

Technical Memorandum

Date: January 5, 2018

Project: 16-1922

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Ms. Aleta Froman-Goodrich, PE – City Engineer
City of Oregon City

Mr. Bob George, PE – Chief Engineer
Clackamas River Water District

From: Brian Ginter, PE
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Murraysmith

Re: Clackamas River Water / City of Oregon City Joint Engineering Analysis
Water Service Conflict Area Technical Analysis

Purpose

Clackamas River Water (CRW) and the City of Oregon City (City) are engaged in discussions with the goal of defining their adjoining service area boundaries for existing and future conditions to provide more efficient and economic water service to all customers. Murraysmith was selected by both providers to perform the engineering analysis and facilitate discussions between the two water providers.

The purpose of this white paper is to develop a framework for defining current and long-term service area boundaries, orderly service transfers, and infrastructure management through a study of current conflict areas and overlapping service identified by the providers. This report will:

- Present the historical events regarding boundary realignment
- Identify typical conflicts present between service providers
- Document the identified water service conflict focus areas
- Propose individual or policy-based solutions for each conflict area
- Develop an approach to guide future conflict resolution
- Provide an action plan for the next steps

This report also fulfills the study requirements set forth in the May 2014 Settlement Agreement between CRW and the City.

Introduction

The Clackamas River is the primary water source for municipal water supply to Oregon City and the surrounding urban and semi-urban areas, as illustrated in **Figure 1**. Three separate Water Treatment Plants (WTPs) along the river supply six different water providers, including the City and CRW (**Table 1**).

Table 1
Water Treatment Facilities along the Clackamas River

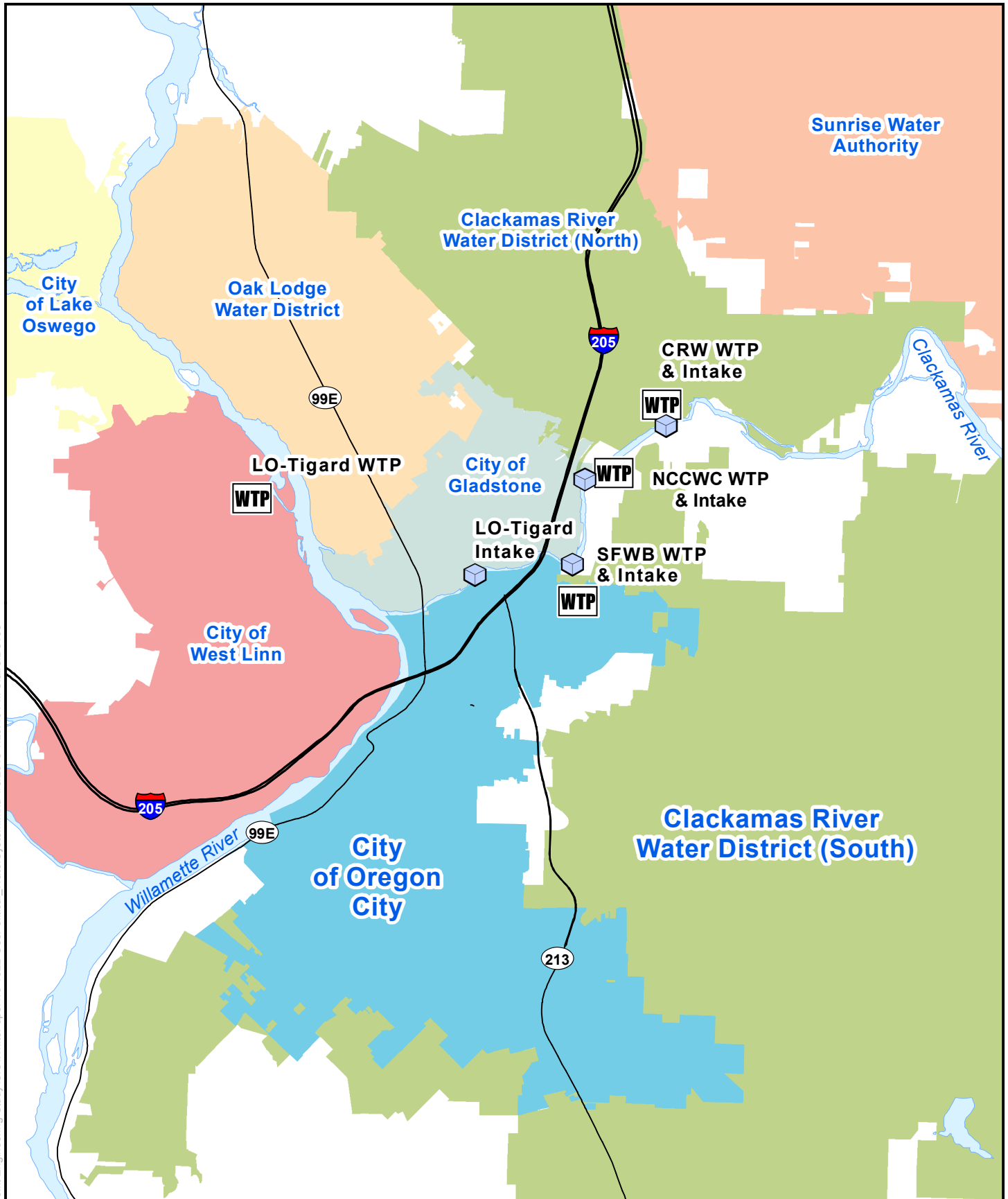
Water Treatment Plant	South Fork Water Board WTP	North Clackamas County Water Commission WTP	Clackamas River Water WTP
Water Provider Served	Oregon City	Sunrise Water Authority	Clackamas River Water (North)
	West Linn	Gladstone	Sunrise Water Authority
	Clackamas River Water (South)	Oak Lodge Water District	

Historically, these water providers have coexisted and provided service to separate areas. Cities generally supplied the urban centers and water districts or water authorities have served the semi-urban areas both within and outside the Metro Urban Growth Boundary (UGB). With development and subsequent UGB expansion cities can legally serve areas that were once limited to water district or water authority service. Under ORS 222.520 to 222.580, a city may annex and withdraw territory, and assume facilities, from special districts if the facilities are non-essential to the operation of the remaining district water system. This same rule does not apply to water authorities – their service areas are protected and cannot be withdrawn by cities.

This study is the result of a legal dispute over the right to withdraw territory between Oregon City and CRW. As a municipal corporation, the City provides water service to residents within city limits and some areas within the UGB, but is limited in its ability to serve customers outside the UGB. CRW, a domestic water supply district organized under ORS 264, borders the City to the north, south, and east and primarily serves customers within unincorporated Clackamas County outside the UGB, as well as customers within the city limits and the UGB.

In November of 2013, CRW and Sunrise Water Authority (SWA) approved Ordinance 03-2013 and Resolution 2013-02 respectively (collectively known as the 190 Agreement) to form the Clackamas

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- City of Oregon City
- Clackamas River Water District
- City of Gladstone
- City of Lake Oswego
- Oak Lodge Water District
- Sunrise Water Authority
- City of West Linn
- Major Roads
- Water Intake
- Oregon City UGB
- WTP Water Treatment Plant

1 inch = 6,000 feet

Oregon City - Clackamas River Water Joint Engineering Study

Figure 1 Vicinity Map



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Regional Water Supply Commission (CRWSC). CRW and SWA created the CRWSC to oversee the efficient supply of domestic water services within the two water providers' service areas. The City and South Fork Water Board (SFWB) were concerned the 190 Agreement would extend SWA boundary protection rights under ORS 450.987 as a Water Authority to CRW, thus limiting the City's right to annex and withdraw CRW territory.

In December of 2013, the City and SFWB filed an appeal to the Land Use Board of Appeals (LUBA) stating that the creation of the CRWSC infringed on the City's expansion rights and constituted material harm to the City and SFWB. This appeal led to discussions between CRW and the City regarding the goals of the CRWSC. In May 2014, a Settlement Agreement was signed by the City and CRW calling for this engineering study to provide direction for existing and future disputes.

This study is focused only on service provision conflicts between Oregon City and CRW. For the remainder of this study, areas and service providers north of the Clackamas River and west of the Willamette River will be ignored.

Conflict Characterization

Neither party disputes the City's right to annex and withdraw CRW territory. Rather it is how prior annexations and withdrawals have occurred that is the primary driver of conflict. The agreements for service transitions are outdated or do not address the current challenges, which has led to irregular policies and an uncertainty in long-term service provider boundaries. This uncertainty has led to CRW's reluctance to invest in areas that might soon be taken by the City, animosity over the condition of existing infrastructure in areas that are eligible for annexation, and a general short-term perspective on coordinated planning. The lack of a clear plan has at times resulted in annexation without withdrawal of territory resulting in continued uncertainty for both water providers related to long-term service requirements. All compiled, this has meant customers of both providers have seen failing infrastructure, frequent road repairs, higher costs, and a lack of clarity regarding long term service. As annexations and withdrawals are becoming more and more frequent, and in order to efficiently and effectively plan for the long-term service to all customers in the area, the parties concluded that a formalized process should be developed that is acceptable to both water providers.

Remuneration for Assets

Typically, urbanization and city expansion occurs where there is no existing public water service provider. However, CRW already provides water service to much of the semi-urban area surrounding the City. When the City expands service into these area, existing CRW infrastructure, often with remaining useful life, might be present, however the infrastructure may be inadequate by City standards. This creates a potential source of conflict between the two water providers associated with:

- CRW's willingness to invest in the renewal or replacement of aging infrastructure that may ultimately be withdrawn by the City;

- The City's desire to efficiently transfer service to City rate payers without constructing redundant facilities; and
- Identification of critical infrastructure that must remain within CRW's ownership for continued water service to CRW customers.

In order to address these sources of conflict, both water providers have acknowledged the need to develop a fair and objective remuneration policy that encourages coordinated planning and equitable, long-term focused investment in infrastructure development and renewal.

Reduce Isolated CRW Service Areas

When newly annexed areas are inconsistently withdrawn, isolated pockets of CRW customers are created within City service area. To supply these customers, either parallel and redundant infrastructure must be constructed and maintained, or the City must wheel water through their infrastructure to supply CRW infrastructure and customers. Traditionally, the latter has been chosen and facilitated in two ways – as a master meter connection or as Joint Users. These two mechanisms are detailed below:

- **Master Meters:** Master meters cleanly divide two systems and retain infrastructure maintenance responsibility with the system paying for the water by recording the totalized flow through a single supply point. They can supply entire pressure zones or a limited area such as a single road. Typically, master meters are used in areas that are not predicted to transition soon, or where a significant number of customers are served in the receiving system.
- **Joint Users:** Joint users are CRW customers that are supplied through City, CRW, or jointly owned infrastructure without an intervening master meter. Joint Users are not ideal in that the supplying system must take on a significant amount of risk if the receiving system does not adequately maintain its pipes but certain conditions such as system looping, or a limited number of customers, prevent the use of master meters.

Master meters and Joint Users are both integral solutions to serving isolated customers. The problem arises when these short-term solutions are selected without thought to long-term service goals.

For long term service, the simplest technical solution is often annexation and withdrawal of CRW service areas. However, political motives and a reluctance to be included in city limits stalls this type of solution. The City currently has a policy (Oregon City Municipal Code 13.04.260B) to charge 1.5 times the retail rates for service to customers outside of city limits. This policy may discourage orderly transition of service in the interest of protecting the customer as Master Metered or Joint User customers currently only pay their system's nominal rate.

The inconsistent application of master meters and Joint Users, the lack of certainty regarding annexation and withdrawal of territory, and the economic consequences for both water providers

and customers require the development of an approach to isolated service that can be consistently and fairly applied.

Water Service Provider Goals

The consultant team met individually with CRW and City staff to understand both providers' goals (without the influence of the other provider). The following goals that influence each water providers' definition of success in this study were identified in the discussions.

- Joint Engineering Study Goals for Both Providers
 - The City and the CRW are both committed to providing high quality potable water service to customers at reasonable rates.
 - Both providers recognize the benefits of continued collaboration to provide seamless service to conflict area customers that may be transferred, but each also recognizes their first duty is to customers within their own long-term service areas.
 - Both providers desire certainty of long-term water service area boundaries to inform ongoing system development and renewal/replacement capital investment.
 - Both providers are amenable to wheeled water from the other purveyor's WTP in cases where a higher level of service could be provided more economically and long-term agreements are in place to support investments needed to achieve and maintain the level of service.
 - Both providers recognize the value of interconnected systems with redundant emergency supply and are committed to working together with neighboring water providers to minimize impacts on customers during emergencies as well as periods of growth and transition.
- City Specific Goals
 - The City wants to be the water service provider to existing and future annexed City residents and businesses.
 - The City is part owner of SFWB, and therefore prefers to supply the City's customers with water sourced from the SFWB WTP, thereby serving the City's ultimate service area and customers. This results in better utilization of excess capacity at the WTP, higher certainty and control of water supply, control over water supply costs, control over planning and implementation of capacity expansions, etc.
- CRW Specific Goals

- CRW prefers to supply the district's customers with water sourced from the CRW WTP as this results in better utilization of excess capacity at the WTP, higher certainty and control of water supply, control over water supply costs, control over planning and implementation of capacity expansions, etc.

Keeping these goals in mind, existing conflicts and solutions to key areas identified during scoping will be explored in the next section.

Study Area

Figures 2A and 2B highlights the overall study area of this white paper and identifies the individual focus areas discussed in detail later in this section. Study conflict areas are generally located near the Oregon City city limits or the edge of the UGB, where annexation and withdrawals occur.

Focus Areas:

- South End
- Central Point
- Canyon Ridge
- Leland McCord
- Country Village
- Beavercreek
 - Beavercreek Concept Plan
 - Fairway Downs
 - Thayer and Loder Roads
 - Henrici Ridge
 - Park Place
- HOPP/Barlow Crest

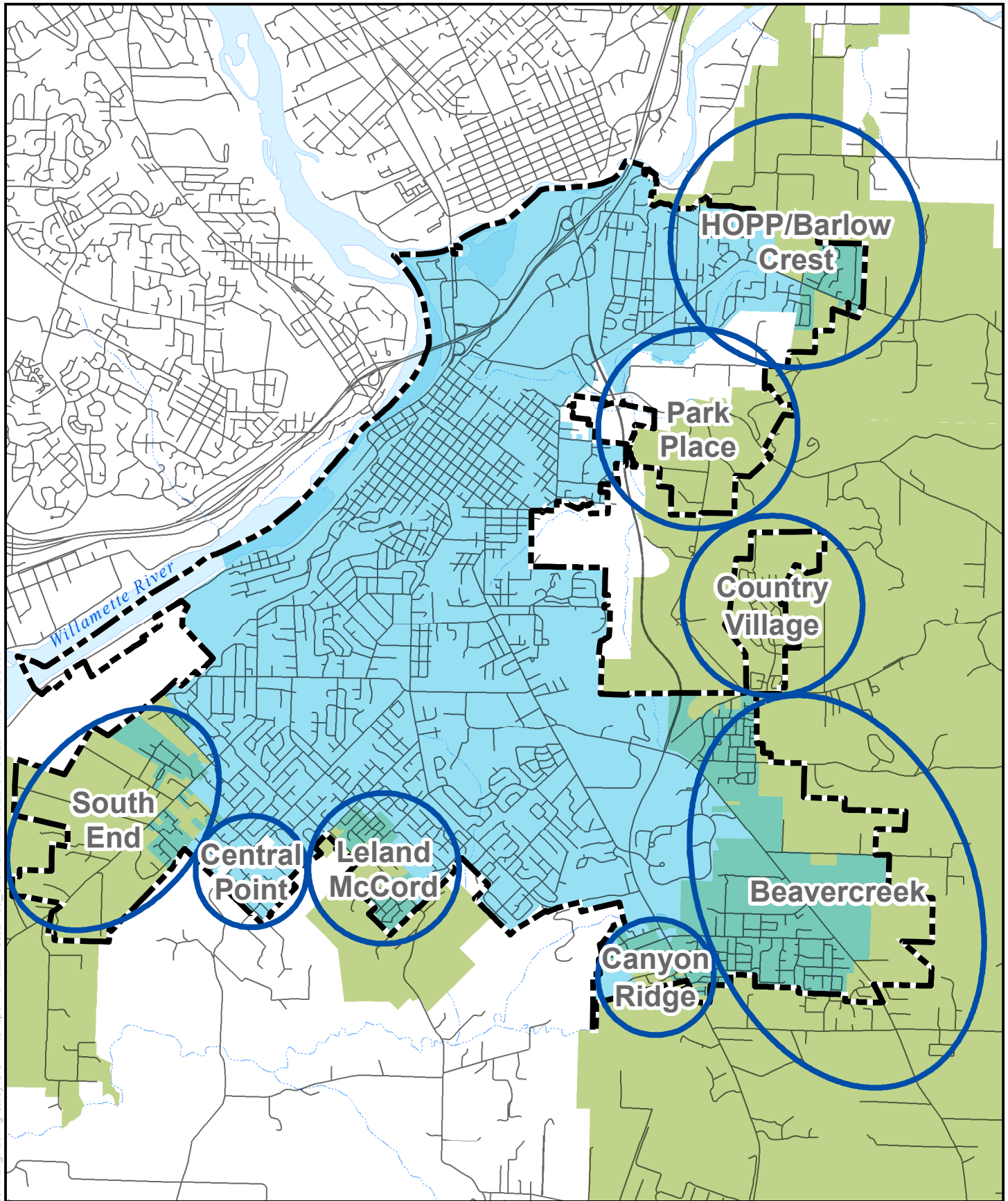
Study Area Discussion

The following section details existing conditions, conflicts, and proposed solutions for each study area. While specific solutions are unique, the general goals described in the previous section helped drive a common approach to the solution process.

Comments Regarding Mapping

The figures in this section present the existing and proposed service conditions in the focus areas. Existing infrastructure is color coded: dark blue represents City ownership, green CRW ownership, light blue joint ownership, and yellow SFWB or other ownership. Taxlots currently served by CRW are highlighted in colors representing either their existing or future service category. City taxlots have not been highlighted because there is assumed to be no change of service at the individual customer scale. Future conditions maps are only presented if deemed necessary and are intended to be used as a guide for long-term service; intermediate steps may be necessary to achieve this configuration and other alternatives may be preferred, based on actual timing and character of

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- Urban Growth Boundary (UGB)
- Oregon City City Limits
- Clackamas River Water District Boundary
- Areas of Overlap

- Focus Area
- Road
- River

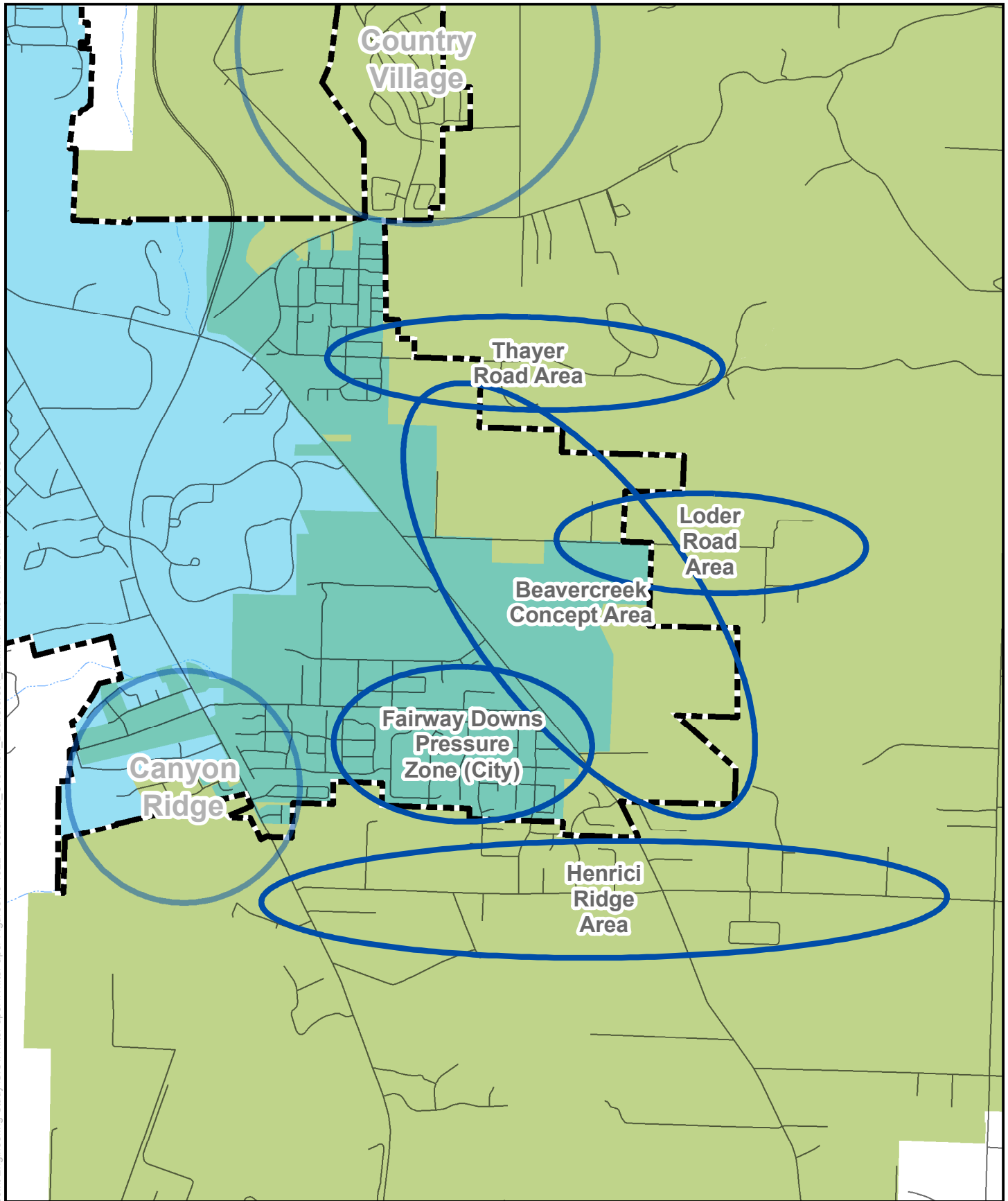
1 inch = 4,000 feet

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Figure 2A
Study Area



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- Urban Growth Boundary (UGB)
- Oregon City City Limits
- Clackamas River
- Water District Boundary
- Areas of Overlap
- Focus Area
- Beavercreek Areas
- Road
- River

1 inch = 2,000 feet

Oregon City - Clackamas River Water Joint Engineering Study

Figure 2B
Study Area - Beaver Creek



annexation and urban development. Finally, all mapping is limited by the accuracy of the data provided by the City and CRW. Best efforts have been made to resolve lingering inaccuracies but due to ongoing service transitions and the nature of two separate system databases, some inaccuracies are likely.

South End

The South End Concept Area is a prime example of conflicts that arise when service transitions occur without a long-term service plan. As the City developed, the geopolitical boundary and service area expanded south into CRW service areas, effectively isolating the CRW South End Area from the rest of the CRW system. Additionally, City annexation occurred at the individual taxlot level, resulting in an inconsistent patchwork of City and CRW service areas and infrastructure. Both providers will continue to collaborate to develop a long-term solution in this area. In this study, the existing condition will be explained and key areas of agreement will be noted, but a finalized solution and transition phasing was not developed.

Most customers in the South End Area are served via a jointly-owned 12-inch diameter transmission main in South End Road and supplied with water wheeled through the City system from the SFWB WTP. CRW customers south of Impala Way are master metered, while north of Impala Way CRW and City mains are served as City customers and CRW joint users. **Figure 3** presents the existing system infrastructure and service provider for taxlots currently served by CRW in the South End area.

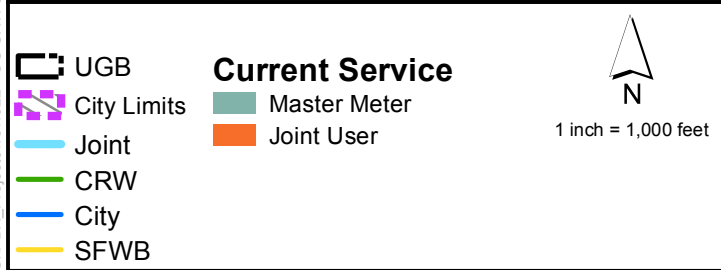
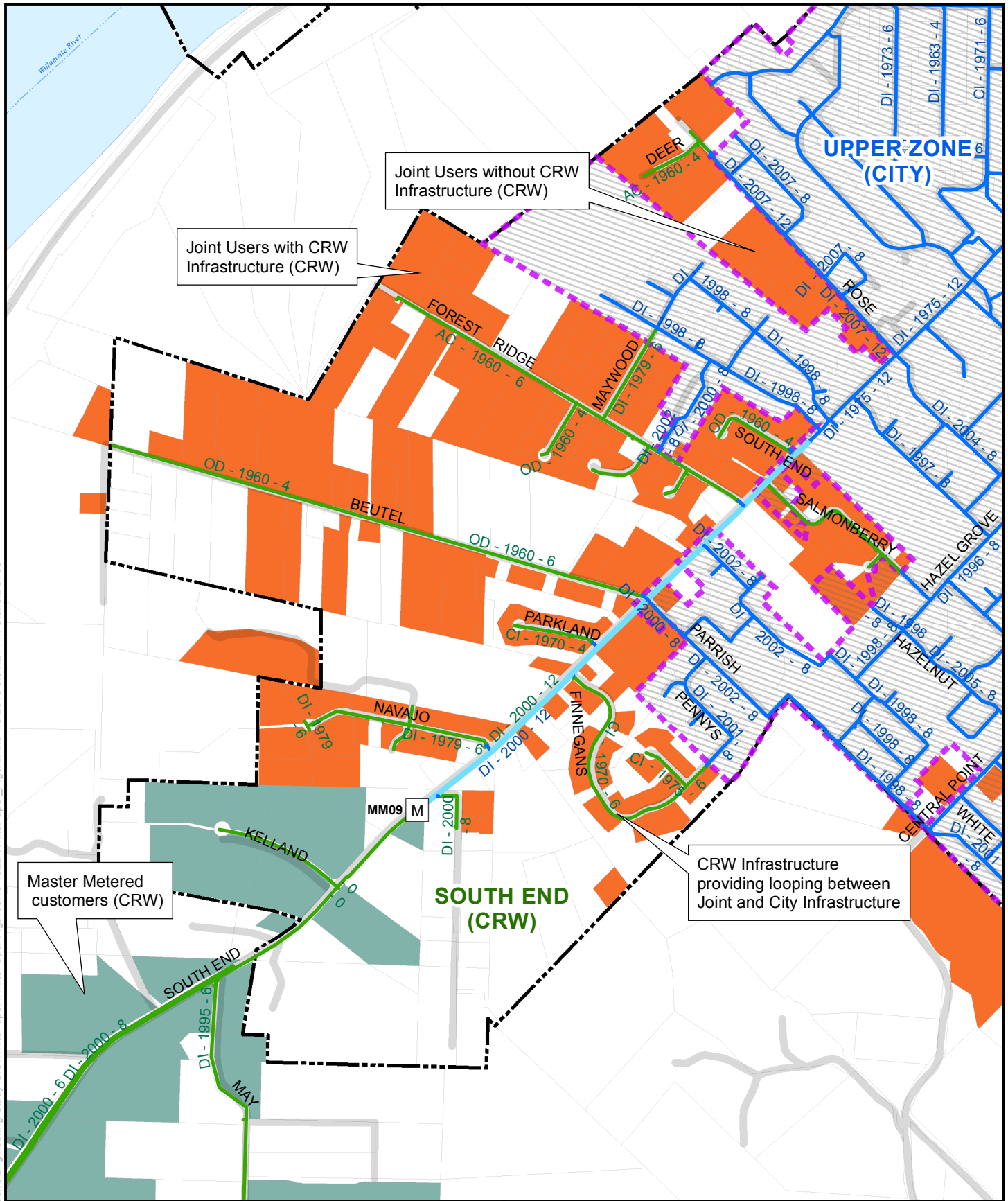
Both providers have recognized the need for a consistent approach to service and infrastructure transitions in South End. To achieve this goal, policy-level agreements are required, including:

- A remuneration methodology and agreement for the transfer of infrastructure assets
- An updated cost-assignment for installation and maintenance of shared and interfacing (master meter) infrastructure
- A methodology and agreement of triggers for the transfer of service area
- A methodology and agreement for wheeled service (master meter or Joint User status) and development of a wheeling charge

Each of these policy level agreements will continue to appear throughout the discussions of the conflict areas and are explained in greater detail in the **Typical Conflict/Solutions** section (page 19 of this report). Given the complexity of the South End area water service boundary overlap and uncertainty of future development timing and character, a specific plan for service transfers and infrastructure/territory withdrawal was not developed. A general understanding that the City will ultimately annex and withdraw all territory within the UGB was agreed upon.

Resolution: Ongoing collaborative communication and planning will be required; service agreements 9especially Joint User) addressing ongoing leak detection and mitigation.

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Figure 3 - Existing South End

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Clackamas River Water

OREGON CITY

Central Point

The Central Point area is an example of incomplete annexation and withdrawal. Existing infrastructure in the area is entirely City owned and CRW customers are classified as Joint User served via City mains. **Figure 4** illustrates the existing service configuration in Central Point.

Both providers agreed that given the lack of CRW infrastructure and the adjacent City service area, the City should provide service to all customers in this area. Recently, local development has been the primary driver of provider transitions, and additional efforts should be made to complete all transitions in the near future. There may be a few remaining taxlots outside the present UGB that will necessitate Joint User service, but within the UGB, all efforts should be made to withdraw these customers. One specific issue that will need to be addressed is the City's policy (Oregon City Municipal Code 13.04.260B) for water service outside the City limits. Currently, these customers pay 1.5 times the City retail rate.

Resolution: All customers within the UGB to be withdrawn by the City; Joint Users remain outside the UGB; City to pursue current extraterritorial service policy change.

Canyon Ridge

The Canyon Ridge area is another example of a CRW service area completely reliant on City supply, although without an intervening master meter. Existing service is provided by CRW through the Joint User agreement via CRW distribution mains in Canyon Ridge Drive and City mains in Molalla Avenue. Canyon Ridge customers are primarily single family homes within the UGB and outside of city limits while others CRW customers are large lots outside the UGB. **Figure 5** shows the current service configuration in Canyon Ridge.

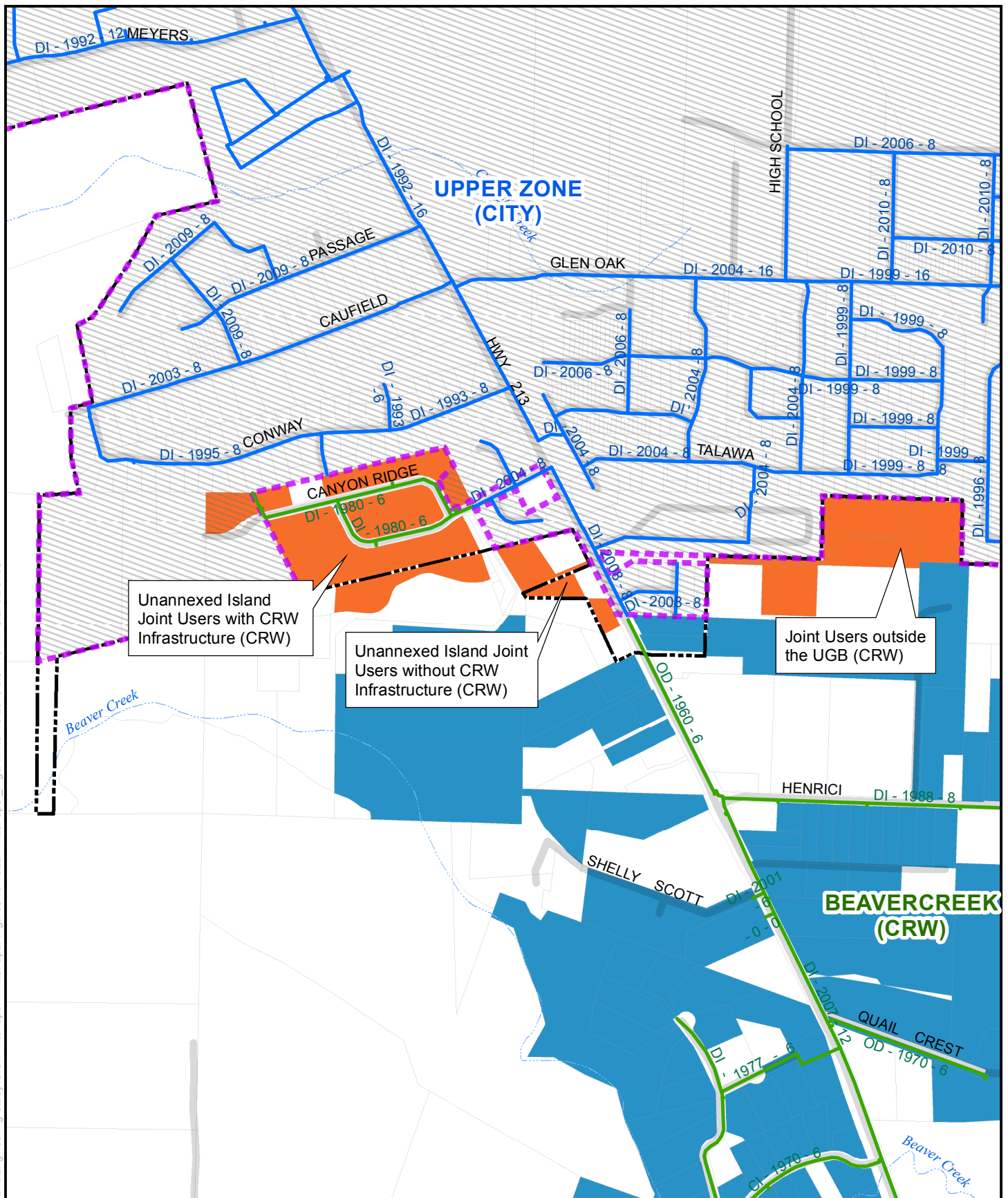
City development west of Canyon Ridge is expected to require looping to the CRW main in Canyon Ridge Drive. To maintain service area continuity and minimize the need for redundant infrastructure, the City should annex and withdraw all CRW customers and infrastructure within the UGB. Taxlots outside the UGB will necessarily remain CRW Joint Use customers served from City mains. East of Molalla Ave these areas are Urban Reserve while west of Molalla customers are Rural Reserve and as such cannot be considered for UGB expansion for several decades, if ever.

Resolution: City to withdraw customers and infrastructure within the UGB; Joint Users remain outside the UGB; City to pursue current extraterritorial service policy change.

Leland McCord

The Leland McCord area is similar to the South End area in that supply to CRW customers is entirely dependent on water wheeled through the City system. The City supplies water to a master meter at the intersection of Leland and Meyers Road. CRW and City mains run parallel in Leland Road to just south of Kalal Court, beyond which CRW mains continue in Leland past the UGB. Additional City development and infrastructure has continued along the south-east edge of the UGB, further

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- UGB
- City Limits
- Joint
- CRW
- City
- SFWB

Current Service

- Beavercreek
- Joint User

N
1 inch = 700 feet

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Joint Engineering Study

**Figure 5 - Existing
Canyon Ridge**



isolating CRW service area. **Figure 6A** shows the existing infrastructure and service boundaries in the Leland McCord area.

Following the logic used for South End and Central Point, the City should serve customers in the Leland McCord area within the UGB. A master meter should be installed at the UGB to serve remaining CRW customers outside the UGB from the existing CRW distribution main. **Figure 6B** shows the long-term resulting infrastructure and customer configuration after transfers.

Recent City development south of Jessie Ave to the UGB has extended City infrastructure to the point where looping through the CRW service areas is required and will necessitate either redundant infrastructure or infrastructure withdrawal. However, most of the CRW infrastructure is failing 1960's steel pipe which the City will not withdraw from the district. Both parties prefer to minimize the construction of unnecessary parallel infrastructure. CRW, however, is reluctant to replace the mains without guaranteed return on investment while the City is unwilling to accept the immediate risk by withdrawing the failing infrastructure. Development of a remuneration policy for infrastructure withdrawal would minimize investment in parallel infrastructure, and incentivize system renewal in conflict areas to the benefit of both City and CRW customers.

Resolution: Continued collaboration; eventual transition to City service within UGB with development; Master meter for customers outside the UGB; City to pursue current extraterritorial service policy change; collaboration for replacement of Leland Road and McCord Road CRW mains applying the remuneration methodology.

Country Village

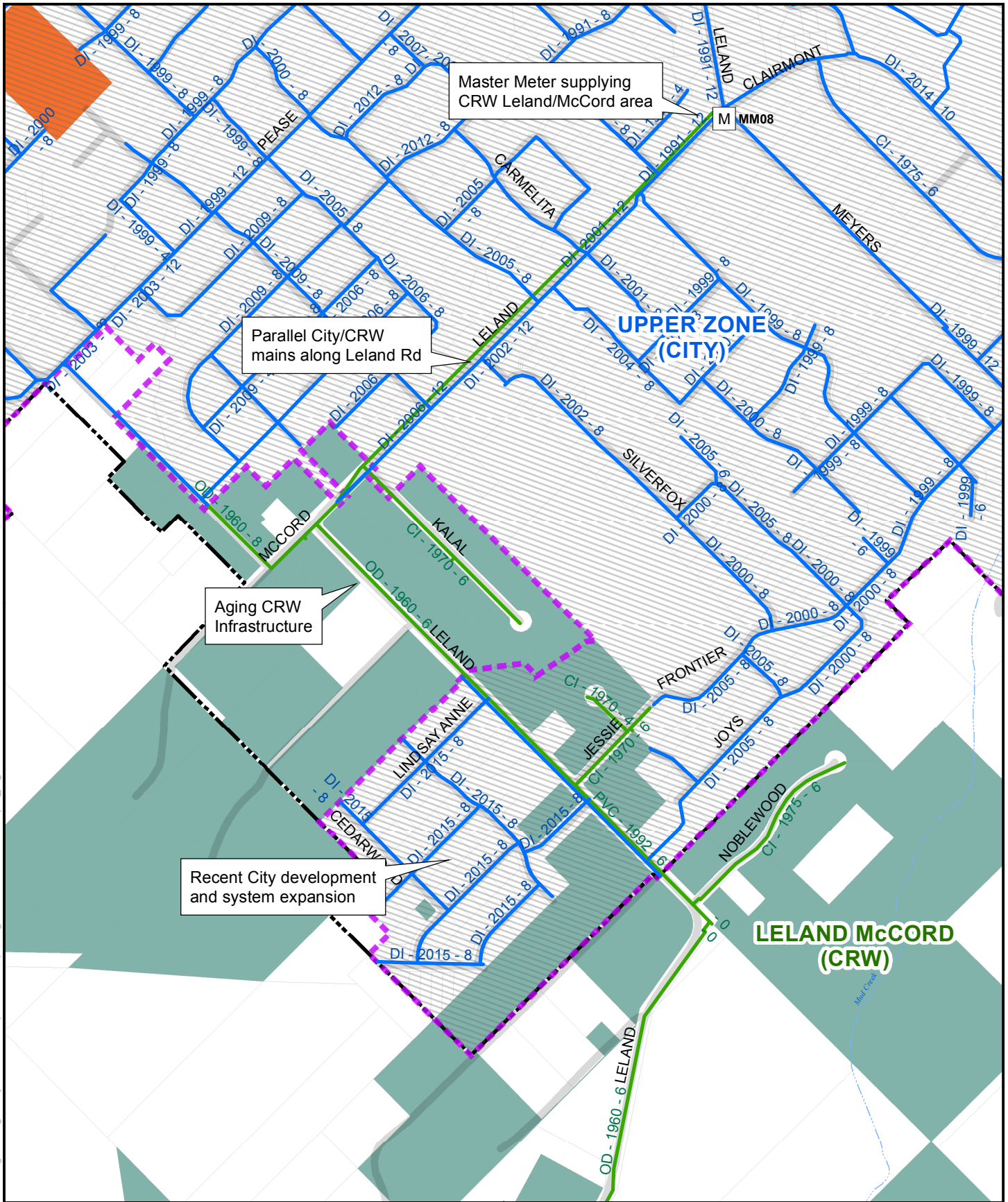
Country Village is unique in that it is an area served by CRW with limited drivers for development already within the UGB. The area is served by CRW from a single critical transmission main that is not eligible for City withdrawal. This CRW transmission main is the primary supply main from the CRW Holly Lane Pump Station to the CRW owned Henrici Reservoirs, feeding SFWB wholesale water to CRW's Henrici and Beavercreek pressure zones. Because the main is vital to the CRW transmission network, a redundant line would be necessary for the City to annex, withdraw, and provide service. **Figure 7** illustrates the focus area, key infrastructure, and service areas.

Additionally, the area is not adjacent to other City service and there is minimal development expected between Country Village Estates and City service areas. Although customers are within the UGB, CRW should continue to serve existing and future customers in the area, until such a time that the City has either built out infrastructure to serve the area or redevelopment requires annexation and extension of other City services to the area.

Resolution: No change from present service arrangement.

Beavercreek and Surrounding Areas

Service to the Beavercreek area affects recommendations for both City and CRW service areas including the City's Beavercreek Concept Area, the City's Upper Zone, the City's Fairway Downs



Legend

- UGB
- City Limits
- Joint
- CRW
- City
- SFWB

Current Service

- Master Meter
- Joint User

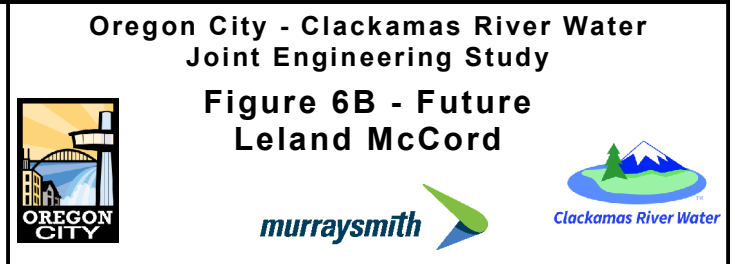
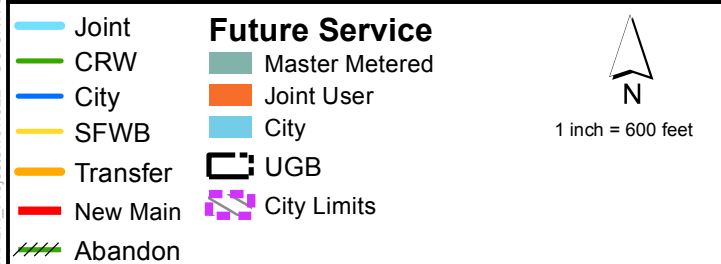
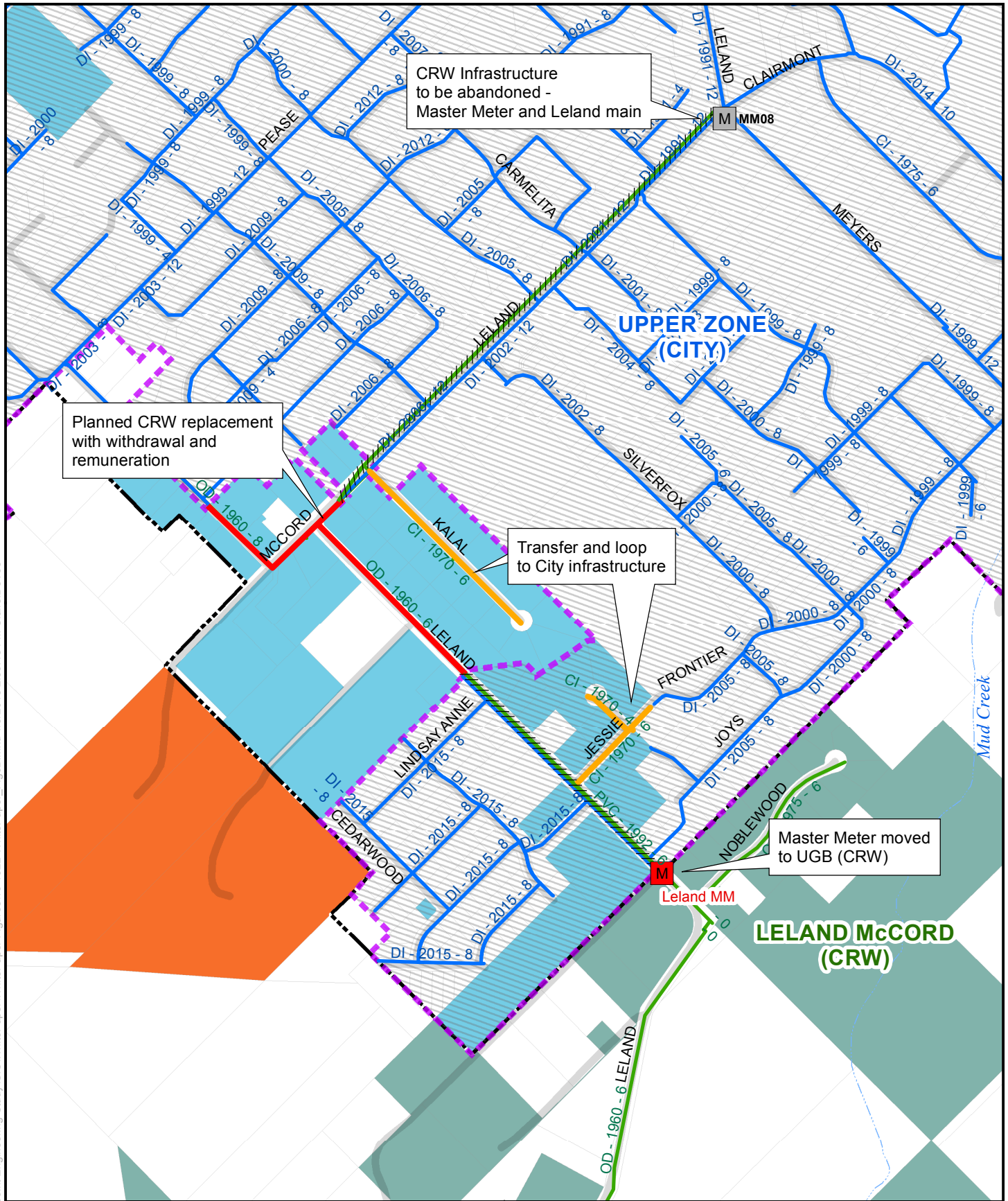
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1 inch = 600 feet

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**Figure 6A - Existing
Leland McCord**

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Zone, CRW's Beaver Creek Zone, CRW's Henrici Zone, the Henrici Ridge Area, and the City's Park Place Concept Area. Because the Beaver Creek area is so highly linked to both systems, an opportunity to minimize redundant existing and future facilities, and potentially provide additional flexibility and resiliency to both systems, is present if both providers agree to the development of jointly owned facilities.

Existing Service

Currently, CRW and the City have essentially duplicate pressure zones at similar hydraulic grades serving partially redundant areas: CRW's Henrici zone (590 ft reservoir overflow) and the City's Upper zone (592 ft). The City's Upper Zone serves most of the southern part of the City within the UGB while CRW's Henrici Zone serves areas outside the UGB and provides some overlapping service along the eastern limits of the UGB.

Because of these essentially redundant zones, there are two separate pathways for water to reach an HGL of 590 ft. Within the City's system, water can be pumped from the SFWB WTP via the SFWB Division Street Pump Station to the City's Intermediate Zone (490 ft), then via the City's Mountainview Pump Station to the City's Upper Zone and City Henrici Reservoir (592 ft). Within CRW's system, water can be delivered from the SFWB WTP through the Anchor Way master meter, then pumped via the CRW Holly Lane Pump Station to the CRW Henrici Zone and CRW Henrici Reservoirs (590 ft). Two interties exist between the two systems at the 590 ft level, and could allow for supply in either direction.

Both systems also provide service to elevations requiring hydraulic grades greater than 590 ft. The City serves the closed Fairway Downs Pressure Zone (652 ft) via the Fairway Downs Pump Station. Supply to this zone is provided by the City's Upper Zone. CRW serves the Beaver Creek Pressure Zone (744 ft) via the Glen Oak Pump Station. Supply to this zone is provided by CRW's Henrici Zone.

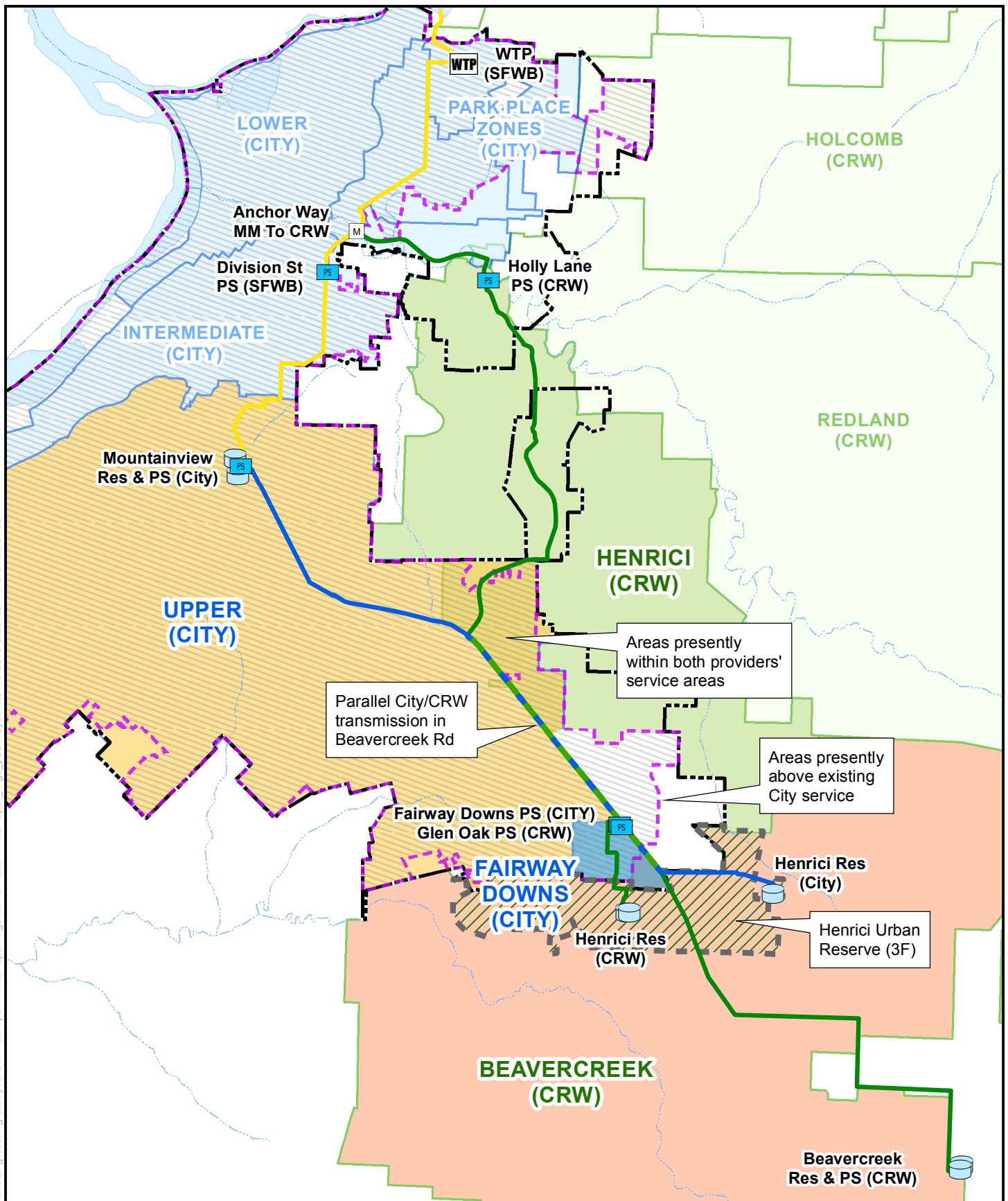
Figure 8 illustrates the configuration of existing infrastructure serving the Beaver Creek area and associated service areas.

Expected Development

Development is expected in the Beaver Creek area, although there is uncertainty over timing and extent. Within the UGB and north of Beaver Creek Road, the City's Beaver Creek Concept Plan calls for a mixed-use neighborhood. This development is expected to be served primarily by the City's Upper zone, and elevations above 480-ft (approximately south of Loder Road) will require a hydraulic grade similar to the City's existing Fairway Downs zone. However, the City's existing Fairway Downs Pump Station does not have capacity for this expansion and additional investment will be required to serve this area.

Continued development is expected in the CRW service areas outside the UGB, with the added confusion of possible service area withdrawal within the development timeframe. This is especially key for the Henrici Ridge area, which is currently designated as Urban Reserve and will be among the areas next considered for UGB expansion. When that occurs, City service to the area (to be consistent with service area goals) would require an even higher hydraulic grade than the City's Fairway Downs zone.

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- UGB
- City Limits
- CRW
- City
- SFWB
- Parallel City/CRW

PRESSURE ZONES

- City
- CRW

1 inch = 3,750 feet

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FIGURE 8 - EXISTING BEAVERCREEK



To meet the developing needs of the Beavercreek area, additional storage and transmission facilities will be required for both the City and CRW. Both providers have independently developed alternatives for service to the area, and through extensive discussions, we have developed a shared infrastructure alternative that may be more cost effective and in-line with the providers' goals set forth earlier in this report.

Demand and Storage Characterization

Existing and buildout demands and storage capacities for applicable CRW and City service areas were calculated and are presented in **Table 2**. For this analysis, storage needs for the existing pressure zones serving elevations in the Beavercreek area and the pressure zones supplying these zones were evaluated. Service area transfers likely to occur were included in buildout figures. Based on these estimates, the City will need to build additional storage at the City's Upper zone elevation and CRW will require additional storage at the CRW Beavercreek zone level. A summary of key assumptions for this analysis follows:

- Since the existing City Fairway Downs zone does not have existing storage, the *Existing Average Day Demand* (ADD) of this zone is included in the City Upper zone demands for the purposes of calculating existing storage needs. This also applies to demands for the CRW areas served from master meters at South End and Leland.
- *Build-out Average Day Demand* is based on recent planning documents and future service area boundaries described in this report. A comprehensive analysis of City and CRW pressure zone boundaries and a refined estimate of build-out development needs has not been completed. This analysis is intended to provide an order of magnitude estimate of storage volume needs for the purpose of evaluating alternatives.
- *Total Available Storage* is based on the volume of storage currently serving each pressure zone. For the City's Upper Zone, the 2010 Water System Master Plan considers the full volume of the City's Mountain View Reservoir No. 1, which provides suction supply to the City's Mountain View Pump Station serving the Upper zone, to be available storage for the Upper zone. This assumption should be verified before final decisions regarding City Upper zone storage needs are made, as it could result in a change to the long-term storage need in the Upper zone.
- *Existing Storage Need* and *Build-out Storage Need* are the sum of the three components of water system storage – equalizing, fire suppression and emergency – as defined in each water provider's Water System Master Plan. These volumes are calculated based on the zone's existing and build-out demand projection.
- *Existing Available Capacity* and *Build-out Available Capacity* are calculated as the difference between the *Total Available Storage* and *Existing (or Build-out) Storage Need* for the zone. A negative value represents a capacity deficit.

Table 2
Beavercreek Area Demands and Storage Capacity

	Existing Average Day Demand (MGD)	Build-out Average Day Demand (MGD)	Total Available Storage (MG)	Existing Storage Need (MG)	Existing Storage Surplus (MG)	Build-out Storage Need (MG)	Buildout Storage Surplus (MG)
City Upper	2.9	5.5	14.5	9.1	5.4	16.5	-2.0
City Fairway Downs	--	0.6	--	--	--	1.8	-1.8
CRW Henrici	0.2	0.2	1.5	0.6	0.9	0.6	0.9
CRW Beavercreek	0.6	1.7	2.0	1.8	0.2	4.7	-2.7

Notes:

1. MG = Million Gallons; MGD = Million Gallons per Day

The individual and shared infrastructure alternatives will need to address these storage requirements to be considered viable. **Table 3** presents a summary of each alternative and planning level cost estimates for service to the Beavercreek Area. More detailed descriptions of each alternative are given in the following sections.

The values presented are only planning level estimates and need to be verified prior to development of infrastructure designs. In particular, the capacity of existing City Upper Zone and CRW Henrici zone transmission piping to supply the expanded Beavercreek service area at build-out will need to be confirmed as additional transmission improvements to address existing deficiencies may have a significant impact on cost estimates.

Table 3
Supply Alternatives to the Beavercreek Area

City Independent Infrastructure Alternative			CRW Independent Infrastructure Alternative			Shared Infrastructure Alternative			Preliminary Buildout Cost Sharing		
Item	Size	Total Cost ¹	Item	Size	Total Cost ²	Item	Size	Total Cost ³	City Cost	CRW Cost	
Pump Stations	Fairway Downs Improvements	100,000	Beaver Lake	3MGD	1,700,000	New Station at the City's Henrici Site	3MGD	1,700,000	500,000	1,200,000	
	Beavercreek	2 MG	4,000,000	Beavercreek Elevated	3.5 MG	7,000,000	Beavercreek Elevated	2x2.75 MG	11,000,000	4,000,000	7,000,000
Transmission	Fairway Downs Pump Station to New Reservoir	16-inch 10,750 lf	3,400,000	Grasle Road	12-inch 13,480 lf	3,200,000	New Pump Station to Beavercreek Reservoirs	12-inch 3,200 lf	800,000	200,000	500,000
	Total		\$ 7,500,000	Total		\$ 11,900,000	Total		\$ 13,500,000	\$ 4,700,000	\$ 8,700,000
								Cost decrease:	37%	27%	

Notes:

1. City costs updated from 2013 City Technical Memo
2. CRW costs updated from 2015 Backbone Project Memo
3. Unit costs for shared infrastructure solution – reservoir 2\$/gal; Pipe 20\$/in-lf
4. Joint costs consistent with CRW pump station cost, study unit costs
5. Cost division based on buildout demand for pump station and transmission piping, storage requirements for elevated reservoirs

A. City Service to Beavercreek Concept Area and Fairway Downs

In the Oregon City Technical Memorandum dated November 5, 2013, the City presented three options to serve the Beavercreek area within the UGB. Based on our understanding that CRW does not have excess capacity in the existing CRW Beavercreek Reservoirs, two of the three options are infeasible. The remaining option for the City would be to build a new 2 MG Beavercreek Reservoir with a 16-inch diameter transmission main and improve the existing Fairway Downs Pump Station (City Independent Infrastructure Alternative in **Table 3**).

Additional costs and political investment would be incurred during the land acquisition and permitting process. The City does not currently own property for a reservoir at the proper elevation. This is a significant hurdle, and should not be disregarded.

While the City has planned for service within the existing UGB, the planning does not provide adequate pressures for the Henrici Ridge area that is currently designated as Urban Reserve. If this alternative is selected, the City will need to consider capital costs for additional infrastructure to serve this higher elevation area once development occurs.

B. CRW Service to Beavercreek Pressure Zone and Fairway Downs

CRW's current planning for improved service to their Beavercreek pressure zone is part of the larger CRW Backbone Project. Overall, the project is designed to improve system connectivity and transmit water from the CRW WTP to CRW service areas south of the Clackamas River. Phase 1 of the Backbone Project is currently in various stages of design and construction and will transmit water to the Redland Reservoirs and associated pressure zone. Phase 2 would construct transmission and pumping improvements to transmit water from the Redlands Reservoirs south to the Henrici and Beavercreek pressure zones as well as north to the Holcomb pressure zone (CRW Independent Infrastructure Alternative in **Table 3**).

Phase 2 currently plans for service to the entire existing Beavercreek pressure zone. However, it is probable that some of this area will eventually be City territory and supplied by the City, rendering some of the Phase 2 facilities oversized and unused with remaining useful life. CRW cost estimates in Table 3 were updated similarly to City estimates, and storage capacity in the elevated tank was decreased to reflect the volume required to serve CRW customers to buildout.

C. Shared Infrastructure to Serve the Beavercreek Area

Typical of conflicts between the City and CRW, planning in the Beavercreek area has been limited by boundaries that are subject to change. It is expected that the lifespan of infrastructure built now will extend beyond the lifespan of the current UGB. Opportunity to develop shared infrastructure to serve both providers' customers and facilitate transfer of service area without construction of parallel redundant infrastructure is a goal of this study. Already, the City and CRW serve similar elevations from their Henrici Reservoirs. Emergency interties exist between the two systems and additional overlap of service and infrastructure is expected with continued development if coordination does not occur.

To optimize the use of existing infrastructure, one possible alternative would be a new pump station at the City's Henrici Reservoir to replace CRW's Glen Oak Pump Station, new transmission main along Henrici Road to increase the capacity of CRW's existing transmission to CRW's Beavercreek Reservoirs, and two new elevated tanks at the existing CRW Beavercreek Reservoir site for additional storage for both providers (Shared Infrastructure Alternative in **Table 3**). A PRV and meter could be installed at the existing City Fairway Downs Pump Station to supply the City's expanded Fairway Downs zone.

Benefits of Shared Infrastructure Development

Shared infrastructure will allow for greater flexibility with construction phasing, minimize the land acquisitions required, provide redundant supply pathways, reinforce emergency supply pathways and allow for future infrastructure consolidation. Other potential benefits include minimizing operational & maintenance costs and future infrastructure renewal needs.

Given the uncertainty of development timing, shared infrastructure could be built in stages, with existing facilities providing supply until upgrades are required. The shared Beavercreek Reservoirs

could be built one at a time, allowing for future demolition of the existing ground level tank to provide a site for the second elevated tank. The CRW Glen Oak Pump Station can continue to be used to supply the Beavercreek zone as is, until the new shared Henrici Pump Station is completed. When the UGB is expanded and/or CRW areas are annexed by the City, shared infrastructure would simplify the transition process because independent infrastructure service to the area would require significant parallel and costly redundant facilities throughout the area. Ultimately, with a shared solution there will be opportunity to decommission aging redundant facilities when the cost to maintain these facilities exceeds their value as backup infrastructure. This is specifically true for the City's existing Fairway Downs Pump Station, CRW's Henrici Reservoir and CRW's Glen Oak Pump Station.

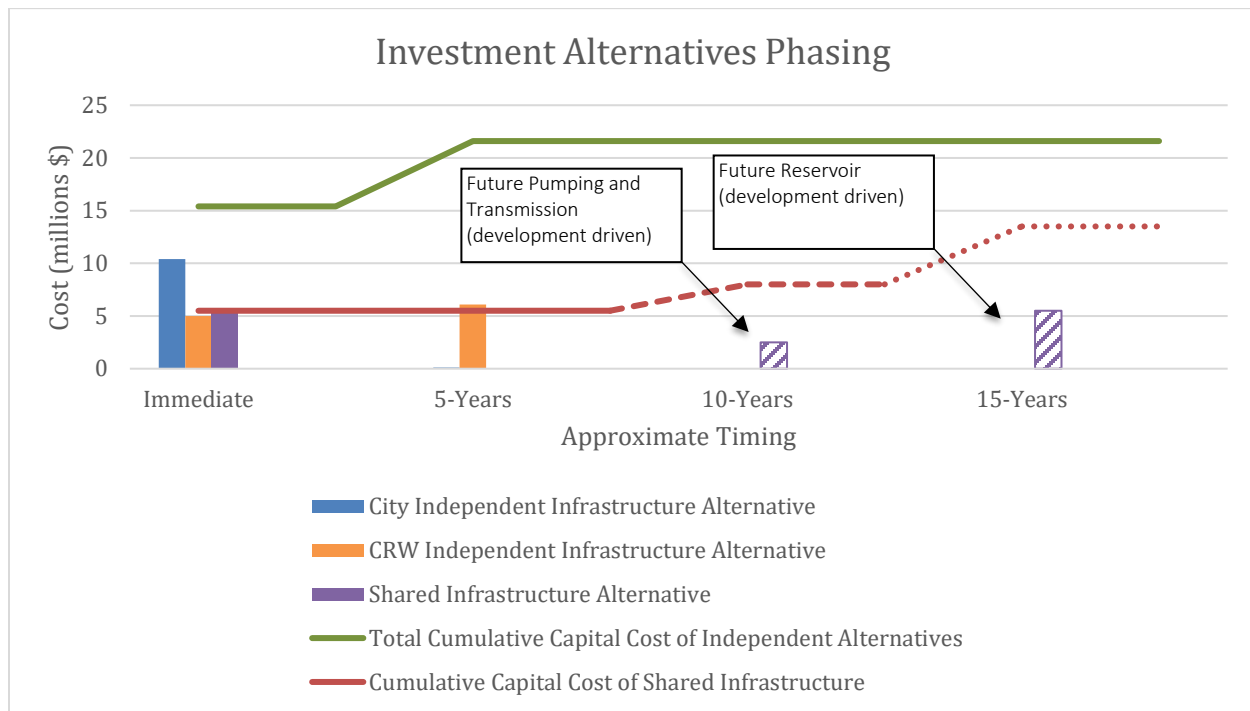
Figure 9 illustrates the capital cost over time of the individual and shared infrastructure alternatives. The shared infrastructure alternative is based on a potential phasing schedule, with the first reservoir built immediately, the transmission and pump station built in 10 years, and the second reservoir built in 15 years. These dates are conceptual to illustrate the potential phasing opportunity and are dependent on development of the City's Beavercreek concept plan area. The individual alternatives must be built within the next 5 years, if not sooner, with limited flexibility for shifts in development timing.

Utilizing existing infrastructure will minimize both monetary and political cost of additional land acquisition for new infrastructure siting. The City's Henrici Reservoir site has capacity for both a new pump station and additional reservoir, if deemed necessary in the future. CRW's Beavercreek site has capacity for at least one additional reservoir, with a second reservoir potentially able to be built at the site of the existing ground level tank.

The shared infrastructure alternative will also provide redundant pathways for service and emergency supply to the Beavercreek and Fairway Downs zones. Given recent emphasis on seismic resiliency this redundancy aligns with resiliency goals. The primary supply via the SFWB Division Street Pump Station and the City's Mountainview Pump Station have adequate supply for normal service. The secondary supply via the master meter at Redland and Anchor Way, the CRW Holly Lane Pump Station, and the emergency intertie between the City and CRW at Beavercreek provides redundancy not necessarily guaranteed in independent infrastructure alternatives.

Another benefit of a shared infrastructure alternative is the potential for continued consolidation of redundant and aging infrastructure. As the system is served today, the City and CRW have redundant pressure zones at the 590 HGL. Four tanks, (two CRW and two City-owned), serve this zone, although none of the tanks currently meet updated seismic standards and some are approaching the end of their useful lives. A shared infrastructure solution lays the groundwork for continued development of efficient infrastructure investment through partnership.

Figure 9
Infrastructure Investment Phasing Alternatives



Service Transitions in Affected Areas

Within each pressure zone, there are additional specific areas that will be affected more than others by the solutions to serve the Beavercreek Area.

Thayer and Loder Roads:

At present, CRW supplies customers along Thayer and Loder Roads via CRW distribution mains branching from the CRW transmission line along Beavercreek Road. Both mains begin within city limits and extend outside the UGB. In both cases, areas within the UGB are part of the City's Beavercreek Concept Area and should be annexed and withdrawn by the City. The City will then need to connect the existing CRW mains in each road to the City transmission main in Beavercreek Road. This will transition supply from the CRW Henrici zone to the City's Upper zone. At the UGB, master meters or Joint User status may be negotiated to supply remaining CRW customers outside the UGB.

Henrici Ridge:

Henrici Ridge is the area just south of the UGB along Henrici Road that cannot be served by the City's existing grades. As an Urban Reserve area, it is expected to eventually be annexed into the UGB and City service. If the shared infrastructure alternative is not selected, future service by the City to this area will require significant investment in parallel infrastructure.

Park Place Concept Area:

The Park Place area is located entirely within the UGB and outside of city limits. The area, currently served by CRW, is supplied from SFWB via the Redland and Anchor Way Master Meter and pumped up to higher pressures by the Holly Lane or the Redland Pump Stations (see **Figure 10A**). Until urban development occurs, the area should be served as is.

The 2008 Park Place Concept Plan calls for a City distribution network starting south of Ogden Middle School and connecting north to existing City distribution mains along Holcomb Boulevard. A reservoir at Holly Lane and Morton Road is proposed to provide additional storage.

Given the limited number of existing services, it is recommended that the providers plan for future City service to the entire Park Place area. CRW will need to maintain transmission from the existing Anchor Way MM through Park Place to reach CRW's Holly Lane and Redland Road Pump Stations. Some existing CRW transmission infrastructure through this area is aging and will need to be replaced. It is suggested both providers fund a shared transmission main from the master meter to Holly Lane.

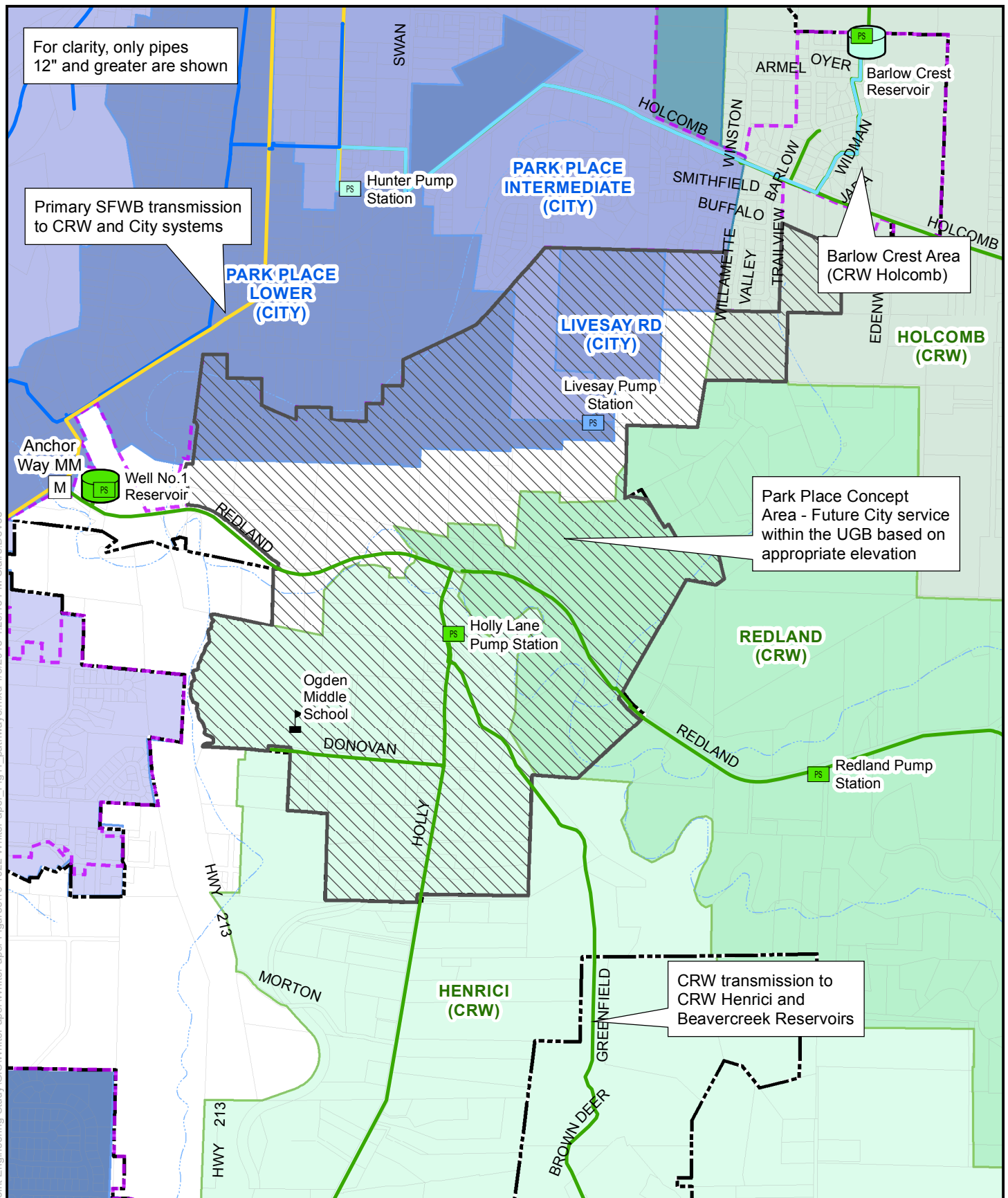
Existing CRW infrastructure is critical for CRW supply from the SFWB supply at Master Meter 02 to the CRW system. As such, the only water mains that may be eligible for withdrawal and remuneration are a portion of the CRW 12-inch diameter steel main in Holly Lane, extending south from CRW's Holly Lane Pump Station to the UGB, and a CRW 12-inch diameter ductile iron main in Donovan Road that serves the middle school. The possible shared improvement along Redland Ave would require relocating the Anchor Way Master Meter to Holly Lane (which would become a City to CRW master meter) and would replace aging infrastructure and serve the common needs of both utilities – water transmission backbone piping in Redland Road between Anchor Way and the UGB.

Figure 10B illustrates the proposed future service area and infrastructure withdrawals.

In order to accommodate the phased development of the Park Place area, the City should develop a detailed Park Place water service master plan to include:

- Confirmed siting, configuration, and capacity of future storage identified as the proposed Holly Lane Reservoir
- Confirmed water main sizing and backbone transmission facilities to serve the Lower Park Place pressure zone, including SFWB transmission main connections and pressure reduced supply from the Intermediate Park Place pressure zone
- Coordination with CRW to determine if new shared transmission in Redland Road is feasible and to determine if potential withdrawal of mains between Holly Lane and the UGB is feasible and desirable.

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- UGB
 - City Limits
 - Joint
 - CRW
 - City
 - SFWB
- PRESSURE ZONES**
- City Zones
 - CRW Zones
 - Park Place Concept Area

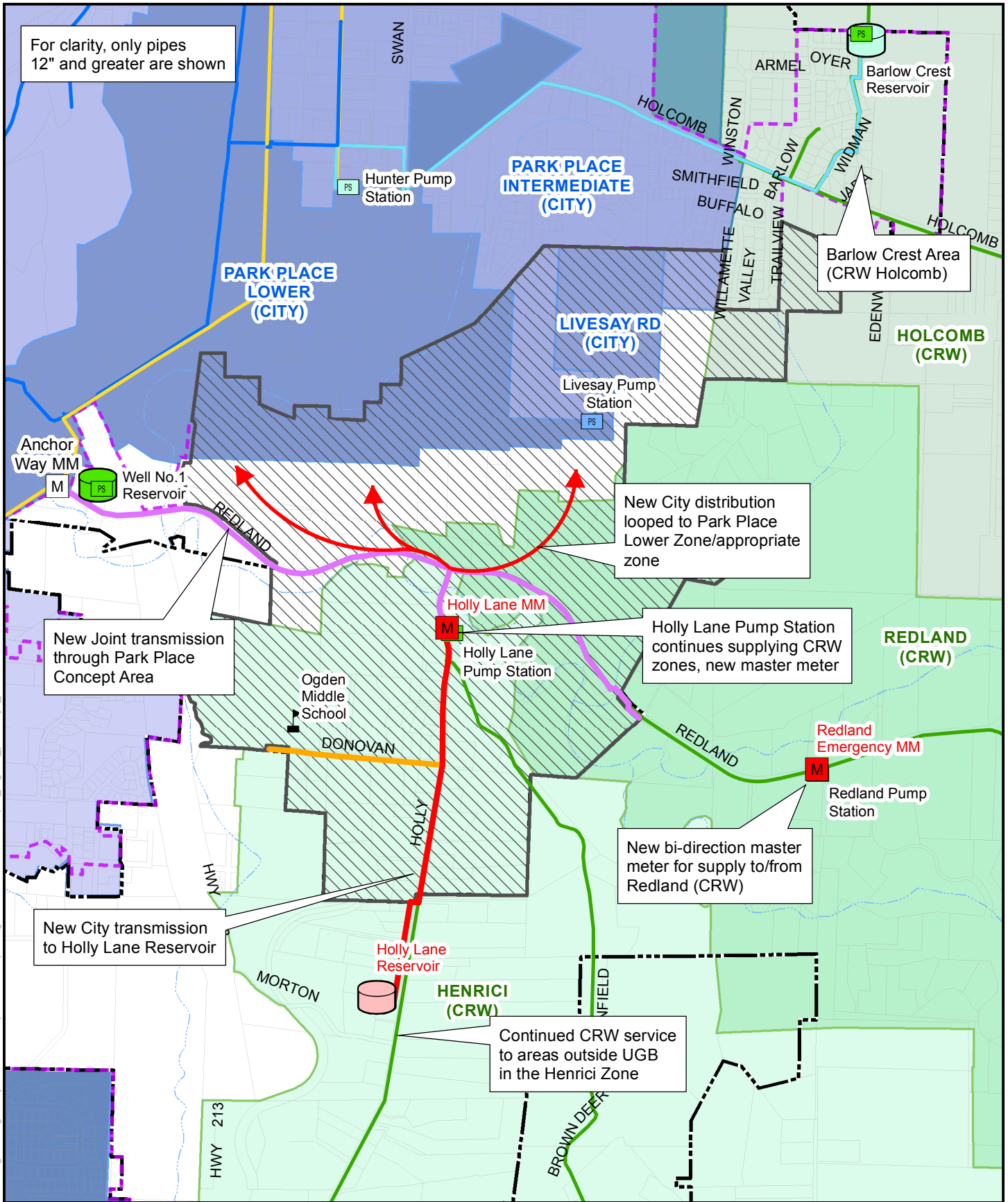
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**FIGURE 10A - EXISTING
PARK PLACE**



For clarity, only pipes 12" and greater are shown



New Joint transmission through Park Place Concept Area

New City transmission to Holly Lane Reservoir

New City distribution looped to Park Place Lower Zone/appropriate zone

Holly Lane Pump Station continues supplying CRW zones, new master meter

New bi-direction master meter for supply to/from Redland (CRW)

Continued CRW service to areas outside UGB in the Henrici Zone

Joint

CRW

City

SFWB

Transfer

New City

New Joint

PRESSURE ZONES

City Zones

CRW Zones

Park Place Concept Area

UGB

City Limits

1 inch = 1,250 feet

N

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FIGURE 10B - FUTURE PARK PLACE

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These studies will inform how infrastructure develops in the near-term and will support CRW development of additional infrastructure to provide limited service until annexation and withdrawal occurs with the full development of the City water system facilities to provide service.

Resolution: Continued discussions regarding shared storage and transmission infrastructure in the Beavercreek and Park Place areas; Partial developer driven transfers and potential master meter relocation to the UGB

HOPP/Barlow Crest

The Holcomb-Outlook-Park Place focus area includes the CRW Holcomb-Barlow master metered zone, the CRW Holcomb pressure zone, and City service areas near Holcomb Road. Existing service to the HOPP area was set up under the 1998 HOPP Agreement which terminates in the year 2028, and includes jointly owned facilities and transmission mains. Presently, the SFWB WTP is the sole water supplier to the area. **Figure 11** illustrates the focus area, critical facilities, and customer designations.

North of the City, the CRW Holcomb-Barlow zone is served via multiple master meters from the City's Park Place Intermediate zone. This area is not expected to develop in the near future and should continue to be served as is via master metering.

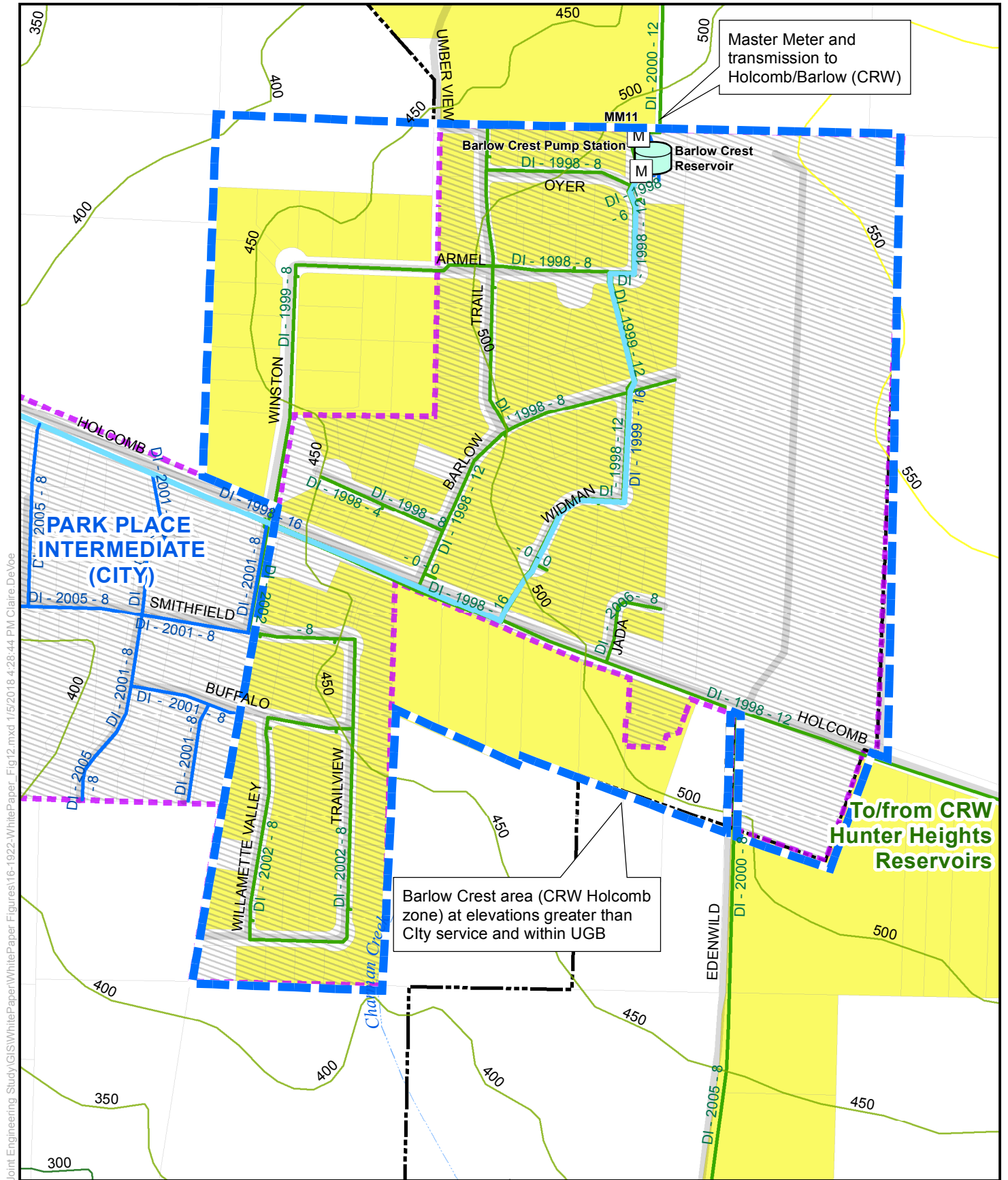
Similarly, within the existing City service area, City customers should continue to be served without change.

The main point of conflict in the HOPP area is the CRW/City interface at Barlow Crest. The CRW Holcomb pressure zone (797-ft HGL) is currently supplied with SFWB sourced water wheeled through jointly funded infrastructure from the SFWB WTP to the jointly owned Barlow Crest Reservoir (549-ft overflow). The CRW Barlow Crest Pump Station pumps from the jointly owned Barlow Crest Reservoir to the CRW Hunter Heights Reservoirs (797-ft overflow) which provide gravity supply to the CRW Holcomb pressure zone.

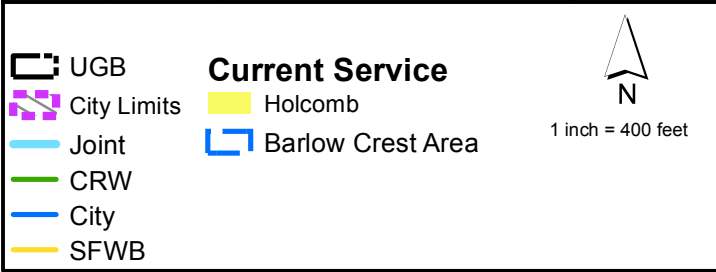
Much of the CRW Holcomb zone located within the UGB has been annexed into the city limits. However, the City does not have the existing infrastructure to provide service to this area as the Barlow Crest Pump Station is an essential facility for CRW's supply to the Hunter Heights Reservoir which serves CRW's Holcomb pressure zone both inside and outside the UGB.

Additionally, the CRW Backbone Project Phase 2 is proposed to include a new pump station and transmission facilities to boost water from the CRW Redland pressure zone to the Holcomb pressure zone/Hunter Heights Reservoir. This will provide a second supply route and water source to the Barlow Crest pressure zone. These improvements will allow CRW to supply the Holcomb zone from CRW's WTP.

Given the current understanding of the CRW Backbone Project, existing infrastructure, and the goals outlined in this white paper, there are two alternatives to consider:



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**Figure 11
HOPP/Barlow Crest**





A) Continued service as is, recognizing the City will continue to annex the land within the UGB but will not withdraw the territory from CRW. CRW would remain the service provider for the entire Holcomb pressure zone area inside and outside the UGB serving customers above an elevation of approximately 450 feet. The Phase 2 Backbone Project improvements would provide a second feed to the Holcomb pressure zone, allowing for a second source, the CRW WTP, to supply this area. The primary advantage of this option is that infrastructure and master meters are already in place to continue service as is for areas above an elevation of 450 feet. The primary disadvantage is that this alternative is not consistent with the goal of City service within the UGB, where feasible.

B) The City continues to annex and withdraw territory within the UGB and the associated distribution piping. An additional master meter would be installed at the UGB to deduct City supplied Holcomb pressure zone demand from the total supply from the CRW's Barlow Crest Pump Station. If improvements identified in the Phase 2 Backbone Project area constructed, future supply could be provided by CRW from either the CRW Barlow Crest Pump Station or the future CRW Bradley Road Pump Station with master metering to totalize the demand of the City area in the joint Holcomb pressure zone inside the UGB. This option would most effectively meet the goal of aligning service area boundaries with associated geo-political boundaries. However, it creates a complicated master metering and water wheeling arrangement.

Alternative A is recommended as it does not require the construction of additional master metering infrastructure, and minimizes disruption to existing rate payers. It is also compatible with the CRW Backbone Project as all water supply impacts are to CRW customers only.

In order to facilitate City management of sewer service, including the ability to take action in the event of non-payment by a customer, an agreement between the two agencies should be developed similar to the existing agreement between CRW and the City of Milwaukie.

Resolution: No change from the existing condition; development of a billing and customer shut off agreement

Typical Conflicts/Solutions

This section outlines proposed policy-level criteria for service area and infrastructure transfer.

Annexation and Withdrawal

Areas under consideration for withdrawal should meet the following criteria:

- Located within the UGB. Areas located within city limits should be given highest priority for withdrawal from the district, if possible.
- Adjacent to existing city limits. Priority should be given to CRW areas surrounded by City service area.

- Priority should be given to areas currently receiving additional City services such as sewer, etc.

The City and CRW will need to collaborate for the development of a plan and typical procedure for implementing service transfers once areas have been identified for withdrawal.

Infrastructure Remuneration

A remuneration policy should be developed to encourage proper maintenance and replacement of aging infrastructure and to encourage sizing to meet long-term needs regardless of the future water service provider ownership. The economic analysis was completed as part of this project and addresses the specific financial elements and further detail the parameters of the policy.

Master Meters and Joint Users

Master meters are required when water is supplied through wheeling and meets one or more of the following criteria:

- The service area crosses the UGB at which point a meter would be placed at the UGB
- The total length of pipe past the meter is greater than 1,000 lf
- The service area is not predicted to be withdrawn by the other provider in the near future.

Master meters are preferable to joint user customers when infrastructure reliability is questionable, proven through leak history and/or obsolete pipe material.

Joint User Customers should only be allowed where:

- The provider whose service boundary they reside within cannot supply the customer with water from their infrastructure
- AND the number of customers does not warrant the cost of a master meter

In these limited cases, Joint User is the only way to reasonably serve these customers. As an example, customers outside the UGB and served via private service lines off City mains (located within the UGB) must be Joint User because there is no justification for the City to extend service beyond the UGB.

In addition, a formal supply agreement between CRW and SFWB should be developed to address ongoing master metered supply to CRW.

Jointly Developed Infrastructure

Jointly developed infrastructure should continue to be encouraged where applicable to minimize redundant facilities and encourage future collaboration.

Summary of Customer and Infrastructure Withdrawal Potential

Table 4 illustrates the maximum number of the existing customers and length of water main infrastructure in each focus area, potentially eligible for withdrawal by the City from CRW if the recommendations and agreed strategies presented in the study area are executed. These areas are illustrated graphically in **Figure 12**. **Table 5** summarizes the total number of customers and the share of CRW's south system demand that could be withdrawn through this process.

Additional Action Items

The following action items will require additional study and are recommended to conclude the conflict resolution process. It is suggested that all action items will be completed within a year of this study, although certain items are dependent on the completion of others.

- Adopt a Remuneration Policy as outlines in the Remuneration Methodology TM (FCS Group, 2018)
- Adopt an updated, stand-alone Joint User Agreement
- Perform and adopt the findings of a Wheeling Charge Study to determine fair City and CRW rates for Joint User or Master Metered customers based on a defensible methodology such as cost of service
- Develop a water supply agreement for supply from SFWB to CRW
- Develop process for systematic transitions of service with communication to customers

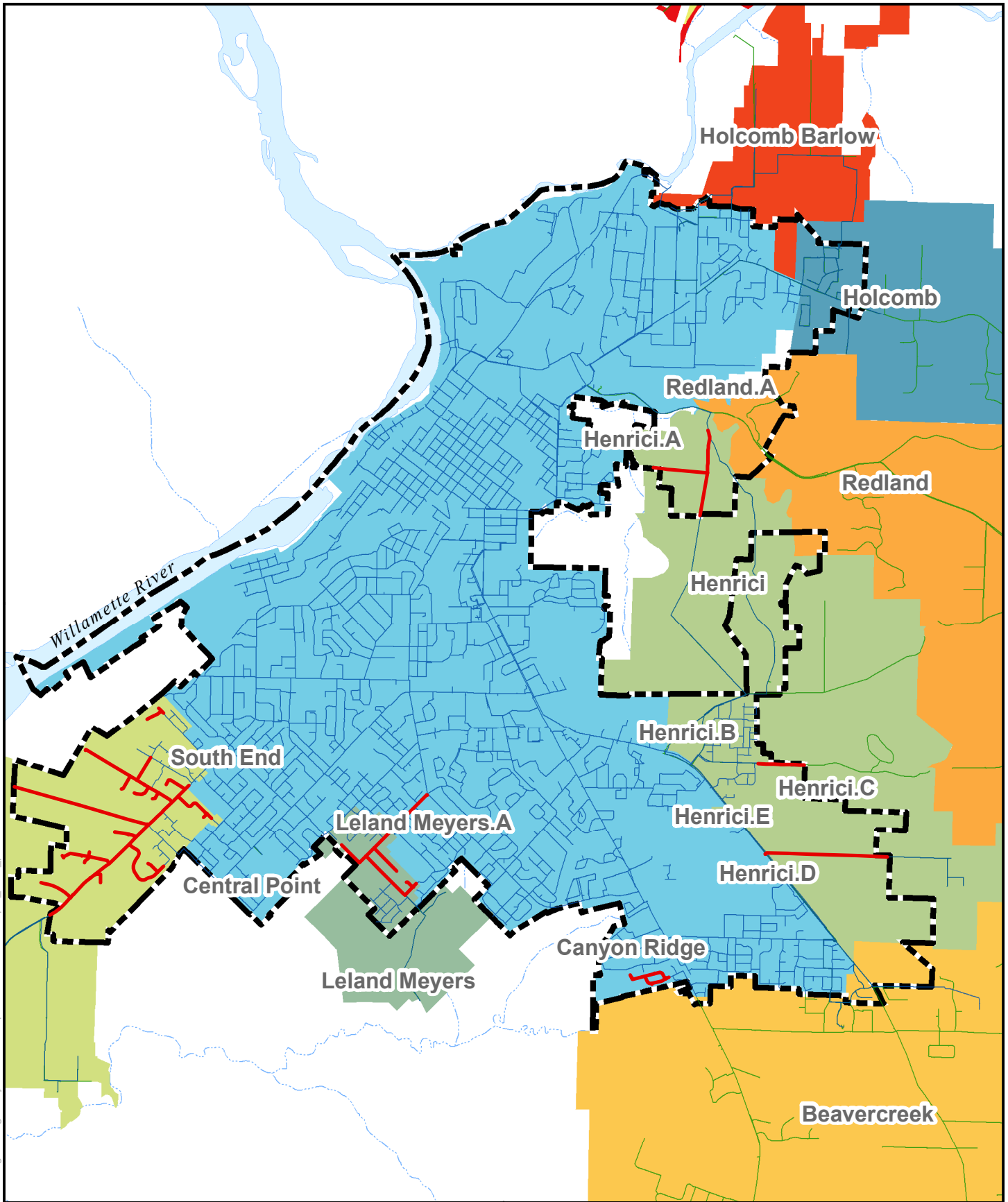
Throughout this process, certain areas have been identified where mapping of service provider transition has not been completed. A common mapping convention and agreed schedule for updates should be coordinated, to include:

- Consistent and agreed upon Joint User properties
- Accurate service area boundaries
- Shared GIS data that avoids duplication by mapping of the other provider's infrastructure

Summary

As urban areas expand, boundary disputes as typified by the conflicts between Oregon City and Clackamas River Water become ever more common. The two water providers have a long history of working together to develop creative solutions to address the unique challenges they face. Formalizing this process in a common framework, rather than a rigid set of specific solutions, ensures common goals lead the process, and not individual opinions or short term changes in priorities. Developing methodologies and strategies that adapt to unique situations is more important for long-term cooperation and conflict resolution. It is the goal of this study to provide a framework for Oregon City and Clackamas River Water to continue to efficiently provide high quality water to current and future customers for years to come, and minimizes conflict or misunderstanding.

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- Urban Growth Boundary (UGB)
- City of Oregon City
- Clackamas River Water District
- Water Mains
- Potential Transfers
- River

N
1 inch = 4,000 feet

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Joint Engineering Study

Figure 12 - Potential Customer & Infrastructure Transfers



Table 4
Summary of Conflict Areas by CRW Pressure Zone

Conflict Area	HGL	Description	Potential Customer Transfers	CRW South Customer Count	CRW South Infrastructure Transfer (lf)
Holcomb-Barlow	549	Master metered from OC Park Place Intermediate Zone (Barlow Crest Res.)	No change	72	
Holcomb	797	Master metered from Barlow Crest Pump Station	No change	726	
Hunter Heights	910	Pumped up from CRW Holcomb	No change	70	
Redland	697	Master metered from Anchor Way and pumped via Redland PS		1082	
Redland.A			Development triggered transfers within Park Place Concept Area	8	
Henrici	590	Master metered from Anchor Way and pumped via Holly Lane PS		262	
Henrici.A			Development triggered transfers within Park Place Concept Area	46	2600' 12" 1960 OD; 1650' 12" 2004 DI
Henrici.B			Transfers within expanding development north of Thayer Road	14	
Henrici.C			Customer transfers along Thayer Road within UGB	7	1400' 12" 2003 DI
Henrici.D			Customer transfers along Loder Road within UGB	21	3700' 8" 1988 DI
Henrici.E			Additional Henrici Pressure Zone potential transfers	6	
Beavercreek	744	Pumped from CRW Henrici via Glen Oak PS	No change	1389	
Canyon Ridge	592	Joint Users supplied directly from OC Upper Zone		8	

Conflict Area	HGL	Description	Potential Customer Transfers	CRW South Customer Count	CRW South Infrastructure Transfer (lf)
Canyon Ridge.A			Customer transfers within UGB	21	2200' 6" 1980 DI
Leland Meyers	592	Master metered from OC Upper Zone		33	
Leland Meyers.A			Customer transfers within UGB	59	1650' 6" 1960 OD; 3650' 8" 1960 OD; 250' 4" CI 1970; 1450' 6" 1970 CI
Central Point	592	Joint Users supplied directly from OC Upper Zone		2	
Central Point.A			Joint User customer transfer within UGB	9	
South End	592	Master metered and Joint Users supplied directly from OC Upper Zone	TBD based on future development potential	334*	3500' 4-6" 1960 AC; 5500' 4-6" 1960 OD; 1000' 8" 1966 DI; 4000' 4-6" 1970's CI; 4050' 6" 1980's DI; 650' 8" 2000 DI; 6050' 12" 2001 DI**

*Total CRW South End customer count within the UGB

**4100 lf of water main constructed as a joint project with a cost sharing agreement

Table 5
Summary of Potential Transfers

	Customer Count	Existing Water Mains (lf)	Existing Reimbursable Water Wains (lf)	2016 Demand (gpd)	Percent of Demand
Total CRW-South	4,172	1,381,446		1,212,360	100%
Possible Transfers Excluding South End	191	18,535	6,705	48,405	4%
South End Transfers	334	24,789	6,682	83,432	7%
Total Possible Transfers	525	43,324	13,387	131,837	11%
Remaining CRW within UGB	214	14,545		140,860	12%