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File: FY 2024 Water Conservation & Drought Rate Structure Analysis

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Castle Rock Water (CRW) prepares an annual rates and fees study to determine sufficient cost-of-service based water, water resources, wastewater, and stormwater rates and fees. Stantec Consulting Services (Stantec) is engaged to assist with the annual updates and findings. As an extension of the scope for this work for 2024 rates, Stantec was asked to evaluate the adequacy of CRW's current irrigation and excess use rates as well as the conservation surcharge to respond to potential drought stages and encourage conservation in the service area. The purpose of this technical memorandum is to provide a summary of the tasks completed to update the Conservation Impact Model for CRW and document the findings. For the evaluation, Stantec updated the Conservation Impact Model (CIM), created in 2013, with current billing data and water rates. The results of this analysis are applied in the context of the current Drought Management Plan for CRW.

1. DROUGHT MANAGEMENT PLAN

CRW's Drought Management Plan outlines five levels of water conservation targets for five drought stages, each of increasing severity. Through a combination of continued customer education and engagement, use restrictions, combined with modifications to rate structures and prices, CRW intends to develop and modify its current rate plan to prepare for levels of droughts. Figure 1 details the current drought stages, trigger points, and response guidance.

FIGURE 1 – CURRENT DROUGHT STAGES & RESPONSE

Table 14: Drought Stages, Trigger Point Guidelines and Response Targets

Drought Trigger Point Guidelines			
Drought Stage	WSI	Response Targets ¹	Key Restrictions
Advisory	1.09 to 1.05	10% water savings	Voluntary water use reductions.
Watch	1.04 to 1.00	25% water savings	Outdoor watering limited to 2 times per week. This includes a 2x/wk limit on hand watering and no exemptions for "Water Wise" customers.
Warning	0.99 to 0.95	40% water savings	Outdoor watering limited to 1 time per week. This includes a 1x/wk limit on hand watering and no exemptions for "Water Wise" customers.
Emergency	0.94 to 0.90	50% water savings	All outdoor watering/irrigation banned.
Critical/Crisis	<0.90	60+% water savings	All outdoor watering/irrigation banned, plus some indoor water use restrictions.

¹ Percentage water savings is measured as the most recent month or months of total retail water sales divided by the retail water sales used in the original WSI calculation.

Stantec evaluated various rate and structure adjustment scenarios to test the sensitivity of price drivers of a customer's water use behavior. Changes in the water portion of a customer's bill were used to evaluate price responsiveness and potential water savings. To achieve a demand response from price signals, Stantec applied the following adjustments:

1. reduced Evapotranspiration (ET) Factors,
2. increased excessive use rates, and
3. decreased the gallon threshold that triggers the current conservation surcharge rate.

2. CURRENT RATE STRUCTURE

CRW applies a water budget-based rate structure across all customer classes, with the exception of indoor use only commercial or multi-family customers. A customer's water budget has two main components, an indoor use assumption and outdoor use assumption. The indoor use assumption is equal to the customer's average winter monthly consumption (AWMC), which is the average water use measured from November-February of the preceding year. The outdoor use assumption is calculated by using the customer's irrigable area and multiplying by the appropriate monthly plant material water needs, also known as the evapotranspiration factor (ET). Irrigable area will vary per account. The 2024 ET factors are provided in Table 1 and represent the average gallons of water allotted per square foot of irrigable area, adjusted for natural monthly precipitation.

TABLE 1 – EVAPOTRANSPIRATION FACTORS ASSUMED FOR 2024

Month	Avg. ET
April	3.5294
May	4.4920
June	5.6150
July	5.7754
August	5.2941
September	4.1711
October	2.7272

Table 2 lists the current rates for the irrigation season (April – October) and Table 3 lists the rates in the winter months (November – February) for each customer class.

TABLE 2 – IRRIGATION SEASON RATES

Irrigation Season (April 1 – October 31) Consumption	Tier 1 (AWMC)	Tier 2 Irrigation	Tier 3 Excess Use	Residential Surcharge >40kgals
Residential	\$3.08	\$6.27	\$9.35	+\$9.35
Multi-Family (Indoor use only)	\$3.08	N/A	\$4.04	N/A
Multi-Family with irrigation	\$3.08	\$5.32	\$7.95	N/A
Commercial (Indoor use only)	\$3.08	N/A	\$4.31	N/A

Commercial with irrigation	\$3.08	\$5.38	\$8.05	N/A
Greenbelt (Irrigation only)	N/A	\$8.58	\$12.86	N/A

TABLE 3 – WINTER SEASON RATES

Winter Season (November 1 – February 28) Consumption	Tier 1 (AWMC)	Tier 2 Irrigation	Tier 3 Excess Use	Residential Surcharge >40kgals
Residential	\$3.08	N/A	\$6.27	+\$9.35
Multi-Family (Indoor use only)	\$3.08	N/A	\$4.04	N/A
Multi-Family with irrigation	\$3.08	N/A	\$5.32	N/A
Commercial (Indoor use only)	\$3.08	N/A	\$4.31	N/A
Commercial with irrigation	\$3.08	N/A	\$5.38	N/A
Greenbelt (Irrigation only)	N/A	N/A	\$12.86	N/A

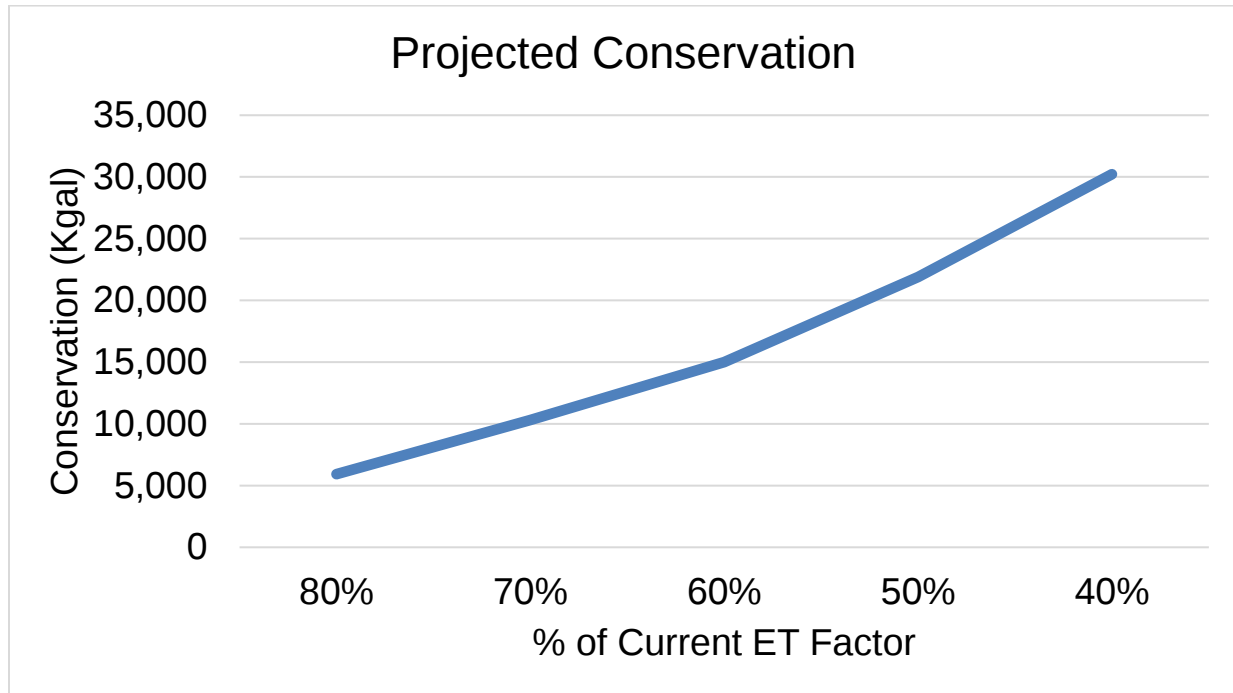
3. TEST SCENARIOS & ASSUMPTIONS

Using the CIM, Stantec worked with CRW to receive updated customer billing data and rates and fees. Due to high-levels of precipitation in the region in 2023, Stantec used the 2022 billing data as a more representative sample with a gross-up assumption for account growth to estimate 2024 account data. This billing dataset provided the baseline for the analysis. The CIM model calculates a projected bill impact for each customer and incorporates price elasticity factors to estimate water conservation due to price response.

Stantec ran various scenarios to test the sensitivity of price drivers of a customer's water bill. Stantec included the following scenarios:

1. Reduced Evapotranspiration (ET) Factors
2. Increased excessive use rates.
3. Decreased the gallon threshold needed to reach the current conservation surcharge rate.
4. And combinations of the three listed drivers.

To understand the sensitivity of conservation to changes in ET factors, Stantec simulated a range of ET factors from 80% of current ET factors to 40% of current ET factors. ET and conservation are inversely related, as the ET factor decreases, outdoor budgets will decrease. The effect is more usage is considered to be part of the second and third tiers, thus charged at a higher block rate and resulting in a higher water bill. We assume customers respond more to higher prices from usage in higher tiers, therefore we also assume it drives water conservation. At an ET factor 40% of current levels, all else being equal, the CIM estimates 30.2 million gallons conserved, or 1% of total system use. Figure 2 graphically depicts anticipated conservation at a given level of current ET.

FIGURE 2 – ET FACTORS VS CONSERVATION


The current directive is to first decrease ET factors to induce conservation. The following scenarios for various drought stages assume a decrease in the ET factor.

3.1 DROUGHT STAGE 2 – WATCH

The first drought rate will come into effect in stage two. During this stage it is proposed the ET factor drops to 40% of current levels and the residential conservation surcharge threshold decreases from 40,000 gallons to 30,000 gallons. No changes are made to the surcharge rate at this stage. Per the current drought management plan, the current conservation target during the watch stage is 25% of total water use. Once the ET factor is lowered, and the threshold is lowered, the CIM calculates expected conservation of 3.19% of total water use, or 98,887 thousand gallons (kgals). Table 4 details the projected conservation by customer type.

TABLE 4 – DROUGHT STAGE TWO CONSERVATION

Class	Conservation (KGal)
Residential	91,975
Multi-Family (Indoor use only)	N/A
Multi-Family with irrigation	1,412
Commercial (Indoor use only)	N/A
Commercial with irrigation	1,379
Greenbelt (Irrigation only)	4,121
Total	98,887 (3.19%)

While collecting additional revenue is not a goal of the utility during the drought stages, lowering outdoor budgets, and lowering the conservation surcharge thresholds as outlined in this scenario is anticipated to bring \$2.8 million of additional revenue. However, much of this could reasonably expected to be offset by operational challenges and expenses incurred during a drought.

3.2 DROUGHT STAGE 3 – WARNING

Drought stage three represents a further worsening of drought conditions. Further water conservation response is needed. To achieve a part of the 40% water savings target, the decrease of ET factors to 40% of current levels, lowering of the conservation surcharge threshold to 30,000 gallons will be applied in addition to an increase of 10% to the tier 3 conservation surcharges. The increased price combined with smaller outdoor budgets leads to high users experiencing a price signal to conserve more than that of the second drought stage. Incremental conservation is estimated to be 51,041 thousand gallons, bringing total conservation to 149,928 kgals or 4.86% for this scenario. Potential additional revenue collected is estimated to be \$3.2M.

TABLE 5 – DROUGHT STAGE THREE CONSERVATION

Class	Conservation (KGal)
Residential	134,647
Multi-Family (Indoor use only)	N/A
Multi-Family with irrigation	2,203
Commercial (Indoor use only)	N/A
Commercial with irrigation	2,778
Greenbelt (Irrigation only)	10,300
Total	149,928 (4.86%)

3.3 DROUGHT STAGE 4 – EMERGENCY AND BEYOND

The emergency drought stage is the final stage before critical levels of drought and a 50% water conservation target is needed. In practice, CRW may ban all outdoor water use during this stage. For purposes of this scenario, banning outdoor use is modeled as eliminating the outdoor budget by setting the ET factor to 0% of current use. Additionally, the conservation surcharge will be set to 15,000 gallons. That threshold represents the higher end of the range of AWMC. All use above that threshold will be charged at the surcharge rate plus an additional 10%. Total water conservation is projected to be 317,325 kgals or 10.29%. Additional revenue from the surcharges is potentially \$5M; however, significant additional voluntary conservation would lower revenues collected from CRW and potentially lower water production and distribution costs in this severe drought stage.

TABLE 6 – DROUGHT STAGE FOUR CONSERVATION

Class	Conservation (KGal)
Residential	263,946
Multi-Family (Indoor use only)	N/A

Multi-Family with irrigation	5,106
Commercial (Indoor use only)	N/A
Commercial with irrigation	3,462
Greenbelt (Irrigation only)	44,811
Total	317,325 (10.29%)

In the final, catastrophic drought scenario at the critical/crisis level, the conservation surcharge could be further lowered or set to indoor use so that all use in excess of the indoor allowance would be charged at the surcharge rates. In this scenario total conservation is 13.4% of total water use.

4. CONCLUSIONS

The objective of this Study was to test conservation potential that could be achieved through a variety of price signaling tools including:

1. Lower outdoor water budgets
2. Lower surcharge thresholds
3. Higher surcharge rates

The conservation induced from price and rate structure changes, along with voluntary conservation, customer education, and customer engagement and buy-in to drought plans, are intended to work together to reach the conservation targets set forth by CRW. Price alone is not and cannot be expected to be a standalone solution to needed conservation during times of drought. However, it remains a key tool in CRW's toolkit to achieve conservation. A summary table of potential conservation in each drought stage from price signals versus the conservation target is presented below.

TABLE 7 – SUMMARY OF FINDINGS

Drought Stage	Drought Rates in Effect	Conservation from Price (% total use)	Conservation Target (% total use)	Key Restrictions
Advisory	N	N/A	10%	Voluntary
Watch	Y	3.19%	25%	2x per week outdoor water
Warning	Y	4.86%	40%	1x per week outdoor water
Emergency	Y	10.29%	50%	Outdoor water banned
Critical/Crisis	Y	13.40%	+60%	Outdoor water banned + indoor restrictions