CLASIC

CASE STUDY

Community Life-Cycle Analysis for Stormwater Infrastructure Costs

San Diego
California

CLASIC Case Studies showcase the variety of ways that the online tool can assist communities with stormwater project planning and decision-making.

CASE STUDY HIGHLIGHTS

- Assess stormwater control measure performance across various future climate scenarios in CLASIC

Background and Project Purpose

Communities across the U.S. understand that climate change may impact the effectiveness of the current stormwater infrastructure or planning of future stormwater infrastructure investments. Communities can test future climate scenarios by utilizing the CLASIC tool.

This case study looks at the impacts of two different climate change scenarios in San Diego, CA. One scenario predicts increased precipitation over time, and the second scenario predicts decreased precipitation to assess the effectiveness of various stormwater infrastructure technologies.

HOT-DRY CLIMATE SCENARIO WITH DETENTION BASIN TECHNOLOGY

Inputs

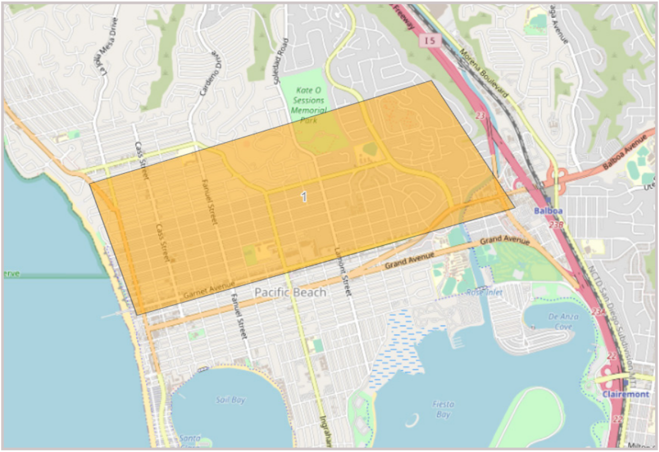
Baseline Scenario – No technologies and historical weather data.

Hot-Dry Scenario – Adjusted the baseline historical weather data, through the custom climate adjustment selection in the Build Scenarios section, to a more hot and dry condition.

- Decreased precipitation by 15% and increased evaporation by 10% across all months

Detention Basin Scenario – Used the baseline climate data and added detention basin technology.

- Added 3 medium detention basins: medium-sized (4 ft depth, 100,000 ft^3), seepage rate of 2-inches per hour, 10% impervious area captured, irrigation system included, 9 month irrigation season



Project area in northwest San Diego, CA

Hot-Dry Detention Basin Scenario - Cloned the Hot-Dry Scenario (decreased precipitation by 15% and increased evaporation by 10%), then added detention basin technology.

- Added 3 detention basins with the same technology inputs as the Detention Basin Scenario, except increased the irrigation season to 12 months due to added hot-dry conditions

Options for Future Climate Scenarios in CLASIC

CLASIC provides multiple options for customizing future climate scenarios so that users can assess stormwater plans to meet climate resiliency goals.

In each Build Scenario, users can select a climate model.

- Default - historical climate data
- Custom – user can adjust % precipitation and/or evaporation change from baseline by month (most customizable option)
- Middle (NorESM1-M)
- Warm (MRI-CGCM3)
- Wet (CNRM-CM5)
- Dry (IPSL-CM5A-MR)
- Hottest (HadGEM2-ES365)

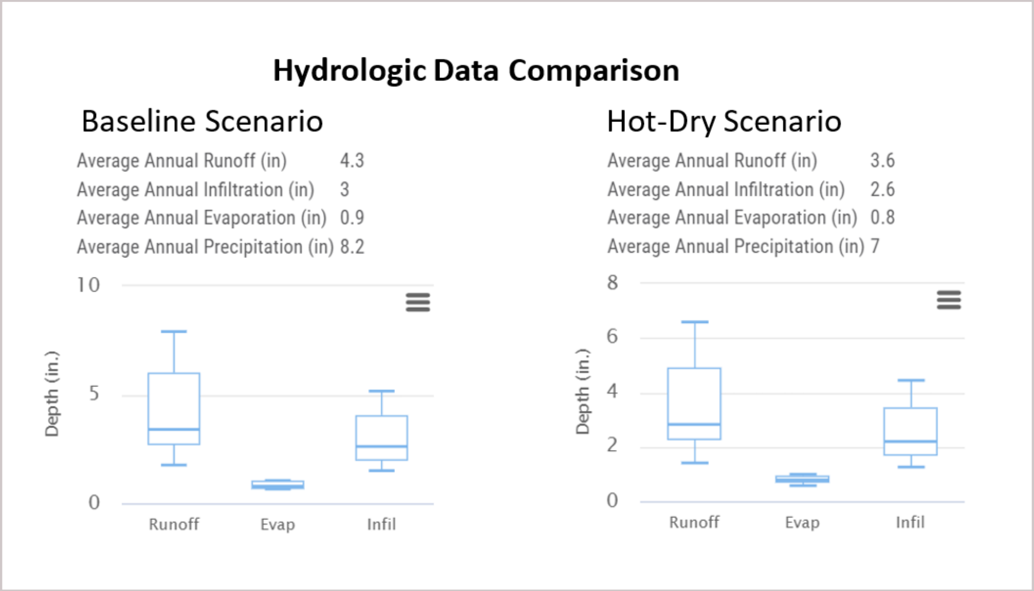
Each climate model has an option for the Representative Concentration Pathway (RCP).

- RCP 4.5 – assumes medium mitigation of greenhouse gases
- RCP 8.5 – assumes little mitigation of greenhouse gases, most extreme climate changes predicted

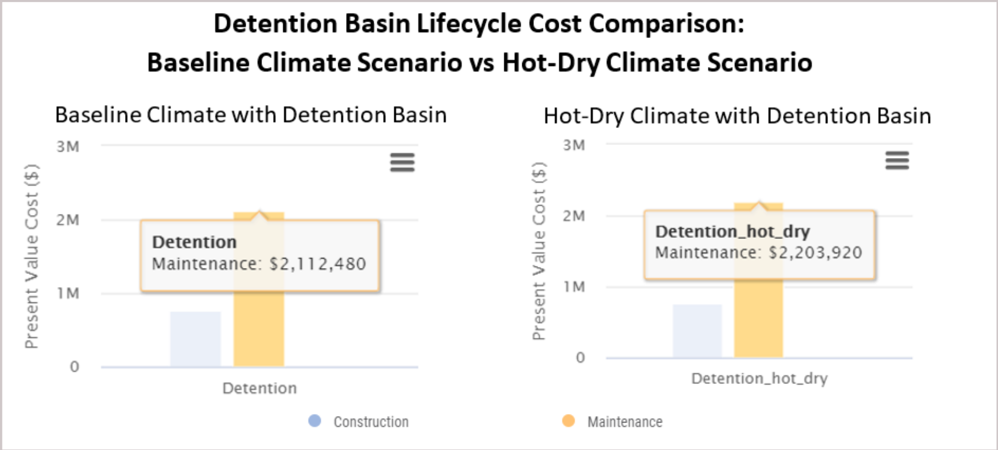
For more information see the CLASIC User Guide and Future Climate Scenario videos on the CLASIC Homepage.

Outputs

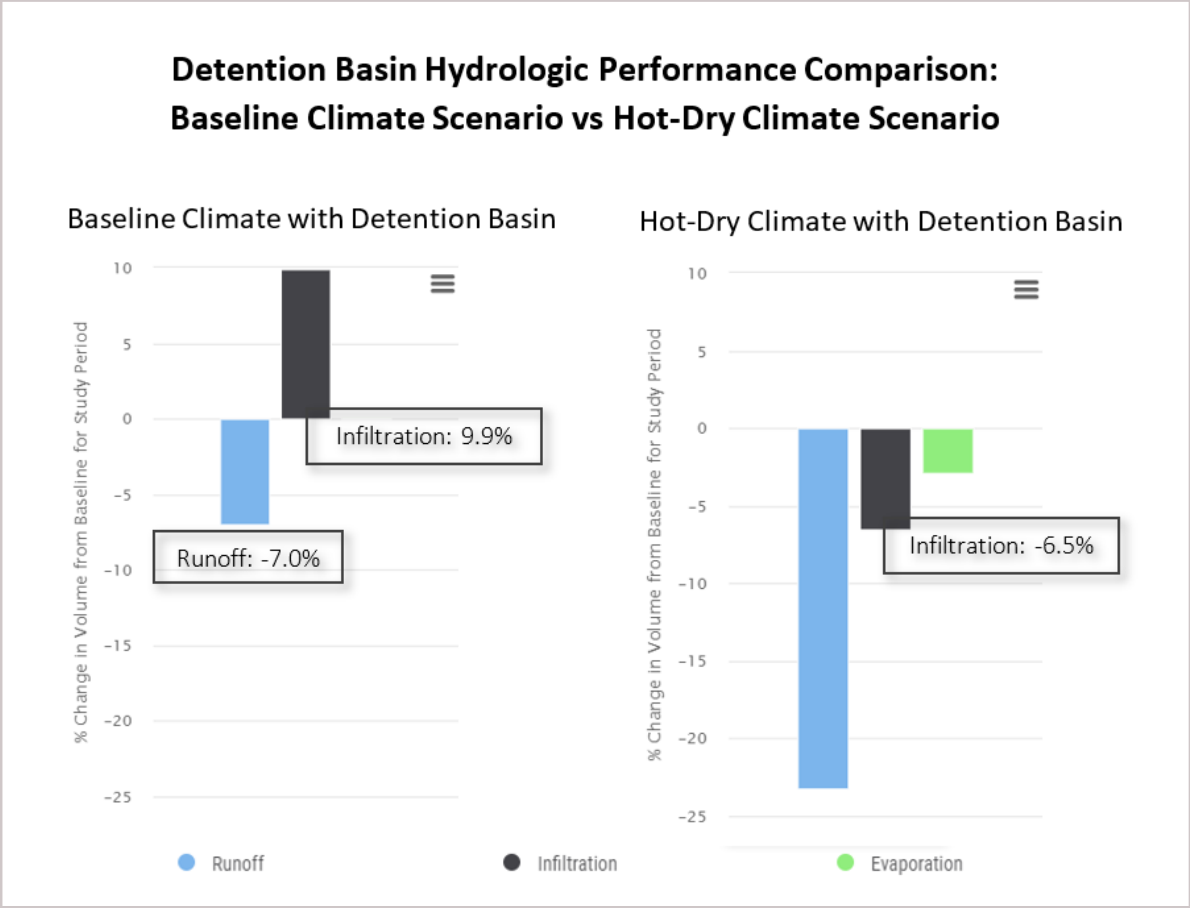
Comparing Baseline Scenario and the Hot-Dry Scenario's "Hydrologic Data" shows the decrease in precipitation modeled under the adjusted climate scenario. Annual precipitation decreases by 1.2 inches which leads to decreases in annual evaporation, infiltration and runoff.



CLASIC allows the user to compare the lifecycle costs of the Detention Basin Scenario and the Hot-Dry Detention Basin Scenario and identify that the construction costs are the same in both climate scenarios, however the increased maintenance costs over time are likely due to the need for increased irrigation due to the hot-dry climate condition.



The hydrologic performance outputs are shown in percent change in volume from the Baseline Scenario, which is no technologies and the historical weather data. The Detention Basin Scenario shows a decrease in runoff by 7.0% and an increase in infiltration by 9.9%. The Hot-Dry Detention Basin Scenario shows even further runoff decrease due to reduced rainfall.



Conclusion

In this project area, the detention basin technologies designed for the historical weather data are over-designed for stormwater needs of the hot-dry climate condition. The increased maintenance costs of the detention basins in the hot-dry climate, due to increased irrigation needs, does not "pay off" in hydrologic benefits.

WET CLIMATE SCENARIO WITH RAIN GARDEN TECHNOLOGY

Inputs

Baseline Scenario – No technologies and historical weather data.

Rain Garden Scenario – Using the baseline climate data added rain garden technology.

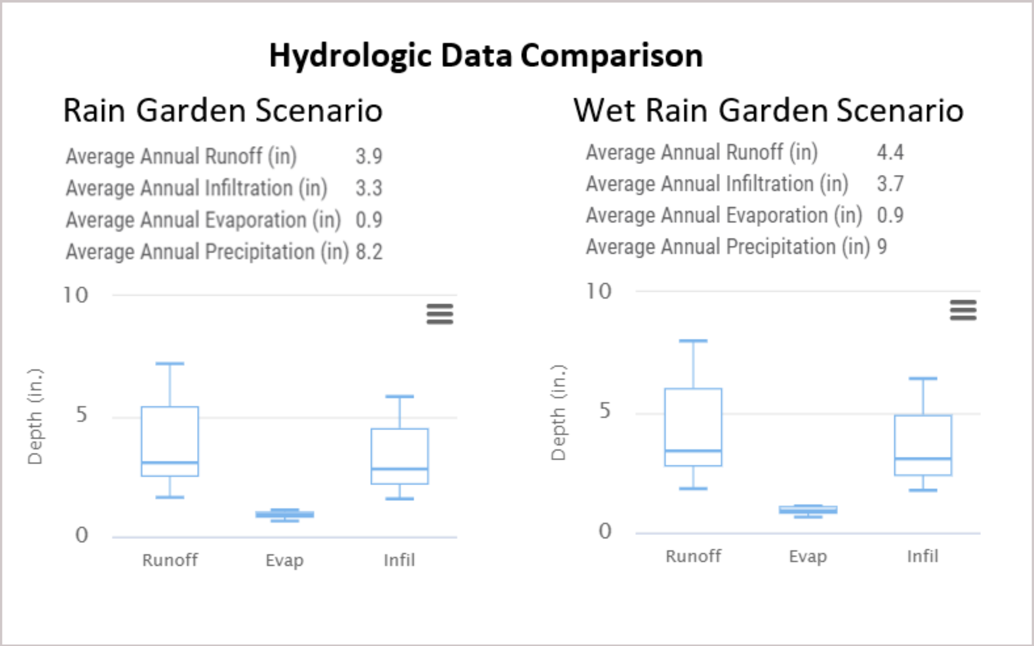
- Added 16 large rain gardens: larged-sized(10,000 ft^2), seepage rate of 0.5-inches per hour, diverse vegetation, > 50% flowering vegetation, 10% impervious area captured, irrigation system included, 9-month irrigation season

Wet Rain Garden Scenario – Cloned the Wet Scenario (increased precipitation by 10% across all months) then added rain garden technology

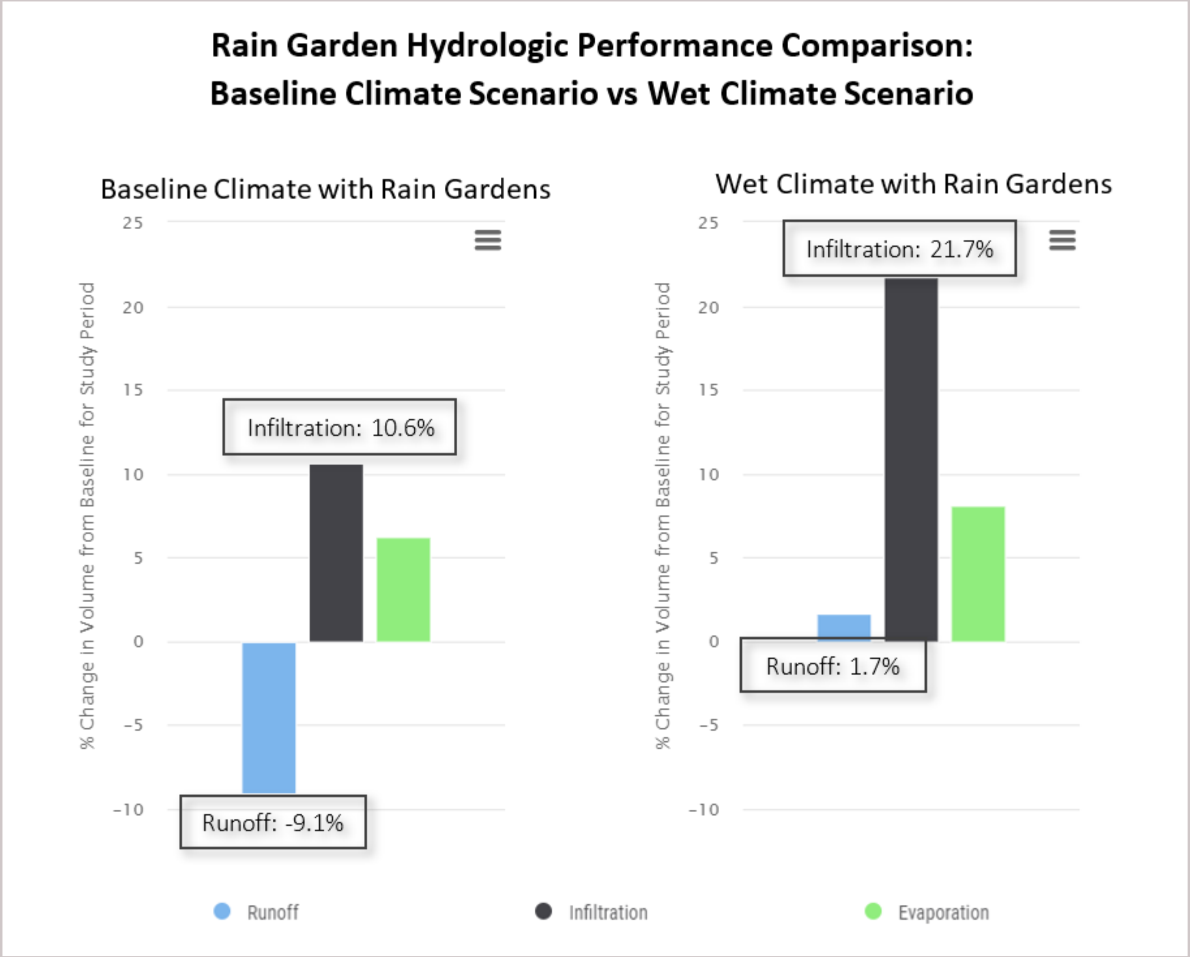
- Added 16 rain gardens with the same technology inputs as the Rain Garden Scenario

Outputs

The hydrologic data of the Rain Garden Scenario with the historical climate data and the Wet Rain Garden Scenario with the increase in precipitation by 10% shows an increase in rainfall by 1.2 inches annually, as well as increases in annual runoff and infiltration, and steady evaporation.



Cost remains unchanged between the two rain garden scenarios, regardless of climate changes. However, there is a change in the rain garden technology performance as seen in the hydrologic data. The hydrologic performance of rain gardens in historical weather conditions is a nearly 9% decrease in runoff. Runoff actually increases in the Wet Rain Garden Scenario due to increased rainfall. Infiltration increases from 10.6% under historical weather conditions to 21.7% in the wet climate scenario tested in this case study.



Conclusion

In this project area, if a future climate condition is wetter than the historical condition, rain gardens may be under-designed to handle runoff. However, stormwater planners and community decision makers could determine that the infiltration benefits of the rain gardens help meet system-wide goals to increase infiltration and improve groundwater supplies.

This case study is based on a hypothetical project in a real-world location. The project and results do not represent any actual construction or spending in the city listed.