Conserving and Budgeting Water with GIS

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Quality. Service. Value.

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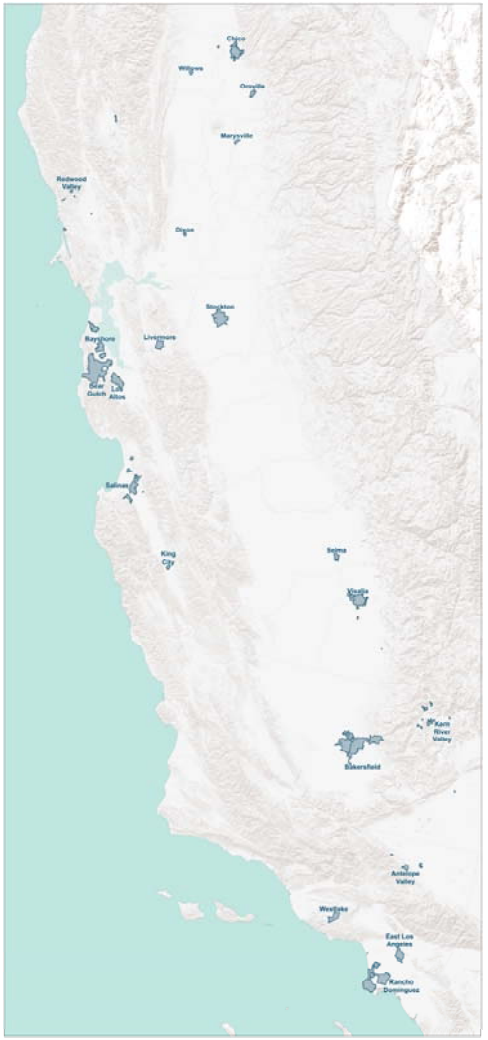
Overview

1. Background about Cal Water, and the Drought
2. Using GIS as a solution
3. Methods + Model
4. Results
5. Future Use
6. Other Water Conservation Effort

Background

- California Water Service is an investor-owned, public utility
- Cal Water operates and maintains 24 service areas throughout the state of California



California Drought + Water Conservation

- Water Conservation as the “New Normal”
- Changes in Regulations – State Water Resources Control Board

California Drought + Water Conservation

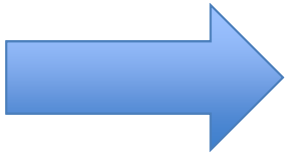
- Implementation of Water Budgets
- Based on 2013 water usage + reduction for Service Area determined by the State Water Resources Control Board
- Equitable budget for indoor and outdoor usage

How is GIS Used to calculate Water Budgets?

- Customer file for an appeal
- Customer does not have a history of use

High resolution imagery

Vegetation classification data



Outdoor Water Budget

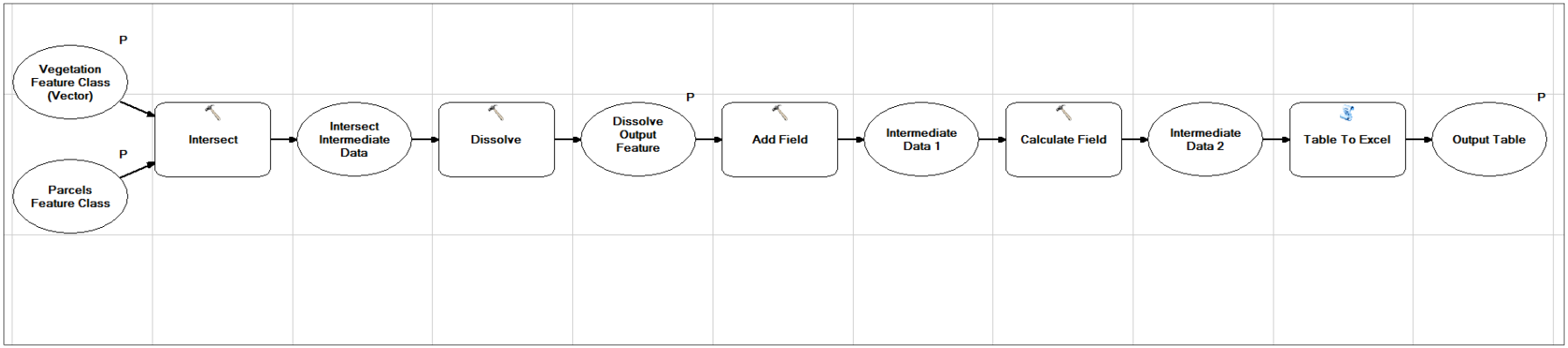
Method

- Variables
  - Waterfluence Formula
    - Reference ETo, Irrigable Area, Crop Coefficients

$$\text{BUDGET} = \text{AREA} * \left[\frac{K_L * \text{ETo} - \text{ERain}}{\text{IE}}\right] * C$$

BUDGET =	Volume of water budgeted for a given hydrozone area for a given period. The overall water use budget for a site is the sum of budgets over all hydrozones.
AREA =	Landscape area irrigated in hydrozone (square feet).
K_L =	$K_S * K_D * K_{MC}$
K_S =	Species or plant factor relating a specific plant type's water requirements as a fraction of ETo.
K_D =	Density factor accounting for differences in vegetation density or collective leaf area among landscape plantings. The default value is 1.0. For sparsely planted areas, the density factor is less than 1.0. For areas with multiple tiers of foliage canopies, the density factor is greater than 1.0.
K_{MC} =	Microclimate factor adjusting ETo for variations in exposure. The default value is 1.0. For areas with abundance of shade (e.g., the north side of buildings and under mature trees), for example, the microclimate factor is less than 1.0. For plantings surrounded by heat-absorbing surfaces or reflective surfaces, the microclimate factor is greater than 1.0.
ETo =	Reference evapotranspiration (inches) equals the depth of water evaporated and transpired from a reference crop (4 to 7 inch tall fescue grass) with an abundant water supply. ETo is the "standard" measure of water needs from which other plant types are compared via K_S.
ERain =	Effective rainfall (inches) equals the depth of rain effective in offsetting ETo for each hydrozone. Effective rainfall varies widely with rainfall frequency, magnitude, time of year, and root zone depth.
IE =	Irrigation Efficiency measures the percent of applied water that is beneficially used by plants. All irrigation systems have some inefficiencies as water is lost as runoff, overspray, or percolates past the root zone.
C =	Conversion factor putting the water budget in desired volumetric terms. A factor of 0.0008333 puts the water budget into hundred cubic feet (ccf). A factor of 0.0006233 puts the water budget into thousand gallons.

Tool and Geoprocessing Model



Model Output

Model Output

Budget Calculation

Account Number	Customer Name	Customer Address	Distric	Irrigated Vegetat	Total Vegetation	Area (Sqft)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Bare	20.83558352	0.4	0.8	0.02	0.02	0.04	0.05	0.06	0.08	0.08	0.08	0.06	0.04	0.02	0.02
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Non-woody	7281.715693	0.8	0.65	15.09	19.49	33.98	46.23	54.52	66.09	72.96	67.14	48.69	34.80	20.01	15.31
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Water	497.6361905	1.2	1	1.01	1.30	2.26	3.08	3.63	4.40	4.86	4.47	3.24	2.32	1.33	1.02
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Woody	7117.423132	0.4	0.8	5.99	7.74	13.49	18.36	21.65	26.24	28.97	26.66	19.33	13.82	7.95	6.08

Account Number	Customer Name	Customer Address	District	Budget Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Outdoor Budget (CCF)	20.35	24.51	40.70	52.51	57.65	62.36	61.04	57.65	45.95	37.31	26.26	20.35
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Outdoor Budget w/ Reduction	13.02	15.68	26.05	33.61	36.90	39.91	39.07	36.90	29.41	23.88	16.80	13.02
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Indoor Budget	8	8	8	8	8	8	8	8	8	8	8	8
1111155555	Testa McTesterson	1212 Testing Avenue	AV	Total	21.02	23.68	34.05	41.61	44.90	47.91	47.07	44.90	37.41	31.88	24.80	21.02

Update

- Changes at the SWRCB have led Cal Water to remove the water budgets.
- However, we would like to continue the momentum and the water conservation lifestyle and efficiency mentality

Future

- Update GIS model to do other calculations and crate budgets for all customers
- Explore creating an irrigation efficiency goal for every customer based on indoor and outdoor water use efficiency
  - Efficiency standard

Questions? To learn more, visit www.calwater.com

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