Recommendations for Development of Regional Wellhead Protection Measures

By: The Spokane Valley Rathdrum Prairie Wellhead Protection Policy Coordinating Committee

Date: **29 April 2014**

This document contains recommendations for the development of regional Wellhead Protection measures. These recommendations have been developed by the Spokane Valley Rathdrum Prairie Wellhead Protection Policy Coordinating Committee (WHP PCC) which is comprised of representatives of local municipalities listed in appendix 4.

These proposed Wellhead Protection measures are intended to compliment the current aquifer protection measures and are specifically targeted at protecting public drinking water wells located within the Spokane Valley Rathdrum Prairie aquifer.

Contents

Background

The Federal Safe Drinking Water Act (SDWA) amendments of 1986 established a new wellhead protection (WHP) program to protect groundwater that contributes to public drinking water supplies. Under the SDWA, Section 1428, each state must prepare a WHP program for submittal to the EPA. As legislated through the Revised Code of Washington (RCW) 70.119A.080, the Washington State Department of Health, issued an EPA approved WHP program in May of 1994.

In 1994 the City of Spokane began the first phase of the WHP program. This phase was completed in 1998 and documented in the City of Spokane Wellhead Protection Program Phase I – Technical Assessment Report February 1998. The Spokane Aquifer Joint Board (SAJB) began work on phase one in 1995. Phases I and II were completed in 2000 and documented in the Spokane Aquifer Joint Board Wellhead Protection Plan. Phase I included aquifer research and modeling, the identification of potential wellhead protection areas, and the identification of potential contaminant sources.

For phase II of the WHP program the City of Spokane, SAJB, Spokane County Public works and Millwood worked together. This phase included purveyors susceptibility assessments, notification of both the purveyors and the regulatory/emergency response agencies of the potential contaminate sources and preparation of contingency plans to aid each purveyor in providing alternate sources of water. Phase II included input from the Citizens Wellhead Committee; public meetings informing citizens of the WHP program and process and seeking input; and a survey of public opinion. A Policy Coordinating Committee (PCC) composed of staff representatives from the cooperating municipalities reported the recommendations generated from findings of the Citizens Wellhead Committee and the public survey.

The PCC presented their recommendations in two sets. The first set of recommendations addressed consensus items which did not require approval of regional governments, and were implemented jointly by the City and SAJB. Recommendations included the funding and oversight of an Education and Awareness Campaign, Proactive Business Assistance and Chemical Reduction, Enhanced Household Hazardous Waste Removal, and a Potential Contaminate Source Inventory Update Program.

The second set of recommendations involved land use regulations. Two regulatory items were recommended,1) tightening existing regulations regarding stormwater runoff, and 2) restricting relatively high-risk land use activities in the vicinity of public drinking water system wells.

The PCC met in 1999 and 2000 and anticipated a move to adopt the regulatory items by the City of Spokane and Spokane County in mid 2001. The Phase I and II Wellhead Protection Reports were made part of the water purveyors water system comprehensive plans as they became due and subsequently were approved by Washington State Department of Health.

The SAJB, which the City of Spokane joined in 1998, implemented the consensus items from the PCC and has continued to this date with Education and Awareness, Proactive Business Assistance, Enhanced Household Hazardous Waste Removal and the Potential Contaminate Source Inventory. The County and City Planning Departments delayed action on the regulatory wellhead protection items as they grappled with Growth Management Act deadlines. The two planning directors moved and the new Cities of Liberty Lake and Spokane Valley came into being. The regulatory wellhead protection items were not implemented.

In 2006 the SAJB again addressed the regulatory items developed from the PCC in 1999. In September of 2007 the SAJB issued the Spokane Aquifer Joint Board (SAJB) 2007 Wellhead Protection Update. These water purveyor recommendations became the foundation for the current set of wellhead protection recommendations.

In 2008, following presentations to the Spokane Regional Health District Board and to the Spokane City Council, City of Spokane Environmental Programs staff floated an agreement to the regional government planning departments that would establish a new policy coordinating committee. City of Spokane Planning, City of Spokane Water, Spokane County Planning, the Town of Millwood, and the Spokane Aquifer Joint Board signed the agreement. However the City of Liberty Lake indicated a desire to just follow the process, while the City of Spokane Valley and Fairchild AFB choose to participate informally. The current WHP PCC operates as an informal regional group facilitated by City of Spokane Environmental Programs staff.

In 2011, the State Department of Health offered to provide funding for updating the wellhead protection model to expand over the entire aquifer, and explore the model use in helping to identify potential stormwater facility risks. This funding offer was subject to some local match from the SAJB. The City of Spokane, SAJB, and WA State Department of Health came to agreement on a scope of work which was subsequently completed by Groundwater Solutions Inc. located in Portland, Oregon.

Technical Information

The Spokane Valley Rathdrum Prairie (SVRP) Aquifer, as a consequence of its formation by the glacial Lake Missoula floods, is an unconfined aquifer composed of highly porous cobble and gravels. This composition makes the ground water highly susceptible to contamination from the surface.

The flow rate in this Aquifer is very rapid compared to most aquifers and the water quality very good. As a consequence nutrients that might be present in other aquifers to aid in biological degradation of contaminants and the time of travel sufficient for such degradation is limited. In this Aquifer a one year time of travel, considered reasonable treatment for some drinking water contaminants, can easily exceed a mile in length flowing beneath mostly developed properties, some of which are almost certainly potential contaminant sources.

We desire here, as the SAJB did in their 2007 Wellhead Protection Update, to make clear the importance of aquifer-wide protection of groundwater quality, and achievement of a meaningful level of special wellhead protection to help assure clean, healthy drinking water at a reasonable cost for the populace.

Regionally there are many aquifer protection policies, rules, and programs that contribute directly or indirectly to maintaining or improving aquifer water quality. While many of the Aquifer water quality protection measures are similar, there are differences from one jurisdiction to another. It is felt that more consistent regulation between jurisdictions would result in better Aquifer water quality protection, and provide greater understanding and more certainty to the regulated public. The following is our attempt to list the currently existing Aquifer protection measures:
Current Aquifer Protection

- *The 1979 Spokane Aquifer Water Quality Management Plan laid the foundation for Aquifer protection in the City of Spokane and Spokane County.*
- *The Spokane Regional Stormwater Manual (SRSM) recognizes the uniqueness of the aquifer and the importance of protecting a sole source aquifer. This manual has established Best Management Practices (BMP's) to protect ground water. All of the regional Washington jurisdictions have adopted the SRSM.*
- *The City of Spokane and Spokane County implemented septic tank replacement programs to reduce septic infiltration into the aquifer. The County program has resulted in a quantifiable reduction in nitrate at sampling wells in many locations in the Spokane Valley.*
- *The City of Spokane has ordinances requiring connection to the sanitary sewer system. Liberty Lake has nearly all of the properties in its service area connected to the sanitary sewer.*
- *All septic systems have to be properly designed. Their installation is permitted and regulated by the Spokane Regional Health District.*
- *All installations of underground storage tanks (UST) are regulated by the City of Spokane, Spokane County, or the Washington State Department of Ecology.*
- *Above ground storage tank (AST) installation is regulated by the City of Spokane and Spokane County.*
- *The Cities of Spokane, Spokane Valley, Liberty Lake, and Millwood, and the Counties of Spokane and Kootenai, have regulations governing the use, handling and storage of critical materials. In Idaho these regulations apply to all locations with the triggering level of chemical, while in Washington the regulations do not apply to businesses that existed before the regulations went into place provided the business activity on the site has not changed.*

- *Critical Materials regulation is actively enforced in Kootenai County with dedicated funding and regular inspections. In the City of Spokane the Fire Department inspects for compliance with critical materials regulation.*
- *The City of Spokane Valley and Spokane County have uses and activities that are regulated in critical aquifer recharge areas.*
- *The water purveyors, following state wellhead protection rules and with the assistance of Spokane County, maintain lists of businesses that have used hazardous or critical materials. These businesses are notified on a biennial basis of their location near wells and their potential to contaminate groundwater.*
- *The Spokane Aquifer Joint Board has lent some support to the locally funded EnviroStars program which assists small quantity dangerous waste generating businesses with appropriate waste handling information. The SAJB also provides community education on the Spokane Aquifer and protection of its water quality.*
- *The Regional Solid Waste System maintains free household hazardous waste disposal locations. They provide many educational opportunities on the need to properly dispose of household hazardous waste. The System provides assistance to small quantity dangerous waste generating businesses.*
- *Spokane County and City of Spokane Utilities have programs that assist in aquifer water quality/quantity monitoring and aquifer education.*

Basis for Wellhead Protection

The cost effectiveness of wellhead protection measures and programs can be compared to local water purveyor experience with contaminated wells, the costs to replace wells, and the health consequences of contaminants in drinking water.
Community health and economic vitality are linked to water quality and availability. There are businesses located here whose operating costs are significantly linked to the quality and reliability of the water provided. The missing piece for protecting drinking water quality in our regional regulatory structure is control of activities just beyond 100 feet of the wells (just beyond the currently regulated sanitary control zone). These are areas where water can fairly quickly be moved out of the aquifer and to a home or business. They are also areas where activities can occur which may contaminate the ground water and/or jeopardize the existence of a well. Spokane County Water District 3 lost a drinking water well to contamination, as has Sundance Estates. In addition private wells have been adversely contaminated over the years by industrial activities and landfills, a number of wells were contaminated to the point of not being useable. The City of Spokane has lost wells to expanding airports and expanding wastewater facilities. As the region becomes more highly developed and the water distribution systems become larger and more complex, the opportunities for reasonably replacing lost wells diminish. The recommendations that follow are intended to reduce the risk that drinking water quality from drinking water wells will be adversely impacted by changing land use practices, and that potential impacts to wells will be considered in land use decision-making.

Recommendations:

I. **Aquifer-wide Protection: Jurisdictions (cities, counties, state and federal) formally recognize the importance of Aquifer wide groundwater quality protection. In particular they should:**
   1) **Legally recognize the SVRP Aquifer and areas tributary to the SVRP Aquifer for ground water protection;**
   2) **Strive to achieve regionally consistent Aquifer protection requirements;**
   3) **Recognize and participate in the Aquifer Protection Council**

II. **Regulated Special Wellhead Protection Areas (RSWPAs): Jurisdictions (cities, counties, state and federal) formally recognize RSWPAs and current methods of derivation consistent with the Wellhead Protection Policy Coordinating Committee recommendation as outlined in Appendix 1 and mapped on Map 1. This is for Group A Community systems and Group A non-transient non-community systems (NTNC) drawing water from the SVRP aquifer. Further recognize that such boundaries may need to be modified as new information is available. The RSWPAs are in addition to the defined special wellhead protection areas which the State has previously recognized. The previously defined zones may be required by WA-DOH for use by the purveyors in notification of potential contaminant sources.**

III. **SEPA/NEPA Notifications: Permitting agencies and SEPA/NEPA administrators notify drinking water purveyors of proposed land-use actions and development proposals in the purveyors' RSWPAs. *See Table 1 below for current list*. In addition it is recommended that SEPA/NEPA notices related to RSWPAs go to the Spokane Aquifer Joint Board and the Spokane Aquifer Protection Council.**

IV. **Stormwater Treatment and Disposal: The Wellhead Protection PCC recommends that each jurisdiction adopt the following in their Critical Area Ordinances for all new development and redevelopment exceeding the jurisdictional threshold, both public and private. The jurisdictional threshold is as specified in the Spokane Regional Stormwater Manual. The RSWHPAs referred to below are those as defined when the updated Ordinances are adopted and when amendments or additions are made. It is intended that compliance with the recommendations in areas of future RSWPA amendments**

or additions be triggered by subsequent new development or redevelopment exceeding the jurisdictional threshold.

A. Treatment and disposal of Stormwater within RSWPAs

1) **Stormwater treatment and disposal will be in compliance with the Spokane Regional Stormwater Manual and/or the Stormwater Management Manual for Eastern Washington except as augmented by the requirements below.**
2) **No new direct injection of untreated stormwater from pollutant generating impermeable surfaces (PGIS) in RSWPA zones is allowed. "Untreated stormwater" here means stormwater that has not passed through a stormwater treatment best management practices facility, regardless of the level of treatment provided, before discharge to a drywell or other underground injection control facility.**
3) **Development project proponents should be encouraged to avoid increasing the size of the post-development basin tributary to a RSWPA zone.**
4) **Stormwater Underground Injection Control (UIC) facilities, other infiltration facilities and injection wells should be located as far as practical from wellheads**.
5) **New stormwater facilities within <u>300 feet</u> of a drinking water well shall provide treatment at least equivalent to a bio-infiltration swale with engineered soil as defined in the Spokane Regional Stormwater Manual and/or the Stormwater Management Manual for Eastern Washington.**
6) **Except for uncontaminated (non-PGIS) runoff, no stormwater discharge treated or otherwise shall occur within the sanitary control area, which is the area within 100 feet of a drinking water well.**
7) **Regional stormwater facilities within RSWPAs should be allowed only when either a) the size of the post-development basin tributary to the RSWPA is not greater than the size of the pre-development basin tributary to it, or b) an engineering analysis demonstrates that the proposed basin increase does not have an adverse impact to the wellhead protection zone. An adverse impact would be an expected decline in water quality at the well (e.g. an increase in any contaminant concentration greater than 10% of the MCL), or a significant change in the well's modeled capture area such that the currently recommended RSWPA was no longer appropriate (e.g. a**

boundary displacement greater than 250 feet which would then potentially change the parties impacted by the zoning).

B. Disposal of Stormwater Outside of RSWPAs but still over the aquifer

1) As part of the analysis required in the Regional Stormwater Manual (section 1.5) for assessing down-gradient impacts of proposed facilities, new stormwater disposal facilities both public and private with six acres or more of PGIS directed to a common disposal point over the Aquifer but not in RSWPA zones shall be modeled using the aquifer model used for wellhead protection capture zone delineation IF they: a) are up-gradient of a RSWPA zone and are within a 2 year time of travel from the wellhead as mapped on Map 2 and are designed to discharge in a day more than 20 percent of the well's average pumping volume, OR b) have 20 acres or more of PGIS directed to a common disposal point over the Aquifer. No less than the ten year design storm, 24 hour volume after adjustment for evaporation / transpiration loss will be inputted into the steady state and/or transient aquifer average conditions model.

Such proposed facilities would be acceptable when the model shows that:

i. no more than 20% of any well's modeled production comes from this source of recharge, and

ii. where stormwater runoff could include perennial surface water, the recharge facility location is at least a one year time of travel from drinking water wells.

2) Drinking Water Purveyors listed in Table 1 will be given notice by jurisdictions when public or private stormwater facilities are proposed where conditions a or b in the above section "B.1)" is or are met. Such notice will include the location of the proposed facility, the adjusted 24 hour design volume, and whether or not the facility is expected to get perennial surface waters along with the stormwater.

V. Stormwater Contamination Mitigation: To address potential and actual contamination from stormwater facilities reaching wells

1) **Group A Water Purveyors must have and implement a Contingency Plan which addresses contaminant detection and includes Preventative Action Limits (PALs). If PALs are exceeded at the well and stormwater is the**

suspected source of contamination, the water purveyor shall notify and work with the local stormwater utility and/or owners of private stormwater injection facilities such that the stormwater utility and/or private owner mitigates the source of contamination. This may include installation of stormwater treatment BMPs where existing facilities do not meet requirements of the Spokane Regional Stormwater Manual. The notification of the stormwater utility and facility owners would be in addition to the notifications made to the State and County agencies responsible for water quality.

2) **Stormwater Utilities will provide water purveyors information appropriate for private companies and individuals regarding proper maintenance of, and housekeeping around, stormwater facilities. Water Purveyors are currently required to identify Potential Contaminant Sources and notify them and emergency responders that they are located in wellhead capture areas. Water Purveyors will publish and distribute the provided stormwater facility maintenance information to potential contaminant sources in RSWPAs when sending out their every-other-year potential contaminant source notices.**

3) **Whenever the Spokane Regional Stormwater Manual is <u>updated,</u> the participating stormwater utilities should determine what mechanisms can reasonably be brought to bear so as to further limit contaminants from impervious surfaces reaching the Aquifer, providing, if reasonably achievable, protection above the then-current requirements of stormwater facilities within RSWPAs. This process should include all available local data on stormwater Best Management Practice (BMP) efficiencies of removal and should include the latest available health risk information for chemicals that have been detected in the Aquifer and/or the purveyors wells before and after initial treatment. This analysis should include, but not be limited to, consideration of impervious surface area and contaminant loading being treated, available treatment options and their removal efficiency, and inspection and maintenance minimum standards. The results of this analysis should be documented in the updated manual.**
4) **In order to assure proper maintenance and functioning of new stormwater facilities placed within RSWPAs, whether public or private, they should be conditioned with the right of the local government and/or stormwater utility to:**
   1) enter the property for inspection of the stormwater facility, and

2) require testing and/or do testing as deemed necessary, and

3) require maintenance and/or do maintenance as deemed necessary.

E. **Water purveyors shall notify affected stormwater utilities when there is a water line leak/break that causes eroded material to enter a stormwater system.**

VI. Wastewater Collection Systems: All Wastewater Management Plans for Wastewater utilities providing any service in the Spokane Aquifer Sensitive Area should recognize:

A. There is a desire to have properly designed, constructed, and functioning wastewater collection systems (nominally 8-inch diameter pipes) within wellhead protection areas in so far as septic systems are eliminated and wastewater is conveyed away from the capture areas to treatment facilities.

B. Beyond the wastewater conveyance systems discussed in "A" above, additional wastewater conveyance should be avoided in RSWPAs whenever an alternative route is feasible.

C. All new sewer systems and sewer system additions should be tested per section C1-5 Testing, Criteria for Sewage Works Design, WA-DOE August 2008, 98-37 WQ (as amended), or local jurisdiction equivalent.

D. Critical portions of sewer systems include areas where failure is most likely and where the consequence of that failure is highest. Sewer systems inside RSWPAs are considered critical because the consequence of failure is unacceptably high. Therefore, inspection frequency should be increased. Inspections should be in accordance with section C1-7.4.2 Manhole Inspection and/or C1-7.4.3 TV Inspection, Criteria for Sewage Works Design, WA-DOE August 2008, 98-37 WQ or as amended. If these critical portions of the sewer system are found to be structurally deficient or undersized during inspection, they should be given priority and repaired or replaced within 5 years of such a determination.

E. Wastewater force (pressurized) mains should be constructed outside RSWPAs whenever practical. If a portion of a force main system must be located within a RSWPA, that portion must be constructed of ductile iron pipe or, after consultation with potentially affected purveyors, other Recommended pipe material for unusual conditions from Table C1-4, Criteria for Sewage Works Design, WA-DOE August 2008, 98-37 WQ. or as amended.

F. Wastewater (gravity) collection system mains & trunks (12-inch diameter pipe and larger) should not be located in a RSWPA whenever an alternative

route is feasible. If a portion of a transmission main system must be located within a RSWPA it should be located as far from the wellhead as possible.

VII. Septic Systems: The Spokane Regional Health District and Washington State Department of Health should permit septic systems in RSWPAs, but only if in compliance with the most recent requirements, and only if:

A. in densities of no greater than one single family residence system in five acres, OR

B. in net densities of no greater than one single family residence system in five acres where each residence has its own septic system and drain field.

It is recognized that prior approval has already been given by local governments in some cases for development rights that would exceed the one in five acre density limit. The intent is that this recommendation would apply for all development approvals granted after this recommendation is agreed to by the local governments.

VIII. Rules/Plans Consistency: Federal, State, County, and the Spokane Regional Health District (SRHD) rules and all comprehensive plans (land use and water/wastewater utility) for areas over the Spokane Aquifer Sensitive Area should recognize:

A. the need for cooperatively working with the SRHD and Washington State Department of Health to eliminate any septic systems in RSWPAs that have been documented by a water purveyor to be diminishing drinking water quality; and

B. that Washington State Class A reclaimed water as defined in Water Reclamation and Reuse Standards, September 1997, Washington State Department of Health and Washington State Department of Ecology, can be used in RSWPAs for otherwise acceptable commercial/industrial activities and can be used for outdoor irrigation where the rate of application does not exceed the normal plant uptake rate less available precipitation; and

C. that the use of reclaimed water of a lower classification than Washington Class A in a RSWPA should be treated as a potentially harmful activity and not be permitted without a public hearing to decide appropriate controls and conditions; and

D. That surface percolation and/or direct injection of Washington Class A reclaimed water into the groundwater and/or into the ground below the ground surface for recharge can occur in RSWPAs if such injected water is no closer to drinking water wells than one year time of travel; and

E. surface percolation of reclaimed water into the Spokane Rathdrum Prairie Aquifer is the preferred type of reclaimed water recharge in this area and then only permitted if the reclaimed water is Washington Class A; and

F. That all reclaimed water aquifer recharge projects should be required to be modeled using the same aquifer model as used for wellhead protection capture area delineation, and permitted only when all the following are true:

1) **No significant change in well capture areas is demonstrated;**
2) **The recharge point is greater than one year time of travel from drinking water wells; and**
3) **No more than 20% of any well's modeled production comes from this type of recharge.**

IX. Potentially Harmful Activities: The Wellhead Protection Policy Coordinating Committee recommends that each jurisdiction adopt the following regarding activities that, if located within RSWPAs, could potentially be harmful.

A. Potentially harmful activities are:

Animal Feedlots
Bio-Research Facilities
Chemical/Agricultural Chemical Warehousing
Composite Products Manufacturing
Dry Cleaning (performed on location)
Electronics Manufacturing
Electroplating/Metal Finishing
Engine & Vehicle Repair/Service/Salvage
Furniture Stripping
Junk/Salvage/Recycling Yards
Metal Fabrication
Mining/Sand & Gravel Extraction
Storage of Critical Materials
Transfer of Critical Materials
Oil & Gas Drilling
Paint Manufacturing and Wholesale Storage
Petroleum Bulk Storage & Transmission
Photo Processing
Printing and Lithography
Solid Waste Handling & Recycling Facilities
Vehicle Washing
Wastewater Bulk Storage, Treatment & Pumping Facilities
Wood Treatment Facilities
Other activities as determined by local government and/or local groundwater purveyors as potentially harmful

B. These activities would be allowed in RSWPA zones only when:

1. **the proponent obtains approval from each of the applicable purveyor(s) whose RSWPA zone(s) would be developed in, and**
2. **obtains development approval from each of the jurisdictions where the development will occur, consistent with each jurisdiction's adopted permit/approval process for wellhead protection areas.**

C. Any of these activities currently occurring in RSWPA zones should be considered "non-conforming" and subject to the above requirements only upon future expansion or re-development, consistent with the jurisdiction's adopted regulations pertaining to wellhead protection areas and nonconforming uses.

Explanatory Comments:

Introduction, last paragraph Page 6: The Spokane County Water District 3 well that was lost to contamination had a combined cost of at least $700,000 dollars (1997, with 2013 est.$ 1.016M) to replace and the source of contamination has not yet been determined. To provide some context as to how these costs might vary from a smaller system/well to a larger, the City of Spokane has a rough estimate of the cost to replace the Parkwater & Well Electric well stations of $ 110.9 million dollars (2013). Not including costs to abandon the existing well stations or to deal with contamination that might enter the distribution system.

Documented Aquifer drinking water well contamination incidents:
1) Seventy-two residents north of Kaiser Mead were provided piped in water due to aquifer contamination (CDC Mead LLC, State ID 3)
2) Spokane Co. Water District 3 converted their Dakota well to emergency use only as a result of the Kaiser Mead contamination, it served 800 connections previously.
3) One residential well contaminated (Greenacres Landfill, State ID 631)
4) Fifty residential homes provided piped in water due to aquifer contamination (Northside Landfill, State ID 111)
5) Spokane County Water Dist. 3 well which served 800 homes, lost to contamination (Spokane Co. Water Dist. 3 Mead, State ID 738)
6) Sundance Estates well lost to arsenic contamination (21 properties served)
7) Wandermere & St. Georges Academy wells now used for irrigation only due to contamination.

See appendix 2 for a list of groundwater contaminated sites. *[Return]*

IV.A.5 The 300 foot distance was derived to meet two expressed concerns: 1) The concern expressed by purveyors that their wells might be considered under the influence of surface water should a discharge point be within 200 feet of a drinking water well; and 2) A concern expressed by the City of Spokane and Spokane County staff that it was important to define a distance and not leave it arbitrary. WADOH regulations state: ""Potential GWI" means a source identified by the department as possibly under the influence of surface water, and includes, but is not limited to, all wells with a screened interval fifty feet or less from the ground surface at the wellhead and located within two hundred feet of a surface water, and all Ranney wells, infiltration galleries, and springs." *Ginny Stern, a WADOH hydrologist has agreed that the 300 foot distance combined with the bioswale bmp is protective of the wells.* *[Return]*

IV.A.7.b A basic engineering analysis regarding the potential of increasing contaminant levels at a well by more than 10% of an MCL could be done in one of the following ways:
a) Demonstrate that before treatment worst case stormwater quality from the contributing area would not exceed drinking water MCLs; or
b) Assume that the contaminant concentrations being discharged from the treatment facility at the aquifer interface is at the drinking water MCL level. (This assumption follows the stormwater manual assumption that BMP's will at least deliver water that does not exceed the MCLs.) The wellhead protection aquifer model after incorporation of project details could then be used to determine the appropriate dilution factor to apply in making the determination if 10% of an MCL is exceeded.
The 250 foot displacement criteria used in determining if a project would render an RSWPA no longer appropriate is based on a 300 foot block width.

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IV.B.1 The wellhead model referred to is the one recognized in Recommendation II, and documented in Appendix 1, B & C. *[Return]*

IV.B.1.a Basis for the six acre threshold: The RSWPA boundaries are based on current groundwater and surface water flow conditions. A concern is that future projects may have a drainage design where large areas will have their stormwater runoff collected and conveyed to an infiltration point thus changing the location and distribution of stormwater infiltrating into the aquifer. These changes could, in turn, increase the risk posed by use of a well by altering the groundwater flow conditions and changing the boundaries of the RSWPAs. Small projects will have little effect on the boundaries but large projects could have a measurable effect. To determine when a drainage design should be considered for modeling to evaluate its impacts, a threshold was found that would trigger consideration.

The factor that was decided for the threshold was the 10-year stormwater volume that would fall within a RSWPA in a day and assumed to infiltrate. For the RSWPAs within the SAJB service area, the smallest rainfall depth from the SRSM was 1.5 inches which was used to calculate the volume. For this event, the smallest calculated quantity of water that would fall in a representative RSWPA, when wells not currently in use but kept for emergency purposes are eliminated from consideration, was 44,000 cubic feet. This volume became the threshold.

Thus, the recommended threshold for proposed infiltration facilities located outside the RSWPA but within a two-year time of travel from a wellhead is 44,000 cubic feet of stormwater in a 24-hour period at a common disposal point. This volume is typically generated from approximately 6 acres of impervious surface as calculated using a 24-hour long precipitation event in the Bowstring method (see the SRSM). Based on this, for a quick determination, facilities that have 6 or more acres of impervious surface draining to a common disposal point would need to be considered for modeling using the aquifer model to access impacts; if below this area then no modeling would be required.
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IV.B.1..i The twenty percent limit on stormwater discharge from a facility to a well provides a fivefold dilution of any contaminants coming from the facility and then being distributed from the well. It is based on an understanding that stormwater facilities do not technically have to clean water up beyond the drinking water standards at the point of discharge into the aquifer and that facilities can fail for a variety of reasons to meet their design water quality levels. It assumes facility failure to meet design water quality levels will not go on for long and so would not involve more than one facility at a time in a RSWPA zone. Drinking water purveyors report their test results to the public, and are concerned about the public's perception of the water quality. The purveyors have increased monitoring and reporting requirements when detected levels reach half of a maximum contaminant level. *[Return]*

IV.B.1.ii Water from a perennial surface water body can significantly vary in water quality from stormwater runoff as it is more likely contaminated to some extent with water borne organisms (such as Giardia) that can cause disease. The WA-DOH has indicated that a one year time of travel is reasonable to provide protection from pathogenic organisms and includes a reasonable margin of safety. In determining whether this one year time of travel requirement is met it is acceptable to add months on to the modeled horizontal time to compensate for vertical time of travel of the stormwater through the unsaturated zone if the vertical time of travel for the particular area has been determined by a WA State registered Hydrogeologist. Given Table 2, on page 15 of USGS Report 2007-5044, vertical transmission times in excess of 5 months would not be expected. In the Spokane Valley very short times of travel, less than a day, have been experienced by water purveyors when doing pump tests.
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V.C. The intent of this recommendation is to have the folks most knowledgeable about current stormwater quality, stormwater BMPs in use, and those potentially available, including information about their contaminant removal efficiencies consider occasionally if there is more that reasonably could be done to reduce the risk posed by stormwater chemical concentrations in the vicinity of wells in the Aquifer. It is recognized that stormwater picks up contaminants and can move them into the aquifer depending on a variety of factors. It is also recognized that stormwater is not the sole potential source of these contaminants. The Spokane Aquifer and purveyors systems contain some contaminants that have Maximum Contaminant Level Goals (MCLGs) of 0 as a consequence of their impacts on human health. Contaminant human health impact

studies are occasionally updated, but for many contaminants have not yet been done. The concentration of contaminant that ultimately reaches the aquifer via stormwater is dependant on how much of the contaminant is exposed to stormwater; the contaminant chemistry including how the contaminant interacts with sunshine, air, water, and soils; the amount of the sunshine, air, water and soils the contaminant interacts with, the duration of time these interactions occur over, and the quantity and type of treatment the stormwater receives before discharge. By decreasing the contaminants getting in water and increasing the amount and duration of degrading and diffusing interactions contaminant concentrations and resulting health impacts can be lowered, but at some cost. *[Return]*

VIII.D & VIII.F.2 In determining whether these one year time of travel requirements are met it is acceptable to add months on to the modeled horizontal time to compensate for vertical time of travel of the stormwater through the unsaturated zone if the vertical time of travel for the particular area has been determined by a WA State registered Hydrogeologist. Given Table 2, on page 15 of USGS Report 2007-5044, vertical transmission times in excess of 5 months would not be expected. In the Spokane Valley very short times of travel, less than a day, have been experienced by water purveyors when doing pump tests. *[Return]*

IX *The Potentially Harmful Activities List was originally referred to as the "High Risk Activities List". A fairly complete history of that list is contained in Appendix 3. Addition of major highways and railroad lines was proposed and ultimately decided against. Electroplating and Critical Materials storage and handling were added during the Wellhead Protection Policy Coordinating Committee process (see August & Sept. 2011, and March 2012 minutes). In the February 2014 meeting Washington State Department of Health recommendations to remove' fiberglass' from the reference to composite manufacturing and to add 'Salvage/Recycling' to Junk Yards were adopted. Finally an "Other" category was added to allow control of activities identified in the future as potentially harmful.* *[Return]*

Glossary

disposal point- The ultimate destination where stormwater from a particular site is discharged, either through infiltration or other approved downstream discharge point.

direct injection- Injection of water into the ground other than by way of percolation through native soils, including underground injection control wells (e.g. drywells) and discharges into gravel pits.

existing condition -.The site condition prior to development; not necessarily the pre-developed condition.

infiltration—The passage of water through the soil surface into the ground. (SRSM)

infiltration facility (or system)- A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as percolation, to dispose of surface and stormwater runoff. (SMMEW)

pre-development basin- Existing condition, as defined in the Spokane Regional Stormwater Manual, of a surface water basin.

pre-developed condition- The native vegetation and soils that existed at a site prior to the influence of Euro-American settlement. (SRSM) Jurisdictions may choose to require that either the pre-developed condition or the "existing condition" be used to calculate runoff volumes to be compared to the runoff generated under the "proposed development condition". Because there is limited information available to identify and confirm actual pre-developed conditions for many areas of eastern Washington, jurisdictions may choose to apply a reasonably determined set of conservative curve numbers for use in determining the runoff volume compared to that under the proposed development condition. (SMMEW)

regional stormwater facility- Regional stormwater facilities are grass-lined ditches, natural drainage ways, ponds, pipes and various other means of conveying, treating and disposing of stormwater runoff that serve as the "backbone" of a system to which smaller drainage elements can be connected. Most regional facilities serve more than a single development within a given contributing drainage basin. . For the purposes of this document, the term is based on its design flow being greater than that which would result from six acres of pollutant generating impervious surface.

regulated special wellhead protection areas (RSWPAs) – Special wellhead protection areas that have been recognized by local governments for increased land use regulation and control designed to protect the well and water entering the well.

stormwater facility- A constructed component of a stormwater drainage system designed or constructed to perform a particular function or multiple functions. Stormwater facilities include, but are not limited to: pipes, swales, ditches, culverts, street gutters, detention ponds, retention ponds, constructed wetlands, infiltration devices, catch basins, oil/water separators, and biofiltration swales. (SMMEW)

special wellhead protection area – A wellhead protection area, usually other than a 1, 5, or 10 year time of travel area and derived from alternative criteria approved by the WA Department of Health. Over the SVRP Aquifer these are common because the aquifer rate of flow is high and the area is in many places developed.

underground injection control (UIC) well- a bored, drilled, or driven shaft whose depth is greater than the largest surface dimension; or a dug hole whose depth is greater than the largest surface dimension; or an improved sinkhole; or a subsurface fluid distribution system which includes an assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground. Examples of UIC wells or subsurface infiltration systems are drywells, drain fields, catch basins, pipe or french drains, and other similar devices that discharge to ground.

wellhead capture area- An area derived from a model or calculation designed to show where groundwater is flowing to a well. Typically these areas are based on a specified time of travel.

wellhead protection area - Area managed by a community (or private association, homeowner's association, etc.) to protect its groundwater based drinking water supply. Wellhead Protection areas may consist of a number of zones, but always include the standard sanitary control area, and frequently other areas based on groundwater time of travel to the well, and aquifer or watershed boundaries.

Table 1:

Name	Water District	email Address	Phone (p) Cell (c)	Address
Terry Squibb	Carnhope Irrigation District #7	carnhope7@comcast.net	536-9180p 768-7296c	4613 E 3rd Ave Spokane, Wa 99212
Paul Allen	City of Millwood	cmillwood_water@comcast.net	924-0960p 342-1500c	9103 E Frederick Ave Millwood, WA 99206
Dan Kegley	City of Spokane	dkegley@spokanecity.org	625-7800p	914 E North Foothills Dr Spokane, WA 99207
Bob Ashcraft	Consolidated Irr #19	consolidatedirrigation@comcast.net	924-3655p	120 N Greenacres Road Greenacres, WA 99016
Rick Adkins	East Spokane Water District	dist1@comcast.net	926-6072p 370-8036c	704 S Coleman Road Spokane Valley, WA 99212
Denise Coyle	ESLLIC		255-6837	321 S Sandy Beach Ln Liberty Lake, WA 99019
Joseph Duricic	Fairchild AFB	Joseph.duricic@us.af.mil	247-2318	92nd CES/CEOIU Fairchild AFB, WA 99011
BiJay Adams	Green Ridge Estates	bijay@libertylake.org	922-9016 922-5443x27	22510 E Mission Ave Liberty Lake, WA 99019
Michael Croom	Honeywell Electronic Materials	michael.croom@honeywell.com	252-2290p 252-2200p	15128 E Euclid Ave Spokane, WA 99215
Terry Squibb Walt McKee	Hutchinson I.D. #16	hutchinsonid16@qwestoffice.net	926-4634p 768-7296c	618 N Sargent Road Spokane, WA 99212
Glen Terry	Irvin Water District #6	irvinwater@windwireless.net	924-9320p	11907 E Trent Spokane Valley, WA 99206
Sarah Scott	Kaiser Aluminum-Trentwood	sarah.scott@kaisertwd.com	927-6122p 290-2530c	15000 E Euclid Ave Spokane, WA 99215
BiJay Adams	Liberty Lake Sewer & Water Dist	bijay@libertylake.org	922-9016 922-5443x27	22510 E Mission Ave Liberty Lake, WA 99019

Scott Inch	Moab Irrigation District #20	moabdistrict@qwest.net	226-0545p 496-0141c	25805 E Trent Ave Newman Lake, WA 99206
Jim Lahde	Model Irrigation District #18	jim@modirr.org	926-5759p 939-7108c	1506 S. Pierce Road Spokane, WA 99206
Joe Morgan	Modern Electric Water Co	jmorgan@mewco.com	928-4540p 879-6417c	904 N Pines Road Spokane, WA 99206
Sister Mary Janae	Mount Saint Michaels			8500 North Street Spokane, WA 99217
Gary Lowe	North Spokane Irrigation District #8	nsid8@comcast.net	467-6727p 370-5773c	7221 N Regal Spokane, WA 99217
Mike Klein	Orchard Avenue Irrigation District	orchardaveirrigationdist6@comcast.net	926-4563p 991-3329c	8101 E Buckeye Spokane, WA 99212
Bruce Davidson	Pasadena Park Irrigation District #17	ppid17bruce@comcast.net	926-5535p 939-4446c	9227 E Upriver Drive Spokane, WA 99206
Ed Wolfe	Pinecroft MHP		389-5337	11920 E Mansfield #40A, Spokane, WA 99206
Frank Triplett	Pioneer Water Co	Pioneerh2o@gmail.com	991-7483	PO Box 54 Nine Mile Falls, WA 99026
Jim Gady	Rivervale Water Assn.	gadypump@hotmail.com	466-4054	508 E. Half Moon Rd. Colbert, WA 99005
Ty Wick	Spokane County Water District #3	scwd3@comcast.net	536-0121p	5221 E Desmet Ave Spokane, WA 99212
R. David Enos	Spokane Industrial Park (Rep for)	David.enos@urscorp.com	944-3807 209-0102	920 N Argonne Ste 300 Spokane, Wa 99212
Peggy Jones / Chris Heftel	Sundance Estates (aka: Ninemile Manor Addition & River Bluff Land Co.)	chrisheftel@aol.com	995-2899	4425 W. Lookout Mountain Lake, SuiteA
Mark Whitlow	Timberline MHP		928-8150	19625 E Wellesley, Otis Orchard, WA 99207
Mike Klein Jr.	Trentwood Irrigation District #3	tidist3@yahoo.com	922-7532p 998-4160c	4402 N Sullivan Road Spokane, Wa 99216

Dennis Overbay	Vel View #13		466-4322	3609 W Velview Road
Todd Henry	Vera Water and Power	thenry@verawaterandpower.com	924-3800p	601 N Evergreen Road Spokane, WA 99216
Frank Triplett	Whitworth University		777-4780 991-7483	
Susan McGeorge Doug Babin	Whitworth Water District #2	mcgeorge@asisna.com doug@whitworthwater.com	466-0550p	10828 N Waikiki Road Spokane, WA 99218

System No Longer Class A, but wishing to stay informed:

Mike Butler	Hutton Settlement	mbutler@huttonsettlement.org	838-2789	9907 E. Wellesley Ave.

Appendix 1 – Wellhead Protection Model Files

A. Recommended protection areas by system:

File	*Date*	*Size*	*Water System*
AllCarnhope.dxf	*12/5/2012*	*3,060 KB*	*Carnhope Irrigation district*
AllCentralPreMix.dxf	*11/30/2012*	*1,543 KB*	*Central Pre Mix*
AllCID.dxf	*11/28/2012*	*73,494 KB*	*Consolidated Irrigation District*
AllESLLIC.dxf	*11/30/2012*	*1,056 KB*	*East Side Liberty Lake Improvement Club*
AllESWD.dxf	*11/28/2012*	*14,299 KB*	*East Spokane Water District*
AllFairchild.dxf	*11/30/2012*	*5,608 KB*	*Fairchild AFB*
AllGreenridge.dxf	*11/30/2012*	*1,504 KB*	*Green Ridge Estate Water System*
AllHID.dxf	*11/29/2012*	*5,893 KB*	*Hutchinson Irrigation District*
AllHoneywell.dxf	*11/29/2012*	*8,630 KB*	*Honeywell*
AllIrvin.dxf	*2/28/2013*	*7,423 KB*	*Irvin Water District*
AllKaiserT.dxf	*12/6/2012*	*4,277 KB*	*Kaiser Trentwood*
AllLibertyLake.dxf	*4/2/2013*	*10,077 KB*	*Liberty Lake Sewer and Water District*
AllMillwood.dxf	*11/30/2012*	*9,249 KB*	*City of Millwood*
AllMoab.dxf	*11/30/2012*	*3,438 KB*	*Moab Irrigation District*
AllModel.dxf	*11/30/2012*	*13,403 KB*	*Model Irrigation District*
AllModernWaterEL.dxf	*4/25/2014*	*18,760 KB*	*Modern Electric and Water Co.*
AllMtStMich.dxf	*11/8/2012*	*1,786 KB*	*Mount Saint Michaels*
AllNSID.dxf	*11/8/2012*	*5,362 KB*	*North Spokane Irrigation District*
AllOID.dxf	*11/30/2012*	*5,591 KB*	*Orchard Avenue Irrigation District*
AllPasadena.dxf	*12/5/2012*	*8,759 KB*	*Pasadena Park Irrigation District*
AllPinecroft.dxf	*11/30/2012*	*2,954 KB*	*Pinecroft MHP*
AllPioneer.dxf	*11/30/2012*	*2,888 KB*	*Pioneer Water Company*
AllRivervale.dxf	*11/21/2012*	*3,385 KB*	*River Vale Water Association*
AllSIP.dxf	*11/30/2012*	*11,012 KB*	*Spokane Business and Industrial Park*
*AllSpokane.dxf***	*4/2/2013*	*22,127 KB*	*City of Spokane*
AllStevensCoPUD	*8/13/2013*	*2,205KB*	*Stevens County PUD*
AllTID.dxf	*11/30/2012*	*15,267 KB*	*Trentwood Irrigation District*
AllTimberline.dxf	*11/30/2012*	*3,611 KB*	*Timberline MHP*
AllVera.dxf	*3/1/2013*	*44,292 KB*	*Vera Water and Power*
AllWD3.dxf	*1/24/2013*	*36,070 KB*	*Spokane County Water District 3*
AllWWD.dxf	*11/28/2012*	*22,987 KB*	*Whitworth Water District*
AllWWU.dxf	*11/28/2012*	*5,358 KB*	*Whitworth University*

***The City of Spokane is in the process of developing a new well. When the relevant information is available this well will be added to the above file and the file date and size adjusted.*

B. Recognized model software and input files used to derive the recommended regulated special wellhead protection areas.

1) Microfem model version 4.10.62;
copyright 1997..2012 C.J.Hemker and R.G. deBoer
(Dr. C.J. Hemker, Amsterdam, The Netherlands; microfem.com)

Input files – All below file names should be preceeded with: "SVRP_Wellhead_"

a. Average conditions model

AverageConditionsvF.feb	04/24/2014	424	Batch file
AverageConditionsvF.fem	04/24/2014	6,042,741	Model file
AverageConditionsvF.fpr	04/24/2014	674	Project file
AverageConditionsvF.lb2	04/24/2014	101,295	Label file
AverageConditionsvF.lb3	04/24/2014	89,763	Label file
AverageConditionsvF.lb4	04/24/2014	167,632	Label file
AverageConditionsvF.lb5	04/24/2014	96,834	Label file
AverageConditionsvF.ppn	04/24/2014	443,795	Precipitation
AverageConditionsvF.sto	04/24/2014	357,665	Storativity
AverageConditionsvF.thi	04/24/2014	1,501,817	Thickness
AverageConditionsvF.wc1	04/24/2014	139,612	Riverbed resistance
AverageConditionsvF.wh1	04/24/2014	139,420	River top
AverageConditionsvF.wl1	04/24/2014	138,909	River bottom
AverageConditionsvF.xtr	04/24/2014	14,452,927	Data

b. Wells at maximum, average tributaries & river

MaxPump_MeanRivTribvF.fem	04/24/2014	6,042,313	Model file
MaxPump_MeanRivTribvF.fpr	04/24/2014	595	Project file
MaxPump_MeanRivTribvF.lb2	04/24/2014	101,294	Label file
MaxPump_MeanRivTribvF.lb3	04/24/2014	89,763	Label file
MaxPump_MeanRivTribvF.lb4	04/24/2014	167,632	Label file
MaxPump_MeanRivTribvF.lb5	04/24/2014	96,834	Label file
MaxPump_MeanRivTribvF.ppn	04/24/2014	443,795	Precipitation
MaxPump_MeanRivTribvF.thi	04/24/2014	1,501,817	Thickness
MaxPump_MeanRivTribvF.wc1	04/24/2014	139,612	Riverbed resistance
MaxPump_MeanRivTribvF.wh1	04/24/2014	139,420	River top
MaxPump_MeanRivTribvF.wl1	04/24/2014	138,909	River bottom
MaxPump_MeanRivTribvF.xtr	04/24/2014	14,452,900	Data

c. Wells at maximum, minimum tributaries & river

MaxPump_MinRivTribvF.fem	04/24/2014	6,041,870	Model file
MaxPump_MinRivTribvF.fpr	04/24/2014	584	Project file
MaxPump_MinRivTribvF.lb2	04/24/2014	101,294	Label file
MaxPump_MinRivTribvF.lb3	04/24/2014	89,763	Label file
MaxPump_MinRivTribvF.lb4	04/24/2014	167,632	Label file
MaxPump_MinRivTribvF.lb5	04/24/2014	96,834	Label file
MaxPump_MinRivTribvF.ppn	04/24/2014	443,795	Precipitation
MaxPump_MinRivTribvF.thi	04/24/2014	1,501,817	Thickness
MaxPump_MinRivTribvF.wc1	04/24/2014	139,612	Riverbed resistance
MaxPump_MinRivTribvF.wh1	04/24/2014	139,092	River top
MaxPump_MinRivTribvF.wl1	04/24/2014	138,909	River bottom
MaxPump_MinRivTribvF.xtr	04/24/2014	14,452,927	Data

d. Other wells average, tributaries & river maximum

MeanPump_MaxRivTribvF.fem	04/24/2014	6,024,335	Model file
MeanPump_MaxRivTribvF.fpr	04/24/2014	606	Project file
MeanPump_MaxRivTribvF.lb2	04/24/2014	101,294	Label file
MeanPump_MaxRivTribvF.lb3	04/24/2014	89,763	Label file
MeanPump_MaxRivTribvF.lb4	04/24/2014	167,632	Label file
MeanPump_MaxRivTribvF.lb5	04/24/2014	96,834	Label file
MeanPump_MaxRivTribvF.ppn	04/24/2014	443,795	Precipitation
MeanPump_MaxRivTribvF.thi	04/24/2014	1,501,817	Thickness
MeanPump_MaxRivTribvF.wc1	04/24/2014	139,612	Riverbed resistance
MeanPump_MaxRivTribvF.wh1	04/24/2014	139,306	River top
MeanPump_MaxRivTribvF.wl1	04/24/2014	138,909	River bottom
MeanPump_MaxRivTribvF.xtr	04/24/2014	14,452,900	Data

e. Display only model – surface elevations

DisplayAveCondvF.fem	04/24/2014	6,350,454	Model file
DisplayAveCondvF.fpr	04/24/2014	588	Project file
DisplayAveCondvF.lb2	04/24/2014	101,294	Label file
DisplayAveCondvF.lb3	04/24/2014	89,763	Label file
DisplayAveCondvF.lb4	04/24/2014	167,632	Label file
DisplayAveCondvF.lb5	04/24/2014	96,834	Label file
DisplayAveCondvF.ppn	04/24/2014	443,795	Precipitation
DisplayAveCondvF.sto	04/24/2014	357,665	Storativity
DisplayAveCondvF.thi	04/24/2014	1,501,817	Thickness

DisplayAveCondvF.wc1	04/24/2014	139,612	Riverbed resistance
DisplayAveCondvF.wh1	04/24/2014	139,420	River top
DisplayAveCondvF.wl1	04/24/2014	138,909	River bottom
DisplayAveCondvF.xtr	04/24/2014	14,452,924	Data

2) Water system and well information used in the modeling is summarized in the EXCEL spreadsheet:
"Water System and Well Summary sheetv3.xlsx"

C. The model has been prepared by a licensed hydrologist, John Porcello, and its appropriate use documented. It is recommended that the model use be as broad as possible regionally. This will help inform folks of the current level of understanding of how the aquifer works and will facilitate model improvements going forward.

1) The input files will be shared with the local and state agencies and with the water purveyors whose wellhead protection areas have been derived from its use.
2) Until an alternative arrangement is agreed upon, the official wellhead protection model input files will reside jointly between the City of Spokane and the SAJB.
3) It should be recognized that the model input files and the base model itself will have to change over time. Further with multiple users it is recognized that model output differences will show up. Where these differences are considered significant by either a purveyor or land use regulator the "correct" answer will have to be determined by a State certified hydro-geologist.
4) Some changes have already been made in the model since it was transferred to Environmental Programs from GSI. These changes and the reason for same are documented in an Excel workbook titled "Changes to Base model Tracking sheetv4.xlsx".

D. References for the methods used to derive the recommended Special Wellhead Protection Areas

1) GSI Water Solutions Inc. Technical memorandum by John Porcello—
Attachment 1: Recommended Modeling Procedure for SWPA Delineation

Using the City/SAJB Models of the SVRP Aquifer, dated 24 September 2012.

2) City of Spokane Environmental Programs memorandum by Doug Greenlund -- *Detailed Directions for Special Wellhead Protection Area Technical Definition*, dated 7 August 2013.

E. Transient modeling of regional stormwater facilities

1) GSI Water Solutions Inc. provided methods and directions for running stormwater input impact evaluations using the steady state model (stormwater input is modeled as continuous), and using two linked steady state models, one with stormwater being inputted and the second without. A third option of running the model in full transient mode was discussed but considered outside the contract scope.

2) Stormwater utility staff raised concerns that a steady state representation of stormwater input was far from representative of what happens in the real world. As a consequence of this concern City of Spokane Environmental Program staff set about running the model in transient mode to evaluate several scenarios. The procedure and example input files are briefly outlined in "*Potential Transient method for Regional Facility Evaluation.pdf*". This model use and transient method have not been validated by a licensed hydro-geologist at this time.

Transient model files

StoreAvgCondvF.Feb	04/24/2014	424	Batch file
StoreAvgCondvF.fem	04/24/2014	6,042,554	Model file
StoreAvgCondvF.fpr	04/24/2014	609	Project file
StoreAvgCondvF.lb2	04/24/2014	101,459	Label file
StoreAvgCondvF.lb3	04/24/2014	89,763	Label file
StoreAvgCondvF.lb4	04/24/2014	167,632	Label file
StoreAvgCondvF.lb5	04/24/2014	96,834	Label file
StoreAvgCondvF.ppn	04/24/2014	443,795	Precipitation
StoreAvgCondvF.sto	04/24/2014	850,189	Storativity
StoreAvgCondvF.thi	04/24/2014	1,501,817	Thickness
StoreAvgCondvF.wc1	04/24/2014	139,612	Riverbed resistance
StoreAvgCondvF.wh1	04/24/2014	139,420	River top
StoreAvgCondvF.wl1	04/24/2014	138,909	River bottom
StoreAvgCondvF.xtr	04/24/2014	14,727,483	Data

Appendix 2 – Aquifer Contamination Incidents

FacilitySite Id	CleanupSiteName	Address	City	SiteStatus	State Ranking
3	CDC Mead LLC	2111 E HAWTHORNE RD	MEAD	Cleanup Started	0
630	General Electric Co	4323 E MISSION AVE	SPOKANE	Construction Complete-Performance Monitoring	0
631	Greenacres Landfill	308 N HENRY ROAD	LIBERTY LAKE	Construction Complete-Performance Monitoring	0
667	North Market St	N MARKET ST & FREYA ST	SPOKANE	Construction Complete-Performance Monitoring	0
111	Northside Landfill	7202 N NINE MILE RD	SPOKANE	Cleanup Started	0
52126416	HOLCIM INC	12207 E EMPIRE AVE	SPOKANE VALLEY	Cleanup Started	1
627	Aluminum Recycling Corp	3412 E WELLESLEY	SPOKANE	Construction Complete-Performance Monitoring	2
28314355	Appleway Chevrolet Inc	8500 E SPRAGUE AVE	SPOKANE VALLEY	Cleanup Started	2
650	City Parcel	708 N COOK ST	SPOKANE	Cleanup Started	2
53481373	Kaiser Aluminum & Chemical Corporation	15000 E EUCLID AVE	SPOKANE	Cleanup Started	2
738	SPOKANE CO WATER DIST 3	11600 N MARKET	MEAD	Awaiting Cleanup	2
629	ARGONNE ROAD	N 6018 ARGONNE RD	SPOKANE VALLEY	Cleanup Started	3
638	BJ CARNEY & Co	1102 N HOWE RD	SPOKANE	Cleanup Started	3
737	BNRR TAYLOR EDWARDS A	CINCINNATI & TRENT	SPOKANE	Cleanup Started	3
676	BNSF PARKWATER RAILYARD	PARKWATER	SPOKANE	Cleanup Started	3
84461527	HAMILTON STREET BRIDGE SITE	111 N ERIE ST	SPOKANE	Construction Complete-Performance Monitoring	3
674	SPOKANE FIRE DEPT TRAINING FAC	REBECCA & MISSION	SPOKANE	Cleanup Started	3
654	US DOE BPA Bell Maintenance HQ	2400 E HAWTHORNE RD	MEAD	Awaiting Cleanup	3
744	A to Z Rental	8000 N MARKET ST	SPOKANE	Cleanup Started	
4354868	BESTWAY MOTOR FREIGHT	822 E PACIFIC AVE	SPOKANE	Cleanup Started	

CITY OF SPOKANE ENVIRONMENTAL PROGRAMS
Dave Mandyke, Director –Utilities Division
Lloyd Brewer, Environmental Programs Manager

MEMORANDUM

19 September 2011

To: Wellhead Policy Coordinating Committee
File
Fr: Lloyd Brewer, Environmental Programs Manager LAB
Cc: Frank Triplett, Chris Peterschmidt, Dave Mandyke, Gerry Gemmill

Re: List of Relatively High Risk Business Activities

About half of the List of Relatively High Risk Business Activities currently under consideration originated in the first Wellhead Protection Policy Coordinating Committee. The original list from that process is documented in the City of Spokane's Wellhead Protection Program Phase II, (2000, section 4.6.2) and in the SAJB Wellhead Protection Plan (2001, section 8.7.2). The original list was brought forward by Stan Miller, then Spokane County's Spokane Aquifer Water Quality Program Manager and a Wellhead Protection Policy Coordinating Committee member. In his position Stan had significant knowledge of the contaminant sources which had already caused contamination of the Aquifer. In addition, he had years of experience working with EPA on the Sole Source Aquifer program.

The original list was further modified in 2007 as it was brought to, and considered by, the Spokane Aquifer Joint Board for inclusion in their Wellhead Protection recommendations. The list currently under consideration with the names and dates of those contributing changes is attached as Table 1. The list was nearly doubled near the end of the SAJB process when Martin Palaniuk, a City of Spokane Planning Intern, came across an EPA reference with double the number of business types considered potentially risky as compared to the first list. Martin was working on the Critical Aquifer Recharge portion of the City's Comprehensive Plan at the time.

Finally in our current process we have heard recommendations for highways and railroads to be considered as well. These were considered by the first Wellhead Protection Policy Coordinating Committee, the Wellhead Protection Citizen's Advisory Committee, and resulting Focus Groups.

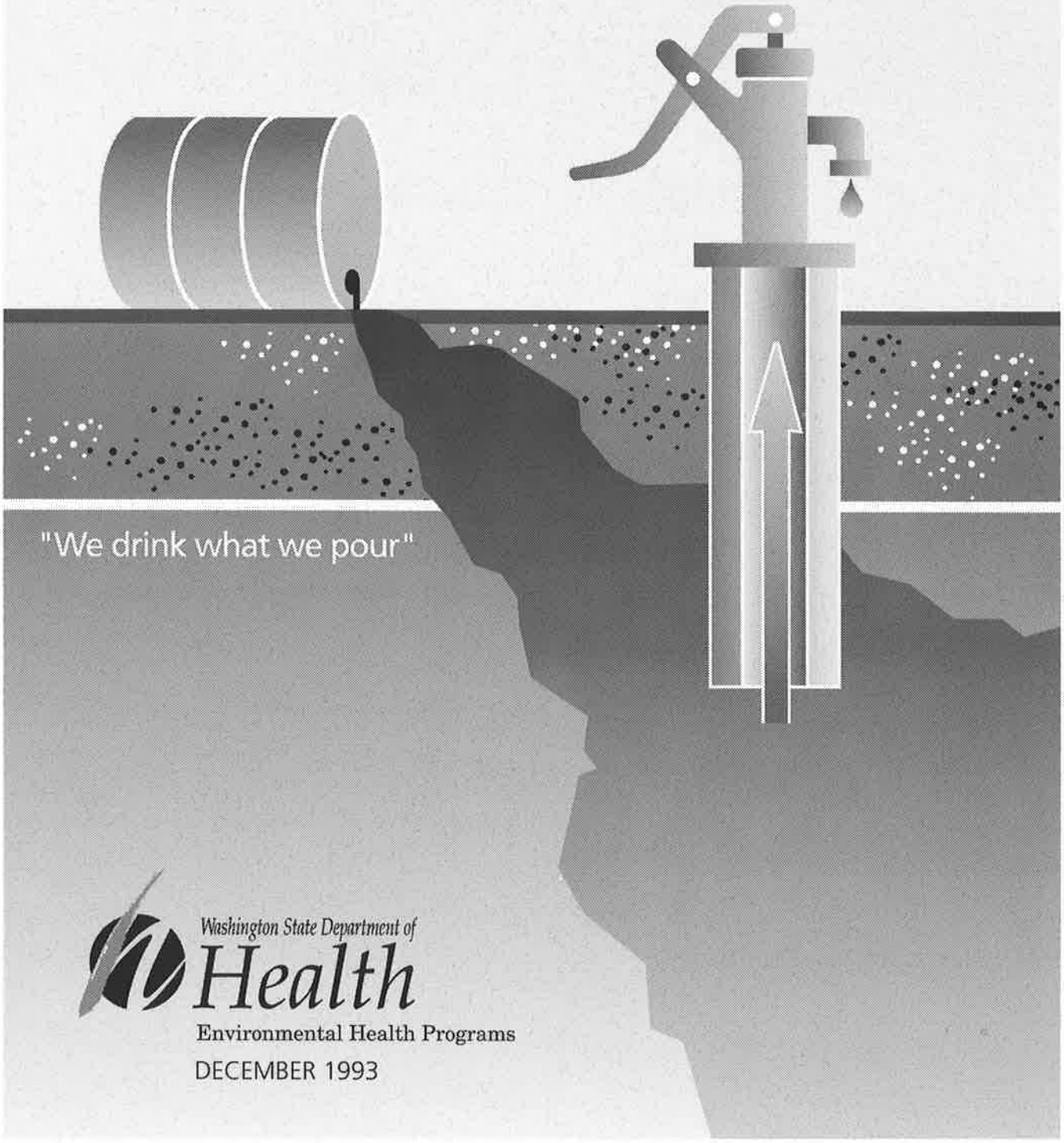
I am attaching three pages from the Washington State Department of Health Guidance on Wellhead Protection (Dec 1993; Inventory of Potential Contaminant Sources in Washington's Wellhead Protection Areas; pages 4, 5, & 10) whose contents originated with EPA. As you will see, the whole list we currently have before us is included in the WA-DOH / EPA listing.

TABLE 1:

Stan 2/00		Chemical/Agricultural Chemical Warehousing
Stan 2/00		Composite ("fiberglass") Products Manufacturing
Stan 2/00		Dry Cleaning (performed on location)
Stan 2/00		Electronics Manufacturing
Stan 2/00		Electroplating
Stan 2/00		Engine & Vehicle Repair/Service/Salvage
Stan 2/00		Metal Fabrication
Stan 2/00		Paint Manufacturing and Wholesale Storage
Stan 2/00	Lloyd 2/07	Petroleum Bulk Storage & Transmission
Stan 2/00		Printing and Lithography
Lloyd 2/07	SAJB 4/07	Wastewater Bulk Storage, Treatment & Pumping Facilities
SAJB 6/07		Mining/Sand & Gravel Extraction
Martin 9/07		Animal Feedlots
Martin 9/07		Bio-Research Facilities
Martin 9/07		Furniture Stripping
Martin 9/07		Junk Yards
Martin 9/07		Oil & Gas Drilling
Martin 9/07		Photo Processing
Martin 9/07		Solid Waste Handling & Recycling Facilities
Martin 9/07		Vehicle Washing
Martin 9/07		Wood Treatment Facilities
Bruce 7/11		Freeways & major Highways
Bruce 7/11		Railroad lines

Stan	Stan Miller, former Spokane County Water Quality Management Program Lead
Lloyd	Lloyd Brewer, City of Spokane Environmental Programs Manager
Martin	Martin Palaniuk, former City of Spokane Planning Intern, currently City of Spokane Valley Planner
Bruce	Bruce Rawls, Spokane County Director of Utilities

Inventory of Potential Contaminant Sources in Washington's Wellhead Protection Areas



Washington State Department of Health
Environmental Health Programs
DECEMBER 1993

Table 1. Potential Contaminant Sources Listed by Type

CATEGORY I—Sources designed to discharge substances

Subsurface percolation (e.g., septic tanks and cesspools)
Injection Wells
- Hazardous waste
- Non-hazardous waste (e.g., brine disposal and drainage)
- Non-waste (e.g., enhanced recovery, artificial recharge solution mining, and in-situ mining)

Land application
- Waste water (e.g., spray irrigation)
- Wastewater byproducts (e.g., sludge)
- Hazardous waste
- Non-hazardous waste

CATEGORY II—Sources designed to store, treat, and/or dispose of substances; discharge through unplanned release

Landfills
- Industrial hazardous waste
- Industrial non-hazardous waste
- Municipal sanitary

Open dumps, including illegal dumping (waste)
Residential (or local) disposal (waste)
Surface impoundments
- Hazardous waste
- Non hazardous waste

Waste tailings
Waste piles
- Hazardous waste
- Non hazardous waste

Materials stockpiles (non-waste)
Graveyards
Animal burial
Aboveground storage tanks
- Hazardous waste
- Non-hazardous waste
- Non-waste

Underground storage tanks
- Hazardous waste
- Non-hazardous waste
- Non-waste

Containers
- Hazardous waste
- Non-hazardous waste
- Non-waste

Open burning sites
Detonation sites
Radioactive disposal sites

CATEGORY III—Sources designed to retain substances during transport or transmission

Pipelines
- Hazardous waste
- Non-hazardous waste
- Non-waste

Materials transport and transfer operations
- Hazardous waste
- Non-hazardous waste
- Non-waste

CATEGORY IV—Sources discharging substances as a consequence of other planned activities

Irrigation practices (e.g., return flow)
Pesticide applications
Fertilizer applications
Animal feeding operations
De-icing salts applications
Urban run-off
Percolation of atmospheric pollutants
Mining and mine drainage
- Surface mine-related
- Underground mine-related

CATEGORY V—Sources providing conduit or inducing discharge through altered flow patterns

Production wells
- Oil (and gas) wells
- Geothermal and heat recovery wells
- Water supply wells

Other wells (non-waste)
- Monitoring wells
- Exploration wells

Construction excavation

CATEGORY VI—Naturally occurring sources whose discharge is created and/or exacerbated by human activity

Ground water- surface water interactions
Natural leaching
Saltwater intrusion/brackish water upconing (or intrusion of other poor-quality natural water)

Source: United States Environmental Protection Agency. 1989. *Wellhead Protection Programs: Tools for Local Governments.* EPA 440/6-89-002

Table 2. Potential Contaminant Sources Listed Alphabetically

Agricultural

Animal burial areas
Animal feedlots
Chemical application
(e.g., pesticides, fungicides, and fertilizers)
Chemical storage areas
Irrigation
Manure spreading and pits

Commercial

Airports
Auto repair shops
Boat yards
Construction areas
Car washes
Cemeteries
Dry cleaning establishments
Educational institutions (e.g., labs, lawns, and chemical storage areas)
Gas stations
Golf courses (chemical application)
Jewelry and metal plating
Laundromats
Medical institutions
Paint shops
Photography establishments/printers
Railroad tracks and yards/maintenance
Research laboratories
Road deicing operations (e.g., road salt)
Road maintenance depots
Scrap and junkyards
Storage tanks and pipes (above-ground, below-ground, underground)

Industrial

Asphalt plants
Chemical manufacture, warehousing, and distribution activities
Electrical and electronic products and manufacturing
Electroplaters and metal fabricators
Foundaries
Machine and metalworking shops
Manufacturing and distribution sites for cleaning supplies
Mining (surface and underground) and mine drainage
Petroleum products production, storage, and distribution centers
Pipelines (e.g., oil, gas, coal slurry)
Septage lagoons and sludge
Storage tanks (above-ground, below-ground, underground)
Toxic and hazardous spills
Wells - operating and abandoned
(e.g., oil, gas, water supply, injection, monitoring (and exploration)
Wood preserving facilities

Residential

Fuel storage systems
Furniture and wood strippers and refinishers
Household hazardous products
Household lawns (chemical application)
Septic systems, cesspools, water softeners
Sewer lines
Swimming pools (e.g. chlorine)

Waste Management

Fire training facilities
Hazardous waste management units (e.g., landfills, land treatment areas, surface impoundments, waste piles, incinerators, treatment tanks)
Municipal incinerators
Municipal landfills
Municipal wastewater and sewer lines
Open burning sites
Recycling and reduction facilities
Stormwater drains, retention basins, transfer stations

Source: United States Environmental Protection Agency. 1989. *Wellhead Protection Programs: Tools for Local Governments.* EPA 440/6-89-002

Table 3. Quantities and Types of Chemicals Typically Used, Stored or Transferred by Land Use Activities

Large Amounts of Chemicals

Industrial Activities Chemical manufacturing; electronics; petroleum refining and storage; metal treating; food processing; wood and pulp processing; textile manufacturing; warehousing	**Chemical Categories** Metals and a variety of synthetic organic compounds including petroleum based hydrocarbons, solvents, degreasers, and pesticides
Commercial Activities Gas stations; furniture strippers; drum cleaning	Petroleum products; other synthetic organic compounds*

Moderate Amounts of Chemicals

Commercial Activities Dry cleaners; junk yards; auto repair and body shops; pest controllers; photographic processing; machine shops; auto parts stores; lawn and garden/farm stores; paint stores; hardware stores; medical facilities	**Chemical Categories** Metals; nutrients; fertilizers; pesticides; petroleum products; other synthetic organic compounds*
Agricultural Activities High intensity agricultural operations (fruits and vegetables); concentrated animal operations (feedlots, dairies, poultry)	Nitrates and other nutrients; fertilizers; pesticides
Residential Activities Urban housing; high density using septic systems, urban gardening	Nitrates and other nutrients; fertilizers; pesticides; petroleum products; other synthetic organic compounds*

Small Amounts of Chemicals

Commercial Activities Grocery stores; department stores; office buildings; laundromats; food service; shoe repair; barber and beauty shops	**Chemical Categories** Petroleum products and other synthetic organic compounds*
Agricultural Activities Low chemical use agriculture (forage crops)	Nitrates
Residential Activities Moderate and low density, septic systems, urban gardening	Nitrates and other nutrients; fertilizers; petroleum products; pesticides; and other synthetic organic compounds*

* Synthetic organic compounds include volatile, semi-volatile and non-volatile compounds. In general they include the following: solvents; degreasers; plasticizers; petroleum based hydrocarbons and by-products; other industrial chemicals; and pesticides (herbicides, fungicides, rodenticides, and insecticides).

Adapted from: United States Environmental Protection Agency. 1991. *Guide For Conducting Contaminant Source Inventories For Public Drinking Water Supplies. EPA 570/9-91-014.*

Appendix 4 Wellhead Protection Policy Coordinating Committee Attendees

Name	Organization
Lloyd Brewer	City of Spokane
Doug Greenlund	City of Spokane
Henry Allen	City of Spokane Valley
Ty Wick	SAJB
Rob Lindsey	Spokane County
Bill Rickard	City of Spokane
Matt Zarecor	Spokane County
Tonilee Hanson	SAJB
Jeremy Jenkins	Liberty Lake Sewer and Water District
Lynn Schmidt	City of Spokane
Tom Richardson	City of Millwood
Gloria Mantz	City of Spokane Valley
Steve Holderby	Spokane Regional Health District
Lori Barlow	City of Spokane Valley
Jim Lahde	Model Irrigation District
Rob Lindsay	Spokane County
Karen Kendall	City of Spokane Valley
Art Jenkins	City of Spokane Valley
Bill Shelton	Fairchild Air Force Base
John Porcello	GSI Water Solutions Inc.
Matt Kohlbecker	GSI Water Solutions Inc.
Tirrell Black	City of Spokane
Lee Mellish	Liberty Lake Sewer and Water
Bruce Rawls	Spokane County Utilities
Mike Taylor	City of Spokane
Ben Brattebo	Spokane County
Erin Casci	SAJB
Heather Cannon	Washington State Department of Health
Dorothy Tibbetts	Washington State Department of Health
Dave Johnson	Spokane County Conservancy Board
Scott Kuhta	City of Spokane Valley
Jim Falk	Spokane County
Chris Green	City of Spokane
Mary Kate McGee	City of Spokane Valley
Mike Hermanson	Spokane County
Amanda Tainio	City of Liberty Lake
Ed Perry	Washington State Department of Health
David Luders	Fairchild Air Force Base

Map 1
Proposed Regulated Special Wellhead Protection Areas over SVRP Aquifer

Printed by: dgreenlund Print date: 4/29/2014

Legend

- Carnhope Irrigation District
- City of Millwood
- City of Spokane
- Consolidated Irrigation District
- East Spokane Water District
- Honeywell
- Hutchinson Irrigation District
- Irvin Water District
- Kaiser Trentwood
- Liberty Lake Sewer and Water District
- Moab Irrigation District
- Model Irrigation District
- Modern Electric and Water Co
- Non SAJB
- North Spokane Irrigation District
- Orchard Ave Irrigation District
- Pasadena Park Irrigation District
- Spokane Business and Industrial Park
- Spokane County Water District 3
- Stevens County PUD
- Trentwood Irrigation District
- Vera Water and Power
- Whitworth Water District

0 7,700 15,400 23,100
Feet

Geographic Information System

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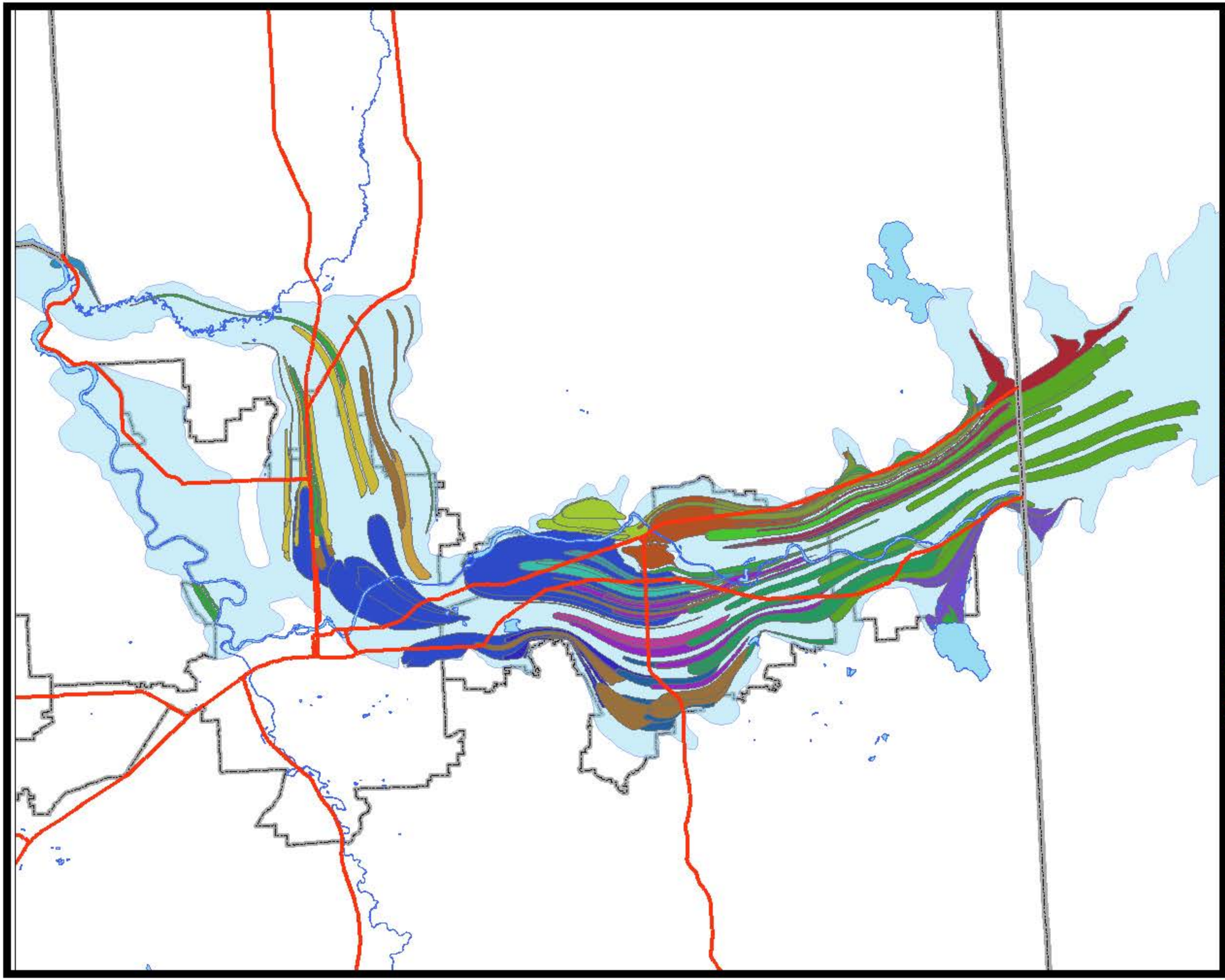
CITY OF SPOKANE

THIS IS NOT A LEGAL DOCUMENT.
The information shown on this map is compiled from various sources and is subject to constant revision. Information shown on this map should not be used to determine the location of facilities in relationship to property lines, section lines, streets, etc.



Map 2

2 Year Time of Travel Wellhead Protection Areas

Printed by: dgreenlund Print date: 4/29/2014

Legend

WaterSystem

- Carnhope Irrigation District
- City of Millwood
- City of Spokane
- Consolidated Irrigation District
- East Spokane Water District
- Honeywell
- Hutchinson Irrigation District
- Irvin Water District
- Kaiser Trentwood
- Liberty Lake Sewer and Water District
- Moab Irrigation District
- Model Irrigation District
- Modern Electric and Water Co
- Non SAJB
- North Spokane Irrigation District
- Orchard Ave Irrigation District
- Pasadena Park Irrigation District
- Spokane Business and Industrial Park
- Spokane County Water District 3
- Stevens Co. PUD
- Trentwood Irrigation District
- Vera Water and Power
- Whitworth Water District

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Feet

Geographic Information System

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CITY OF SPOKANE

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