

City of Yelm Water Right Mitigation Plan

Mitigation for City of Yelm Water Right Application:

G2-29085 - Priority Date January 10, 1994

For Additional Information Please Contact:

Shelly Badger
Yelm City Administrator
shellyb@ci.yelm.wa.us
(360) 458-8405

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ABBREVIATIONS AND ACRONYMS

| | |
|----------|---|
| ac-ft/yr | acre-feet per year |
| cfs | cubic feet per second |
| City | City of Yelm |
| DOH | Washington State Department of Health |
| Ecology | Washington State Department of Ecology |
| FERC | Federal Energy Regulatory Commission |
| GMA | Growth Management Act |
| gpm | gallons per minute |
| Mgd | Million gallons per day |
| MOA | Memorandum of Agreement |
| MISF | Minimum Instream Flows |
| MPC | Master Planned Community (Thurston Highlands) |
| NRCC | Nisqually River Coordinating Committee |
| Qa | annual water right |
| Qi | peak daily (instantaneous) water right |
| Qga | Advance Vashon Outwash (Qga) |
| Qpg | Pre-Vashon Gravel Aquifer |
| RM | River Mile |
| SEPA | State Environmental Policy Act |
| SSPA | S.S. Papadopulos & Associates |
| TQu | Undifferentiated Tertiary Aquifer |
| USGS | U.S. Geological Survey |
| WAC | Washington Administrative Code |
| WRIA | Water Resources Inventory Area |

UNIT CONVERSIONS

| | | | | | | |
|--------------|---|-------------------|---|---------------------|---|----------------|
| 1 cfs | = | 448.8 gpm | = | 646,272 gallons/day | = | 723.9 ac-ft/yr |
| 1 acre-foot | = | 43,560 cubic feet | = | 325,872 gallons | | |
| 1 mgd | = | 694 gpm | | | | |
| 1 acre | = | 43,560 sq.ft | | | | |
| 1 cubic foot | = | 7.481 gallons | | | | |

Section 1

Introduction

The City of Yelm (Yelm) has developed this Mitigation Plan in support of their water right application G2-29085, submitted to the Washington State Department of Ecology (Ecology) with a priority date of January 10, 1994. This proposal revises the 2008 Mitigation Plan submitted to Ecology in October of 2008 by significantly reducing the request for additional water rights to reflect a more sustainable and environmentally sound proposal. This Mitigation Plan presents a summary of mitigation actions proposed by Yelm to address predicted groundwater and surface water impacts in the Nisqually and Deschutes River Basins through 2028 by adding one new production well (Southwest Well 1A) to be associated with the subject water right application G2-29085. Yelm will conduct a State Environmental Policy Act (SEPA) review of the mitigation plan in support of the water rights request.

This mitigation plan has been revised to reflect several conditions that have changed relative to the 2008 draft submittal. The primary changes reflected in this plan include:

- The model baseline has been updated to reflect more current pumping conditions in the Yelm sub-basin.
- Water rights transfers (golf course and another pending transfer) have been modified to reflect current conditions; and the proposed well located at the Nisqually Golf Course is no longer being considered.
- Rather than multiple phases of development, water rights associated with the 1994 water right application (G2-29085) will be developed at a single new well location (SW Well 1A).
- The City will maintain its facilities and continue its historic withdrawals at the downtown well locations.
- The phased approach of requesting additional water rights to meet 30+ year growth projections has been revised to meet 18-20 year projections. The City's request for new water has decreased from 4,186 AFY (2008) to 942 AFY (2010).
- A new pumping distribution regime continuing the use of the City's downtown well sources and the addition of a new source of supply, SW Yelm Well 1A.

Current water demand forecasts recently completed as part of the 2010 update to Yelm's 2002 Water System Plan indicate that Yelm will need to secure additional water rights in 2011 to continue to meet its obligations under the Growth Management Act. This Mitigation Plan establishes a commitment to mitigate impacts that are expected to result from these new water rights.

Yelm has worked alongside its partners in the Nisqually watershed to address water-related issues and water right applications throughout the entire watershed planning process. Cumulative hydrologic impacts resulting from the future pumping of the cities have been modeled, and opportunities for joint mitigation are being discussed and implemented. However, this Mitigation Plan addresses only Yelm's water rights and mitigation requirements and strategies.

1.1 Yelm's Approach to Water System Expansion

Historically, Yelm's groundwater supply source has been derived from a relatively shallow (yet highly productive) aquifer in the downtown Yelm area. Consistent with its watershed and capital planning efforts, Yelm has developed a new well that targets a deeper portion of the aquifer system (TQu), in an effort to limit impacts to nearby surface water features. As part of its long-term water management program, Yelm is requesting approval of water right application G2-29085 to support the development of this new supply source. This plan details the development of, and mitigation for, 942 acre-feet per year (ac-ft/yr) of water from the new source.

1.2 Environmental Stewardship

Yelm is recognized statewide for its exceptional conservation and reclaimed water programs, both of which are unusual for a city of its size (2010 population of 5,900). Yelm plans to expand both its water system and reclaimed water system in an effort to accommodate future population projections to year 2028. This plan supports sustainable development while maintaining the watershed objective of reducing impacts and providing mitigation to offset potential impacts across the Nisqually and Deschutes watersheds.

1.3 Yelm's Existing Source

Since the 1950's, Yelm's water has been supplied by two primary wells (downtown Wells 1A and 2) located in the downtown area of Yelm (Figure 1-1). Since 2001, both of these wells have been upgraded to provide additional pumping capacity and redundancy for Yelm's growing community. Additionally, in early 2011 the City completed further rehabilitation work on the downtown wells to improve source capacity and reliability to meet projected peak day demands. These wells are relatively shallow (less than 100 feet deep) and draw water from the highly productive Advance Vashon Outwash (Qga) aquifer. Yelm will continue to maintain these wells as water supply assets.

1.4 Southwest Yelm Well 1A

Yelm used a numerical groundwater flow model to evaluate the effects of water rights transfers and the development of the new supply well Southwest Well 1A (SW Well 1A). The model evaluated the potential hydrologic impacts of the development of a new supply from a deeper groundwater source (TQu) located in the southwest portion of Yelm. In the summer and early fall of 2010, Yelm drilled and tested SW Well 1A to examine the supply capacity, water quality, and potential for impacts resulting from pumping the deeper system. A summary of Yelm's findings include:

- A deeper portion of the aquifer system specifically targeted by this well (the TQu aquifer) was clearly identified below well-defined confining layers and aquifers in a sequence and thickness consistent with the accepted conceptual hydrogeologic model adopted by the watershed partners and used to develop the McAllister Numerical Groundwater Model (the model) as well as work published by the USGS.
- The well was cased and sealed to a depth of 310 feet bgs (approximate elevation 381 ft msl) to limit the potential for hydraulic interaction with overlying aquifers.
- The well was tested at a rate of 2,100 gpm for 72 hours. During this test, the rate of drawdown stabilized and there was no apparent hydraulic response at wells included in the observation well network.
- Recovery response did not indicate a change in storage (dewatering).
- The well is highly productive, and could be rated for a production capacity much greater than Yelm currently plans to use.
- Water quality is suitable for Yelm's needs.

Consequently, this well appears to be a viable new supply source that can satisfy Yelm's growth in demand for an estimated 18-20 years. Annual production from SW Well 1A at 942 ac-ft was simulated using the most current version of the model to assess the long term potential for impacts to surface water features in the watershed that could result from Yelm's projected demand per the City's 2008 Water System Plan.

The model is a sophisticated and complex tool originally developed for the City of Olympia (*CDM 2002a, 2002b*) to characterize the hydrogeologic dynamics of the area and predict hydrologic impacts from groundwater development plans. Since 2006, Yelm has collaborated with the Cities of Lacey and Olympia to update and refine the model for purposes of hydrologic impact analysis in the lower Nisqually

and Deschutes watersheds. Appendices A, B, and Section 3.2 provide additional details on the groundwater model. The modeling analyses of Yelm’s future pumping completed for this Mitigation Plan indicate hydraulic interaction between Yelm’s current and future proposed water supply aquifers and surface water bodies in portions of the Nisqually and Deschutes Water Resource Inventory Areas (WRIAs 11 and 13).

The most current model results (*Shannon and Wilson, 2010*), summarized in Section 3.2 and Appendix A of this plan, show predicted hydrologic impacts of continued downtown pumping and the development of the new deep source at SW Well 1A. The model predicts flow depletions in the following parts of the lower Nisqually and Deschutes watersheds:

- The Upper McAllister Valley;
- The Nisqually River Valley (including Yelm Creek);
- The Woodland Creek Sub-basin (including Hicks, Long and Pattison Lakes), and;
- The Deschutes River

The predicted groundwater discharge reductions (or “depletions”) to these surface water features vary seasonally, with the maximum depletion sometimes occurring during high-flow periods.

Given that the predicted impacts of pumping at SW Well 1A will cross jurisdictional boundaries, Yelm has collaborated with the Cities of Olympia, Lacey, and the Nisqually Indian Tribe to form a multi-party approach to managing and mitigating water resources.

1.5 Existing Water Rights and Water Right Applications

As part of long range planning addressing Yelm’s future water needs, three water right applications (G2-29084, G2-29085 and G2-29086) were submitted to Ecology with a priority date of January 10, 1994 (Table 1-1). These applications consist of two, 3,000 gallons per minute (gpm) municipal use rights and one 1,500 gpm right, for a total instantaneous limit (Qi) of 7,500 gpm. Together, the three applications request 10,000 ac-ft/yr of water for municipal supply. This annual quantity represented Yelm’s projected long-range potable water demand at the time.

| Application # | Priority Date | Source | Application Qi (gpm) | Application Qa (ac-ft/yr) |
|---------------|---------------|---------|----------------------|---------------------------|
| G2-29084 | 1/10/94 | 3 wells | 1,500 | 3,000 |
| G2-29085 | 1/10/94 | 3 wells | 3,000 | 3,500 |
| G2-29086 | 1/10/94 | 3 wells | 3,000 | 3,500 |

Due to Yelm’s exceptional conservation and reclaimed water programs, the current long-term demand projection for potable supply is estimated to be 1,837 ac-ft/yr, occurring in approximately 2028. This quantity is significantly less than that originally anticipated in the three applications when they were submitted in 1994. Yelm’s existing water rights (after completion of recent and pending transfers) authorize total annual pumping of 894.92 ac-ft/yr, leaving 942 ac-ft/yr of new water rights that are required to serve demand through 2028. The City requests that the 942 ac-ft/yr new water be associated with application #G2-29085 that will be modified to reflect a single point of appropriation, Qa of 942 ac-ft/yr, and Qi of 2,100 gpm.

Section 2

Future Water Use – Wellfield Facilities and Operations

2.1 Background

In 2005, Yelm investigated the presence of a deeper portion of the aquifer system located southwest of Yelm (*Golder, 2006*). The purpose of that investigation was to explore deeper portions of the aquifer system away from Yelm Creek and the Nisqually River. The test well intercepted a portion of the regional, undifferentiated Tertiary (TQu) aquifer, and subsequent testing and numerical groundwater flow modeling showed that the investment in new supply infrastructure and supporting water rights would allow Yelm to expand its source of supply while distributing the resulting hydrologic impacts in a way that is more sustainable and beneficial for overall Nisqually and Deschutes watershed health. SW Well 1A represents Yelm's first planned production well targeting the deeper system. Figure 1-1 shows the location of the new SW Well 1A.

Table 2-1 provides the demand forecasts for an 18-20 year planning horizon. To meet the increasing demand, Yelm will develop the new source of supply in a single phase at SW Well 1A with use increasing in parallel with demand up to the requested total amount of new water (942 ac-ft/yr) by 2028. Yelm will accomplish this through variable speed/frequency/rate pumping systems, and infrastructure upgrades as the demand increases. The mitigation approach Yelm describes in this plan will implement mitigation actions to offset the impacts resulting from appropriating the total request for new water rights (942 ac-ft/yr).

2.2 Yelm's Demand Forecast

Yelm intends to maintain the infrastructure and production capacity at the two existing downtown wells (Wells 1A and 2) in addition to the development of SW Well 1A. Yelm's 2008-2015 Water System Plan (WSP) was approved by the Washington State Department of Health in 2010 (Brown & Caldwell, 2010). Portions of that work have been incorporated into the current water rights mitigation and capital improvements planning process.

The demand forecast is prepared in units of ac-ft/yr, or Q_a annual demand volumes (Brown and Caldwell, 2010). The future demand forecast remains conservative as the 2010 projected demand was 868 acre feet and the actual demand was 738 acre feet. To assess whether the requested Q_i is adequate to meet the City's needs at full development of the forecasted total volume of 1,837 ac-ft/yr, Yelm evaluated the relationship between Q_a and Q_i using historic pumping records. Table 2-1 presents the WSP's demand forecast associated with Yelm's request for new water rights and this Mitigation Plan.

| Table 2-1 Demand Forecast by Year | | | |
|--------------------------------------|----------------------------|--|--|
| Year ⁽¹⁾ | Qa ⁽²⁾ | Qa ⁽³⁾ Average Annual Pumping | Qi ⁽⁴⁾ Peak Day Pumping |
| | <i>ac-ft/yr</i> | <i>gpm</i> | <i>gpm</i> |
| 2006 | 766 | 475 | 1,249 |
| 2007 | 731 | 453 | 1,059 |
| 2008 | 819 | 508 | 1,124 |
| 2009 | 843 | 523 | 901 |
| 2010 | 868 | 538 | 1,144 |
| 2011 | 904 | 560 | 1,192 |
| 2012 | 952 | 590 | 1,255 |
| 2013 | 994 | 616 | 1,310 |
| 2014 | 1,036 | 642 | 1,366 |
| 2015 | 1,079 | 669 | 1,422 |
| 2016 | 1,134 | 703 | 1,495 |
| 2017 | 1,190 | 738 | 1,569 |
| 2018 | 1,245 | 772 | 1,641 |
| 2019 | 1,302 | 807 | 1,716 |
| 2020 | 1,358 | 842 | 1,790 |
| 2021 | 1,406 | 872 | 1,853 |
| 2022 | 1,455 | 902 | 1,918 |
| 2023 | 1,503 | 932 | 1,981 |
| 2024 | 1,552 | 962 | 2,046 |
| 2025 | 1,601 | 993 | 2,110 |
| 2026 | 1,666 | 1033 | 2,196 |
| 2027 | 1,752 | 1086 | 2,309 |
| 2028 | 1,816⁽⁵⁾ | 1126 | 2,394 |

Notes:

- (1) Actual data were used for 2006 and 2007.
- (2) B&C annual forecast demand, without MPCs, 215 gpd/ERU and 6.9% DSL
- (3) B&C forecast demand (Qa) converted to average rate (in gpm) over the year.
- (4) Peak day pumping calculated using historical correlation between peak and average.
- (5) The 1,816 ac-ft/yr forecast provided by Brown and Caldwell corresponds to the 1,837 ac-ft/yr needed to meet demand through 2028, the value modeled to assess impacts.

This forecast indicates that a Qi of approximately 2,400 gpm is associated with the peak day pumping rate in 2028 (all sources). The 1,816 ac-ft/yr forecast provided by Brown and Caldwell closely matches the combination of the 894.92 ac-ft/yr Yelm will have assigned to the downtown wells, and the 942 ac-ft/yr requested at SW Well 1A (1,837 ac-ft/yr total). Consequently, this request will satisfy Yelm’s anticipated growth demand through 2028-2030. Yelm is requesting a Qi of 2,100 gpm to be associated with the new 942 ac-ft/yr allocation. Though less than the anticipated need of approximately 2,400 gpm total, Yelm will balance peaks between the two sources. The 2,100 maximum day demand (Qi) requested at SW Well 1A will allow Yelm (with storage) to provide supply and emergency services in the event of a service interruption at the downtown facilities. The forecast demand through 2028 is compared to existing water rights in Table 2-2 below.

| Table 2-2 Projected Water Demands Compared with Current Water Rights | | | | | |
|---|-----------------------|------------------|--------------------|---|-------------------------|
| Year | Existing Water Rights | New water Rights | Total Water Rights | Annual Demand (Forecast) ⁽¹⁾ | Excess/Deficit Capacity |
| 2009 | 796.66 | 0 | 796.66 | 843 | -46.34 |
| 2010 ⁽²⁾ | 796.66 | +31.26 +67 | 894.92 | 868 | 26.92 |
| 2011 | 894.92 | 942 | 1836.92 | 904 | 932.92 |
| 2028 | 1836.92 | 0 | 1836.92 | 1816 | 20.92 |

Notes: All units are ac-ft/yr

⁽¹⁾ Based on average annual demand projections prepared by Brown and Caldwell, July 2008.

⁽²⁾ 2010: Added 31.26 ac-ft/yr from exempt well consolidation work, and another pending transfer of 67 ac-ft/yr.

2.3 Southwest Well 1A Development

Yelm will increase use of the new SW Well 1A to meet increasing demand until the limit of 942 ac-ft-yr is reached. Based on the demand forecast, this is expected to occur in 2028-2030. Yelm will accomplish this through use of infrastructure that allows variable rates of production by utilizing a pumping regime from both the downtown well field and the new well. System upgrades to SW Well 1A (including treatment facilities and the installation of a new transmission main) are expected to be complete by the end of 2012. Because this mitigation plan addresses the potential impacts that could occur pumping 942 ac-ft/yr from the new deeper source, only two conditions will be addressed with the groundwater flow model: the current or “Baseline” conditions, and expected 2028-2030 pumping at full development of the 942 ac-ft/yr. Table 2-3 shows the distribution and location of pumping, peak (modeled) monthly pumping rates for the current baseline, and peak forecast for 2028/2030.

| Table 2-3 Summary of Modeled Pumping Rates | | | | | | | | |
|---|-----------------|------------------------|-----------------|------------------------|-----------------------------|-------------------------|------------------|------------------|
| Scenario | Downtown Wells | | SW Well 1A | | | Total Yelm Water Rights | | |
| | Annual ac-ft/yr | Peak Month Modeled gpm | Annual ac-ft/yr | Peak Month Modeled gpm | Peak Capacity Available gpm | Annual Ac-ft/yr | Month Peak (gpm) | Daily Peak (gpm) |
| Baseline | 894.92 | 930 ⁽¹⁾ | - | - | - | 894.92 | 930 | |
| (2028-2030) | 894.92 | 928 ⁽¹⁾ | 942 | 977 | 2,100 | 1836.92 | 1,902 | 2,460 |

Notes: (1) – Actual pumping capacity is higher. The model simulates average monthly pumping rates for the peak month (August).

As discussed in Section 1.5, substantial planning and refinement of demand forecasts have taken place since submittal of applications Nos. G2-29084, G2-29085, and G2-29086. Tables 2-1 and 2-3 are based on Yelm’s current estimates of future demands, and are not related to the phases identified in correspondence from the January 1994 applications. More detailed information on mitigation actions is included in Section 4.

To summarize:

1. Yelm installed and tested the new SW Well 1A in 2010.
2. This well has capacity to support Yelm’s demand through 2028-2030.
3. Yelm will increase withdrawals from this location to supply new water up to 942 ac-ft/yr.
4. Yelm will mitigate impacts predicted from appropriation (942 ac-ft/yr) as a condition of approval of the request for new water rights associated with 1994 application G2-29085.
5. Yelm will complete infrastructure improvements necessary to bring SW Well 1A on line in 2012.

2.4 Qa, Seasonal Pumping, and Peak Monthly Pumping Rates

In any given year, withdrawals from SW Well 1A are expected to vary consistent with Yelm’s historical seasonal pumping distribution pattern for the two downtown wells. Table 2-4 presents this seasonal distribution, and is based on a trend analysis. These factors were then used to estimate the maximum monthly average pumping rate associated with any forecast demand rate (Qa in ac-ft/yr converted into annual average gpm).

| Table 2-4 Yelm Seasonal Pumping Distribution | | | | | | | | | | | | |
|---|------|------|-------|-------|------|------|------|------|-------|------|------|------|
| Month | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
| Distribution Factor | 0.77 | 0.68 | 0.76 | 0.78 | 0.94 | 1.25 | 1.63 | 1.67 | 1.15 | 0.87 | 0.71 | 0.77 |

The modeled 1,837 ac-ft/yr **volume** for 2028 translates to an average annual demand **rate** of 1,139 gpm (if the wells were pumped at a single constant rate throughout the year). For the model to more accurately simulate actual conditions, this rate was adjusted to reflect seasonal differences in demand. The peak month pumping rate (August) for the 1,837 ac-ft/yr demand was estimated by multiplying the annual average rate by the August distribution factor of 1.67, giving 1,902 gpm. Note that this is an average rate for the peak month used for model simulations. Actual supply system capacity (or Qi) would be greater (closer to 2,400 gpm).

Section 3

Predicted Water Resource Impacts

This section describes the method used to identify water resources predicted to be impacted by pumping at SW Well 1A. The regulatory appropriation status of each water body is provided, as are the predicted surface water impacts relative to the accuracy of the McAllister Model.

3.1 Water Bodies of Interest

Groundwater modeling identified potentially impacted water bodies for which mitigation is required by Washington Administrative Code (WAC). Table 3-1 lists the regulated water bodies and the regulatory status of each with regard to appropriations of surface water allowed under the State Water Code. Figure 3-1 shows the WRIA boundaries and other major hydrologic features represented in the model.

| Table 3-1 Regulatory Status of Key Water Bodies in WRIAs 11 and 13 | |
|---|--|
| Water Body | Regulatory Status (Chapters 173-511 and 173-513 WAC) |
| WRIA 11 (Nisqually River Watershed) | |
| Lower Nisqually River ¹ (RM ² 4.3 to RM 12.6) Control Station: “New gage” at RM 4.3 | Open year round. New appropriations subject to instream flows of 600-900 cfs varying seasonally. |
| Bypass Reach of Nisqually River (between RM 12.6 – RM 26.2) Control Station: 12-0895-00 at RM 21.8 | Closed to new appropriations June 1 – October 31 (370-500 cfs varying seasonally). New appropriations subject to instream flows of 600 cfs in remaining months. |
| Middle Nisqually River (from RM 26.2 – approximately RM 39.9) Control Station: 12-0884-00 at RM 32.6 | Closed to new appropriations June 1 – October 31 (600-800 cfs varying seasonally). New appropriations subject to instream flows of 700-900 cfs in remaining months. |
| Upper Nisqually River (from approximately RM 39.9 to headwaters including all tributaries) Control Station: 12-0825-00 at RM 57.8 | New appropriations subject to instream flows of 300-650 cfs varying seasonally. |
| McAllister Creek | Closed to new appropriations (year round). |
| Lake Saint Clair | Closed to new appropriations (year round). |
| Yelm Creek | Closed to new appropriations (year round). |
| WRIA 13 (Deschutes River Watershed) | |
| Deschutes River (from confluence with Capitol Lake upstream to RM 41) | Closed to new appropriations April 15 – November 1. New appropriations subject to instream flows in remaining months (150-400 cfs, varying seasonally). |
| Woodland Creek and all tributaries | Closed to new appropriations (year round). |
| Long Lake | Closed to new appropriations (year round). |
| Patterson Lake (a.k.a. Pattison Lake) | Closed to new appropriations (year round). |
| Hicks Lake | Closed to new appropriations (year round). |

¹ The Lower Nisqually River includes modeled reaches 1, 2, and 3 as discussed in this section.

² River Mile.

To analyze the effects of groundwater pumping on the discharge to the Nisqually and Deschutes Rivers, each water body was subdivided into distinct reaches. Modeled reaches defined for the Nisqually River begin at River Mile 4.3 (RM 4.3) and consist of three Lower sub-reaches (1, 2 and 3), a Middle reach and an Upper reach. Modeled reaches defined for the Deschutes River consist of a Lower, Middle and Upper

reach. An earlier version of the groundwater model did not include the Middle Deschutes Reach due to the believed presence of a geologic boundary to the east of the river in the form of a basalt intrusion (Drost et. al, 1999). After consultation with the Squaxin Island Indian Tribe, the groundwater model was modified to incorporate the results of additional hydrogeologic information available in this area (Golder, 2008a; Appendix B).

In addition to the water bodies listed in Table 3-1, other water resources that are of interest for this plan are:

- Kalama Creek Springs, located near the west bank of the Nisqually River, which are used to supply the Nisqually Indian Tribe Kalama Creek Hatchery); and
- Silver Springs, which support Silver Creek, a tributary to the Deschutes River in the Middle Deschutes Reach.

State law related to appropriations of new water rights does not identify these two resources for any specific restrictions such as those listed in Table 3-1. However, the model was used to assess potential impacts to these features from future groundwater withdrawals.

3.2 Numerical Model of Groundwater System

The model was used to assess potential hydrologic impacts to the water resource components identified in Section 3.1 As described in Appendix B, the model extent covers an area approximately 15 miles (north-south) by 8 miles (east-west). It extends from the Deschutes River on the west to the Nisqually River on the east, and from McAllister Springs upstream to a point above McKenna on the Nisqually River and to approximately Lake Lawrence in the Deschutes River watershed. Within this area, the model grid ranges from 100-foot spacing in the vicinity of the SW Well 1A to 1,000-foot spacing in other areas distant from the well. The model has nine distinct geologic layers including aquifers and aquitards. It simulates flow through the aquifers, interactions between aquifers, flow gradients, and recharge and discharge to streams and springs. The rivers in this model, Nisqually and Deschutes, are modeled as no-flow boundaries for the purpose of model development. This construction does not accurately reflect “real” conditions below ground, where water would actually flow beneath rivers at depth. This is one area where the model design leads to over-predictions of depletions along river boundaries.

For purposes of this mitigation plan, hydrologic impacts due to changes in pumping are defined as either (a) reduced groundwater inflow to a surface water body or (b) increased loss from a surface water body. Either of these conditions constitutes potential surface water depletion. Surface water depletion is analyzed by simulating a set of hydrologic conditions and conducting a water budget analysis on the results of the simulation. The surface water depletion is therefore the difference between the water budget of a surface water body under the Baseline and future pumping conditions.

Over the past three years, Yelm has worked with the Cities of Lacey and Olympia and through consultation with the Nisqually and Squaxin Island Tribes in updating and refining the model for purposes of hydrologic impact analysis in the Nisqually and Deschutes watersheds. Groundwater model changes were peer reviewed through a regional process and coordinated closely to ensure any subsequent runs of the model accommodated the new data. Since 2008, the following model refinements were made to better reflect known conditions:

- Updating the hydrogeologic interpretation based on new boring logs;
- Representing the actual elevation of hydrogeologic units in the model;
- Modeling the aquifers for both saturated and unsaturated conditions (variable saturation);
- Refining the model grid for more accuracy in model results particularly in the area of pumping wells;
- Updating pumping rates for the Cities of Olympia, Lacey, and Yelm;
- Representing the Middle Reach of the Deschutes River as in contact with the regional aquifer;

- Adding hydrologic features not included in the USGS model including Kalama Spring, Silver Springs, Silver Creek, and Yelm Creek; and
- Calibration of the model to steady-state and transient data.

The changes result in a more realistic and reliable model for making estimates of the impact of pumping on surface water bodies. The Cities consulted with Golder Associates, S.S. Papadopolous & Associates, and Shannon & Wilson to evaluate the cumulative predicted impacts from future pumping. The cumulative run evaluated surface water impacts in the Nisqually and Deschutes watersheds. The model predicted depletions as being generally additive and illustrated the net benefit in flow to some water bodies such as McAllister Creek once Olympia moves to their new wellfield.

3.2.1 Model Accuracy for Predicting Small Depletions

At this time the numerical groundwater model represents the best available science for analyzing the effects of groundwater pumping and making water rights decisions for large water right requests within the model's boundaries. However, for many of the hydrologic features the predicted effects are very small compared with the flow of groundwater not only through the entire hydrogeologic system but compared to the baseline discharge to the specific feature. The smaller the predicted depletion, the less likely we are to know for certain whether that impact will actually occur. The conservative construction of the model potentially leads to over-prediction of depletions along much of the model boundaries, which includes the Deschutes and Nisqually Rivers.

SSPA and Golder reported that the model has a high degree of precision but the accuracy of the model for predicting small flow depletions in areas with large groundwater flow is questionable. Consequently, the modelers contracted by the cities (SSPA, Golder Associates, and Shannon & Wilson) felt it was important to define the accuracy limit for the model. If predicted depletions fall below certain criteria, it is not clear that actual surface water depletions would occur. The accuracy limit considered in this plan is:

- Predicted depletions that are 1 percent or less of the total groundwater flow rate at a surface water body should be considered as beyond the accuracy limit of the model.

Yelm considered the relative accuracy of the modeling results in the development of mitigation strategies proposed in this plan. Predicted depletions that are above the model accuracy limit are considered to pose greater potential for risk to the resource, and consequently in some cases more mitigation is proposed in order to provide a margin of safety.

3.2.2 Predicted Impacts on Modeled Surface Water Bodies

Table 3-2 presents the predicted (1) highest annual and (2) highest summer depletions for surface water bodies in the model in response to new pumping at SW Well 1A. Summer is defined as the months of June, July, August and September. The well was simulated at its full withdrawal rate (the seasonal distribution associated with 942 ac-ft/yr). Table 3-2 includes the individual depletions for the various reaches and a sum of the reaches that form the full water body upstream from the respective regulatory control points (Table 3-1). For example, for the purpose of this analysis, the total impact of groundwater discharge to the Nisqually River above RM 4.3 is equal to the sum of the Lower, Middle and Upper reaches, the Kalama Springs Complex and Yelm Creek.

The three cities assessed the cumulative effects of their proposed future pumping at the full future allocation with a single model run. The purpose of the cumulative run was to evaluate whether it is valid to sum the results from individual runs completed by the three cities to address mitigation of predicted cumulative effects on common water bodies. The cumulative run confirmed that the sum of the results from individual/separate runs were at least as great, and in some instances greater than the cumulative model run. Consequently, the approach of evaluating cumulative impacts presented by the three cities is valid and in many cases conservative.

| Table 3-2 Predicted Changes in Groundwater Discharge from Future Yelm Pumping | | | | | |
|--|-----------------------------------|-------------|----------------|-------------------------|--------------------|
| Hydrologic Area/Feature | Highest Seasonal Discharge Change | | | Summer Discharge Change | |
| | cfs | % | month(s) | cfs | % |
| Nisqually Valley | | | | | |
| - Yelm Creek | -0.06 | -2.6 | Apr | -0.05 | -56 ⁽¹⁾ |
| - Upper reach | -0.11 | -0.5 | Aug | -0.11 | -0.5 |
| - Kalama Creek Spring | -0.02 | -0.5 | Jul-Aug | -0.02 | -0.5 |
| - Middle reach | -0.06 | -0.4 | Aug | -0.06 | -0.4 |
| - Lower reach | -0.09 | -0.4 | Aug-Sep | -0.09 | -0.4 |
| Nisqually River at RM4.3 | -0.32 | -0.5 | Aug | -0.32 | -0.5 |
| Deschutes Valley | | | | | |
| - Upper reach | -0.15 | -0.5 | Feb | -0.11 | -1.0 |
| - Middle reach | -0.03 | -1.6 | Jul | -0.03 | -1.6 |
| - Silver Creek/Spring | -0.01 | -1.1 | Sep | -0.01 | -1.1 |
| - Lower reach/Spurgeon Creek | -0.06 | -0.2 | Feb | -0.04 | -0.4 |
| Deschutes River at Tumwater | -0.24 | -0.3 | Feb-Mar | -0.19 | -0.9 |
| McAllister Valley | | | | | |
| - McAllister Spring | -0.12 | -0.3 | Aug-Sep | -0.12 | -0.3 |
| - Other upper valley springs | -0.09 | -0.3 | Aug-Sep | -0.09 | -0.3 |
| - McAllister Creek | <0.01 | - | - | <0.01 | - |
| - Valley-bluff springs | <0.01 | - | - | <0.01 | - |
| - Lake St. Clair | <0.01 | - | - | <0.01 | - |
| McAllister Creek at Medicine Creek | -0.21 | -0.3 | Aug-Sep | -0.21 | -0.3 |
| Woodland Creek Basin | | | | | |
| - Long-Hicks-Pattison lakes | -0.02 | -2.8 | Aug | -0.02 | -2.8 |
| - Woodland Creek | <0.01 | - | - | <0.01 | - |
| Woodland Creek at Henderson Inlet | -0.02 | -1.7 | Oct | -0.02 | -0.9 |

Notes:

cfs = cubic feet per second

RM = River Mile

Negative values indicate a decrease in groundwater discharge (or depletion) to the feature

(1)-Baseline discharge rate (June) for Yelm Creek is 0.09 cfs.

The impacts that are predicted to occur during closure periods are shown in Table 3-3.

| Table 3-3 Predicted Depletions During Closure and Non-Closure Periods, in acre-ft | | | | | |
|--|-------------------------------|--------------------|---------------------------|--------------------|--------------|
| Feature | Monthly Depletion Range (cfs) | | Total Depletion (acre-ft) | | |
| | Closure Period | Non-Closure Period | Closure Period | Non-Closure Period | Annual Total |
| Nisqually River at RM4.3 | NA | 0.24 – 0.32 | NA | 197.0 | 197.0 |
| Yelm Creek | 0.04 - 0.06 | NA | 36.6 | NA | 36.6 |
| Deschutes River at Tumwater ⁽¹⁾ | 0.15 – 0.19 | 0.18 – 0.24 | 65.8 | 64.9 | 130.7 |
| McAllister Creek | 0.14 – 0.21 | NA | 118.6 | NA | 118.6 |
| Woodland Creek at Henderson | 0.02 | NA | 14.6 | NA | 14.6 |

NA – not applicable as closed/open year-round

(1) - Closed April 15th –November 1st

Nisqually Valley

The groundwater discharge to the Nisqually River upstream from RM 4.3 includes discharge directly to the river, seepage from Kalama Springs in the middle valley area, and discharge from Yelm Creek near RM 21.8 where the Centralia Canal re-enters the river.

As seen in Table 3-2, the model predicts that the SW Well 1A pumping will decrease the discharge to the Nisqually River at RM 4.3 by between 0.24 and 0.32 cfs, with the greatest depletion occurring in August (Figure 3-3). The predicted depletion range for the river reach upstream of RM 21.8 (upper Nisqually River reach) is 0.08 to 0.11 cfs. Neither depletion (RM 4.3 or RM 21.8) is predicted to exceed 1 percent of the respective Baseline discharge.

The highest summertime depletion (in June) to Yelm Creek equates to a 56 percent decrease of Baseline discharge. This ratio is high due to the Baseline flow being very small (0.09 cfs) during that month. The monthly depletions predicted for Yelm Creek exceed one percent of the Baseline discharge during all months of the year. No streamflow data is available for Yelm Creek, nor has the Creek been consistently monitored for flow. USGS peak flow (winter flood flows) was measured from 1968 through 1976 near the headwaters of Yelm Creek at station 12089700. Thurston County measured gage height at two locations from the fall of 2007 through the spring of 2008, though no rating curves or instream flow measurements were collected to correlate with the stage data. These locations exist near the confluence with the Nisqually River and at 103th Ave. SE.

Deschutes Valley

The groundwater discharge to the Deschutes River upstream from Tumwater includes discharge directly to the river, seepage from Silver Springs in the upper valley area, and discharge from Spurgeon Creek.

As seen in Table 3-2, the model predicts that SW Well 1A pumping will decrease the discharge to the Deschutes River by between 0.15 and 0.24 cfs, with the greatest depletion occurring in February and March (Figure 3-4). The predicted depletion during the closure period (April 15 to November 1; WAC

173-513; Ecology, 1988b) ranges from 0.15 to 0.19 cfs. The depletion is predicted to exceed one percent of the Baseline discharge only during September and October. Most of the total depletion to the river occurs to the upper river reach (above Silver Springs).

McAllister Valley

The groundwater discharge to McAllister Creek upstream from the confluence with Medicine Creek includes discharge directly to the creek, seepage from numerous, relatively small springs located along the western valley bluff, and (principally) discharge from the pool and wetland area fed mainly by McAllister and Abbot Springs. McAllister Creek and Lake St. Clair are closed year-round to consumptive appropriations (WAC 173.511; Ecology, 1988a).

As seen in Table 3-2, the model predicts that SW Well 1A pumping will decrease the discharge to McAllister Creek by between 0.14 and 0.21 cfs, with the greatest depletion occurring in August and September (Figure 3-5). All of the depletion is predicted to occur at the McAllister-Abbott Springs complex at the headwaters of the creek. The depletion to the creek is not expected to exceed one percent of the Baseline discharge during any month.

Woodland Creek Basin

The groundwater discharge to Woodland Creek upstream from Henderson Inlet includes discharge directly to the creek and drainage from the tri-lakes (Long, Hicks and Pattison) and the inter-lake wetland areas. These three lakes and Woodland Creek are closed year-round to consumptive appropriations (WAC 173-513; Ecology, 1988b).

The model predicts that the SW Well 1A pumping will decrease the discharge to the Woodland Creek Basin year-round by 0.02 cfs (Figure 3-6). All of this depletion is predicted to occur to the Tri-lakes and related wetland area at the headwaters of the creek. The depletion is expected to exceed one percent of the Baseline discharge only during October.

Potential Impacts on Nearby Wells and Springs

Increasing production by adding the new SW Well 1A will cause slight local groundwater level declines. Three separate aquifers were analyzed for water level changes:

- The Advance Vashon Outwash Aquifer, Qga (model layer 3),
- The Pre-Vashon Gravel Aquifer, Qpg (model layer 5), and
- The Undifferentiated Tertiary Aquifer, TQu (model layer 8).

Figures 3-7, 3-8 and 3-9 show the model-predicted changes in water levels under 2028 pumping conditions in the month of August. These are summarized below:

- In the Qga aquifer, the predicted maximum decrease in potentiometric level is 0.3 foot, generally centered on the SW Well 1A (Figure 3-7).
- In the Qpg aquifer, the maximum predicted decrease in potentiometric level is 0.8 foot, also centered on the SW Well 1A (Figure 3-8).
- In the TQu aquifer, the maximum predicted drawdown resulting from the new pumping is 6.0 feet (Figure 3-9). At a distance of 2.5 miles from SW Well 1A, groundwater levels are predicted to be drawn down by approximately 1 foot.

The Nisqually Tribe operates a hatchery near the Nisqually River at the Kalama Creek Spring Complex. The model predicted drawdown at the spring (which discharges from the Qpg aquifer) is predicted to be less than 0.25 feet (3 inches).

Although the TQu aquifer does not extend to the west of the upper and middle Deschutes River reaches in the southern model area (bedrock appears at land surface), the TQu aquifer does extend beneath the Nisqually River into Pierce County and to the west of the lower Deschutes River reach. Consequently, the model construction (using the river as a boundary) can cause the predicted drawdown near the Nisqually River to be greater than what will actually occur because groundwater will actually move beneath the river to recharge the aquifer system.

Section 4

Mitigation Program

Yelm's mitigation approach is designed to offset the impacts caused by Yelm's new source of supply: the new SW Well 1A well which is capable of supplying Yelm's anticipated growth through 2028/2030. This mitigation plan addresses the impacts associated with the full allotment of new water (942 acre feet/yr) in 2028. This section describes Yelm's regional partnerships, coordinated mitigation efforts, and the approach Yelm intends to implement to accomplish the required mitigation.

As presented in Section 3, computer modeling of withdrawals from Yelm's SW Well 1A identifies a range of potential impacts to surface water bodies. In screening and proposing mitigation alternatives, the significance of these impacts was considered. SEPA rules under WAC 197-11-794 define "significant" as, "a reasonable likelihood of more than a moderate adverse impact on environmental quality." There are two key reasons why Yelm proposes that impacts to environmental quality as a result of this project will be minimal:

- Design of the computer model along river boundaries is such that over-prediction of impacts in most river areas is likely.
- Most predicted depletions are small relative to the overall groundwater and surface water flow volumes.

Yelm is proposing a mitigation package that provides a "margin of safety" where feasible and meets the requirements under the SEPA for appropriate mitigation. The State Environmental Policy Act Rules establish the following definition of "Mitigation" at Section 197-11-768 Washington Administrative Code:

1. Avoiding the impact altogether by not taking a certain action or parts of an action;
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;
3. Rectifying the impact by repairing, rehabilitating or restoring the affected environment;
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
5. Compensating for the impact by replacing, enhancing or providing substitute resources or environments;
6. Monitoring the impact and taking appropriate corrective measures.

Yelm's approach to the overall mitigation package includes targeting flow augmentation through water rights acquisition as far upstream as possible during closure periods to maximize the environmental benefits of flow mitigation. In addition, land acquisition and habitat restoration projects will be completed to offset impacts during the non-closure period.

Yelm considered several reports to prepare this Mitigation Plan:

- *Mitigation Measures Used in Water Right Permitting*, published by Ecology in April 2003. This report summarizes mitigation measures approved by Ecology in conjunction with various applications for new water rights or changes to existing water rights.
- *The Nisqually Watershed Management Plan* issued by the Nisqually Watershed Planning Unit on October 31, 2003. This plan includes mitigation strategies to consider for the Nisqually Watershed.

- The *Phase IV Nisqually Implementation Plan for Watershed Management in WRIA 11* issued by the Nisqually Watershed Planning Unit on February 14, 2007. This plan outlines implementation actions associated with the *2003 Nisqually Watershed Management Plan*.
- The *Nisqually Chinook Recovery Plan* identifies and prioritizes habitat areas in the Nisqually Basin for protection and enhancement related to salmon recovery efforts. It identifies a number of specific action items. Related information was also obtained from the *Nisqually Wildlife Refuge Conservation Plan*.
- The *Salmonid Habitat Limiting Factors: Water Resources Inventory Areas 13. Final Report. 1999*. This report evaluates stream flow, ground water and water quality conditions, and water rights and fish status.
- The *Final Deschutes River Watershed Recovery Plan: Effects of Watershed Habitat Conditions on Coho Salmon Production*. Prepared for the Squaxin Island Tribe by Anchor Environmental in 2008, this plan identifies specific reaches and projects within the basin for Coho salmon habitat enhancement and restoration.

Yelm met on a regular basis with the McAllister-Yelm Sub-basin Technical Subcommittee of the Nisqually Watershed Planning Unit to discuss the proposed withdrawals and associated mitigation issues. The staff from the cities of Yelm, Lacey and Olympia also met with the Squaxin Island Indian Tribe on several occasions to discuss regional water management efforts, modeled impacts within the Deschutes and Woodland Creek watersheds, and specific mitigation strategies. The cities also met on a number of occasions with staff from Ecology’s regional office as well as with Washington State Department of Fish and Wildlife.

Based on the level of impact to the environment, mitigation sequencing priorities, information gathered, and ideas shared, a set of mitigation alternatives was defined for each surface water body potentially impacted by the City’s SW Well 1A. Seven (7) criteria were defined to determine those mitigation alternatives with the greatest merit.

- Direct versus indirect offset of depletion
- Technical feasibility
- Permitting feasibility
- Programmatic feasibility
- Certainty of desired results
- Cost effectiveness
- Listed in watershed plan, or other significant planning document

Following the initial screening process, and after meeting with stakeholders, the resulting list of potential mitigation actions was further refined and developed. The remainder of Section 4 describes the specific mitigation actions selected for each surface water body predicted to be impacted by SW Well 1A.

4.1 Mitigation Approach

Yelm proposes to carry out the mitigation actions listed in this section as a condition of the changes requested for the SW Well 1A water right (G2-29085). The proposed mitigation program assumes that no significant adverse impacts to these water bodies will result from the development of the new well. Additionally, mitigation actions are planned to be completed ahead of Yelm’s full impacts of pumping in 2028. By working together as mitigation partners, the Cities have developed large mitigation projects that will have a greater overall benefit than would have been possible through individual efforts. These collaborative mitigation actions are described within each of the basin discussions in this section.

4.2 Stewardship & Adaptive Management

Yelm will participate in a Stewardship Coalition aimed at protecting water resources in the Nisqually Watershed. The creation of a Stewardship Coalition was initially conceived as part of the 2004 *Nisqually Watershed Management Plan in WRIA 11* and is intended to be an open organization and include the other major regional water purveyors, including both cities and Tribes. Activities of the proposed Stewardship Coalition include water conservation commitments, joint aquifer protection, sharing of water use and quality data, coordination of joint mitigation actions, and funding for staffing and stewardship related projects. Stewardship and maintenance of the groundwater model based on best available data will be important roles of this Stewardship Coalition.

The cities of Yelm, Lacey, and Olympia would also establish and support a stewardship group for projects within the Deschutes and Woodland Creek basins. Actions that could be taken by this group would include model refinements, coordinating monitoring and data collection within the basin, and coordinating joint mitigation within the basins. The cities would work with Ecology and the Squaxin Island Tribe to determine the membership and structure of this group.

4.3 Mitigation Strategy by Water Body

Yelm proposes to implement the mitigation actions listed in this section as a condition of the approval of Yelm's water right applications. As discussed previously, Yelm intends to implement a single mitigation effort associated with the eventual (2028) withdrawal of the requested 942 ac-ft/yr from the new SW Well 1A. The mitigation strategy is described by water body in the following sections.

4.3.1 Nisqually River

Minimum In-stream Flow Requirements

Within the model domain, Chapter 173-511 WAC established minimum in-stream flow (MISF) requirements at two control points on the Nisqually River (RM 4.3 and RM 21.8). Although this WAC references a RM 4.3 control point, no permanent flow gage has been established at or near this location. Therefore, mitigation of Yelm's impacts on the Nisqually River due to pumping are only required when Ecology MISFs are not met at RM 4.3. A USGS gage station does exist at RM 21.8 (McKenna; 12089500). The 2010 predicted impacts include an estimated depletion of 0.11 cfs in the upper reach of the river.

Summary of Predicted Impacts

Yelm's predicted depletion of the groundwater discharge to the Nisqually River upstream from RM4.3 and RM 21.8 will be up to 0.32 cfs and 0.11 cfs, respectively (both in August). During no month will the depletions exceed one percent of the simulated Baseline discharge for the Nisqually River at either MISF control point.

Mitigation

The lower mainstem of the Nisqually River is open year-round to appropriation, subject to seasonal instream flows for RM 4.3 that are regulated in Chapter 173-511-030 WAC. Currently there is no flow gage at RM 4.3 for documenting whether instream flows are met at this control point. Flows in the Nisqually River are mainly controlled by operation of the Alder/La Grande dams by Tacoma Power, and the river diversion through the Centralia City Light power project. These projects are regulated by the Federal Energy Regulatory Commission (FERC) and are required to be operated at a level that ensures sufficient instream flows for fish in the river.

Given that water from the lower reach of the Nisqually River is available for appropriation and that Yelm’s predicted impacts are less than 1% of the baseline flow, Yelm is proposing voluntary out of kind mitigation actions in the Nisqually Basin in the form of habitat restoration for Yelm Creek (Section 4.3.2). Table 4-1 summarizes Yelm’s mitigation strategy for the Nisqually River.

| Table 4-1 Nisqually River Watershed Mitigation Strategy | | | | |
|--|-------------------------------------|---------------------------|---------------------------|---|
| Feature/Reach | 2028 Depletion Range (cfs) | Mitigation Strategy | Mitigating Partners | Above or Below Model Accuracy Limit ¹ |
| Nisqually River at RM4.3 | 0.24 - 0.32 (max. in Aug.) | Yelm Creek Restoration | Nisqually Indian Tribe | Below all months |

¹ Defined as one percent of Baseline discharge

4.3.2 Yelm Creek

Minimum In-stream Flow Requirements

Yelm Creek is a tributary stream to the Nisqually River. Chapter 173-511 WAC lists the creek as closed as a surface water source year-round. However, Yelm Creek has not been monitored for flow on a consistent basis. USGS peak flow (winter flood flows) was measured from 1968 through 1976 near the headwaters of Yelm Creek at USGS station 12089700. Thurston County measured stage at two locations from the fall of 2007 through the spring of 2008, though no rating curves or instream flow measurements were collected to correlate with the stage data. These locations exist near the confluence with the Nisqually River and at 103rd Ave. SE. The lack of actual flow data is an impediment to understanding normative hydrology for Yelm Creek, potential impacts, and benefits of mitigation efforts.

Summary of Predicted Impacts

Full appropriation of the requested 942 ac-ft/yr from SW Well 1A is predicted to result in groundwater discharge to Yelm Creek decreasing by between 0.04 and 0.06 cfs (maximum in April). These depletions equate to between 1.3 and 56 percent of the simulated Baseline discharge. Therefore, all predicted monthly depletions are above the model’s one percent accuracy limit.

Mitigation

Yelm recharges the shallow aquifer system to the benefit of Yelm Creek with reclaimed water at Yelm’s Cochrane Park Memorial Park (Cochrane Park), located less than one mile from Yelm Creek (Figure 3-1). Yelm recharges 56 ac-ft/yr at the facility, with a uniform year-round rate (equivalent to 0.08 cfs). This rate is equivalent to a mitigation ratio of between 1.33:1 and 2:1. An agreement has been signed with the Department of Ecology whereby Yelm commits to continue this recharge.

Additionally, Yelm will work with the Nisqually Tribe to complete out-of-kind mitigation projects for Yelm Creek. Possible projects include:

- Creek channel restoration between 103rd Avenue and First Street, with meanders and in-stream habitat features,
- Create a continuous vegetated buffer along creek,
- Stream gage on Yelm Creek (per Watershed Plan), and
- Remove riprap weirs at pipeline crossing

Data collected from a calibrated stream gage will improve understanding of Yelm Creek hydrology, the potential for impacts, and the benefits of mitigation efforts. Table 4-2 summarizes Yelm’s mitigation strategy for Yelm Creek.

| Table 4-2 Yelm Creek Mitigation Strategy | | | |
|---|---|------------------------|-------------------------------------|
| 2028 Depletion Range (cfs) | Mitigation Strategy | Mitigating Partners | Above or Below Model Accuracy Limit |
| 0.04 – 0.06 (max. in April) | <ul style="list-style-type: none"> Maintain Recharge of Reclaimed Water from Cochrane Park above a 1:1 ratio Out-of-Kind Mitigation – Habitat Restoration | Nisqually Indian Tribe | Above, year round |

4.3.3 McAllister Springs and McAllister Valley

Minimum In-stream Flow Requirements

McAllister Creek is a tributary to Puget Sound. Minimum instream flows in McAllister Creek are closed to further stream appropriation year-round (Chapter 173-511 WAC). Olympia monitors its withdrawals at McAllister Springs and discharge from the pond to the headwaters of McAllister Creek. No other stream gage exists along the creek.

Summary of Predicted Impacts

The groundwater modeling analysis predicts that the proposed pumping of SW Well 1A alone will result in groundwater discharge depletion to McAllister Creek at the confluence with Medicine Creek by between 0.14 and 0.21 cfs. The highest seasonal depletion will occur in August and September. However, all depletions are less than one percent of the modeled baseline discharge.

Mitigation

Regional mitigation in the McAllister Creek system will be provided when Olympia transfers its water rights and withdrawals from McAllister Springs to its new McAllister wellfield. This regional mitigation action originated as a recommendation in the *Nisqually Watershed Management Plan* (Golder Associates, 2003), and is anticipated to occur in late 2012.

When Olympia ceases its withdrawals from McAllister Springs and moves its withdrawals to the McAllister wellfield, flow in McAllister Creek will increase and predicted impacts from all three cities will be fully mitigated. Yelm’s required infrastructure improvements at SW Well 1A will coincide with Olympia’s transition from McAllister Springs to the McAllister Wellfield. Table 4-3 summarizes Yelm’s mitigation strategy for the McAllister Valley.

Table 4-3
McAllister Valley Mitigation Strategy

| 2028 Depletion Range ¹ (cfs) | Mitigation Strategy | Mitigating Partners | Above or Below Model Accuracy Limit ² |
|--|---|---------------------|--|
| 0.14 – 0.21 (max. in Aug-Sep) | Olympia’s Transition off McAllister Springs resulting in a net increase of >13 cfs ³ | City of Olympia | Below all months |

¹ Total Depletion McAllister Valley

² Defined as one percent of Baseline discharge.

³ Olympia transition off McAllister Springs is anticipated to occur in 2012.

4.3.4 Woodland Creek Basin

Minimum In-stream Flow Requirements

The Tri-lakes and associated wetlands complex forms the headwaters for Woodland Creek (at the outlet from Long Lake). Woodland Creek flows northwards and drains into Henderson Inlet (a distance of approximately 6.5 miles), and receives several small tributaries from the west and east during its course. Minimum in-stream flows for the Woodland Creek Basin (including Long, Hicks and Pattison Lakes) are included in Chapter 173-513 WAC. All features are closed to appropriations year-round.

Stream monitoring data in the upper reach of Woodland Creek is limited. However, the City of Lacey reports that the reach between Lake Lois and Martin Way frequently goes dry during summer months (City of Lacey Comprehensive Water Rights Mitigation Plan – Phase 1, September, 2008). This is believed to occur due to the convergence of the shallowest (Qgr) aquifer and the more regionally pumped Qga aquifer in this area (City of Lacey Water System Plan Update, Carollo Engineers and Golder Associates, 2010). Thurston County monitors levels at the three lakes.

Summary of Predicted Impacts

Yelm’s depletion to the Tri-lakes complex (lakes and associated wetland area) is 0.02 cfs year-round. However, Yelm’s predicted depletion to Woodland Creek at Henderson Inlet is between 0.1 and 1.7 percent of the Baseline discharge, exceeding the model accuracy criteria of one percent of the Baseline discharge rate only during the month of October.

Mitigation

Yelm’s impacts are small and do not consistently exceed the accuracy limit that indicates impacts are likely to occur. Yelm’s contribution to Lacey and Olympia’s Woodland Creek mitigation program will be out-of-kind (financial) participation in the land acquisition for riparian preservation. The amount of property required to mitigate Yelm’s small impacts will be formalized in an agreement with the City of Lacey. The predicted impacts associated with Yelm’s pumping will occur only after Yelm’s pumping at SW Well 1A increases substantially.

Regional Non-Flow Mitigation for Woodland Creek: Riparian Land Protection

Lacey, Olympia, and Yelm propose to jointly purchase approximately 20 acres of property or conservation easements along Woodland Creek to increase the amount of undeveloped protected land along the creek. This will augment 498 acres of existing buffers, parks, and protected open space in the

basin. For mitigating water rights, Washington State Department of Fish and Wildlife (WDFW) recommends combining stream flow augmentation with riparian land reserves (Beecher 1998). Riparian land protection will supplement the available in-kind mitigation for winter months, and since the benefits will be year-round, this will further increase summer mitigation. As stated by WDFW:

“The purpose of riparian land reserves is to maintain structural integrity of the stream channel and protect groundwater-stream interactions. Maintaining vegetation and trees will provide a source of large woody debris (LWD), which is important in dissipating energy of flood waters, thereby reducing erosion and stream widening. LWD also increases depth and provides cover, as well as substrate for benthic insect production. Vegetation protects soil from rills during high rainfall, thus reducing fine sediment input. The reserves serve as groundwater recharge areas.”

In addition to being a viable mitigation option, riparian land acquisition in the Woodland Creek basin was highly recommended in the *City of Lacey: Woodland Creek Riparian Habitat Assessment* for protecting forested stream buffer (Agua Tierra Environmental Consulting 2003). Riparian land reserves will also complement recommendations in the water quality improvement reports for the Henderson Inlet Watershed TMDL, which recommend preserving mature trees (“site-potential shade”) for ensuring the continued compliance with state water quality standards for stream temperature and dissolved oxygen in the mid- and lower reaches of Woodland Creek (Ecology 2006; 2008). Riparian protection property on Fox Creek is shown in Figure 4-1.

4.3.5 Deschutes River and Tributaries

This section presents the mitigation program for the Deschutes River basin which would serve to mitigate predicted depletions from the three cities. The cities are proposing flow mitigation for the closure period through acquisition and retirement of irrigation water rights, and land acquisition and habitat restoration for predicted non-closure period impacts. To date, the three cities have signed two Interlocal Agreements, including one amendment to formalize this collaborative effort, as outlined below. Copies of the Interlocal Agreements and Amendment are provided in Appendix D. Work on these agreements has included a variety of specific actions, including:

- Updating groundwater model features to better reflect features within the Deschutes River Basin;
- Research into consumptive water rights available within the Deschutes River Basin;
- Negotiations with water rights holders for acquisition of priority water rights;
- Two option agreements for the purchase of water rights finalized. A third is in negotiation;
- Negotiations and finalization of an option agreement to purchase the Smith Ranch for non-flow mitigation;
- Research, field work, and a habitat restoration feasibility assessment report produced on the Smith Ranch; and
- Discussions with the Squaxin Island Tribe regarding priorities for water rights acquisitions and habitat restoration.

For the Deschutes River, where predicted depletions fall below the model’s accuracy limit, it is not certain that Yelm’s future pumping will or will not impact surface water in the Deschutes River. Given the sensitive nature of this basin, and the potential for an impact, the shared participation mitigation package the cities are proposing represents a “margin of safety” under these circumstances.

Minimum In-stream Flow Requirements

Within the model domain, Chapter 173-513 WAC established MISF requirements at one control point on the Deschutes River at RM 3.4 (where the river enters Capitol Lake near Tumwater Falls). The USGS gage 212080000 is located at this site. The river is closed between April 15th and November 1st, with minimum in-stream flows in winter months ranging from 150 to 400 cfs.

Summary of Predicted Impacts

The predicted groundwater discharge depletion to the Deschutes River above Tumwater in 2028 ranges from 0.15 to 0.24 cfs. The maximum monthly depletions occur in February and March (outside the closure period). The maximum depletion during the closure period ranges from 0.15 to 0.19 cfs. Most of the total depletion to the Deschutes River will occur upstream of where Silver Creek enters the river. The monthly depletions exceed one percent of the Baseline discharge only during the months of September and October.

Model-predicted depletions to be addressed collaboratively by the Cities of Olympia, Lacey and Yelm are shown in Table 4-4. These depletions represent potential impacts to the upper, middle, and lower reaches of the basin, and are quantified as the flow depletion predicted near the mouth of the Deschutes River in Tumwater. The volume of depletions in acre-feet was split out between the closure period and the non-closure period because the regional flow mitigation program will focus flow replacement during the closure period.

| Application Phase | Closure Period | | Winter Period | |
|----------------------------------|----------------------------|-------------------------------|----------------------------|------------------------------|
| | Max Summer Depletion (cfs) | Closure period Depletion (AF) | Max Winter Depletion (cfs) | Winter period Depletion (AF) |
| Lacey Phase 1 | 0.03 | 11.13 | 0.03 | 2.80 |
| Lacey Phase 2 | 0.09 | 32.21 | 0.13 | 36.26 |
| Lacey Phase 3 | <u>0.12</u> | <u>44.77</u> | <u>0.18</u> | <u>51.68</u> |
| <i>Subtotal Lacey</i> | 0.24 | 88.11 | 0.34 | 90.75 |
| Olympia Phase 1 | 0.16 | 60.49 | 0.24 | 66.68 |
| Olympia Phase 2 | 0.02 | 11.17 | 0.04 | 12.31 |
| Olympia Phase 3 | <u>0.06</u> | <u>21.40</u> | <u>0.09</u> | <u>23.59</u> |
| <i>Subtotal Olympia</i> | 0.24 | 93.10 | 0.37 | 102.58 |
| Yelm SW Well 1A | <u>0.19</u> | <u>65.8</u> | <u>0.24</u> | <u>64.9</u> |
| <i>Subtotal Yelm¹</i> | 0.19 | 65.8 | 0.24 | 64.9 |
| TOTAL: | 0.67 cfs | 247.01 AF | 0.95 cfs | 258.23 AF |

¹ Updated flow depletion modeling results from Golder Associates Technical Memo, November 14, 2010

Flow Mitigation through Water Right Acquisition

In accordance with Chapter 173-513 WAC, the Deschutes River is closed to further appropriation from April 15 to November 1. Yelm will mitigate during these months through acquisition and retirement of water rights. During other months, any mitigation requirement is dependent on instream flows.

The cities propose to provide mitigation for the closure period by purchasing irrigation water rights and placing those water rights into the trust program or relinquishing them. Actual water would thereby be

returned to the river during the critical low-flow closure period to mitigate the predicted impacts of the above water right applications.

Table 4-7 presents the regional package of water right acquisitions in the Deschutes River proposed by the cities of Olympia, Lacey and Yelm. On paper, the water rights total 330 ac-ft/yr. With these rights equally divided between the three cities, 110 ac-ft/yr would be available for Yelm’s use to offset its predicted 65.8 ac-ft closure period depletion. Final water rights credit would be determined after review by Ecology.

The majority of the irrigation rights being acquired are in the upper portion of the Deschutes River. Therefore, the flow benefits are cumulative for these acquisitions throughout much of the river system. For every cfs or AFY put back in the river at the upper end, this water provides benefits to all points downstream.

| Water Right Certificate | Modeled River Reach ¹ | Qa | Qi |
|---|----------------------------------|----------------|-----------------------|
| S2-00972CWRIS Dillard and Juanita Jensen | Upper | 100 AFY | 0.50 cfs |
| G2-26862GWRIS Ron Smith Farms | Upper | 170 AFY | 300 gpm (0.67 cfs) |
| Irrigation Water Right ⁽²⁾ | Middle | 60 AFY | 0.37 cfs |
| Totals | | 330 AFY | 1.54 cfs |
| Total potential water available to each city | | 110 AFY | 0.51 cfs |

¹ As defined in the McAllister Groundwater Model, Appendix B.

² In negotiation for acquisition at this time. May include acquisition of surrounding land.

Flow put back into the river by retiring irrigation water rights in upstream reaches benefits downstream reaches at differing ratios. The total volumetric depletion during the closure period (April 15 through November 1) is 65.8 ac-ft. The mitigation quantity provided by retiring both the Jensen and Smith water rights (1/3 of the total available on paper) is 0.39 cfs (90 ac-ft). For the Upper Reach, this provides a quantity of flow for mitigation that is 4.1 times the amount predicted to be depleted from pumping at SW Well 1A (or 4.1:1 cfs mitigation ratio). For the Middle Reach, the ratio is approximately 6.9:1 and 8.5:1 for the Lower Reach.

Table 4-6 quantifies how the specific location of these water rights corresponds to predicted depletions by reach of the Deschutes River.

| Table 4-6 Deschutes Flow Mitigation By Reach for Closure Period SW Well 1A Predicted Depletions | | | | | | |
|---|-------------------|---------------------|-----------------------|------|------------------------------|-------|
| Predicted Depletions | Cumulative Impact | | Mitigation Quantities | | Paper Right Mitigation Ratio | |
| | AF ¹ | cfs | AF | cfs | AF | cfs |
| Upper Reach (58% of total) 38.20 AF (0.10 cfs) | 38.2 | 0.10 | 90 | 0.39 | 2.4:1 | 4.1:1 |
| Middle Reach (21% of total) 13.82 AF (0.03 cfs) | 51.93 | 0.13 | 110 | 0.51 | 3.9:1 | 6.9:1 |
| Lower Reach (21% of total) 13.82 AF (0.03 cfs) | 65.8 | 0.17 ⁽²⁾ | 110 | 0.51 | 4.7:1 | 8.5:1 |

1 - Acre feet depletions are calculated based on a relative percentage of CFS impact by reach in order to match total AF depletion amount in Table 4-4.

2- Rounded from third significant digit.

The Table 4-6 ratios are important because the reach containing the point of diversion will get a direct benefit from retirement of these rights, as well as all downstream reaches. Mitigation ratios, which estimate the quantity of these benefits, also change for different reaches. Using ratios as a method of comparison, each reach of the Deschutes River will receive a significant amount of flow benefit relative to Yelm’s predicted impacts, for both annual quantity and instantaneous flow.

A significant amount of work and coordination for implementing in-kind mitigation has already been completed, all of which demonstrate the feasibility of this mitigation approach and the Cities’ commitment to providing in-kind mitigation. Under contract with WestWater LLC, the Cities have negotiated two option agreements for purchase of irrigation water rights, and are negotiating the acquisition of a third irrigation water right in the middle reach of the Deschutes River. Figure 4-2 shows these acquisitions on a map of the Deschutes River. Appendix D provides a more detailed review of these water right acquisitions, and copies of the Option Agreements for the Smith and Jensen rights. Appendix D also includes copies of the Beneficial Use Analyses (BUA) for the Ron Smith water right (G2-26862GWRIS), the Jensen water right (S2-00972CWIRIS).

Non-Flow Land Acquisition and Habitat Restoration

During the non-closure period, which is regulated by established in-stream flows, the cities propose to provide substantial “non-flow” mitigation which would benefit salmonid habitat year-round and not exacerbate winter high-flow conditions.

Review of the Deschutes River USGS stream flow data at the Tumwater gage indicates the river meets or exceeds the established in-stream flow more than 70% of the time during the non-closure (or “winter”) period. Water is theoretically available for appropriation during these periods when in-stream flows are met. Conversely, this same historical data suggests the river fails to meet minimum in-stream flows

approximately 30 percent of the non-closure period. These periods of winter low flows suggest, therefore, that mitigation is warranted to offset predicted winter impacts.

Two principal challenges exist to providing flow mitigation of winter low flow periods: 1) the lack of active water rights with winter time use that can be purchased and retired, and 2) the inability to predict low flows and time mitigation actions so as to address low flows and not exacerbate high flows/flooding. Consequently, the Cities propose land acquisition and habitat restoration as the most appropriate strategy for “winter” impacts. These actions can have greater biological benefits during the winter than flow mitigation. For example, in the Deschutes, one of the primary limiting factors for fish in the winter is the availability of off channel rearing habitat and/or large woody debris that provide protection from high main stream flows. In addition, these restoration actions will have year-round (high flow and low flow) benefits.

The cities have negotiated an Option Agreement to purchase the Ron Smith Farm, which is located in the upper reaches of the Deschutes River, at the outlet of Lake Lawrence. This Option Agreement is included in Appendix D. This is our proposed acquisition and habitat restoration site for mitigation in the Deschutes River for non-closure periods. The Cities contracted with Anchor QEA to conduct an acquisition and restoration assessment of the Smith Ranch as a potential site for mitigation in the Deschutes River system. This site is uniquely situated to provide habitat restoration benefits, as noted in the Anchor QEA report:

“The Smith Ranch property is an appropriate site to acquire in order to meet desired outcomes for mitigation associated with the Cities’ proposed water rights applications. The Smith Ranch is an ideal location to provide mitigation for predicted flow depletions to all the downstream segments of the river. In this way, the benefits derived from property acquisition, cessation of intensive agricultural land practices, and recommended restoration actions will benefit the full extent of the watershed that is predicted to be impacted by the water withdrawals.”

As part of the feasibility analysis, Anchor QEA developed a quantitative system for both debiting points based on predicted depletions and for crediting mitigation points depending on what type of acquisition or habitat improvements are selected. Recognizing that this type of system is subjective, and relies on professional judgment, it does provide a method of selecting and quantifying projects which is helpful in mitigation planning. Table 4-7 summarizes total mitigation points required using this quantitative system for all three cities. The information in this table was provided by the cities of Lacey and Olympia, and is presented in their mitigation plans. A copy of the full Anchor QEA report, Initial Acquisition and Restoration Assessment of the Smith Ranch, is included in Appendix E.

Table 4-7
Winter Flow Depletion Impact Calculation for Cities of
Olympia, Lacey and Yelm

| River Reach | Reach Length | Predicted Maximum Winter Impacts Flow Depletion ¹ | | Scoring System for Depletion Points per 0.1 cfs-mile | Depletion Points |
|---|--------------|--|----------------------|--|------------------|
| | | Incremental Depletion in Reach | Cumulative Depletion | | |
| Upper Deschutes | 8.8 miles | 0.39 cfs | 0.39 cfs | | 343 |
| Middle Deschutes | 7.0 miles | 0.14 cfs | 0.53 cfs | 10 | 371 |
| Lower Deschutes | 11.0 miles | 0.53 cfs | 1.06 cfs | | 1,166 |
| Total to Mitigate for Winter Flow Depletions | | | | | 1,880 |

Notes:

¹ Flow depletion sources: Golder 2008; Golder 2008a, 2008b, and 2008c; SSPA 2008; and City of Olympia and Nisqually Indian Tribe 2008. The depletions listed in the table are the cumulative predicted depletions for the following water right applications:

- **City of Lacey** – New water right applications G2-29165 (Madrona Wellfield), G2-29304 (Evergreen Estates), G2-30248 (Hawks Prairie #2), G2-30249 (Betti Well), G2-30250 (Meridian Campus), and G2-30251 (Marvin Road)
- **City of Olympia and Nisqually Indian Tribe** – Water right change applications for Certificate Nos. 8030 and S2-001105C (McAllister Springs) and Permit No. 10191 (Abbott Springs)
- **City of Yelm** – Phases I and II, G2-29084, G2-29085, and G2-29086.

Note that the calculation of depletion points was made using Yelm’s 2008 plan for phasing and production targets. The 2010 pumping plan for SW Well 1A involves significantly lower rates and volumes, resulting in lower depletion points, and therefore this table is very conservative.

The Cities propose a package of actions that will total 4,327 mitigation points: 2447 points more than required using the point scoring system. This calculation was made using Yelm’s greater 2008 impacts, and it still results in a ratio of 2.3:1 for non-flow mitigation actions. Actual mitigation ratios would be higher with Yelm’s 2011 reduced water right request. These actions (identified in Figure 4-3) include:

- Acquire the Smith Ranch and cease farming activities by 2012.
- Reshape existing channel from Main Spring (2A)
- Re-establish the wetland around smaller springs on the ranch (2D)
- Construct a small live cribwall to address erosion along the Deschutes River (3A)
- Replant high density 50-foot riparian buffer and install buffer fence along the river (4A)
- Replant low density 50 to 200 feet riparian buffer along the Deschutes River (4B)

As noted in the Anchor QEA report:

“These recommended actions were selected because each action make significant contributions to address the habitat limiting factors, immediately address some of the most impactful alterations resulting from the intensive agricultural practices, and set the stage for future restoration. The

benefits of these actions would extend far beyond the boundaries of the property, thereby significantly contributing the restoration of the Deschutes River watershed.”

The timeframe for these actions is shown in Table 4-8. All non-flow mitigation actions are proposed to be completed by the end of 2016, well ahead of Yelm’s full impacts of pumping in 2028.

| Table 4-8 Deschutes Property Acquisition and Habitat Restoration: Schedule for Completing Actions | |
|--|------------------------------|
| Action | Timeframe¹ |
| Complete property acquisition | 2011 |
| 4A (partial) – Install Buffer Fence 200 feet from Deschutes River and along mouth of Lake Lawrence outlet | 2011 |
| 4A (partial) – Replant High Density 50-foot Riparian Buffer | 2012-2013 |
| 3A – Construct Live Cribwall Along Eroding Reach of Deschutes River | 2013-2015 |
| 2A – Reshape Existing Channel from Main Spring | 2013-2015 |
| 2D – Re-establish Wetland Around Smaller Springs | 2013-2015 |
| 4B – Replant Low Density Riparian Buffer 50 to 200 feet from the Deschutes River. | 2014-2016 |

Note: Timeframe assumes water rights decisions are made in 2011.

Yelm’s Share of Non-Flow Mitigation

Land acquisition and habitat restoration activities are being jointly pursued by the three cities (Yelm, Lacey, and Olympia), and they will be working collaboratively to successfully implement the entire package of acquisition and restoration actions. To mitigate predicted SW Well 1A depletions, Yelm would fund approximately one-third of the non-flow package. This equates to 1443 mitigation points (one-third of the 4327 total points) to offset predicted non-closure depletions. This would include acquisition of the Smith Property and completion of the specific habitat restoration actions outlined in the Anchor QEA report. The cities will update the Deschutes Interlocal Agreement to define proportional cost shares, outline responsibilities and accountabilities for implementation of habitat restoration work, and identify funding mechanisms.

Section 5

Conclusion

This mitigation plan summarizes a series of actions to fully mitigate Yelm's request for additional water rights from the Nisqually Basin in the amount of 942 acre feet. This plan significantly reduces the City's original request for water rights as submitted in the 2008 Mitigation Plan by more than 75%. The reduced request will still provide 20+ years of responsible and manageable growth for the City of Yelm while significantly lessening impacts on surface water bodies in the Nisqually and Deschutes watersheds.

This plan has been developed in a regional context, consistent with the adopted Nisqually Watershed Management Plan. The City of Yelm, Nisqually Tribe and the Cities of Olympia and Lacey have gone to great lengths to coordinate efforts on water supply development and water resource mitigation.

Yelm is an active partner in the regional watershed planning process and remains committed to environmentally sustainable mitigation to offset predicted impacts within the respective watershed(s). These efforts will result in a better outcome for regional water resource management.

Section 6

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FIGURES

APPENDIX A
FUTURE DEMAND/SUPPLY FORECAST AND GROUNDWATER
MODELING FOR MITIGATION PLANNING

APPENDIX B
GROUNDWATER MODELING OF NEW WATER RIGHT AND TRANSFER
APPLICATIONS – CITY OF YELM, WASHINGTON

APPENDIX C
CHAPTERS 173-511 AND 173-513 WASHINGTON ADMINISTRATIVE
CODE

APPENDIX D
DESCHUTES RIVER AGREEMENTS AND BENEFICIAL USE ANALYSES

- 1. Overview of Deschutes Mitigation Actions*
- 2. Interlocal Agreements*
- 3. Smith Water Rights Option Agreement*
- 4. Smith Property Option Agreement*
- 5. Smith Beneficial Use Analysis*
- 6. Jensen Water Rights Option Agreement*
- 7. Jensen Beneficial Use Analysis*

APPENDIX E

ANCHOR QEA REPORT