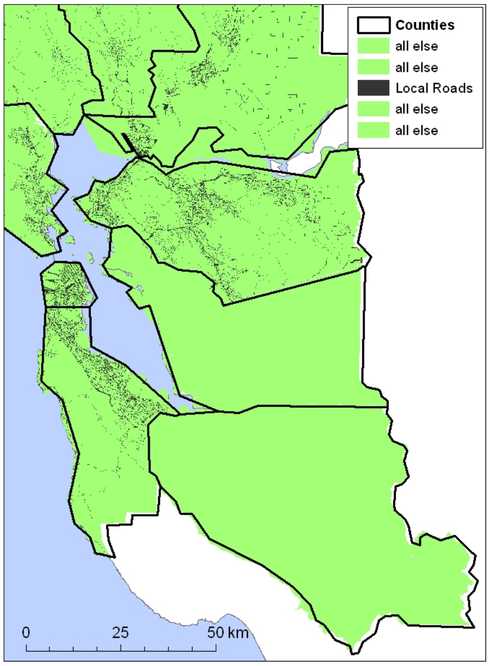

Figure 5 - Discrepancies in ABAG 2000 data set for transportation land use.

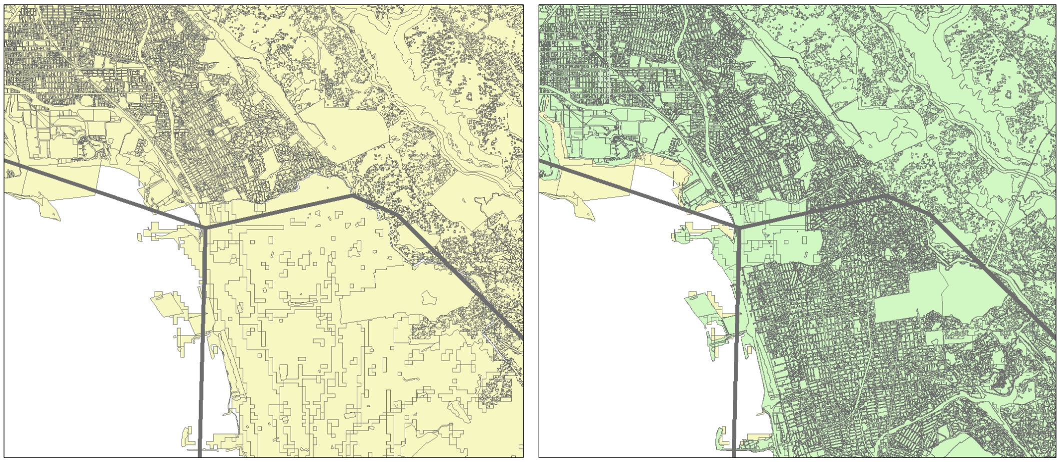

Figure 6 – ABAG 2000 versus ABAG 2005 (zoomed to border of Contra Costa and Alameda Counties).

The revised treatment of transportation land use in Alameda and Santa Clara counties between ABAG 2000 and ABAG 2005 (Figure 7) resulted in more area being assigned very high runoff coefficients (since transportation RC = 0.8). As a result, the modeled runoff increased fairly dramatically and the overall performance shifted towards over-simulation (Table 4). This performance change adds further support to the hypothesis that the previous version of the model was over-calibrated to previous input parameters.

For the development of the base hydrology model, most land use categories were treated as a single land category (as in Davis et al., 2000). However, land use categories can encompass a large range of runoff behavior, either through variable imperviousness or dirt compaction. To improve the treatment of runoff, we used the imperviousness underlying the different land use categories to reclassify some of the land use descriptions and to create higher resolution categories (Figure 8; Table 5). For the example shown in Figure 8, approximately 40 land use descriptions that make up the commercial land use category (e.g., Offices, Hospitals, etc) were reclassified into “High density commercial” and “Low density commercial” based on their average percent imperviousness.

The open land use category was split into two categories based on expected hydrologic behavior. Areas such as forests and rangelands were assigned to the “Infiltrative open” category and areas such as golf courses and cemeteries were assigned to “Compacted open” since we expect a greater fraction of rainfall will runoff compacted ground compared to less disturbed soil.

The revised land use categories were applied to the model (Figure 9) and we re-calibrated the runoff coefficients. The results of the re-calibration (Table 6) do not look as good as version 1 of the model, but we have reduced bias in the calibration data set. Unfortunately, while reducing bias through introducing the high impervious pump station watersheds, we probably have increased the errors associated with the target calibration volumes by using short records with known flaws. To do a better job of calibrating the high imperviousness areas we need high quality, multi-year flow records from highly developed watersheds. Without this type of data, we are limited in our ability to calibrate this portion of the model.

Conclusion

The tasks performed in year 2 of the Regional Watershed Spreadsheet Model (RWSM) served to correct or reduce errors and biases in the hydrological model that were noted in the year 1 report. The hydrologic model will need to be re-visited, for example, in the context of calibrating the sediment model (the development of which is one of the next steps) or the contaminant models. When the hydrologic model is next re-calibrated, to reduce the possibility of over-calibration, the calibration watershed data set should be split into two sets and calibrate to one set and then verify the calibration on the other (Mike Strenstrom, personal communication, October, 2011). In addition next versions of the hydrologic portions of the model may be improved by incorporating runoff coefficients that have either a curvilinear function with imperiousness alone (Peter Mangarella, GeoSyntec Consultants, Oakland, personal communication, February 2012 or runoff coefficients defined as a function of both land use and percent connected imperviousness and rainfall depth (Roger Bannerman, personal communication, December 2011).

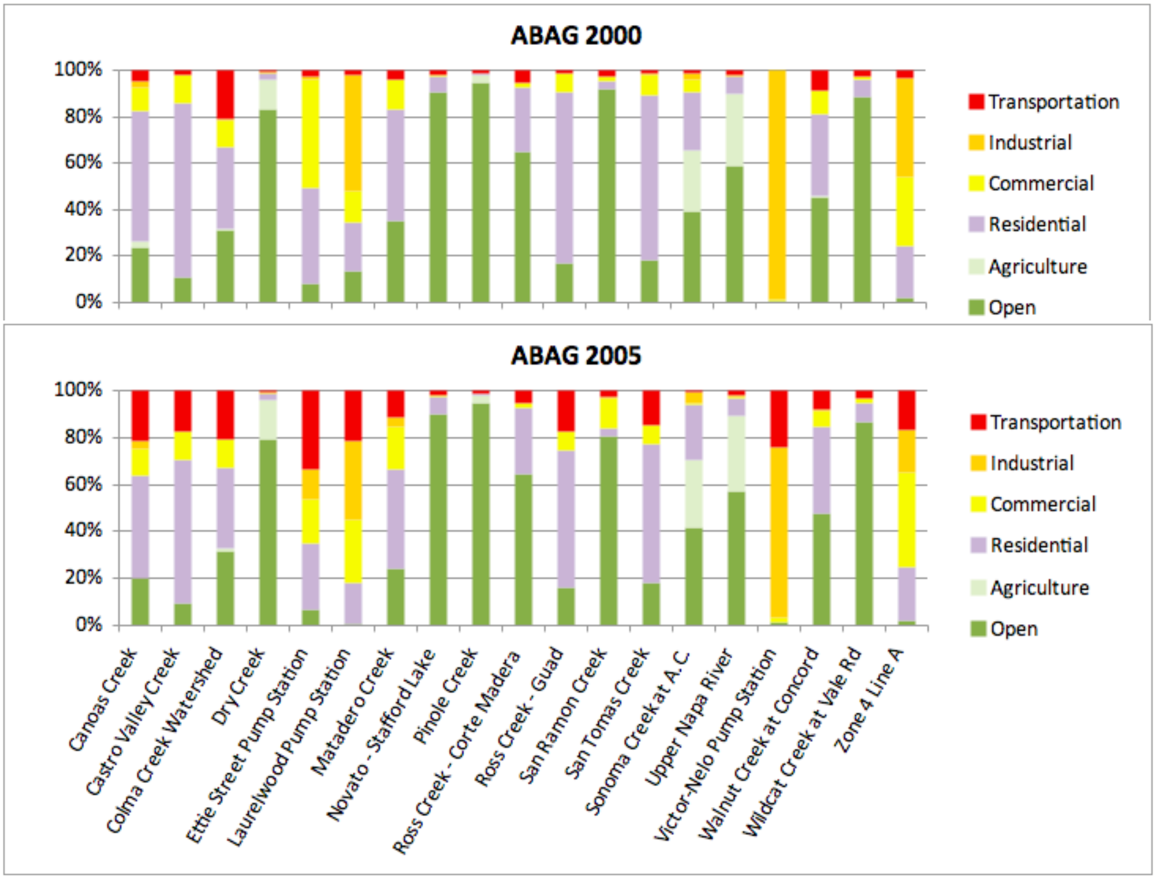

Figure 7 - Changes in land use classification from ABAG 2000 to ABAG 2005 for calibration watersheds.

Table 4 - Model performance for different land use data sets (using updated watershed set).

Land use data set	Mean	Median	Minimum	Maximum
ABAG 2000	+1%	+9%	-95%	+60%
ABAG 2005	+13%	+17%	-78%	+79%

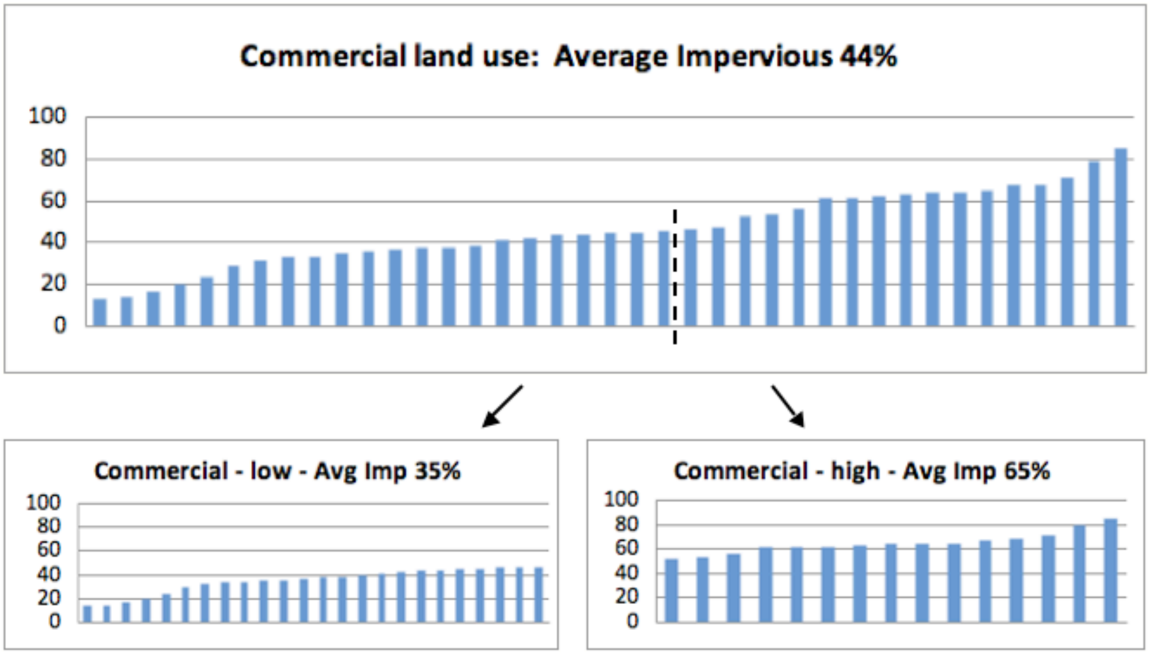

Figure 8 – An example of using imperviousness to reclassify land use descriptions into categories that more accurately group runoff behavior

Table 5 – Revised higher resolution categories for assignment of runoff coefficients. Note the full listing of land use descriptions with assigned categories and average percent impervious is presented in the Appendix.

Original Categories	Revised Categories
Agriculture	Agriculture
Open	Open
	Open – compacted
Residential	Residential – rural
	Residential – low
	Residential – med
	Residential – high
Commercial	Commercial – low
	Commercial – high
Industrial	Industrial
Transportation	Transportation
Water	Water
	Water – runoff

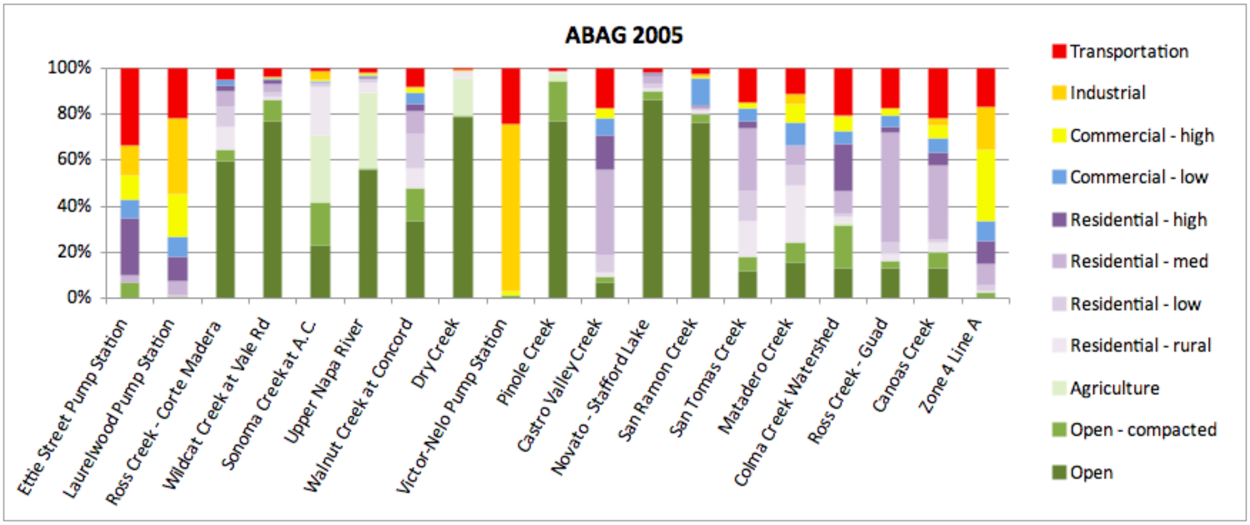

Figure 9 - Distribution of revised land use categories in calibration watershed set.

Table 6 - Model performance.

Model	Mean	Median	Minimum	Maximum
Uncalibrated ABAG 2005	+13%	+17%	-78%	+79%
Calibrated ABAG 2005 (rev. cat.)	+1%	+3%	-75%	+70%

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Appendix - Revised land use classification for runoff coefficients.

Land Use Description	Original Reclassification	New Reclassification	Mean % Imp.
Cropland & Pasture	Agriculture	Agriculture	1
Cropland	Agriculture	Agriculture	1
Confined Feeding (Including Feed Lots)	Agriculture	Agriculture	3
Small Grains	Agriculture	Agriculture	3
Pasture	Agriculture	Agriculture	4
Orchards, Groves, Vineyards, And Nurseries	Agriculture	Agriculture	6
Row Crops	Agriculture	Agriculture	6
Vineyards And Kiwi Fruit	Agriculture	Agriculture	11
Farmsteads And Agricultural Buildings	Agriculture	Agriculture	13
Orchards Or Groves	Agriculture	Agriculture	13
Military Installations	Commercial	Commercial - low	13
Military Hospital	Commercial	Commercial - low	14
Transitional Or Mixed Use Of Land Areas	Commercial	Commercial - low	17
Medical Clinics	Commercial	Commercial - low	20
Colleges & Universities	Commercial	Commercial - low	24
Greenhouses And Floriculture	Agriculture	Commercial - low	29
Stadiums	Commercial	Commercial - low	32
Local Gov't Jails And Rehab Centers	Commercial	Commercial - low	33
Extensive Recreation	Open	Commercial - low	33
State Prisons	Commercial	Commercial - low	35
Medical Long-Term Care Facilities	Commercial	Commercial - low	36
Transitional Areas	Open	Commercial - low	37
City Halls & Co., State, Fed. Govt. Facilities	Commercial	Commercial - low	38
Education	Commercial	Commercial - low	38
Elementary & Secondary Schools	Commercial	Commercial - low	39
Mixed Commercial & Industrial Complexes	Commercial	Commercial - low	41
Other Transitional	Open	Commercial - low	42
Commercial Or Services Vacant	Open	Commercial - low	44
Museums And Libraries	Commercial	Commercial - low	44
Commercial	Commercial	Commercial - low	45
Closed Military Facilities	Commercial	Commercial - low	45
Communications Facilities	Commercial	Commercial - low	46
Local Government And Other Public Facilities	Commercial	Commercial - low	47
Churches, Synagogues, And Mosques	Commercial	Commercial - low	47
Community Hospitals	Commercial	Commercial - high	52
Convention Centers	Commercial	Commercial - high	54
Daycare Facilities	Commercial	Commercial - high	56
Hospitals, Rehab, Health, & State Prisons	Commercial	Commercial - high	61
Hotels And Motels	Commercial	Commercial - high	62
Stadium	Commercial	Commercial - high	62
Research Centers	Commercial	Commercial - high	64
Offices	Commercial	Commercial - high	64
Hosptals - Designated Trauma Centers	Commercial	Commercial - high	64
Fire Station	Commercial	Commercial - high	65
Mixed Use In Buildings	Commercial	Commercial - high	67
Retail And Wholesale	Commercial	Commercial - high	68
Police Station	Commercial	Commercial - high	71
Warehousing	Commercial	Commercial - high	79
Out-Patient Surgery Centers	Commercial	Commercial - high	85
Strip Mines & Quarries, Commercial Opera	Industrial	Industrial	23
Water Storage (Covered)	Industrial	Industrial	26

Land Use Description	Original Reclassification	New Reclassification	Mean % Imp.
Food Processing	Industrial	Industrial	26
Municipal Water Supply Facilities	Industrial	Industrial	32
Wastewater Treatment Plant	Industrial	Industrial	34
Water Treatment (Filtration) Plant	Industrial	Industrial	35
Earth Works Not Part Of Commercial Extra	Open	Industrial	36
Industrial Vacant	Open	Industrial	39
Electric, Other	Industrial	Industrial	40
Electric Substation	Industrial	Industrial	47
Heavy Industrial	Industrial	Industrial	52
Wastewater Storage	Industrial	Industrial	54
Light Industrial	Industrial	Industrial	55
Wastewater Pumping Station	Industrial	Industrial	57
Industrial	Industrial	Industrial	69
Electric Power Plant	Industrial	Industrial	72
Media Broadcast Towers And Facilities	Industrial	Industrial	84
State Psychiatric Facilities	Commercial	Open - Compacted	0
Camps And Campgrounds	Open	Open - Compacted	1
State Mental Health And Devel. Disabled	Commercial	Open - Compacted	2
Military Open Areas	Open	Open - Compacted	4
Golf Courses	Open	Open - Compacted	7
Military - General Use	Commercial	Open - Compacted	9
Urban Open Space - Slated For Redevelopment	Open	Open - Compacted	10
Racetracks	Open	Open - Compacted	11
Bare Exposed Rock	Open	Open - Compacted	14
Cemeteries	Open	Open - Compacted	14
Residential Vacant	Open	Open - Compacted	14
Urban Parks	Open	Open - Compacted	17
Commonly Owned Residential, No Du	Residential	Open - Compacted	18
Other Urban And Built-Up Land	Open	Open - Compacted	20
Sanitary Landfills	Open	Open - Compacted	23
Commercial Intensive Outdoor Recreation	Open	Open - Compacted	24
Urban Vacant Undeveloped Land	Open	Open - Compacted	25
Nonforested Wetlands	Open	Open	2
Mixed Forest - Protected As Park	Open	Open	3
Evergreen Forest - Protected As Park	Open	Open	3
Salt Evaporation Ponds	Open	Open	4
Shrubland - Protected As Park	Open	Open	6
Herbaceous Rangeland - Protected As Park	Open	Open	6
Beaches	Open	Open	7
Herbaceous Rangeland	Open	Open	7
Mixed Forest	Open	Open	8
Mixed Rangeland	Open	Open	9
Mixed Rangeland - Protected As Park	Open	Open	10
Forested Wetlands	Open	Open	11
Deciduous Forest - Protected As Park	Open	Open	11
Sedimentation Ponds	Open	Open	12
Land On Usgs Topo Maps, Water On Other Maps	Open	Open	13
Deciduous Forest	Open	Open	14
Evergreen Forest	Open	Open	14
Mixed Sparsely Vegetated Land	Open	Open	17
Quarries, Strip Mines, And Gravel Pits	Open	Open	19
Shrub And Brush Rangeland	Open	Open	21

Land Use Description	Original Reclassification	New Reclassification	Mean % Imp.
Dune Or Other Sand (Not Beaches)	Open	Open	54
Very Low Density: < 1 & >= 0.2 Du Per Acre	Resid-rural/low	Resid-rural	11
Residential	Residential	Resid-low	16
Low Density: >= 1 Du/Acre And <3 Du/Acre	Resid-rural/low	Resid-low	22
Military Residential	Residential	Resid-med	33
University Housing	Commercial	Resid-med	35
Medium Density: >= 3 Du/Acre And <8 Du/Acre	Resid-low/med	Resid-med	42
Mixed Residential & Commercial Use	Residential	Resid-high	49
Group Quarters Residential	Residential	Resid-high	52
Mobile Homes And Mobile Home Parks	Residential	Resid-high	55
High Density: >= 8 Du/ Acre	Resid-med/high	Resid-high	57
Road Transportation Facilities	Transportation	Transportation	12
Inspection And Weighing Stations	Transportation	Transportation	14
Transportation, Communication, And Utilities	Transportation	Transportation	25
Rail Transportation Facilities	Transportation	Transportation	29
Private Airfield	Transportation	Transportation	30
Military Airport	Transportation	Transportation	33
General Aviation (Public) Airfield	Transportation	Transportation	37
Airports	Transportation	Transportation	42
Truck Or Bus Maintenance Yards	Transportation	Transportation	49
Highways And Interchanges	Transportation	Transportation	50
Local Roads And Streets	Transportation	Transportation	50
Marina	Transportation	Transportation	55
Commercial Port Passenger Terminal	Transportation	Transportation	62
Park And Ride Lots	Transportation	Transportation	63
Commercial Port Other Terminals and Ship	Transportation	Transportation	63
Parking Garages	Transportation	Transportation	63
Rail Yards	Transportation	Transportation	65
Commercial Port Oil & Liquid Bulk Terminal	Transportation	Transportation	65
Commercial Airport Runway	Transportation	Transportation	66
Commercial Airport - General Facilities	Transportation	Transportation	69
Rail Passenger Stations	Transportation	Transportation	70
City, County Or Utility Corporation Yard	Transportation	Transportation	71
Ferry Terminal	Transportation	Transportation	74
Marine Transportation Facilities	Transportation	Transportation	75
Commercial Port Storage & Warehousing	Transportation	Transportation	80
Tow Boat (Tug) Facility	Transportation	Transportation	80
Commercial Port Container Terminal	Transportation	Transportation	85
Military Port	Transportation	Transportation	87
Commercial Airport Passenger Terminal	Transportation	Transportation	90
Commercial Airport Airline Maintenance	Transportation	Transportation	92
Commercial Airport Utilities	Transportation	Transportation	93
Commercial Airport Air Cargo Facility	Transportation	Transportation	96
Bays & Estuaries	Water	Water	5
Lakes	Water	Water	9
Reservoirs	Water	Water	9
Unclassified Water	Water	Water	6
Water - Industrial Ports And Piers Over	Water	Water	67
Water - Residential (Arks) Over Water	Water	Water	38
Water On Usgs Topo Maps, Land On Other Maps	Water	Water	52
Water Storage (Open)	Water	Water	27