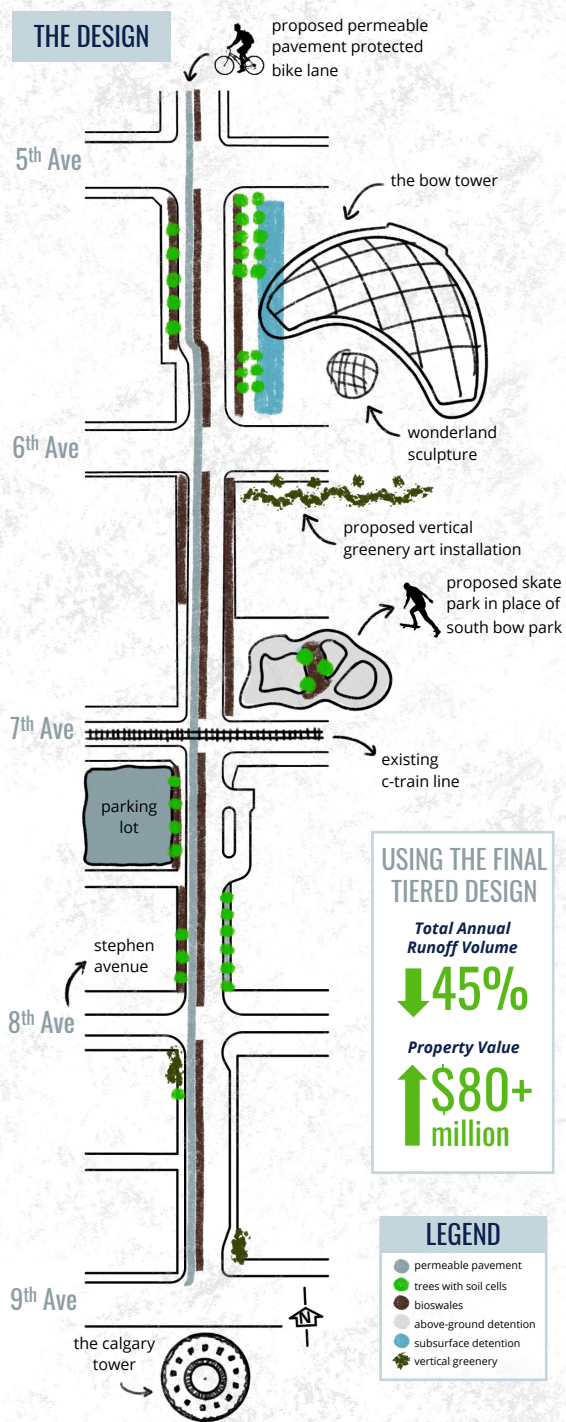


# THE DESIGN



**USING THE FINAL TIERED DESIGN**

**Total Annual Runoff Volume**  
↓ **45%**

**Property Value**  
↑ **\$80+ million**

- LEGEND**
- permeable pavement
  - trees with soil cells
  - bioswales
  - above-ground detention
  - subsurface detention
  - vertical greenery

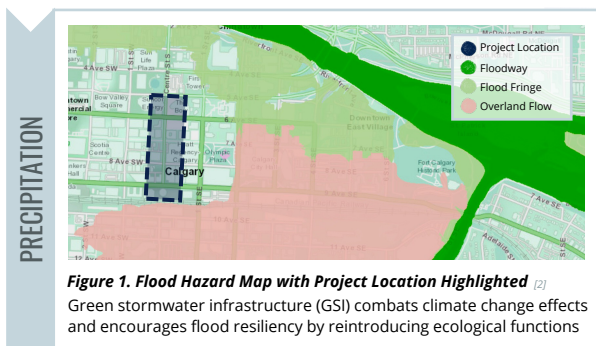
# The Clean, Green Stormwater Dream: Centre Street Capstone



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*Urban stormwater management that protects, restores, and mimics the natural water cycle [1]*



**PRECIPITATION**

**RUNOFF**

- Urban impervious surfaces lead to increased runoff by not allowing water to infiltrate or evapotranspire as it naturally would
- Goals of Green Stormwater Infrastructure:
  - ↓ Runoff Rate
  - ↓ Runoff Volume
  - ↑ Runoff Quality

**Did you know?** A typical city block generates over **5 times** more runoff than a woodland area of the same size [4]



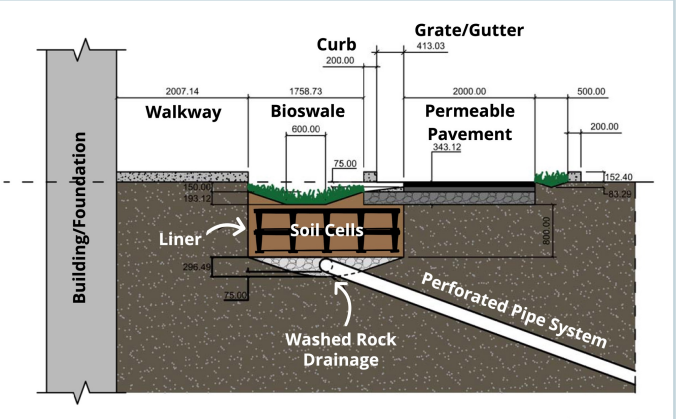
**EVAPOTRANSPIRATION + INFILTRATION + REDIRECTION**

**Types of GSI in Design**

- Bioswale:** Depressed, vegetated channel
- Soil Cell:** Modular soil support system for root health
- Permeable Pavement:** Pavement with voids for water flow
- Perforated Pipe:** Pipes with small holes along length for water outflow or inflow
- Above-Ground Detention:** Grading for temporary water storage and eventual redirection
- Subsurface Detention:** Underground tank for temporary water storage
- Vertical Greenery:** vertical structures that spread vegetation

**Effective GSI Design:**

- Increases volume of vegetation to increase **evapotranspiration**
- Increase engineered soil to increase **infiltration**
- Maximizes runoff captured and implements **redirection** measures
- Accounts for freeze-thaw conditions by increasing flow rates & water storage



**Figure 2. Cross Section A, Showing Most Complex GSI Combination**  
 Pictured: Bioswale, Soil Cells, Permeable Pavement, Perforated Pipe

1 METRE

## References

[1] American Rivers, "What is green infrastructure?". [Online]. Available: <https://www.americanrivers.org/what-is-green-infrastructure/> [Accessed: 24-Mar-2023]

[2] Government of Alberta Environment and Parks, "Alberta Environment and Parks - Alberta Floods Portal, Flood Awareness Mapping Application," 2022.

[3] Google Earth, Version 7.3.6. City of Calgary, 51.04665023, -114.06297938. [Online]. Available: <https://earth.google.com/web/search/South+Bow+Park,+Centre+Street+South,+Calgary,+AB/@51.04665023,-114.06297938,1047.80444336a,0d,60y,83.92455193h,87.9284689t,0r/data=CpsBGnESawoIMHg1MzcxNmZmZTc4YjdkYTRkOjB4YmYwYmVlM2VhY2MxYmlzMhmd8BKc-oVJQCHWfbbEAIrcwCowU291dGggQm93lFBhcmsslENlbnRyZSBTdHJlZXQGU291dGgsIENhbGdhcnksIEFCGAEGASImCiQJCC8OBVWHSUARcJOx4CaESUAZnh6y0f6CXMAhsGr5gLaFXMAiGgoWX1lCZDY2eIVKQXUzd0xXVEhKaXo5QRAC> [Accessed: 27-Dec-2022]

[4] EPA, "Protecting water quality from urban runoff - US EPA". [Online]. Available: [https://www3.epa.gov/npdes/pubs/nps\\_urban-facts\\_final.pdf](https://www3.epa.gov/npdes/pubs/nps_urban-facts_final.pdf) [Accessed: 25-Mar-2023]

[5] Google Maps, Version 7.3.6. City of Calgary, 51.0483205, -114.0611212. [Online]. Available: [https://www.google.com/maps/@51.0483205,-114.0611212,3a,75y,288.57h,74.4t/data=!3m6!1e1!3m4!1sdXph9hf1YjkZCv8\\_bZb5rA!2e0!7i16384!8i8192](https://www.google.com/maps/@51.0483205,-114.0611212,3a,75y,288.57h,74.4t/data=!3m6!1e1!3m4!1sdXph9hf1YjkZCv8_bZb5rA!2e0!7i16384!8i8192) [Accessed: 20-Mar-2023]