

Westminster, Colorado

Colorado Large-Scale Nonresidential Turf Replacements

Case Study at a Glance

Overview

Utility/Community Name: City of Westminster

Location: Westminster, Colorado

Population served: 135,000

Service area: 33.9 square miles

Challenges



Drought



Climate Change



Population Growth



Water Affordability

Community-wide Estimate of Turf Conversion Potential

- Total irrigated turf area: **3,960 acres**
 - Commercial, Industrial, Institutional (CII), including some HOA commons and public parks/open space: **1,900 acres**
- Estimated turf replacement acreage in CII and Public Areas: up to **1,200 acres or 63%**
- Potential water savings in CII and Public Areas: up to **1,830 acre-feet per year (AFY)**
- Potential cost savings from CII turf conversion: **>90%; \$6.3 - \$17.8 million over 30 years**

BACKGROUND

The City of Westminster, Colorado, is in the Denver Metro area, within both Jefferson and Adams counties. Westminster provides drinking water to approximately 135,000 people both inside and outside the city limits, and the population is expected to increase in the future. The city is primarily an urban and suburban area, and virtually all the land in the city (>97%) has been developed.

Westminster relies primarily on a single, local storage reservoir, Standley Lake, which diverts water originating in the Rocky Mountains from nearby Clear Creek for its water supply. The city purchases a small amount of raw water from Denver Water and uses reclaimed water (treated wastewater) for outdoor irrigation.

Westminster serves about 33,500 individual accounts, the majority (93%) of which are single-family residential. However, single-family residential accounts make up only half of Westminster's total water demand. Landscape irrigation, commercial, and wholesale accounts make up about 40% of total water demand. Of these accounts, 2% are dedicated for outdoor watering (i.e., reclaimed and potable water accounts), and they make up roughly 20% of the total water demand. Like most Front Range Colorado communities, water use in Westminster doubles or even triples in the summer, with half of the city's annual treated drinking water used outdoors on landscapes. Replacing non-essential turf, referred to as "turf" herein, on nonresidential properties represents a strong opportunity for the city to reduce overall demand.

Westminster has identified **water efficiency** as the **number one strategy** to reduce future water demand and **secure a sustainable water future**.



CHALLENGES

As noted in Westminster's 2020 Water Conservation and Efficiency Plan,¹ modeling indicates that the city may experience a substantial gap between anticipated future water supply and demand due primarily to climate change related increases in drought frequency and severity. The availability of additional water supplies to meet the service area's growing demand is very limited. Water rate increases are also needed to handle the cost of replacing aging water infrastructure, including construction of a new drinking water treatment facility.

Westminster has identified water efficiency as the number one strategy to reduce future water demand and secure a sustainable water future. The city's efforts are guided by three water efficiency goals in its 2020 Plan, including reducing systemwide water use from 125 gallons per capita per day (gpcd) to 110 gpcd or lower by 2030, for a reduction of 12.5% over 10 years. The other two goals are related to increasing efficiency incentive programs offered to customers, and communicating the importance and value of water efficiency through outreach materials. Given the ambitious permanent demand reduction goal, and the large amount of landscape irrigation accounting for current water use, the city decided to focus on developing a pilot project geared toward reducing turf.

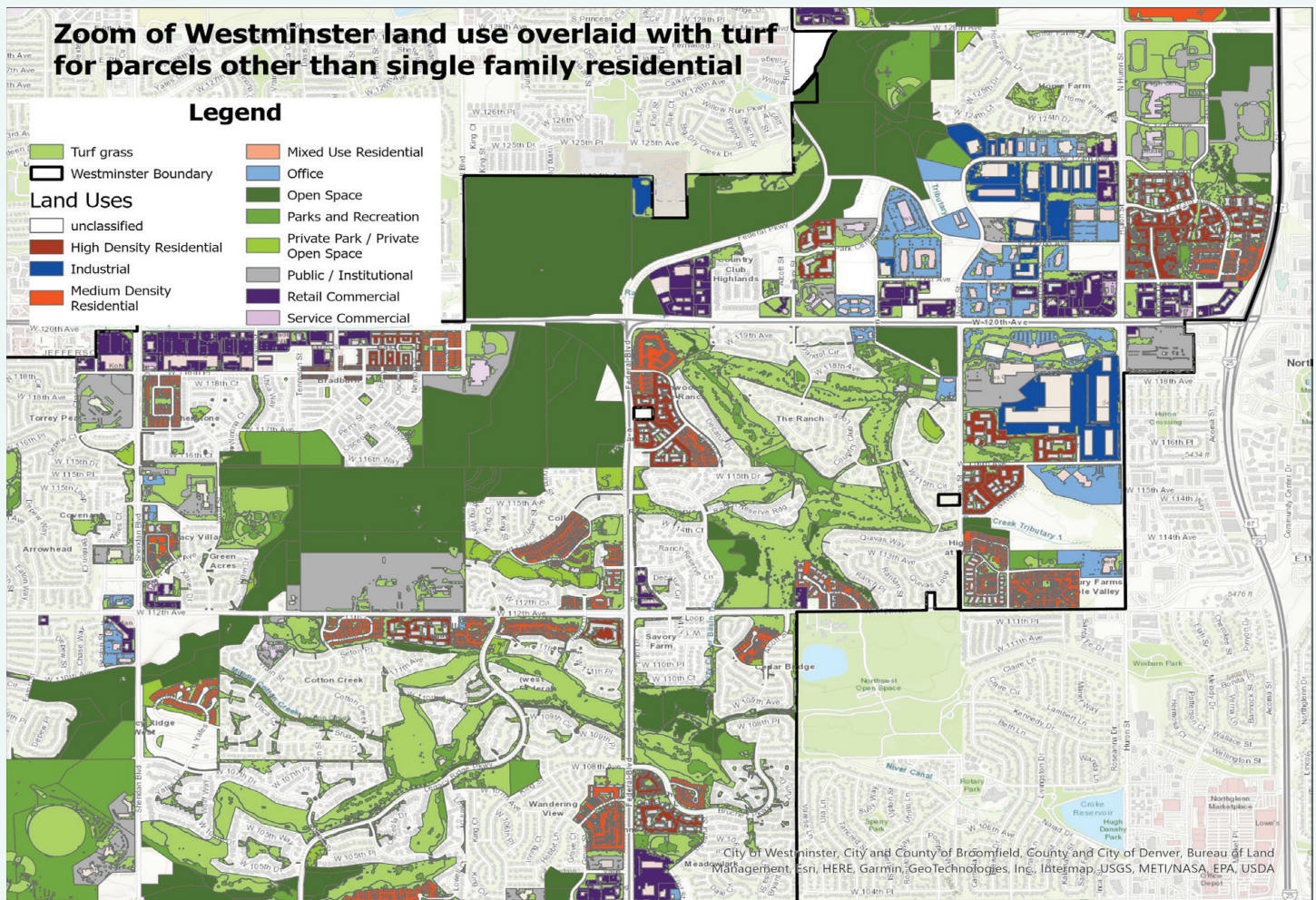
1. Westminster Water Conservation and Efficiency Plan (2020) <https://www.westminsterco.gov/Portals/1/Documents/Government%20-%20Documents/Departments/Public%20Works%20and%20Utilities/PWU%20ADM%20BO%20CoW%202020%20WEP%20Final%20PWU167.pdf>

Western Resource Advocates (WRA) and WaterNow Alliance (WaterNow) worked with Westminster to conduct a community-wide water savings and economic assessment for large-scale, nonresidential, non-essential turf conversion, in addition to supporting Westminster’s pilot turf conversion project.

POTENTIAL FOR NON-ESSENTIAL TURF REPLACEMENTS ON CII PROPERTIES

A community-wide turfgrass assessment for Westminster was conducted by the project team, which included mapping by the University of Colorado Denver. The assessment was based on a spatial analysis using the 2020 Denver Regional Council of Governments (DRCOG)² imagery and land use cover data combined with city land use data. See Figure 1 for a sample of the spatial data showcasing Westminster land use overlaid with turf for parcels other than single-family residential. Using the spatial analysis results, WRA, WaterNow, and Honey Creek Resources, Inc., an economic consulting firm, developed two Microsoft Excel-based planning tools to estimate potential water savings and to prepare economic analyses for turf replacement scenarios.

Figure 1: Sample Area of Westminster CII Land Use and Turf Layers in GIS



2. Denver Regional Council of Governments regional land cover data <https://data.drcog.org/>

Community-wide Turf Replacement Potential on CII Properties

The total annual irrigation water use for existing CII turf is estimated to be **4,120 AFY** or approximately 23% of Westminster’s total water use in 2019.³ Under a high replacement scenario (details below), the total CII irrigation water savings could be as high as 45%, or approximately **1,830 AFY**, equating to 10.4% of total city water use. Under a low replacement scenario, the total CII irrigation water savings is 16%, or **640 AFY**, equating to 3.6% of total Westminster water use.

Through the spatial analysis, the project team found approximately 3,960 acres of irrigated turf in Westminster. Of this total, approximately 2,060 acres are single-family residential turf, and the remaining 1,900 acres of turf consist of other property types, as illustrated in Table 1.

Table 1: Irrigated CII Turf Area by Land Use Category

Category of CII Area	Acres
Open space	190
Public parks and recreation	320
Parks and recreation golf course	480
Private park & private open space	170
Commercial, industrial, medium & high density residential, other*	740
TOTAL	1,900

* Medium & high density residential is largely common property areas.

These estimates of turf coverage are low. The DRCOG land use cover data included approximately 2,360 acres of tree cover in Westminster, some of which is above irrigated turf. The team chose to exclude the tree cover because it would have taken significant additional analysis to identify turf below tree canopy. Additionally, irrigation of trees needs to continue after turf conversion to maintain tree health.

The low and high CII turf replacement scenarios were developed with Westminster staff. Table 2 provides percentage and acreage of assumed turf removal by land use category for the scenarios. Percentages of turf replaced in the scenarios were determined by considering the land use category. For example, commercial and industrial landscape areas likely require little turf for functional purposes as compared to golf courses or public parks that are designed for recreational use. For the turf replacement scenarios, Table 3 shows the assumed breakdown in replacement landscaping type as a percentage of the total area of turf being replaced. The same percentages were used for both scenarios. Land use categories were also considered when developing replacement landscaping assumptions. For example, native grass was assumed to replace turf in open space areas and unused areas of golf courses. In commercial, industrial, and medium and high-density residential areas, replacement landscaping was assumed to include low water planting beds and non-irrigated areas such as plants requiring no supplemental irrigation, mulched areas, walking paths, and sitting areas.

3. Westminster 2020 Water Efficiency Plan: In 2019, total water use by account type was 5,730,071 thousand gallons (pg. 8) <https://www.westminsterco.gov/Residents/Water/Conservation/WaterEfficiencyPlan#:~:text=2020%2D2027%20Water%20Conservation%20and%20Efficiency%20Plan&text=Reduce%20system%2Dwide%20water%20use,12.5%25%20reduction%20over%2010%20years.>

Table 2: CII Turf Replacement Scenarios

Irrigated Turf		Turf Replacement Scenarios			
Land Use Category	Existing Turf (acres)	Low Replacement Scenario		High Replacement Scenario	
		% Replaced	Acres	% Replaced	Acres
Open space	190	30%	57	80%	152
Public parks and recreation	320	20%	64	70%	224
Golf course	480	5%	24	20%	96
Private park & private open space	170	30%	51	80%	136
Commercial, industrial, medium & high density residential, other	740	30%	222	80%	592
TOTAL Irrigated Turf	1,900	22%	418	63%	1,200

Table 3: CII Turf Replacement Scenario Landscaping Assumptions

Irrigated Turf	Assumed Replacement Landscaping by Type		
Land Use Category	Native Grass	Low Water Use Plants	No Irrigation
Open space	90%	5%	5%
Public parks and recreation	85%	5%	10%
Golf course	100%	0%	0%
Private park & private open space	90%	5%	5%
Commercial, industrial, medium & high density residential, other	70%	10%	20%

Table 4: CII Turf Replacement Water Savings

Land Use Category	Current Water Use (AFY)	Estimated Water Savings (AFY)	
		Low Scenario	High Scenario
Open space	412	83	222
Public parks and recreation	693	96	336
Golf course	1,040	34	136
Private park & private open space	368	75	199
Commercial, industrial, medium & high density residential, other	1,603	352	937
Total	4,120	640	1,830

It is important to note that replacing the single-family residential turf in Westminster would also result in significant water savings, up to **2,350 AFY**. To maximize water savings, turf conversions on both single-family and CII properties provide a significant opportunity and should be considered in Westminster's outdoor water conservation planning. For this analysis of large-scale turf replacement potential, Westminster and the project team focused on CII properties. This focus allows for easier scalability of retrofits on larger properties.

For more information on the community-wide turf assessment methods and analysis for Westminster and the other partner communities, see the [Full Project Case Study](#).

Benefits-Costs Analysis Shows a Strong Business Case for Turf Replacements

An analysis was conducted by Honey Creek Resources, Inc. and WaterNow to quantify the benefits and costs of the low and high turf replacement scenarios. The results show that these are cost-effective investments for Westminster.

For the scenarios analyzed,⁴ upscaling financial incentive programs for CII turf replacement would be cost-effective for the city – i.e., the benefits outweigh costs – under both high and low replacement scenarios:

- For the low replacement scenario, assuming replacement of 418 acres of turf, the city's benefit-cost ratio⁵ is 1.77, representing a **net annual benefit of \$908,700**. For this scenario the cost per AF of water would be **\$286** with a cumulative volume of **16,486 AF of water saved** over 30 years. Based on the average household water use in Westminster of 0.25 AFY, when all turf is replaced, annual water savings of 639 AF represent enough water to supply approximately 2,556 households each year. To incentivize replacements, this scenario assumes a subsidy of \$1.50 per square foot, and a rate of adoption of 50 acres per year, i.e., an eight-year program.
- For the high scenario, assuming 1,200 acres replaced, the city's⁶ benefit-cost ratio is 1.09, representing a **net annual benefit of \$320,400**. The cost per acre-foot of water would be **\$318** with **32,670 AF of water saved** over 30 years. Once fully replaced, 1,830 AF would be saved each year, representing a volume sufficient to supply approximately 7,320 households with water annually at current use rates. To incentivize replacements, this scenario assumes a subsidy of \$2.00 per square foot, and a rate of adoption of 50 acres per year, i.e., a 24-year program.

4. This project did not analyze the benefits-costs of replacing single-family residential turf. A separate analysis would be needed to know whether single-family residential turf replacements are cost-effective.

5. The benefit-cost ratio compares the monetary benefits of a project to the costs of the project. A ratio greater than 1 means the project is anticipated to provide an economic benefit.

6. The city here refers to the City's Water Department. Other departments are considered to be property owners for the purpose of this economic analysis.

Economic Analysis Assumptions

Value of Conserved Water

Avoided cost:
\$40,000/AF

"Real" inflation, increase of raw water costs:
2.0%

Treatment and distribution:
\$3.50/1,000 gallons

Retail cost of landscape water:
\$6.28/1,000 gallons

Annual Maintenance (\$/acre)

Mowing:
\$4,000

Grounds:
\$750

Fertilizer and Pesticide:
\$500

Irrigation System:
\$120

Total:
\$5,370/acre, \$0.12/sq. ft.

Replacement Expenditures (\$/sq. ft.)

Native grass, irrigated:
\$3.32

Planting and Trees:
\$7.80

Native grass, non-irrigated:
\$2.53

Hardscape, non-irrigated:
\$1.47

The economics analysis shows that the financial benefits of changing out turf would also outweigh the costs for property owners:

- For the low replacement scenario, assuming replacement of 418 acres and a subsidy of \$1.50 per square foot, property owners' benefit-cost ratio is 1.07, representing a **net annual benefit of \$247,700**.
- For the high replacement scenario, assuming replacement of 1,200 acres and a subsidy of \$2.00 per square foot, property owners' benefit-cost ratio is 1.06, representing a **net annual benefit of \$428,300**.

The economics analysis demonstrates that replacing non-essential turf can **save over 90% of the cost of water** per AF for Westminster.⁷ In addition, the water savings are significant enough to make the case that turf replacements are water infrastructure on par with purchasing new supplies and other more conventional options. This analysis also shows that **rebates of \$1.50 - \$2.00 per square foot are cost-effective** and a good investment decision for both the city and its water customers.

Rebates of **\$1.50 - \$2.00 per square foot are cost-effective** and a **good investment decision** for both the city and its water customers.



The next consideration is the city's share of the overall program cost to achieve the return on investment described above. For the low scenario, Westminster would pay \$23.1 million and property owners would pay \$69.4 million. In other words, in the low scenario, Westminster's cost-share is 25% of the \$92.5 million total program cost. The remaining 75% of the cost would be paid by CII and other property owners. For the high scenario, the city would pay \$71.6 million, i.e., 35% of the \$203.4 million program total. CII and other property owners would pay the remaining \$131.9 million of the total program cost.

With the city's cost-share for turf replacements between \$23-\$72 million, the estimated costs for either the low or high scenarios are more than could be covered with annual operating dollars. To pay for these program costs, the city could treat these turf replacements as capital projects funded through its capital budget. This approach would be consistent with Westminster's approach to its [indoor water use efficiency direct install program for affordable housing developments](#). Further, the Public Works and Utilities Department [should have sufficient legal authority and accounting flexibility](#) to debt finance turf replacements on both public and private property. A debt-financed approach would help lessen the rate impact of these investments and could accelerate the pace of adoption.

7. Based on available sources of water supply, the economics analysis assumes that Westminster would pay \$40,000 an AF for traditional water supplies. The cost per AF of water under the non-essential turf replacement scenarios range from \$286 to \$318 per AF. By spending between \$286 to \$318 per AF for new water supplies instead of \$40,000 per AF, Westminster saves over 90% on the cost of water.

KEY TAKEAWAYS

Replacing high water use turfgrass with waterwise landscaping on CII and public areas has the potential to save a significant amount of water in Westminster. Under a high turf replacement scenario, water savings of up to 1,830 AFY could be realized, with additional water savings of up to 2,360 AFY if single-family residential property is considered. This analysis also indicates that even with the city providing financial incentives, both low and high CII turf replacement scenarios in Westminster yield positive cost-benefit ratios for the city, with potential net annual benefits of \$908,700 and \$320,400, respectively, suggesting that investing in turf conversions can substantially reduce water costs and provide significant returns.

Leveraging federal and state funding opportunities in combination with treating turf replacement projects as capital projects could significantly bolster the financial feasibility of larger-scale projects. Additionally, fostering collaboration across city departments, Public Works and Utilities, Parks, Recreation and Libraries, and the City Manager's office, is crucial for streamlining project implementation and maximizing synergies. Moreover, designing multi-benefit projects not only achieves water savings and cost-effectiveness but also enhances community well-being by creating new recreational spaces. By integrating these strategies into future planning and implementation efforts, Westminster can further advance its water conservation goals while fostering community engagement and broader environmental benefits.



City Hall North Lawn

Colorado Large-Scale Nonresidential Turf Replacements Pilot Project

Pilot Project at a Glance

Project Overview

Name: City Hall North Lawn

Description: Replace non-essential turf with a waterwise landscape containing native grasses, low water use plantings with signage, walking paths with benches, and public art installations.

Area: 172,523 sq. ft. (~4 acres)

Project Goals



Provide community leadership and education on waterwise landscapes



Reduce water demand



Create a recreational amenity

Project Benefits

- Estimated Annual Water Savings: **1,600,800 gallons (5 AF)**
- Estimated Annual Water Cost Savings: **\$10,000**
- Other Expected Savings: Reduced operations and maintenance staff time, chemical herbicide use, and other maintenance costs.

Pilot Project Costs & Funding Sources

- Estimated Total Cost: **\$1 million**
- Funding Source(s): American Rescue Plan Act funds; Colorado Water Conservation Board Water Plan Grant; Parks Open Space and Trails funds; Parks, Recreation, and Libraries Department capital funds.

WESTMINSTER'S TURF REPLACEMENT PILOT PROJECT

An important component of this project was the project team working with Westminster to identify and pursue a pilot turf conversion project. The city identified four acres of cool-season turf grass in the north lawn of City Hall (Figure 2) as a good example of non-essential turf. It is not currently designated for specific purposes, has poor public access, and does not offer a connection for residents from City Hall to other nearby amenities. It also has the advantage of being located along a major local thoroughfare and is visible to thousands of passing cars each day.

The existing turf in the pilot parcel is estimated to require 9 AFY of irrigation water each year. Once established, the new landscaping is expected to use 4.1 AFY. This landscape transformation and irrigation system replacement will save approximately **5 AFY (1.6 million gallons)**, reducing water use by more than **50%**, increasing water efficiency, and improving water supply security and drought resilience. For details on how the water savings for the pilot parcel were calculated, see the [Full Project Case Study](#).

The City Hall North Lawn project will showcase the benefits of non-essential turf conversion by transforming Westminster City Hall's landscaping from an expanse of nonfunctional, non-native Kentucky bluegrass into an accessible low water landscape including an irrigation system upgrade to better optimize water savings. WaterNow and WRA worked with Westminster to support the City Hall North Lawn project, assisting in pilot project planning meetings, estimating water savings, and supporting Westminster in applying for funding to pay for the pilot project.

The project team kicked off the pilot design effort with a brainstorming discussion to explore potential ideas for the site including but not limited to:

- On-site education events
- Walkways
- Interpretive signs
- Show diverse, and attainable landscaping
- Include year-round color with wildflowers and pollinator gardens
- Low maintenance

Figure 2: *City Hall North Lawn Pilot Parcel Existing Turf*



Westminster hired Stream Landscape Architecture and Planning (Stream) to produce technical design plans, which include native grasses, regionally appropriate perennial plants, new shade trees, demonstration gardens, walking paths, seating areas, and a small, revitalized area of functional turf (Figure 3 and Table 5). In addition to saving water, the project will also substantially increase public and employee access to the site, including a new ADA ramp, and will support public art via the city's "sculpture on loan" program. Educational opportunities will be abundant throughout the site, including signage identifying plants, trees and turf types and uses, QR codes with guides to plant care tips, household efficient water use, and information about Westminster's financial incentive programs to promote the efficient use of water.

Table 5: City Hall North Lawn Pilot Parcel Landscaping

Landscape Type	Area (acres)
<i>Existing Landscape</i>	
Cool-season turf	4.0
<i>New Landscape</i>	
Cool-season turf	1.2
Native seed	2.1
Xeric landscape beds and demonstration gardens	0.4
Crusher fines	0.1
Concrete paving	0.2

Figure 3: Stream Landscape Architecture and Planning's Design for City Hall North Lawn Pilot Parcel



FINAL CONCEPT DESIGN
WESTMINSTER CITY HALL XERIC LANDSCAPE | MAY 2023

WESTMINSTER stream
landscape architecture - planning

Pilot Project Costs and Funding

The pilot project is estimated to cost approximately \$1 million, including a construction contingency. Details of project costs are provided in Table 6. Turf replacement projects costs can vary significantly and it's important to note that Westminster's project goals are not only to save water but also to provide new community access, recreational amenities, enhanced aesthetics, and educational demonstration gardens and native grass areas – all which add additional cost but also greatly increase community benefits.

Table 6: City Hall North Lawn Pilot Parcel Project Costs

Item	Cost Estimate
General Conditions*	\$ 68,570
Site Work	\$ 208,104
Planting	\$ 181,317
Irrigation	\$ 425,000
Subtotal	\$ 882,991
Contingency	\$ 117,008
Total Estimated Construction Costs	\$ 999,999

* Includes mobilization, demobilization, erosion control, survey, construction fence, tree protection.

The City of Westminster will pay for the project through a mix of previously received American Rescue Plan Act funding; locally approved debt issuance for parks, open space, and trails; and regular Parks, Recreation and Libraries Department capital funds. The city also received a \$225,000 Colorado Water Conservation Board Colorado Water Plan Grant, which completed funding needed. The City Hall North Lawn Pilot Parcel project is anticipated to kick off in late 2024 and be completed in 2025.

