Comparative Landscape Performance Monitoring

ALIDP Alberta Low Impact Development Partnership

MPE Engineering Ltd.

QUESTION
How well do different landscaping practices retain rainfall events?

We monitored 5 types of landscapes over 3 years to quantify performance.

DATA COLLECTION

We primarily used soil moisture sensors and water level sensors to monitor the hydrological characteristics of each practice:

Ponding Frequency
(water level sensor)

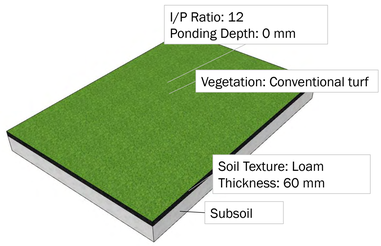
Moisture Regime
(Soil moisture sensor)

DATA PROCESSING

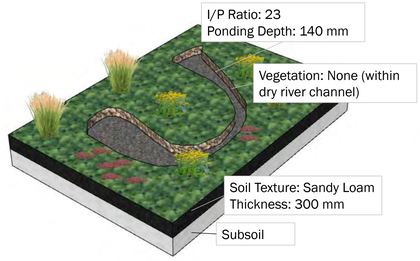
Synthesizing monitoring data with soil texture analysis and rainfall information from the City of Calgary weather stations, we were able to chart various performance characteristics, including the comparisons given here:

- Retention vs. Spill
- Soil Moisture Regime
- Percent Runoff Retained

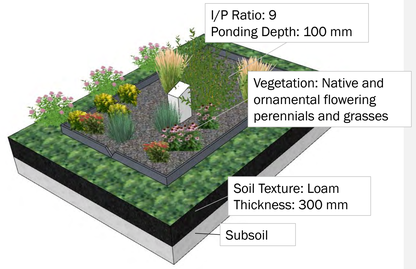
CONVENTIONAL TURF + DOWNSPOUT



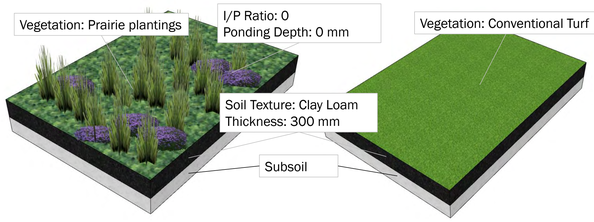
DRY RIVERBED

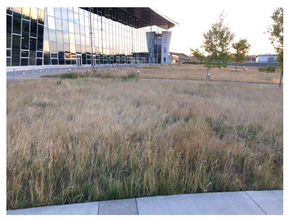


RAIN GARDEN



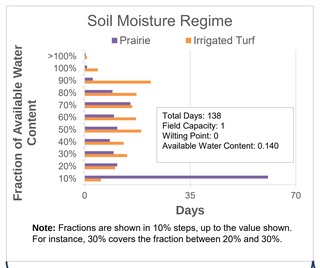
DEEPER SOIL + PRAIRIE VEGETATION



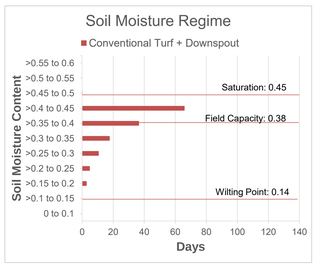


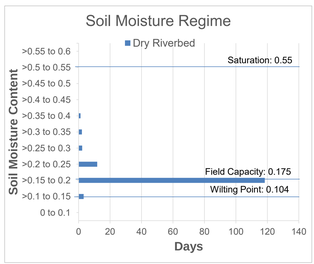
DEEPER SOIL + IRRIGATED TURF

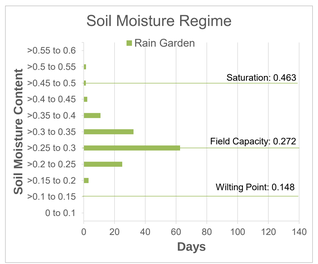
RESULTS



Note: Fractions are shown in 10% steps, up to the value shown. For instance, 30% covers the fraction between 20% and 30%.



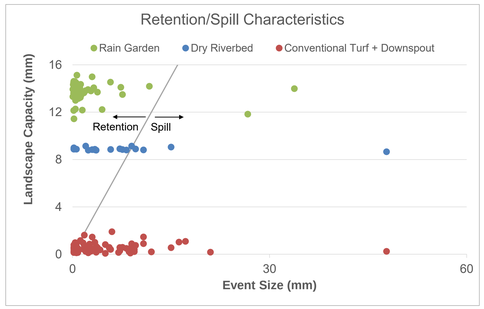


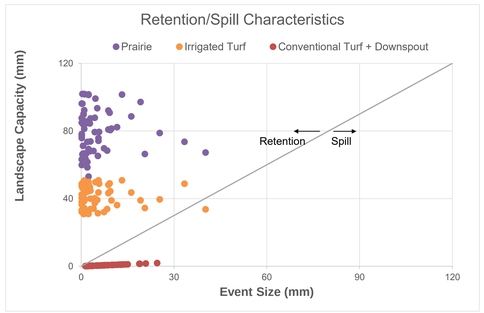


- The above graph shows the soil moisture regime as a **fraction of available water content**, where 0% is at wilting point and 100% is at field capacity.

- These three graphs show the **actual soil moisture ranges** that each site most often experiences throughout the year.
- The conventional turf + downspout displays the wettest moisture regime, being above field capacity at around 50% of the time.
- The dry riverbed displays the driest moisture regime, but generally stays above wilting point.

RESULTS (CONT'D)





- From these graphs, it is evident that there are distinct performance differences for the different landscaping practices.
- Conventional Turf + Downspout has the worst performance out of all options.

TAKEAWAYS

- Monitoring supports the original modeling prediction of performance for rain gardens. An I/P ratio of 4 retains a 100-year, 30-minute storm.
- Conventional turf + downspout generates runoff for almost all events.
- Rain gardens were shown to retain 10 to 15 times the runoff compared to a conventional turf + downspout arrangement.
- Rain gardens were shown to retain 75% of runoff.
- The prairie landscape provides significant storage capacity compared to other landscaping treatments.
- Relating downspout placement compared to landscape areas is a valuable design consideration along with the use of deeper topsoil

FUTURE EXPLORATIONS

- Is the lower retention capacity of irrigated turf on deeper topsoil limited by irrigation practices or by vegetation type, and to what extent?
- Do rain gardens with longer flow paths provide higher retention capacity?