
CHAPTER 4

WATER SUPPLY AND SOURCE ALTERNATIVES

The City of Kent (Kent) is served by multiple groundwater sources located throughout its water system service area. They include Clark Springs, Kent Springs, East Hill Well(s), Garrison Well, Armstrong Springs Well(s), Seven Oaks Well, Summit Well, O'Brien Well, 208th Street Well, and 212th Street Well(s). These sources of supply are served by aquifers that underlie the Green and Cedar River basins and fall within and without Kent's water service area and City limits. In 1985, Kent contracted with Tacoma Public Utilities (TPU) and became a partner in the Second Supply Pipeline project. This project delivers water from the Green River watershed to the Kent Water Service Area (WSA). At this time, these sources are responsible for meeting all of Kent's existing and projected water supply demand. The following chapter describes Kent's source conditions, water rights and water facilities. An analysis of the adequacy of source quantity to meet the existing and projected demands of the City is presented in Chapter 7.

4.1 KENT SOURCE AQUIFERS – OVERVIEW

The main aquifer within the Green River valley is the recent alluvial aquifer (Qal) that occurs within the Pacific/Algona/Auburn areas, and in the Renton area. The Qal aquifers generally occur at depth of less than 100 feet, are unconfined, and are in hydraulic continuity with multiple surface water systems (White, Green, and Cedar Rivers). Aquifer recharge is from direct infiltration through the land surface, and lateral groundwater inflow from deeper aquifers in the adjacent uplands. Natural aquifer discharge is to the above-mentioned rivers. The Qal aquifer within the Renton area (6 miles north of Kent) is very productive with well yields that typically exceed 1,000 gpm. The Qal aquifer within the Algona/Pacific/Auburn area (6 miles south of Kent) is moderately productive with well yields on the order of 500 gpm. Water resources in these aquifers are used by several jurisdictions, including the Cities of Pacific, Auburn, Renton, and Algona.

The Qvr aquifer occurs within the Auburn area at depths of 30 to 40 feet below ground surface to as much as 250 feet below ground surface. The aquifer is very productive given its high permeability and abundant recharge, both from the surface and from the surrounding uplands. The aquifer discharges naturally to the Green River. The characteristics of the Qvr aquifer (extent, thickness, transmissivity, etc.) are well-defined from previous studies by the City of Auburn. No significant aquifers have been identified within the Green River Valley in the Kent area. The Qvr aquifer also occurs within the southeast portion of the Covington Uplands. The aquifer serves as a source of supply to the major spring sources that serve the City of Kent (Kent, Clark, and Armstrong Springs). The aquifer is shallow, and unconfined; recharge is relatively high due to the coarse-grained nature of the surficial soils and underlying geology, and the abundant precipitation that falls on the area. Natural aquifer discharge is to tributaries such as Jenkins Creek and Rock

Creek, which discharge to Soos Creek and the Cedar River, respectively. These basins have been closed to further appropriations by Ecology through administrative rule and/or policy.

The Qva aquifer occurs primarily on the western portion of the Covington Uplands. Low-permeability glacial till overlies the aquifer and limits the amount of direct recharge from precipitation (Bauer and Mastin, 1997). Well yields are moderate to low, but the aquifer serves many domestic wells and is the source of supply for most of the wells serving King County Water District 111. Natural discharge from the Qva aquifer occurs to the headwaters of Big Soos Creek.

The Qc₂ aquifer occurs throughout much of the Covington Uplands. In many areas it can be difficult to distinguish the Qc₂ aquifer stratigraphically from the overlying Qva aquifer. Glacial till overlies large portions of the aquifer, limiting the amount of natural recharge from direct precipitation. The Qc₂ aquifer serves as a major source of supply in the east Covington Uplands near Lake Sawyer, and appears to be in hydraulic communication with the north/northeastern end of the lake. Natural discharge from the aquifer occurs primarily to the lower reaches of Soos Creek.

The Qc₃ and Qc₄ aquifers occur within the Kent area near the valley wall and within other localized areas of the Covington Uplands (e.g., at Kent's Seven Oaks Well). The aquifers are relatively productive near Kent, with well yields that can exceed 1,000 gpm. These deep aquifers are confined beneath the Covington Uplands and receive their recharge as regional-scale downward leakage through the confining aquitard layers. Natural discharge from aquifers that outcrop in the major river valley walls is in the form of springs and seeps which feed the surface rivers. The deeper aquifers (at or below sea level) may discharge naturally to deep valley-filling sediments or through upward leakage across confining aquitard layers in the valley margins. Rates of leakage are usually low, giving rise to good degrees of confinement, as evidenced by artesian water levels in some of the wells located at lower elevations.

There is a general absence of deep well information within the Covington Uplands that might be expected to reveal lateral extensions of these aquifers to the east. Deeper exploratory wells (>500 feet deep) that have been drilled at Kent Springs, and within the KCWD 111 and Covington Water District areas, typically penetrate a thick sequence of fine-grained deposits (clays and silts) with a consistent absence of appreciable water-yielding horizons at depth. Bedrock occurs at shallower depths in the north and east parts of the Covington Upland, limiting the potential lateral extent of any unidentified deep Qc₃ or Qc₄ aquifers.

4.2 KENT SOURCE AQUIFERS - RELIABILITY

As noted above, five aquifer systems exist in the Covington Upland area, all of which are presumed to be part of a larger, hydrostratigraphic unit. Kent's largest groundwater sources, including Kent, Clark, and Armstrong Springs, are located in the shallower aquifer system (i.e., Qvr aquifer) situated within the Covington Uplands which flows or discharges to both the Green and Cedar Rivers. Upstream of Clark Springs, the groundwater flows east to

west, but at Clark Springs the flow pattern splits, with groundwater discharge going to both the Green and Cedar Rivers.

The groundwater split which feeds Clark Springs has been determined by King County, Kent and Ecology to discharge to Rock Creek, which is tributary to the Cedar River and closed to further appropriation due to salmon recovery efforts. The groundwater flowing towards the Green River flows past the City's Kent Springs and Armstrong Springs wells. This same water flows toward Lake Sawyer, which discharges into Covington Creek, which in turn discharges into Soos Creek, which is tributary to the Green River. Kent Springs has also been determined to flow at times into Jenkins Creek, which also flows into Covington Creek and the Green River.

With the exception of one seasonal water right (irrigation of River Bend Golf Course) all of Kent's water rights authorize continuous, annual withdrawals of its authorized quantities.

4.3 GROUNDWATER PROTECTION/RELIABILITY STUDIES

The geology and hydrogeology of southwestern King County, encompassing the Kent area has been summarized in a series of reports including Luzier (1969) and Woodward et al. (1995) the South King County Ground Water Management Plan (1989), and local area Wellhead Protection Plans (Covington Water District, 1995; King County Water District 111, 1996; and the City of Kent, 1996). In November, 1997, Kent authorized Hart Crowser to conduct a Phase 1 well field evaluation of its Clark Springs and Kent Springs groundwater systems. This Study, which was completed in June 1998, included evaluating the maximum well field yield using the MODFLOW groundwater flow model developed for the Kent Wellhead Protection Study.

In September of 2006, Kent retained Robinson, Noble & Saltbush to conduct a reliability study of its in-town water sources, with a project goal of determining the 98% reliable firm yield for these sources. The end result of the study should provide the City with the firm yield for each of these wells, and well sites, such that the City knows how much water is available to be developed through existing wells and potential future wells at each of its existing well sites.

In January 2008, Kent retained Aspect Consulting to undertake a Phase 2 comprehensive wellhead protection study addressing all wells and source aquifers not addressed in the 2008 Phase 1 wellhead protection study. The first task of this study, which was completed in May, 2008, involved compiling the delineated wellhead protection areas (WHPA) for each of Kent's nine groundwater supply sources. Additional tasks included:

- Preparing an inventory of potential sources of groundwater contamination for the each of the nine groundwater supply sources.
- Ranking each of the contaminant sources identified within each WHPA with respect to its potential risk for contamination of the City's well source.

- Refining the management strategies identified in the existing WHPP, and development of new management strategies as appropriate.
- Updating the existing Monitoring Plan, Contingency Plan, and Spill Response Plan to address all groundwater supply sources.

Although there are no new potential sources of contamination outlined in the Aspect study, there are many new confirmed and suspected sites that were not listed in the Hart Crowser study (1996). All of these locations were notified in 2009 about the wellhead protection area. These sites will be notified again in 2011.

4.4 ROCK CREEK PROTECTION/CLARK SPRINGS WATER SUPPLY SYSTEM

Rock Creek is considered an important spawning ground for the Cedar River sockeye salmon, a stock that is recognized as depressed (WDFW et al. 1994). The extent of historic use of Rock Creek by Chinook salmon is uncertain, and recent use has been infrequent and unlikely to include any actual spawning. Rock Creek is used by Coho salmon for spawning.

Because of Rock Creek's outstanding natural habitat and its role in supporting the Clark Springs Water System, Kent has a substantial and ongoing interest in preserving the health and vitality of the Rock Creek watershed. To that end, in 1997 the City installed a streamflow augmentation system that, depending on the aquifer levels, can supply up to 900 gpm (2.0 cfs) of water to be discharged into Rock Creek (Figure 1-3) during low flow periods when listed salmonid species are spawning.

The flow augmentation system operates by pumping water from the clearwell in the Clark Springs System, from which it is then discharged to Rock Creek after aeration. The water available for flow discharge is subject to hydrologic conditions affecting the infiltration gallery. This system has been operated periodically on a voluntary basis, especially when streamflows have fallen below 3 cfs during the October, November, and December salmonid spawning periods. Augmentation reduces the instantaneous amount of water available for the municipal water supply by the amount pumped to the stream.

The flow augmentation project described above was just one of the resource protection measures the Public Works Department implemented both prior and subsequent to Kent's 2002 Water System Plan Update. Those measures include: (1) promoting responsible resource protection measures by governmental agencies and private parties within the Rock Creek basin; (2) sustained and effective monitoring of flow and aquatic habitat conditions; (3) improving flow and aquatic habitat conditions in Rock Creek; and (4) substantially minimizing/avoiding adverse operational effects upon listed species and aquatic habitat.

The listings of salmon and trout stocks in the Puget Sound Region (1998) under the Endangered Species Act (ESA) resulted in a decision by the Kent City Council on January 8, 2001, to notify the National Marine Fisheries Service (NMFS) and US Fish and Wildlife Service (USFWS) of the City of Kent's intent to voluntarily formalize its conservation activities under a Habitat Conservation Plan (HCP), and in so doing, obtain an Incidental

Take Permit (ITP) under Section 10(a)(1)(B) of the ESA. The ITP would allow the City of Kent to operate its existing and proposed water supply operations in a lawful manner without threat of prosecution for incidental take that may occur to species covered by the ITP. Further, the HCP would formalize the City of Kent's voluntary efforts to conserve and enhance important fish and wildlife habitat on the site and elsewhere in the Rock Creek basin.

4.5 CLARK SPRINGS HABITAT CONSERVATION PLAN (HCP)

Since 2001, efforts have been underway to prepare a HCP in support of the City of Kent's application for an Incidental Take Permit (ITP) in conformance with Section 10(a)(2)(A) of the Endangered Species Act (ESA). The HCP is the culmination of more than 6 years of study and planning and represents a long-term commitment by the City of Kent to protect important fish resources that may be impacted by future operations of the Clark Springs System and to mitigate those potential impacts to the maximum extent practicable.

The HCP is the product of a collaborative effort between the City of Kent and the federal fishery Services (Services), including US Fish and Wildlife Service and the National Marine Fisheries Service, to meet the requirements of the ESA, and the domestic, industrial, commercial, fire, and life safety water supply needs of the City. Implementing the HCP and securing an ITP would ensure that activities to supply domestic water within the service area will include measures that benefit fish resources, in particular ESA listed species such as bull trout and Chinook salmon, over both the short- and long-term.

The text of the HCP was completed by the City in December, 2010. The final Environmental Impact Statement (EIS) for the HCP was prepared by the Services in spring of 2011. An Implementation Agreement is anticipated by the Services and the City, and Incidental Take Permits (ITP) will be issued to the City for its Clark Springs Operations upon completion of the agreement.

4.6 EXISTING WATER RIGHTS

At this time, Kent holds twenty-three (23) water rights that authorize a total annual withdrawal (Qa) of 19,885 af/yr (17.75 mgd), and a total instantaneous withdrawal (Qi) of 23,458 gpm or 33.8 mgd. Within that total number of rights, Kent holds fifteen (15) certificated, additive groundwater rights, one (1) claim, six (6) certificated, non-additive groundwater rights, and one (1) non-additive, certificated surface water right. Kent's non-additive rights (Qa) total 9,114 af/yr.

Kent's two largest sources, Clark and Kent Springs, are located 10 to 15 miles east of Kent, in the Cascade foothills, near the cities of Covington, Maple Valley, and Black Diamond. Several of Kent's other sources are scattered along a corridor roughly paralleling the Kent-Kangley Highway running east to west, also the route of Kent's two primary transmission mains. Kent also has sources along the eastern rim of the Kent valley running north to south, as well as several located in the Kent valley itself.

Clark and Kent Springs provide almost 70% of Kent’s current water system needs, or 6 to 8 mgd. The Clark Springs System provides a significant portion of Kent’s supply under all conditions. Kent’s other water sources are primarily groundwater wells located on the East Hill and Valley areas of the City.

**TABLE 4-1: EXISTING INDIVIDUAL WATER RIGHTS
CITY OF KENT**

Water Right/ Claim File Number	Priority Date Month/Year	Source Name	Maximum GPM	Maximum AF/Year
3107-A	02/57	Clark Springs “trench”	2250*(1)	*1350
7232-A	10/31	Clark Springs Rock Creek	2244*(1)	*3600
7660-A	02/69	Clark Springs Wells	5400	8710
G1-22956C	09/77	Kent Springs Wells	3690	5904
123225 (Claim)	05/09	Kent Springs (Springs)	4488	965
G1-23285C	01/79	East Hill Well	1900	3040
G1-23614C	06/80	Garrison Creek Well	500	*800
G1-23713C	10/80	High Meadows	7	11
G1-24073C	04/82	Seven Oaks (Soos Creek)	900	*864
G1-24189C	10/82	Armstrong Springs Wells	1300	*500
G1-24190C	10/82	212th Street Wells	2700	*1400
G1-24404C	08/83	208th Street Well	1200	*600
2890-A	09/56	East Hill Well	120	146
42-D	09/23	East Hill Well	60	90
44-A	09/45	East Hill Well	90	135
651-A	03/48	East Hill Well	60	42
2428-A	02/53	East Hill Well	120	78.4
1116-A	06/50	Summit	200	320
494-A	07/47	Hamilton Road	38	30
4534-A	05/62	Hamilton Road	12	19.2
767-A	01/51	O’Brien	243	45
G1-25204C	03/88	Parks & Recreation	290	290
1957-A	1952	Impoundment	140	60

*NON-ADDITIVE RIGHTS

(1) THE BENEFICIAL USE OF THE INSTANTANEOUS (QI) AND ANNUAL QUANTITY (QA) AUTHORIZED BY SWC 7232 AND GWC 3107-A ARE NON-ADDITIVE ONLY RELATIVE TO THE QI AND QA CEILING ESTABLISHED FOR ALL CLARK SPRINGS SOURCES BY GWC 7660-A (CLARK SPRINGS WELLS).

**TABLE 4-2: TOTAL WATER RIGHTS
CITY OF KENT**

Current Water Rights	Quantity
Total Additive Rights (Qa)	19,885 AF/Year
Total Additive Rights (Qi)	33.8 mgd
Non-Additive Rights Held (Qa)	9,114 AF/Year

4.7 EXISTING WATER SUPPLY FACILITIES

The following paragraphs provide detailed information regarding the current water supply facilities serving the City of Kent.

4.7.1 Clark Springs Water System

The Clark Springs Water Supply System is located off of Kent Kangley Road in a protected, partially fenced, 320± acre section of the Rock Creek watershed (RM 1.8). This property, which is geographically separate from the City of Kent proper, was annexed to the City of Kent in 1958 for municipal water supply purposes. The balance of the area falling outside of Kent's annexed property is bounded and regulated by the City of Maple Valley on the west, and unincorporated King County to the north, south, and east. Substantial development activity with related increases in impervious surface area and installation of over 300 exempt wells have been allowed to occur within the Rock Creek watershed over the past 30 years. Nevertheless, that portion of the watershed falling within Kent's property remains largely in pristine condition.

The Clark Springs Water System is used on a continuous basis throughout the year and is comprised of three (3) separate, but conjunctively managed sources and/or water rights: Clark Springs Trench, Rock Creek Surface Water Diversion, and Clark Springs Wells. Each of these rights/sources draw upon the same shallow aquifer source (Qvr) and are in hydraulic continuity with each other. Within recent years, Kent has begun to evaluate how winter/high flow production rates could be used to provide source water for a proposed aquifer storage and recovery well at the Seven Oaks Well site or at Lakehaven's OASIS project. Water stored during winter pumping would be used to meet summer peaking and emergency standby/reliability standard requirements.

Given the close hydraulic connections among the Clark Springs sources, Kent has found it most effective from a production and environmental protection standpoint to operate these sources in a conjunctive manner whereby the instantaneous and annual withdrawals of the System are limited to the cumulative totals allowed under the combined Clark Springs System surface water, springs, and groundwater rights (i.e., 5,400 gpm - Qi, and 8,710 af/yr - Qa). Future operations and management of

the Clark Springs wells, water rights, and overall water supply system facilities will occur pursuant to the Habitat Conservation Plan (HCP) currently in development and a related implementation agreement.

4.7.1.1 Clark Springs Trench: Certificate No. 3107-A

Clark Springs Trench is a certificated, spring-based source with an authorized instantaneous quantity (Qi) of 2,250 gpm and an annual quantity (Qa) of 1,350 af/yr which is non-additive to Clark Springs Wells/Water Right Cert. No. 7660. The water right has a priority date of 1957. The water right's purpose of use is for "municipal purposes" and the designated place of use is the "City of Kent." The right was initially issued as an additive water right and perfected as such. In 1969, the authorized Qi and Qa became subject to the Qi and Qa limits established in Clark Springs Wells right (G1-7660-A) described below. This source of supply is not, however, subject to the instream flow limitations set for the Clark Springs Wells.

Kent's Clark Springs Trench is located near Kent-Kangley Road, east of the Maple Valley-Black Diamond Road. Rock Creek flows through the property in a westerly-northwesterly direction and is tributary to the Cedar River. Water is collected in the infiltration gallery which is constructed of approximately 500+ feet of perforated steel pipe placed perpendicular to Rock Creek, across a narrow valley of glacial till, and extending under the streambed.

The collection system and the transmission line were constructed in 1957. Water collected by the gallery system has been determined by Kent's hydrogeologic studies to come from the Qvr aquifer, which is the same aquifer source used by Kent's Clark Springs Wells and the Kent Springs Water System, as well as Armstrong Springs Wells at a lower hydraulic gradient.

The design of the Trench infiltration gallery allows the simultaneous withdrawal of water under the Trench water right as well as the Rock Creek surface water right. This design also allows Kent, when appropriate, to limit diversions allowed under its Rock Creek surface water rights (although use of this right is not subject to minimum in-stream flow conditions). In such circumstances, the production of instantaneous and annual quantities authorized under the Rock Creek water right may be voluntarily reduced and shifted to the Trench. This conjunctive management approach assists Kent in meeting system demands in a reliable and continuous manner, while protecting in-stream flow conditions in Rock Creek.

4.7.1.2 Rock Creek Surface Water Diversion: Certificate No. 7232-A

Rock Creek Surface Water Diversion is a certificated, surface water source with an authorized additive instantaneous quantity (Qi) of 5 cfs/2,250 gpm.

As a pre-1964 surface water right, no annual quantity limitation is assigned to the water right, although Kent has established through beneficial use, an annual quantity (Qa) for this right in the amount of 3,600 af/yr which is supplemental to Clark Springs Well Right Cert. No. 7660. The Rock Creek water right has a priority date of 1931, with a purpose of use defined as "domestic/municipal supply" and the designated place of use within the "City of Kent". The right was initially issued as a primary right and perfected as such. In 1969, the authorized Qi and Qa became subject to the Qi and Qa limits established in the Clark Springs Wells right (G1-7660-A) described below. This source of supply is not, however, subject to the in-stream flow limitations set for the Clark Springs Wells.

Rock Creek is Kent's only direct surface water source. Rock Creek is a tributary to the Cedar River and flows through Kent's Clark Springs property in a westerly-northwesterly direction. The "intake structure" for this source is constructed as an extension of the infiltration gallery piping, and is a 12 inch diameter steel pipe which extends under the Rock Creek channel to the southern-most side.

As noted earlier, Kent monitors stream conditions for the purposes of protecting fish and related aquatic habitat and to substantially minimize/avoid potential adverse operational effects. During low flow events or seasonal conditions, Kent may meet its current demand requirements by shifting its withdrawal of authorized (and required) quantities to its Clark Springs Trench/infiltration gallery system.

As noted above, the Clark Springs Trench and the Rock Creek Surface Water Diversion system is capable of withdrawing over 4,000 gpm. Through the conjunctive management of these two sources, Kent is able to meet current demands within the combined authorized withdrawal limits of its Rock Creek and Clark Springs Trench water rights.

4.7.1.3 Clark Springs Wells: Certificate No. 7660-A

The Clark Springs (Wells) water right is a certificated, additive groundwater right with an authorized instantaneous quantity (Qi) of 5,400 gpm, and an annual quantity (Qa) of 8,710 af/ft from three (3) wells. The Clark Springs Wells water right has a priority date of 1969. The right's purpose of use is for "municipal purposes" the designated place of use is the "area served by City of Kent".

The three Clark Springs Wells are located in close proximity to and within the same property as Kent's Rock Creek and the Clark Springs Trench Source, as described above. Each of the three wells tap the same Qvr aquifer that provides source to the Clark Springs Trench source and discharges to Rock

Creek. All of the wells have 16 to 18 inch diameter casings and screens, and a combined production capacity of 5,400 gpm. The individual wells (numbered #3, #2, and #1) have a capacity of 2,700, 1,800, and 900 gpm respectively.

Because of their hydraulic continuity with Rock Creek, the operation and beneficial use of the Clark Springs Wells is conditioned on ensuring the maintenance of the following instream flows: 15 cfs from January 1 - April 30; 15 cfs on May 1 decreasing arithmetically to 2 cfs by June 30, 2 cfs from July 1 through October 31, 15 cfs from November 1 through December 31. A Parshall Flume is installed in Rock Creek to continuously monitor flow conditions. Kent also has the means to discharge untreated water into Rock Creek from its pumping station to ensure minimum flows are maintained during periods of pumping.

4.7.2 Kent Springs Water System

The Kent Springs source is located near Black Diamond. The City owns 75± acres at this source. This property has been annexed into the City for municipal purposes. The site is segregated by Cran-Mar Creek which flows through the property in a westerly direction. (From Page 1-16) Prior to the incorporation of Maple Valley in 1997, and recent annexations by the City of Black Diamond, the Kent Springs Water System property was surrounded by unincorporated King County. Today, Kent Springs is bounded by Maple Valley to the north and east, Black Diamond to the south, and unincorporated King County to the west. Because Kent does not regulate land use outside of its Kent Springs Water System property, Kent's ability to affect land uses potentially affecting the recharge area for these wells, has been and remains limited.

The Kent Springs Water System is comprised of three wells and a spring fed infiltration gallery. Both sources withdraw supply from the same shallow Qvr aquifer, identified by hydrogeologic studies as the aquifer which also serves the Clark Springs System at a higher hydraulic gradient. Due to their close hydraulic connection, the Kent Springs wells/spring sources are operated in conjunctive manner to maximize instantaneous and annual withdrawal capacity.

Kent is presently studying the feasibility of enhancing withdrawals from its Kent Springs system in order to provide supply to a proposed aquifer storage and recovery well at the Seven Oaks Well site or at Lakehaven's OASIS project, and thereby assist in meeting summer peaking and reliability standard requirements.

4.7.2.1 Kent Springs Wells: Certificate No. G1-22956C

Kent Springs (Wells) is a certificated, additive groundwater source with an authorized instantaneous quantity (Q_i) of 3,690 gpm, and an annual quantity (Q_a) of 5,904 af/yr from the wells. The water right has a priority date of

1977. The right's purpose of use is for "municipal supply" and the designated place of use is the "Area Served by the City of Kent Water Supply System". As noted earlier, prior to 1997, the Kent Springs Water System and related wells were surrounded by unincorporated King County. They are now bounded by Maple Valley, Black Diamond, and unincorporated King County. Consequently, and as noted above, Kent's ability to affect land use actions that may adversely affect the recharge area for this source is limited.

Limitations on pumping activity had affected this source's ability to meet Kent's peaking demands and to act as a reliable supply source. To address reliability, a replacement well was drilled and placed on line in 2001, using DOE grant funding for drought relief. The replacement well, which can produce 2500 gpm (Q_i), has significantly restored productive capacity and is being used to help meet summer peaking demands.

Kent is evaluating how winter/high flow production rates could be used to provide source for a proposed aquifer storage and recovery well at the Seven Oaks Well site or at Lakehaven's OASIS project. Water stored during winter pumping would be used to meet summer peaking and emergency standby/reliability standard requirements.

4.7.2.2 Kent Springs Infiltration Gallery (Trench): Claim No. 123225

The second source of supply in the Kent Springs Water System is the Kent Springs Infiltration Gallery. Kent filed a claim establishing its right to withdraw waters from Kent Springs in 1975. Pursuant to its claim, Kent asserts a primary right to withdraw an instantaneous quantity (Q_i) of 4,488 gpm and an annual quantity (Q_a) of 965 af/yr. The purpose of the right is for municipal supply and the place of use is the area served by Kent. As noted above, Kent's ability to effect development that may be adversely affecting source recharge areas falling within Maple Valley, Black Diamond, and unincorporated King County is limited.

The Kent Springs infiltration source is located in close proximity to the Kent Springs Wells and was constructed in 1908 as one of Kent's first sources of municipal supply.

The Kent Springs Wells and Kent Springs infiltration gallery are in close hydraulic connection with each other and withdraw water from the same Q_{vr} source, as does Armstrong Springs. Given this connection, and the seasonal constraints that affect both sources, the Well and Springs sources are operated in a conjunctive alternating manner (well field approach), in order to produce amounts sufficient to meet Kent's peak and annual supply requirements. The gallery is used during periods of high aquifer levels (i.e.,

winter) in order to reduce the costs of pumping or to improve reliability during extreme winter weather/storm events.

4.7.2.3 Armstrong Springs: Certificate No. G1-24073C (Non-Additive)

Armstrong Springs Wells is a certificated, non-additive groundwater source with an authorized instantaneous quantity (Q_i) of 1,300 gpm and an annual quantity (Q_a) of 500 af/yr from two (2) wells. The water right has a priority date of 1982. The right's purpose of use is for "municipal supply" and its designated place of use is "area served by the City of Kent." The Armstrong Springs wells are used primarily during the high demand/summer months (90 day production schedule) to meet summer peaking requirements and offset a portion of seasonal supply deficits from Kent's other sources.

The Armstrong Springs wells are located at SR 516 (Kent-Kangley Road), and east of Wax Road. Both wells withdraw water downstream from the same shallow Qvr aquifer system that serves the Clark and Kent Springs Systems. Kent determined during its 1998 Phase 1 wellhead protection program study that water not captured by the Clark and Kent Springs Systems flows to the Armstrong Springs sources, thus the three sources are considered hydraulically connected.

4.7.2.4 Soos Creek Well: Certificate No. G1-24073C (Non-Additive)

Soos Creek (Seven Oaks) Well is a certificated, non-additive groundwater right/source with an authorized instantaneous quantity (Q_i) of 900 gpm, and an annual quantity (Q_a) of 864 af/yr. The water right has a priority date of 1982. The right's purpose of use is for "municipal supply" and the designated place of use is "Area served by the City of Kent." The Soos Creek (Seven Oaks) well is intended as the candidate site for aquifer storage and recovery (ASR) of the previously mentioned Kent Springs and Clark Springs water rights/sources. To this end, Kent has budgeted funds to drill an injection well to pilot an ASR effort. If successful, this action could potentially increase Kent's supply by approximately 0.5 MGD.

4.7.2.5 East Hill Well 1: Certificate No. G1-23285C

East Hill Well 1 is a certificated, additive groundwater right/source with an authorized instantaneous quantity (Q_i) of 1,900 gpm, and an annual quantity (Q_a) of 3,040 af/yr. The water right has a priority date of 1979. The right's purpose of use is for "municipal supply" and its designated place of use is the "Area served by the City of Kent."

Similar to other Kent well sources, production from the East Hill Well 1 is limited by seasonal aquifer conditions. In general, the well is capable of

producing 1,900 gpm, although some reduction (1,800 gpm) may take place during dry summer and fall months when drops in the static aquifer levels occur.

4.7.2.6 East Hill Wells: Certificate Nos. 2890-A, 42-D, 44-A

Kent holds three (3) certificated, additive groundwater rights for three wells located on the same site as East Hill Well 1. These rights and related wells were acquired from the East Hill Community Well Company in 1978 pursuant to Kent's annexation of the area.

Certificated Well No. 2890-A has an authorized instantaneous quantity (Q_i) of 120 gpm, an annual quantity (Q_a) of 146 af/yr, and a priority date of 1956. Certificated Well 42-D has an authorized instantaneous quantity (Q_i) of 60 gpm, an annual quantity (Q_a) of 90 af/yr, and a priority date of 1923. Certificated Well 44-A has an authorized instantaneous quantity (Q_i) of 90 gpm, an annual quantity (Q_a) of 135 af/yr, and a priority date of 1945. All of the wells are authorized to provide water for domestic supply purposes within Kent.

Because the three wells are hydraulically connected to East Hill Well No. 1 and their physical condition at time of acquisition would have required some reconstruction, Kent has used East Hill Well No. 1 as the point of withdrawal for these sources. In 2004, Kent drilled a replacement well to improve the productive capacity of the source aquifer for these rights. Kent intends to put the replacement well on-line in 2008, subject to receiving source approval from the Washington State Department of Health (DOH).

The three original East Hill wells and the replacement well are located along the eastern rim of the Kent Valley.

Prior to their acquisition by Kent, these three (3) East Hill water rights and sources provided community domestic supply on a continuous basis to more than 15 residential connections. Subsequent to their acquisition, these rights/sources, which qualify as municipal purpose water rights under the MWL, were added to Kent's water supply/water right portfolio for the purpose of augmenting Kent's existing municipal supply sources.

Pursuant to authority provided in the Municipal Water Law (MWL under RCW 90.03.386) and the City's determination that the beneficial use of the water right is consistent with applicable City land use zoning/comprehensive plan policies, the place of use of the above referenced water right shall be conformed by operation of law to reflect Kent's designated retail service area (i.e., "Area served by City of Kent") upon approval of the Plan.

4.7.2.7 East Hill Wells: Certificate Nos. 651-A, 2428A

Kent holds two (2) certificated, additive water rights for two wells acquired from the East Hill Water Company in 1964 pursuant to annexation of the area by Kent.

Certificated Well 651-A has an authorized instantaneous quantity (Qi) of 60 gpm, an annual quantity (Qa) of 42 af/yr, and a priority date of 1948. Certificated Well 2428A has an authorized instantaneous quantity (Qi) of 120 gpm, an annual quantity (Qa) of 78.4 af/yr, and a priority date of 1953. The wells are authorized to provide water for domestic supply, municipal, and irrigation purposes.

In recent years, the wells have been subject to test pumping to evaluate aquifer conditions and check well/screen conditions. Both of the wells are presumed to have a hydraulic connection with Kent's Seven Oaks Well, which is a candidate for an aquifer recharge project. Consequently, Kent is hopeful that the reliable, productive capacity of these sources will be improved once the Seven Oaks Well recharge project proceeds.

Prior to their acquisition by Kent, these two (2) East Hill water rights and sources provided community domestic supply on a continuous basis to more than 15 residential connections. Subsequent to their acquisition, these rights/sources, which qualify as municipal purpose water rights under the MWL, were integrated into Kent's water supply/water right portfolio for the purpose of augmenting Kent's existing municipal supply sources.

Pursuant to authority provided in the Municipal Water Law (MWL under RCW 90.03.386) and the City's determination that the beneficial use of the water right is consistent with applicable City land use zoning/comprehensive plan policies, the place of use of the above referenced water right shall be conformed by operation of law to reflect Kent's designated retail service area (i.e., "Area served by City of Kent") upon approval of the Plan.

4.7.2.8 Garrison Well: Certificate No. G1-23614C (Non-Additive)

Garrison Well is a certificated, non-additive groundwater source with an authorized instantaneous quantity (Qi) of 500 gpm, and an annual quantity (Qa) of 800 af/yr. The water right has a priority date of 1980. The right's purpose of use is for "municipal supply" and its designated place of use is the "Area served by the City of Kent". The Garrison Well has been found to be in close hydraulic connection with Kent's 212th St. and 208th Street wells/water rights.

In 2002, subsequent to the Nisqually earthquake, the Garrison Well began to fail due to the separation of the well screens from the well casing. To restore production from this source, in 2003 a replacement well was drilled. The replacement well has been on-line and in regular use since 2004.

Shortly after drilling, and due to close hydraulic connection with the neighboring 212th and 208th Street wells, the new Garrison (replacement) Well was combined with the existing wells and approved by the Department of Ecology (Ecology) in 2003 as part of a conjunctive well field. Under this approach, Kent may share and/or interchange the authorized quantities of these three sources/water rights among the source wells. However, Kent has yet to be able to include the Garrison Well in the well field configuration due to water quality characteristics (i.e., iron/manganese) that have affected its ability to blend water from this groundwater source. Because of this issue, Kent has applied for and received from Ecology, extensions to the well field permits and management approach approved in 2003.

4.7.2.9 High Meadow Well: Certificate No. G1-23713C

High Meadow Well is a certificated, additive groundwater source with an authorized instantaneous quantity (Q_i) of 7gpm and an annual quantity (Q_a) of 11 af/yr. The water right has a priority date of 1980. The right's purpose of use is for "municipal supply" and the designated place of use is "Area served by City of Kent". Kent intends to transfer the rights from this well to another well in the area, located at the Blue Boy Reservoir site, in order to help meet Kent's near future demands for water supply. The High Meadow Well is located along the eastern rim of the Kent Valley.

4.7.2.10 212th Street Wells (3): Certificate No. G1-24190C (Non-Additive)

The three (3) 212th Street Wells are certificated, non-additive groundwater sources with a combined, authorized instantaneous quantity (Q_i) of 2,700 gpm and an annual quantity (Q_a) of 1,400 af/yr. The water right has a priority date of 1982. The right's purpose of use is for "municipal supply" and the designated place of use is "Area served by the City of Kent." The water from these wells, as well as the 208th Street Well, requires the removal of high levels of manganese and iron to meet drinking water standards. Construction of a Manganese Filtration Plant was completed in 1993.

All of the wells are classified as artesian wells, with an artesian pressure of approximately 15 to 20 psi during the off-season. The Well 2 aquifer partially collapsed in 2000, resulting in substantial loss of well capacity.

A new/replacement well (Well 3) was drilled in 2002 and put on-line in 2003 to recover most of Well 2's lost production pursuant to Ecology granting an emergency change in point of withdrawal. Well 3 went on line in 2003 and is drilled to a depth of 522 feet with a 20, 16 and 12 inch casing, and is screened from 290 feet to 480 feet. Well 2 remains in production, although at approximately 25% of its former production capacity.

To improve reliability from the 212th Street wells, these three (3) wells/water rights, in addition to Kent's 208th Street Well and Garrison Creek Well, were approved by the Department of Ecology (Ecology) in 2003 to be managed as part of a conjunctive well field. The 212th Street Wells are currently operating in a well field configuration with Kent's 208th Street Wells. Consequently, authorized instantaneous (Qi) and annual quantity (Qa) withdrawals are currently being shared between these two groundwater sources.

Because Kent has yet to complete a source recharge analysis for the underlying source aquifer, the extents of the aquifer recharge area for these wells have not been determined. However, The recharge area is believed to be from east of the well site. A final answer on this issue is expected to be determined upon completion of the 2008 Phase 2 Wellhead Protection Study.

4.7.2.11 208th Street Well: Certificate No. G1-24404C (Non-Additive)

The 208th Street Well is a certificated, non-additive groundwater source with an authorized instantaneous quantity (Qi) of 1,200 gpm and an annual quantity of 600 af/yr. The water right has a priority date of 1983. The rights purpose of use is "municipal supply" and the designated place of use is "Area served by the City of Kent." The well is used primarily as a summer peaking source.

The 208th Street well is artesian in nature. Along with the 212th and Garrison Wells, the three sources are hydraulically connected, as pumping of one well will result in a drop in static artesian pressure of the others. Also, the water quality (i.e., manganese and iron) conditions in the 208th Street well are somewhat similar to those found at the 212th Street and Garrison Wells.

The 208th Street Well is currently operating in a well field configuration with Kent's 212th Street Wells. Consequently, authorized instantaneous (Qi) and annual quantity (Qa) withdrawals are currently being shared between these two groundwater sources.

4.7.2.12 Summit Well: Certificate No. 1116A

The Summit Well is a certificated, additive groundwater right with an authorized instantaneous quantity (Qi) of 200 gpm, and an annual quantity

(Qa) of 320 af/yr. The water right has a priority date of 1950. The right's purpose of use is for "municipal supply" and the designated place of use is "City of Kent." Pumping tests indicate that the well has lost some production capacity and is "sanding," or filling with sediment. The water quality has also deteriorated over time, and has high levels of hydrogen sulfide.

The Summit well is located on the east rim of the Kent valley. The well is located on an unused reservoir site 1/3rd acre in size. Because of the well's current condition, Kent is considering redrilling and screening the well at the same site, or applying for a change in point of withdrawal to make use of an existing well drilled within Kent's Earthworks Park site.

4.7.2.13 O'Brien Well: Certificate No. 767-A

The O'Brien Well is a certificated, additive groundwater source that was acquired in 1958 from the O'Brien Water Users Association pursuant to Kent's annexation of "the Community of O'Brien" (Cloverdale addition to Kent). The right has an authorized instantaneous quantity (Qi) of 243 gpm, an annual quantity (Qa) of 45 af/yr, and a priority date of 1951. The water right's purpose of use is "community domestic" and the designated place of use is "Community of O'Brien", which now falls within the City of Kent.

A replacement well for the original well has been drilled and was placed in operation July, 2000, subsequent to receiving DOH source approval. The well's proximity and continuity with the 212th, 208th, and Garrison Wells make this source a good candidate to become part of that approved wellfield. Consequently, Kent may submit an application to the Department of Ecology in the next six years to allow its addition to the wellfield.

Prior to its acquisition by Kent, the O'Brien well/water right provided community domestic supply on a continuous basis to more than 15 residential connections. Subsequent to its acquisition, this right/source, which qualifies as a municipal purpose water rights under the MWL, was integrated into Kent's water supply/water right portfolio for the purpose of augmenting Kent's existing municipal supply sources. To this end, this right has provided water supply to residential, commercial, and industrial customers within Kent's retail service area on a regular basis.

Pursuant to authority provided in the Municipal Water Law (MWL under RCW 90.03.386) and the City's determination that the beneficial use of the water right is consistent with applicable City land use zoning/comprehensive plan policies,, the place of use of the above referenced water right shall be conformed by operation of law to reflect Kent's designated retail service area (i.e., "Area served by City of Kent") upon approval of the Plan.

4.7.2.14 Chappellear Well: Certificate No. 1957A

The Chappellear Well is a certificated, additive groundwater source with an authorized instantaneous quantity (Q_i) of 140 gallons per minute, and an annual quantity (Q_a) of 60 af/yr. The water right has a priority date of 1954. The right's purpose of use is for "domestic supply and irrigation" and the designated place of use falls within the City of Kent.

4.7.2.15 River Bend Golf Course Well: Certificate No. G1-25204C

Kent holds a certificated, additive water right issued to the City of Kent Parks and Recreation Department to provide non-agricultural irrigation water on a proprietary, commercial basis for the River Bend Golf Course which is owned and operated by the City. This certificated, additive groundwater source has an authorized instantaneous quantity (Q_i) of 290 gpm, and an annual quantity (Q_a) of 290 af/yr for the irrigation of 145 acres. The period of use for the water right is during the "irrigation season", which has traditionally involved the months of May through September. The water right has a priority date of 1988, and the designated place of use is the "the River Bend Golf Course." Because the beneficial use of the River Bend Golf Course water right constitutes a governmental proprietary and commercial activity of the City, the water right qualifies as a municipal purpose water right pursuant to RCW 90.03.015(4)(b).

4.7.2.16 Hamilton Road Wells: Certificate Nos. 494-A/4534-A

Kent holds two additive, certificated water rights for two (2) Hamilton Road Wells that were acquired in 1967 from the Hamilton Road Water Community Water Association pursuant to Kent's annexation of the Community of Hamilton Road. The depth of both wells is approximately 200 feet, and they are located in residential areas along the eastern rim of the Kent Valley. The place of use of this right falls within the City of Kent and the purpose of use is "domestic supply". The total instantaneous quantity (Q_i) for these water rights is 50 gpm and the total annual withdrawal rate is 49.2 af/yr. It is Kent's intention to transfer the point of withdrawal of these water rights to a site near the Blue Boy reservoir.

Prior to their acquisition by Kent, these two (2) Hamilton Road water rights and sources provided community domestic supply on a continuous basis to more than 15 residential connections. Subsequent to their acquisition, these rights/sources, which qualify as municipal purpose water rights under the MWL, were integrated into Kent's water supply/water right portfolio for the purpose of augmenting Kent's existing municipal supply sources.

Pursuant to authority provided in the Municipal Water Law (MWL under RCW 90.03.386) and the City's determination that the beneficial use of the water right is consistent with applicable City land use zoning/comprehensive plan policies, the place of use of the above referenced water rights shall be conformed by operation of law to reflect Kent's designated retail service area (i.e., "Area served by City of Kent").

4.8 WATER RIGHT APPLICATIONS

4.8.1 Applications for Non-Additive Rights

Non-additive water rights, formerly referred to by the Department of Ecology as "supplemental" or "alternate" rights", are defined by Ecology as "a water right for with annual or instantaneous quantities of water that does not increase the water available in existing rights."

4.8.1.1 Groundwater Application G1-27619

On May 22, 1995, Kent applied to Ecology for a non-additive groundwater right (additional point of withdrawal) to drill a well approximately 95-120 feet deep, with a casing of 16 inches, on City of Kent property located near the eastern boundary of 124th Ave S.E. This site is in close proximity to Kent's previously planned storage reservoir site. In its application, Kent requested an instantaneous quantity rate (Qi) of 1,200 gpm and an annual quantity (Qa) of 500 af/yr. The application proposes the place of use be the "area served by the City of Kent", the purpose of use as "municipal purposes," and the time of use "continuous".

The well is required as a result of aquifer conditions and source capacity problems that are impairing the ability of Kent's existing sources to meet the City's reliability standard and summer peaking demands. Once permitted, Kent would use this new supplemental well as an additional summer peaking source. This application is still pending processing by the Department of Ecology.

4.8.1.2 Groundwater Application G1 - 27620

On May 22, 1995, Kent applied to Ecology for a seasonal (i.e., winter high flow), non-additive groundwater right (additional points of withdrawal) to install four (4) South Kent (formerly Ranney) Wells on City of Kent property located near the Green River. Test wells have already been drilled, three of which are 100 feet deep, and one that is 300-350 feet deep. The casing size proposed for the wells is 24 inches. In its application, Kent requested an instantaneous quantity rate (Qi) of 7,000 gpm/10 mgd, and an annual quantity (Qa) of 6,496 af/yr. The application proposes the place of use to be

the “area served by the City of Kent”, the purpose of use to be “municipal purposes”, and the time of use to be seasonal (i.e., winter high flow months). At this time, the application is awaiting investigation and processing by Ecology.

Once permitted, Kent intends to pump groundwater from the South Kent Well system into its distribution system or possible Tacoma’s Second Supply pipe line for storage elsewhere. This application is still pending processing by the Department of Ecology.

4.8.2 Applications for Flow Augmentation Groundwater Rights

The basic goal of the Kent Mill Creek Flow Augmentation Project is to increase critically low summer base flows in Mill Creek by pumping and aerating shallow groundwater into the stream. Mill Creek is one of the City’s major streams and experiences extremely low base flows (approx. 0.5-2.0 cfs) during the summer months. Primary benefits desired are to improve salmonid fish habitat by enhancing water quality and increasing habitat volume by roughly doubling summertime streamflows.

4.8.2.1 Application 1: G1-27068

In April of 1995, the City of Kent applied for a non-consumptive groundwater right permit (G1-27068) for the purpose of augmenting summer base flows in Mill Creek. Development of wells for flow augmentation purposes is one of the recommended strategies identified in the recently completed Mill Creek Water Quality Improvement Report which was prepared by Kent in coordination with Ecology.

The application, which was not filed as part of and/or a condition of any existing or proposed project, seeks an instantaneous withdrawal rate (Q_i) of 200 gpm, and an annual quantity of 100 af/yr from an existing monitoring well. Kent has proposed the purpose of use to be “streamflow/water quality enhancement.”

Kent proposes, subject to a detailed monitoring plan, to withdraw water from this groundwater well and discharge it directly into Mill Creek when seasonal/summer low flows normally impair affect fish passage and water quality (e.g., dissolved oxygen) conditions. The well, which is located in close proximity to Mill Creek, and drilled to a depth of 100 feet, was developed pursuant to Kent’s creation of the Green River Natural Resources Enhancement Area. This application is still pending processing by the Department of Ecology.

4.8.2.2 Application 2: G1-27778

In November of 1996, the City of Kent filed for another, non-consumptive groundwater right permit (G1-27778) for the purpose of augmenting base flows in Mill Creek, consistent with the context, goals, purpose, and monitoring plan stated for the application above. The application seeks a permit to develop four wells, with a total instantaneous withdrawal rate (Q_i) of 750 gpm, for seasonal summer use. The wells are existing monitoring wells drilled as part of Kent's Green River Natural Resource Enhancement Area project. Kent proposes to make withdrawals from these wells when low flow conditions in Mill Creek normally impair fish passage and water quality conditions. The wells are located in close proximity to Mill Creek and drilled to a depth of 100 feet. This application is still pending processing by the Department of Ecology.

4.8.2.3 Application 3: G1-xxxxxx

In May, 1998, the City of Kent filed a third, non-consumptive, seasonal groundwater right application for the purpose of augmenting summer base flows and water quality conditions in Mill Creek. Under this application, Kent seeks an instantaneous withdrawal rate (Q_i) of 100 gpm and an annual quantity (Q_a) of 80 af/yr (Q_a) from a new shallow well, approximately 30 feet deep, which will be located in close proximity to and in hydraulic continuity with Mill Creek.

Once permitted, Kent proposes to pump from May through October, clean, shallow groundwater into a system which would oxygenate, filter, and then discharge the water back into the stream channel. Since the groundwater will be in hydraulic continuity with the streambed, the project design is focused on ensuring the inflow from the well roughly equals the ex-flow from the stream to groundwater - resulting in a net change in flow of zero.

Kent has proposed that this application be approved on a temporary basis, over a two year period, subject to a monitoring plan and results that would be shared with Ecology and the Muckleshoot Indian Tribe. Kent has made repeated requests to Ecology to process this application which is still pending.

4.9 SOURCE OF SUPPLY ALTERNATIVES

Over the past twenty-five years, the City of Kent's population and land base have significantly expanded. Further aggressive growth is projected over the next twenty-five years as population density increases within Kent's existing boundaries and new annexations occur, resulting in an approximate doubling of the city's current water service area population.

As a matter of law, Kent has an on-going responsibility to plan for and develop the water supplies necessary to meet its projected population growth, as well as to maintain and protect the viability of Kent's existing sources. Within recent years, however, meeting these responsibilities has become a significant challenge due to a combination of factors that include: seasonal and development-based impacts on source aquifers; the increasingly stringent and dynamic regulatory environment governing water supply, water quality, and water rights; and the implementation of the Endangered Species Act (ESA) in an urbanized setting.

In its efforts to meet the challenges posed by both the natural and regulatory environment, Kent has made significant investments in conservation, source rehabilitation, and the development of new sources of supply. The following paragraphs describe these efforts and possibilities.

4.9.1 Enhanced Conservation Measures

Kent's Conservation Program Demand Management (DM) practices, including water conservation, inclining rate structures, public education, distribution of water efficient household plumbing fixtures, and leak detection can play an important role in prolonging use of existing water supplies and delaying the time when new source is required. To that end, in 1993, Kent adopted and implemented an aggressive and comprehensive conservation program to prolong supply and mitigate peaking demands that place stress on available sources. Since then, the City's Water Department has developed and implemented additional water use efficiency and water conservation programs. These programs are described in detail in Chapter 5 and Appendix I of this Plan. The following elements of water conservation were included in the original (1993) conservation program:

- Metering for all customers;
- Bock rate structure;
- Seasonal rate pricing/summer conservation rates;
- Water shortage emergency/regulation authorizing the Mayor to restrict non-essential public uses and levy fines during drought conditions;
- Public education/promotional materials;
- Single/multi-family conservation kits;
- Distribution of water efficient plumbing fixtures;
- Leak detection;
- Drought tolerant landscaping;
- Water efficient irrigation technology;
- Designation of a conservation specialist;

Kent is a nineteen point four percent (19.4%) partner in Tacoma's Second Supply Pipeline Project. When the Department of Ecology extended the Second Diversion water right, a ten percent (10%) aggregate reduction (conservation) in peak season water demand by 2010 condition was placed on all of the project participants (Tacoma, Lakehaven Utility District, Covington Water District, and Kent). Kent is participating with the partners in the Tacoma SSP to reduce their peak season water demand by ten percent (10%). Reports are given to the Department of Ecology and Department of Health by the project partners to provide updates as requested on the status of meeting this requirement.

4.9.2 Surface Water

The Green River and Cedar Rivers are subject to minimum instream flow rules and/or agreements that effectively preclude all new surface water withdrawals beyond those occurring during high flow winter months. Since the City of Tacoma secured a flow-restricted, seasonal water right on the Green River for its Second Supply/P-5 project in the 1980's, no further surface water applications have been approved by Ecology due to on-going concerns relating to flow levels, cumulative impacts, and tribal treaty rights. Moreover, because streams tributary to the Green and Cedar Rivers have been closed by administrative rule to further appropriation, Ecology has not seriously entertained the issuance of new primary rights for these surface waters for several years. Due to the foregoing factors, and the advent of the Endangered Species Act, development of new surface water rights is not considered a viable supply alternative.

4.9.3 Acquisition or Transfer of Existing Water Rights

State water law allows the transfer of existing rights to new places of use and purposes of use if such actions do not impair existing rights and do not create new, adverse effects upon pre-existing aquatic habitat, flow, and water quality conditions. Given the extreme difficulty in securing new ground and surface water sources within the Green River basin, Kent has explored the potential of securing existing water rights within the vicinity of its service area that are still valid and could provide water of sufficient quality and quantity to be of value to the system. However, no water rights have been identified within a reasonable distance of Kent's service area which are still active and/or provide sufficient quantities to warrant their acquisition by Kent. This alternative is therefore not considered a reasonable or practicable alternative source of supply alternative.

4.9.4 Water Right Changes

Water right changes include a variety of options, including changes in place of use, purpose of use, and to the point of diversion or withdrawal of water, as well as the addition of points of diversion or withdrawals to allow groundwater production in a

wellfield configuration. As noted earlier, Kent has secured approval to operate its 208th street, 212th street, and Garrison Wells in a wellfield configuration to restore the production capacity affected by the Nisqually earthquake.

Three sites within the water system have the potential of benefiting from this option. The first of which is a well located at the Blue Boy reservoir site. Water rights from smaller wells, believed to be in the same aquifer, may be transferred to the Blue Boy Well. It is believed that the well is capable of producing up to 400 gpm; however, this is dependent on a pump test which would need to be performed as well as the total water rights for the site. The second site that may benefit from this option is the Armstrong Springs site. A portion of the water rights for the Kent Springs site, believed to be in the same aquifer, would be transferred to the Armstrong Springs site for an additional well(s). The third site is an existing well located at the City's Earthworks Park.

Currently, it is not known if additional well(s) are a feasible option at the Armstrong Springs site, or the volume that could be produced from these well(s). Additional testing is required to validate this option.

4.9.5 Regional Supply Purchases

Assessing the viability of acquiring water supply from adjacent and regional supply systems has been a constant feature of Kent's water supply planning and system operations.

4.9.5.1 Seattle Public Utilities (SPU)

Around the year 2000, Kent and SPU discussed the opportunity and terms under which Kent could secure either a firm supply in perpetuity, or a bridge supply of water that could assist Kent in meeting its summer peaking needs until the Tacoma Pipeline 5 (now referred to as the regional Second Supply Pipeline or SSP) project was on-line and providing water to the Kent water system. Since that time, the SSP has been completed and Kent has drilled four replacement wells which have greatly enhanced the City's dependable supply. In addition, Kent constructed an intertie with Soos Creek Water and Sewer District that allows the City to receive water from the regional Seattle system via bridging across Soos Creek's distribution system. Consequently, Kent has no current plans to secure water supply directly from SPU.

4.9.5.2 City of Tacoma: Second Supply Pipeline Project (SSP/P-5)

In 1933, Tacoma established a priority date for their second water right diversion from the Green River. In 1963, Tacoma initiated efforts to develop what was referred to as Pipeline-5 and is now called the Second Supply Pipeline project (SSP). In 1985, Kent contracted with Tacoma Public Utilities

(TPU) to purchase 7.2 mgd of summer peaking water from the proposed SSP project.

In 1995, Tacoma, Seattle Public Utilities (SPU) (and its purveyors), and the South King County utilities of Kent, Covington Water District, Lakehaven Utility District, and King County Water District No 111, began nearly five years of discussions/negotiations regarding the framework, conditions and costs of project participation. Significant changes to the contractual framework of the project, including the withdrawal of King County Water District No. 111, occurred in the early stages of the project, and a complex and highly technical, multi-party negotiation ensued.

In October, 2002, a final agreement was reached with Tacoma Public Utilities, Kent, Lakehaven Utility District and Covington Water District. In the course of that final agreement (See Appendix K), Kent's share of the SSP was increased to 12.64 mgd after Seattle determined that it would no longer participate in the project. Water supply from the SSP project became available to Kent in 2007. And the final agreement obligated the participating utilities to the shares of the SSP project outlined in Table 4-3.

**TABLE 4-3: REGIONAL SECOND SUPPLY PIPELINE
PERCENT OWNERSHIP**

Utility Partner	Percent Ownership
Tacoma Public Utilities	41.67% (15/36 ^{ths})
City of Kent	19.44% (7/36 ^{ths})
Lakehaven Utility District	19.44% (7/36 ^{ths})
Covington Water District	19.44% (7/36 ^{ths})

BY AGREEMENT DATED OCTOBER 2002. SEE APPENDIX K.

The SSP source of supply is considered critical to Kent's ability to meet near and long-term demand needs. In this regard, Kent has expended substantial financial resources on the SSP project in reliance on the Ecology-approved water right and place of use documents issued to Tacoma, and the executed contracts. A copy of the SSP agreement is included in Appendix K for reference.

4.9.6 Artificial Recharge

The viability of ASR is subject to many factors, not least of which is the presence and availability of suitable aquifers. In the Puget Sound area, these characteristics are:

- High aquifer transmissivity to permit rapid recharge and recovery;
- Deep aquifer, to provide storage capacity and hydraulic separation from surface waters;
- Good aquifer confinement by aquitards to reduce the loss of stored water;
- Aquifer storativity and depth to water, to provide sufficient aquifer storage capacity; and
- Compatible water quality between aquifer and recharge waters.

A primary limitation in the Puget Sound area in general, and around the City of Kent in particular relative to ASR, is the limited presence of aquifers that are suitable for recharge and recovery. In general, most groundwater resources in the region are drawn from aquifers of shallow or intermediate depth (typically less than 200 feet below the surface).

4.9.7 Soos Creek (Seven Oaks) Well Artificial Recharge

Kent has determined that a small opportunity for ASR may exist at the site of its Soos Creek Well. This well taps into one of the deeper Qc (3) aquifers which are confined but of unknown lateral extent. Production rates from the well have been limited within recent years to only half of the original permitted amount. The main factor in the impaired yield is a long-term lowering of the static water level within the aquifer, which has reduced the available drawdown at the Soos Creek Well.

The aquifer may be affected by additional extraction wells, which are causing an overdraft. Recharge to the confined aquifer is also limited by the hydraulic characteristics of the confining layers, which may impair the aquifer's ability to fully recover from each period of groundwater pumping during the summer months.

To address this problem, Kent intends to drill an injection well at the Seven Oaks/Soos Creek site to pilot the ASR project, and study the feasibility of restoring the aquifer's production capacity by diverting and injecting winter flows from its Kent Springs and Clark Springs sources. If successful, this action could potentially increase Kent's supply by approximately 0.5 MGD.

4.9.8 Lakehaven Utility District (LUD) Oasis/ASR Project

In 2004 the City of Kent submitted copies of the majority of its water rights to Lakehaven Utility District (LUD) to be included in LUD's Optimization of Aquifer Storage for Increased Supply (OASIS) project from the Mirror Lake aquifer. Assuming the Oasis Project is successfully advanced, water stored from Kent's sources in the aquifer would be available to Kent in the future to meet an increment of its projected demands.

4.9.9 Use of Reclaimed Water and Other Non-Potable Sources

4.9.9.1 Wastewater Reuse

The City of Kent currently disposes of over 3 mgd of wastewater (based upon projected population of 50,416 for 1998 and typical water use of 60 gallons per capita per day) to King County's East Division Wastewater Treatment Plant in the City of Renton (Renton WWTP). The highest potential for use of reclaimed water is for irrigation and landscape purposes, where water chemistry is not critical and retrofit of industrial facilities would not be required.

Although the City of Kent has a fairly significant annual irrigation water demand, it is noted that irrigation demands in the Pacific Northwest are very susceptible to fluctuating summer weather patterns. Significant rainfall during winter months limits opportunities for reclaimed water use for irrigation of parks and athletic fields to the summer months. While golf courses might also logically be considered for irrigation with reclaimed water, the only golf course within the City of Kent is irrigated from a permitted well that is not connected to the Kent water system.

The City of Kent believes the reuse of this effluent could occur most cost-effectively if it could divert the effluent flow to a treatment and/or "polishing" plant located within its corporate boundaries to treat wastewater to Class A reuse standards. However, this proposal is currently opposed by King County, which asserts that under its current King County Wastewater Treatment Division (KCWTD) contract, Kent is obligated to provide all effluent collected within its service area to the KCWTD system.

King County retained a consulting firm to develop a Technical Memorandum documenting a Preliminary Analysis of Reclaimed Water options in the Green River Valley. The Draft memorandum dated August, 2007 indicates that three separate alternatives were evaluated for production of reclaimed water for irrigation use during five months of the year. All three alternatives under the peak summer production scenario were in excess of \$10.00 CCF - far beyond any possibility of economic feasibility.

The King County report goes on to evaluate the same three alternatives using a year-round production scenario. Under these conditions, the draft report suggests that year-round production and delivery of reclaimed water would be significantly reduced - ranging from more than \$2.50/CCF to approximately \$7.00/CCF. The cost estimates put forth by King County indicate that additional evaluation of reclaimed water is unwarranted at this time.

As indicated later in this Chapter and detailed in Chapter 7, the City of Kent has sufficient potable water supply to meet existing and near future demands. Development of these sources of supply required a significant investment by the ratepayers of the Kent system. The limitations of the King County Renton WWTP to produce Class A reclaimed water, the exorbitant cost of water under additional scenarios and the adequacy of Kent's existing supply indicate that there is not sufficient need or cost-justification to develop a reclaimed water supply and/or manage a reclaimed water distribution system. In accordance with existing and anticipated regulations and requirements, the City will continue to evaluate the feasibility of offering reclaimed water to its customers in the future. New regulations and information regarding its costs, demands, and potential customer uses will be critical factors in that evaluation.

4.10 SOURCE EVALUATION

The Washington State Department of Health (DOH) Water Design Manual requires, under Washington State Law, that "[All] public water system[s] must have sufficient source capacity to meet the demands of its customers as stipulated in WAC 246-290-222(4). The source(s), in accordance with WAC 246-290-130(1), must provide drinking water of the highest quality feasible. It is further required that the source(s) be sufficient to provide reliable service in accordance with the provisions of WAC 246-290-420."

Comparing available source rates to Fire Suppression Storage (FSS) requirements and projected maximum day demands (MDD) provides an overview of whether the current sources of supply will meet or exceed future demands. A complete source evaluation is provided in Chapter 7 of this document.