Town of Coupeville Water Reuse Feasibility Assessment

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Town of Coupeville, Washington

Town of Coupeville Water Reuse
February 2026

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Executive Summary

Introduction

The Town of Coupeville, Washington (Town) updated its 2010 reclaimed water feasibility assessment to introduce new alternatives for water reuse. The goal of this update is to obtain approval from the Washington State Department of Ecology (Ecology) and Washington State Department of Health (DOH) to reuse Class B effluent from the Town's wastewater treatment plant (WWTP) and reduce or even eliminate effluent discharge to Penn Cove. Penn Cove is a 303(d)-listed impaired water body not fully supporting designated uses and a shellfish aquiculture zone. The Penn Cove shoreline in Coupeville is closed to harvesting of shellfish. Reuse of effluent for irrigation rather than cove outfall discharge could help remove Penn Cove from the 303(d) listing.

At the time of the 2010 feasibility assessment, the recommendations were cost prohibitive and implementation was not feasible. However, new conditions exist that make reuse more feasible now than in 2010, including the potential to reuse existing infrastructure and derive increased benefit from expanded irrigation and shellfish harvesting opportunities. Existing abandoned potable water system pipelines could be used to deliver treated reuse water from the WWTP to Well 6 near the high school. Alternative 1 allows farmers to connect to the reuse water supply near the high school for direct reuse in the summer. Alternative 1 would continue to discharge water to Penn Cove in the winter.

Alternative 2A identifies that, as an expansion of Reuse Alternative 1, water produced in the winter could be stored in the saline Well 6 aquifer by injecting the water into the well, storing it as a reuse water bubble in the saline aquifer, and pumping it back out for summer irrigation. Well 6 is an abandoned municipal well 520 feet deep in a saline aquifer that is not suitable for potable water production. The saline aquifer is the deepest of five known aquifers. Only one other well is in this aquifer, and it is also not in use. This method of reuse is referred to as aquifer storage and recovery or ASR. Peak flows at the WWTP would continue to be treated and discharged to Penn Cove during large storm events.

Alternative 2B is the same as Alternative 2A except that additional conveyance capacity would be added to capture and reuse all flows and eliminate the WWTP outfall to Penn Cove. This alternative would make additional water available for irrigation and could help to restore shellfish harvest in the currently closed or conditionally approved areas near Coupeville. Increasing the harvestable acreage of shellfish is a goal of reuse at Coupeville.

Alternative 3A upgrades the WWTP to produce Class A reuse water (the highest quality) in addition to either Alternative 1 or 2A. Alternative 3B would increase the capacity of the reuse system to use ASR for all WWTP flows and discontinue use of the Penn Cove outfall, similar to 2B but with Class A reuse water.

Jacobs conducted a feasibility assessment on behalf of the Town to evaluate existing conditions, determine potential upgrades and costs, and provide recommendations to the Town for water reuse and ASR alternatives.

In Ecology's review dated August 26, 2025, they supported the Town's potential implementation of Alternative 1 to minimize or eliminate summer discharge with the incorporation of minor WWTP upgrades. The objective was to make the treatment plant more reliable at providing Class B effluent water for irrigation. Ecology indicated that Alternative 2 would require significant testing and monitoring of the saline aquifer to satisfy the groundwater protection rules and observed that winter discharge to Penn Cove has less risk of impact than summer discharge. Adoption of Alternative 3 to produce Class A water was not viewed by Ecology as a Town requirement and is not cost effective. Grant funding for Puget Sound nutrient discharge reduction may be available this year and next to support minor WWTP upgrades and reuse.

The DOH review of the draft report on November 25, 2025, identified that the report should add an alternative to support reopening shellfish areas, which is a goal of the project. Sub-alternatives 2B and 3B were added to address improving conditions for shellfish harvest by providing a reliable alternative to discharge from the outfall of all flows including peak flows. An economic analysis of the commercial and recreational shellfish harvest value of increased areas will be included in the engineering analysis of reuse, which is the next phase of study.

The recommendation of this feasibility assessment is to implement Reuse Alternative 1, the lowest-cost alternative, and pursue grant funding to support permitting, final design, and construction. Alternative 2B is significantly more expensive than Alternative 1 but has the added benefit of removing the WWTP discharge to Penn Cove, which could help to reduce the area of shellfish harvest closures and is the recommended alternative if enough grant funding is available to implement it.

Regulatory Framework

The Reclaimed Water Use Act considers reclaimed water to be a water supply produced for beneficial use(s) outlined in the law and expanded upon in the Act. This updated feasibility assessment complies with the requirements in Washington Administrative Code 173-219-180, "Feasibility Analysis."

ASR wells are regulated through the U.S. Environmental Protection Agency's underground injection control program. The State of Washington administers the program for the State through Ecology. The water injected into the aquifer must comply with the State's groundwater regulations, which include an antidegradation policy. The antidegradation policy states that water injected into the aquifer must be of a quality such that the existing groundwater is not degraded, which means that no water quality constituent in the injected water can exceed that of the existing groundwater. An exception to this policy can be made if:

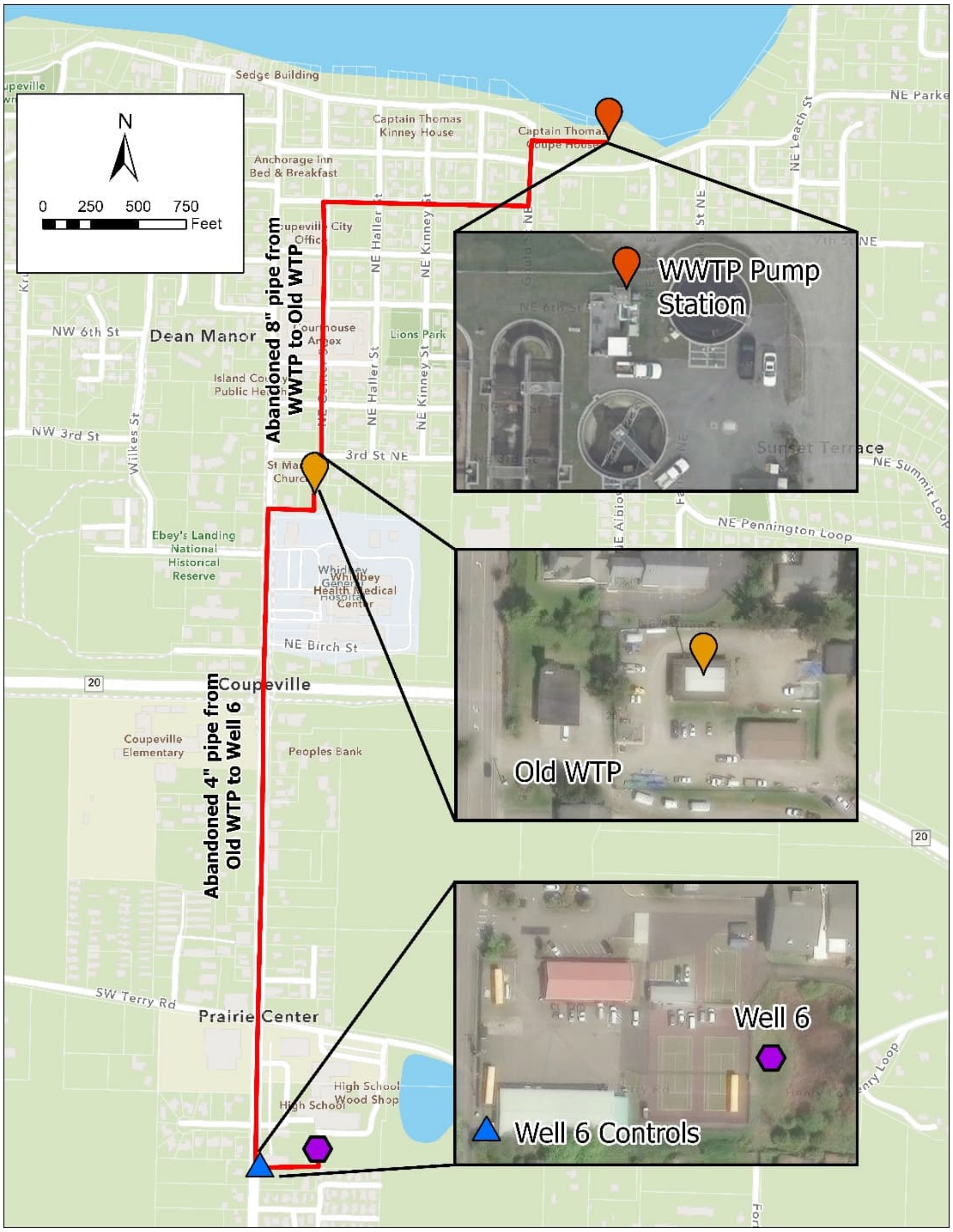
- An overriding consideration of the public interest will be served.
- All contaminants proposed for entry into said groundwaters will be provided with all known, available, and reasonable treatment (AKART) methods of prevention and control prior to entry.

This feasibility assessment is requesting an overriding consideration of the public interest for the use of ASR to store reuse water in a deep saline aquifer and later recover it for irrigation. The contaminants in the proposed reuse water meet the criteria of the current discharge permit and the WWTP is implementing the recommendations of an AKART analysis provided in the Jacobs 2023 *Coupeville Wastewater Treatment Plant All Known, Available, and Reasonable Treatment Analysis* to improve effluent quality. ASR will allow the Town to reduce or completely eliminate discharge to Penn Cove, a scenario that benefits the environment and the community. Eliminating the discharge to Penn Cove will help to improve conditions for shellfish and could result in reducing or removing the restrictions to shellfish harvest in the Coupeville area. It is in the overriding public interest of the citizens of the community and the surrounding rural area to protect human health and restore the full health of Penn Cove.

Alternatives

Three reuse alternatives and two sub-alternatives were evaluated. The alternatives propose reuse with low initial capital and operation and maintenance (O&M) costs and a system that can be expanded as more funding becomes available. All three alternatives and both sub-alternatives make use of the existing infrastructure shown on Figure ES-1. Alternative 1 is the lowest cost and Alternative 3B is the highest cost.

Figure ES-1. Key Locations for Reuse Upgrades



Alternative 1

Alternative 1 provides Class B reuse water for irrigation during the summer with continued discharge of WWTP effluent to Penn Cove in the winter when agricultural irrigation demand is low. Alternative 1 will require implementation of the AKART analysis recommendations provided in the Jacobs 2023 *Coupeville Wastewater Treatment Plant All Known, Available, and Reasonable Treatment Analysis* to consistently produce Class B effluent. Alternative 1 will also require system improvements and modification of existing infrastructure. Two new pumps will be added to the existing outfall pump station at the WWTP to lift effluent about 150 feet to the high point of the Town at the old water treatment plant (WTP) and public works shops near the hospital. From the old WTP, water could gravity flow to Well 6 near the high school.

The existing, abandoned 8-inch polyvinyl chloride (PVC) pipe from the WWTP to the old WTP could be tested and reused for the proposed reclaimed water system. The PVC pipe was originally installed as the drainpipe for flushing the water tank in the basement of the old WTP when the tank was offline and cleaned. The pipe was abandoned in place but is expected to be useable. Evaluation of this pipe should be part of the reuse system design.

In addition to the abandoned PVC pipe, there is an abandoned 4-inch steel pipe from the old sewer lift station to North Main Street near the WTP. This pipe was also abandoned in place and is expected to be useable. This 4-inch pipe was a pressure mainline near the well to the old WTP and does not connect to homes or potable water users.

To start reuse as soon as possible and for the lowest cost, it is recommended that farmers connect their irrigation water pipe to the effluent pipe near Well 6 to extract water from the pipeline before Well 6 is permitted for ASR. Even if ASR were to be available, the farmers will need to connect to the Town reuse pipeline to access summer reuse water that is directly available from the pipeline before it is recharged, and access the stored winter water that is extracted from the well when it is needed in the summer. The benefit to farmers of connecting directly to the pipeline would be that the water could gravity flow to most farms in the prairie from Well 6 with gravity pressure from the WTP. Connecting directly to the pipeline could also reduce the amount of water that farmers currently pump from shallower potable groundwater. Each farm connection would require a backflow preventor to isolate the farms from each other and from the well. Water would only travel in one direction in the pipelines, from the Town to each farm independently. Multiple farmers own land near the well and could access the well pipeline with permanent or temporary piping.

Assuming an average flow of 100 gallons per minute (gpm) for 6 months of summer, Alternative 1 can deliver about 26 million gallons or about 80 acre-feet of Class B irrigation water. Alfalfa hay could produce about 1 ton per acre of additional livestock feed with about 4 inches of irrigation per acre. The U.S. Department of Agriculture's 2025 *Washington-Oregon (Columbia Basin) Direct Hay Report* lists premium-quality alfalfa hay for $200/ton and utility/fair-quality alfalfa hay at $140/ton. Summer reuse water could provide supplemental irrigation on about 240 acres of hay. The potential value of reuse irrigation without stored water is about $48,000 for premium hay and $33,000 for fair hay annually. Farmers that use reuse water instead of pumping their wells could make more water available in the shallow potable aquifers that are used for irrigation by other farmers and as potable water wells, thereby increasing the reliability of groundwater sources.

Alternative 2

Alternative 2 includes all components of Alternative 1 plus the ASR of Class B reuse water at Well 6. This alternative will store reuse water produced by the WWTP in the winter in the deep saline aquifer and extract the water for irrigation in the summer. Direct reuse will also be available for irrigation during the summer. Alternative 2A will use small pumps and not have capacity to pump peak flows from the WWTP to Well 6. Alternative 2B will add a new larger pump station at the WWTP with enough capacity to deliver all flow including winter peak flow to the old WTP and a new larger pipeline from the old WTP to Well 6. Alternative 2B could eliminate the use of the Penn Cove outfall from the WWTP and would add the benefit of increasing the harvestable acreage of shellfish near Coupeville.

For Alternative 2A, the two additional pumps at the WWTP outfall pump station will be 30 horsepower (hp) each rather than the two pumps at 15 hp each as recommended for Alternative 1. All flows up to the peak day flow of 360 gpm could be reused. Assuming an average flow of 100 gpm for 6 months of summer and 140 gpm for 6 months of winter plus peak flows, Alternative 2 can deliver about 70 million gallons or 215 acre-feet of irrigation water. The potential value of larger pumps and reuse irrigation with

ASR-stored water is about $128,000 for premium hay and $90,000 for fair hay annually. The reuse water could be used on about 640 acres for supplemental irrigation of hay.

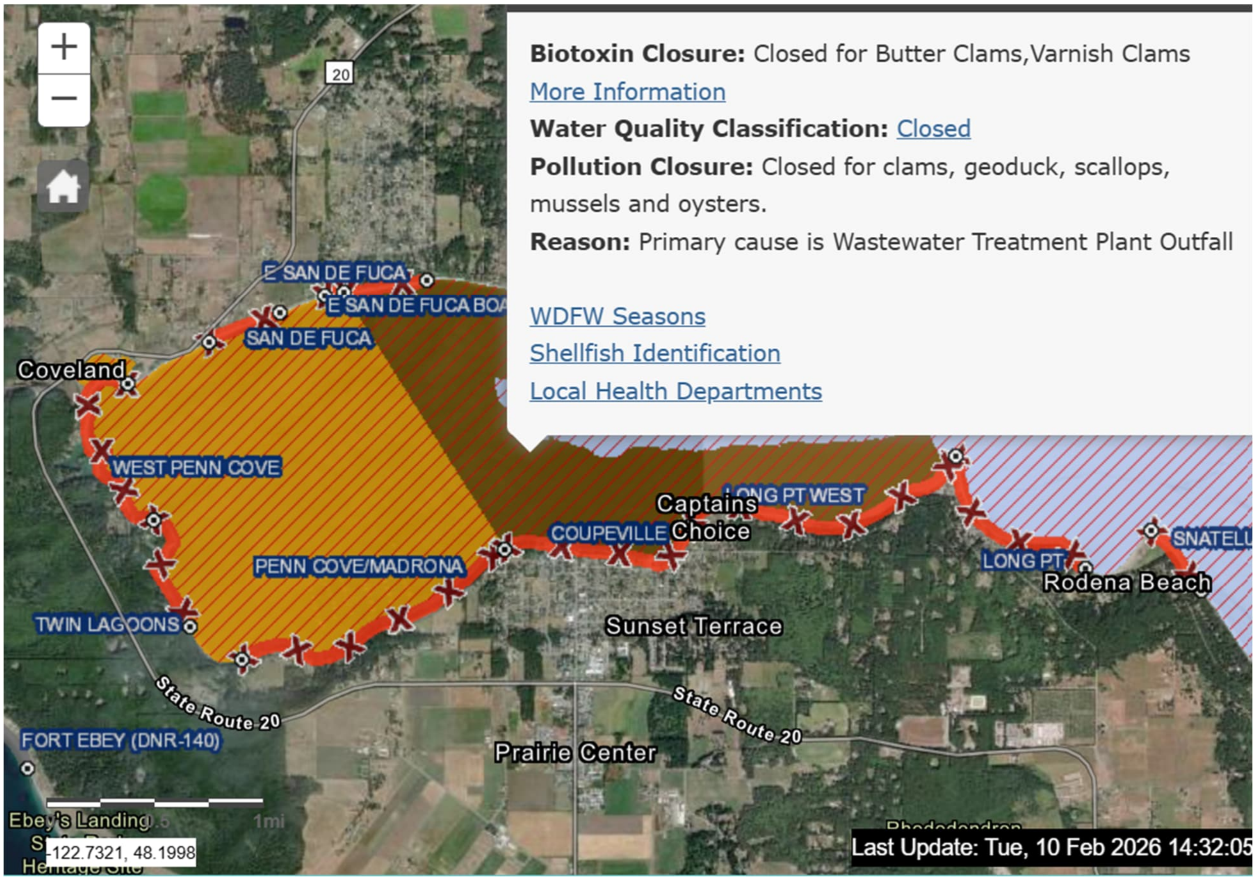
ASR of fresh reuse water with low salinity in the saline aquifer will create a bubble of freshwater that displaces the saline water as the water is injected from the well into the aquifer. Low-salinity reuse water stored and later extracted from a saline aquifer (even if the aquifer is up to seawater salinity) will be nearly as fresh when extracted as it was when it was injected for approximately 60 percent to 90 percent of the volume of the reuse water injected. The 40 percent to 10 percent of the stored and extracted reuse water that is more saline will still be a blend of the aquifer water salinity level and the fresh reuse water salinity level. The Well 6 deep aquifer is too saline for a public water supply but is suitable for irrigation and the salinity will be more suitable when blended with reuse water. The deep saline aquifer is about 400 feet below sea level and is the deepest of five aquifers near the Town.

Alternative 2B is the same as Alternative 2A except that 2B has added capacity to manage all WWTP flows, including peak storm flows. The amount of additional water delivered to Well 6 is not significant compared to the volume presented in Alternative 2A since the peak flow only occurs for a few weeks per year. What is significant is the ability to stop use of the Penn Cove outfall, which will help to improve water quality in the cove and potentially reduce the area of shellfish harvest restrictions. According to the DOH Shellfish Safety Information website (Figure ES-2), the primary cause of closure for shellfish harvest at the beaches and near-shore waters is the wastewater treatment plant outfall. The end of Penn Cove farthest from the WWTP (light brown on the map) is Conditionally Approved. The primary cause is discharge of nondisinfected or untreated sewage from Penn Cove Park WWTP or Coupeville WWTP.

An economic analysis of commercial and recreational shellfish harvest will be included in the next phase of more detailed evaluation of reuse. Increasing the harvestable acreage of shellfish is a goal of reuse at Coupeville.

Alternative 2B requires a new pump station at the WWTP with a wet well large enough to buffer instantaneous peak flows and three new pumps of 50 hp each to have capacity to pump the peak flows with two pumps and one additional pump as redundant. The use of the outfall would be eliminated, but it would remain in place as an emergency-only relief for an unlikely event such as a failure in the pipelines. Additional standby power generation would be required to operate the larger pump station in the event of a power outage. Alternative 2B will also require a new, larger pipeline from the WTP to Well 6. The existing abandoned 4-inch-diameter steel pipe would be replaced or paralleled with an 8-inch-diameter HDPE or PVC pipeline.

Figure ES-2. Washington State Department of Health Shellfish Safety Information Website Image



Alternative 3

Alternative 3 includes all components of Alternatives 1 and 2 in addition to upgrading the WWTP to produce Class A reuse water. Alternative 3 also includes storage of up to 2 days of WWTP effluent in a tank before ASR at Well 6. Alternative 3A will store reuse water produced by the WWTP during the winter except peak flows, in the deep saline aquifer and extract the water for irrigation during the summer. Direct reuse from the pipeline will also be available for irrigation during the summer. Alternative 3B will have the additional capacity to convey all flow including peak flows as described in Alternative 2B and will have the same benefits to Penn Cove as Alternative 2B.

Alternative 3 requires the addition of a 350,000-gallon tank to hold about 2 days of WWTP effluent flow. There is limited space at the WWTP; the new storage tank could potentially be installed in the parking area of the old WTP. The tank will help buffer the flow difference between the diurnal flow of the WWTP and a more constant flow for recharging of Well 6. The tank will also allow farmers to stop irrigation at night and irrigate at a higher rate during the day. Adding the storage tank to the system will allow for the Town to capture more of the peak wet weather flow that would otherwise be discharged to Penn Cove. With a new a larger pump station at the WWTP as described in Alternative 2B and Alternative 3B, all the effluent could be reused, including peak flows.

An additional benefit of the tank is to use it as a settling basin for alum and particulate before filtration. Class A water will require coagulation and filtration. Coagulation alum or powdered activated carbon added at the WWTP after disinfection will have complete mixing in the pumps and pipeline up to the WTP. Locating the tank at the WTP will allow use of the tank as a clarifier for the coagulant. Locating the filter at the WTP to remove the coagulant after about 2 days of settling will produce a lower turbidity water for ASR. This will result in an alum sludge at the WTP that would have to be put into a sewer manhole connection to send it to the WWTP.

For Alternative 3A, the two additional pumps at the WWTP outfall pump station will be 30 hp each. Assuming an average flow of 100 gpm for 6 months of summer and 140 gpm for 6 months of winter plus peak flows, Alternatives 2 or 3 can deliver about 70 million gallons or 215 acre-feet of irrigation water. The potential value of larger pumps and reuse irrigation with ASR-stored water is about $128,000 for premium hay and $90,000 for fair hay annually. The reuse water could be used on about 640 acres for supplemental irrigation of hay.

Alternative 3B, like Alternative 2B, requires a new pump station at the WWTP with a wet well large enough to buffer instantaneous peak flows and three new pumps of 50 hp each to have capacity to pump the peak flows with two pumps and one additional pump as redundant. The use of the outfall would be eliminated, but it would remain in place as an emergency-only relief for an unlikely event such as a failure in the pipelines. Additional standby power generation would be required to operate the larger pump station in the event of a power outage. Alternative 3B will also require a new, larger pipeline from the WTP to Well 6. The existing abandoned 4-inch-diameter steel pipe would be replaced or paralleled with an 8-inch-diameter PVC pipeline.

Feasibility Assessment Conclusions

This feasibility assessment demonstrates that the Town has the long-term technical, management, legal, and financial capacity to design, construct, operate, and maintain the reclaimed water facility, and that distribution and end uses are feasible. A chief purpose of the feasibility assessment is to ensure that resources are sufficient to provide public health and environmental protection for a planning period of 20 years.

Jacobs recommends that the Town start a reuse program as soon as possible, potentially by next summer, by implementing Alternative 1, which is the lowest-cost and simplest system to construct and operate. Even Alternative 1 will require grant or long-term loan funding to not put a large financial burden on the rate payers. Other alternatives require much more grant funding for design, permitting, and construction. Alternative 3, converting to Class A treatment, will also require a much larger annual O&M budget.

The Town should continue to pursue permitting of the ASR well to allow future reuse of all treated wastewater and eliminate discharge to Penn Cove. The Town can expand the reuse program to the levels described in Alternative 2A after a few years of reuse irrigation in summer only. When an ASR permit is available, the Town can fully switch to Alternative 2A, including ASR operations at Well 6. Alternative 2B can be implemented after Alternatives 1 and 2A because nearly all components of those alternatives are also needed for Alternative 2B. The new larger pump station at the WWTP and new larger pipeline from the old WTP to Well 6 could be constructed while reuse is being performed as described in Alternative 1 or Alternative 2A. Alternative 3 is too expensive to justify since the WWTP currently makes Class B water that can be reused or discharged to the Cove. If a future permit requires the WWTP to upgrade to Class A tertiary treated water or if grant money is available to pay for the upgrades including long-term O&M costs, it will be advantageous to have gone through the feasibility-level assessment of this alternative, and this alternative could be implemented if needed and funded.

Cost Estimate Summary

Table ES-1 summarizes the approximate total capital cost, yearly O&M cost, net present value, and annualized cost of each alternative.

Table ES-1. Cost Estimate Summary

Alternative	Total Capital Cost	Yearly O&M Cost	Net Present Value	Annualized Cost
Alternative 1	$240,000	$25,000	$565,198	$43,450
Alternative 2A	$560,000	$60,000	$1,340,476	$103,051
Alternative 2B	$1,240,000	$100,000	$2,540,794	$195,326
Alternative 3A	$2,410,000	$651,500	$10,884,671	$836,772
Alternative 3B	$3,090,000	$741,500	$12,735,385	$979,047

The recommendation of starting with Alternative 1 is derived from a comparative assessment of alternative pros and cons, as follows:

Alternative 1 is the lowest cost to build and operate, but it only captures summer effluent for reuse and discharges all water in winter to Penn Cove, which reduces the environmental benefit of reuse. This alternative supports irrigation on the smallest amount of farmland, and still provides benefit to nearby farmers. This is the most basic and common type of reuse system. Alternative 1 benefits Penn Cove water quality in summer and may allow a seasonal reduction in shellfish harvest limitations.

Alternative 2A is relatively low cost and utilizes primarily existing facilities. It requires more permitting and monitoring than Alternative 1 and uses more energy to recover water from the ASR well. However, it would benefit a much larger community of farmers. The largest number of farmers could become more profitable and sustainable with their existing operations with supplemental irrigation of reuse water. This alternative could essentially eliminate normal discharges to Penn Cove, so it has the greatest environmental benefit and minimizes the potential risk for discharge to the cove during an upset at the WWTP. Alternative 2 costs about two-and-a-half times as much to build and operate as Alternative 1, but it produces more than two-and-a-half times as much reuse water. Alternative 2A removes most flow from Penn Cove except peak flows, which primarily occur in the winter. This alternative minimizes discharges to Penn Cove and could result in seasonal or year-round reduction in the shellfish harvest limitations near Coupeville.

Alternative 2B is similar to Alternative 2A but adds redundancy and capacity to the pumping and piping to allow 100% of the WWTP flows to be reused, so the Penn Cove outfall use would be eliminated or only be for rare emergencies. This alternative should remove the Penn Cove shellfish harvest limitations related to the proximity of beaches and near-shore waters to the WWTP outfall of Coupeville.

Alternative 3 produces Class A water, which has the most uses in the urban and rural area and can be placed on human food crops. However, most of the farms grow livestock feed and do not need Class A water. Producing Class A water is expensive. Alternative 3 costs about four times as much as Alternative 2 and produces about the same volume of reuse water. The benefit to farmers only exists if they plan to convert to human consumption crops, which are higher value but result in a large cost burden on the community. Farmers would need to change operations, including investment in additional specialized equipment, to convert to food crops and it is not certain that they would change if they could also continue to grow livestock feed and be more profitable with irrigation. Class A water is further treated than Class B water and the reliability of a new Class A WWTP with a storage tank would be better than the existing plant. Alternative 3A would continue to discharge peak flows to Penn Cove but the water would be treated to a higher level and should have more benefit to help reduce shellfish harvest limitations than Alternatives 1 or 2A. Alternative 3B would eliminate discharge to Penn Cove except in emergencies and should remove the shellfish harvest limitations related to proximity to the Coupeville outfall.

Recommended Next Step

The recommended next step is to progress to a project-specific engineering report and coordinate with Ecology and DOH to continue the permitting process for both direct reuse water and future ASR operations.

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Acronyms and Abbreviations

Acronym	Description
AKART	all known, available, and reasonable treatment
ASR	aquifer storage and recovery
DMR	Discharge Monitoring Report
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
gpm	gallon(s) per minute
GWQS	Water Quality Standards for Ground Waters of the State of Washington, WAC Chapter173-200
hp	horsepower
Jacobs	Jacobs Engineering Group Inc.
mg/L	milligram(s) per liter
mgd	million gallon(s) per day
NA	not applicable
NPDES	National Pollutant Discharge Elimination System
OCPI	overriding consideration of the public interest
O&M	operation and maintenance
PFOS	per- and polyfluoroalkyl substances
RCW	Revised Code of Washington
RO	reverse osmosis
Town	Town of Coupeville, Washington
UIC	underground injection control
UV	ultraviolet

WAC	Washington Administrative Code
WWTP	wastewater treatment plant
WTP	old water treatment plant

1. Introduction

The Town of Coupeville, Washington (Town) seeks to update its 2010 reclaimed water feasibility assessment (BHC 2010) with three new alternatives and two new sub-alternatives for water reuse. The anticipated outcome is approval from the Washington State Department of Ecology (Ecology) and Washington State Department of Health (DOH) to reuse effluent from the Town's wastewater treatment plant (WWTP; plant) and reduce or even eliminate effluent discharge to Penn Cove. Penn Cove is a 303(d)-listed impaired water body not fully supporting designated uses and a shellfish aquiculture zone. The Penn Cove shoreline in Coupeville and near-shore waters are closed to harvesting of shellfish. Reuse of effluent for irrigation rather than cove outfall discharge could help to improve water quality near the outfall and contribute toward removal of Penn Cove from the 303(d) listing. A goal of this study is to increase the area of Penn Cove and beaches near Coupeville open to both commercial and private shellfish harvest and to provide irrigation water to farmers.

Jacobs conducted a feasibility assessment on behalf of the Town to evaluate existing conditions, potential upgrades, and costs, and provide recommendations to the Town for water reuse and aquifer storage and recovery (ASR) alternatives.

1.1 Objectives

The objectives of this feasibility assessment are summarized as follows, consistent with the scope of work prepared for the Town in November 2024:

- Review the existing study (BHC 2010) and available water quality/quantity data.
- Perform field investigations of the WWTP.
- Meet with local farmers, tribes, and community.
- Evaluate potential wastewater treatment plant upgrades and determine what capital improvements are required to convey WWTP effluent for the reuse alternatives.
- Present assessment results.
- Develop cost estimates based on results.
- Provide recommendations for alternative selection and next steps.
- Prepare this feasibility assessment in compliance with Washington Administrative Code (WAC) 173-219-180 ("Feasibility Analysis").
- Collaborate with Ecology and DOH on the preparation of this feasibility assessment.
- Conduct quarterly (or more frequent) meetings with project partners.
- Prepare public outreach materials, contact list, agenda, and meeting notes.

1.2 Background

Penn Cove, where the Town of Coupeville discharges all effluent, is a Section 303(d)-listed impaired water body and a shellfish aquiculture zone. Coupeville has an opportunity to divert effluent flows from Penn Cove to reuse. A goal of the reuse feasibility assessment is to increase the area of shellfish harvest on beaches and near-shore waters that are currently impacted by the Coupeville outfall discharge and to provide irrigation reuse water to farmers.

Coupeville completed a reuse feasibility assessment in 2010 (BHC 2010) in which reuse was identified as feasible, but not economically viable. The recommended alternative included a new reuse pump station at the WWTP, a new pressure pipeline to the water treatment plant, and a new gravity pipeline to near Well Number 6 (Well 6). Recharge infiltration and storage basins were evaluated for winter storage and shallow aquifer recharge use and farmer-owned pipelines were evaluated for water distribution and reuse in the summer. Increasing the area of shellfish harvest was not addressed in the 2010 report. At the time of the 2010 feasibility assessment, the recommendations were cost prohibitive and implementation was not feasible. However, the following new conditions exist that make reuse more feasible now than in 2010:

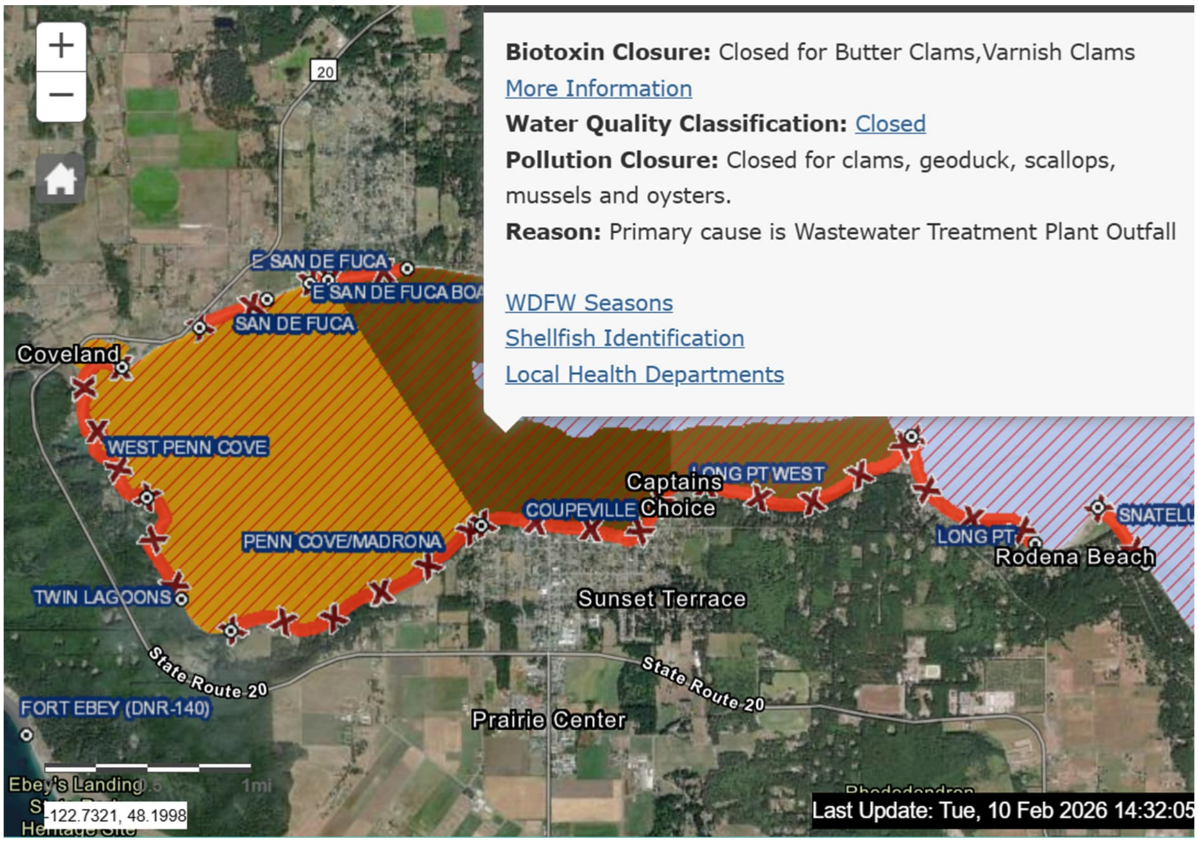
- The Town has two abandoned pipelines that could be used to reduce the cost of conveyance as compared with the previous study. An 8-inch PVC pipeline extends from the WWTP to the old water treatment plant (WTP) near the public works shop and hospital. A 4-inch steel pipeline extends from the WTP to Well 6 near the high school and the Ebey's Prairie Agricultural Zone.
- Well 6 in the brackish aquifer approximately 500 feet deep (finished over 300 feet below mean sea level) is abandoned for domestic water use due to salinity exceeding drinking water standards. Well 6 is owned by the Town and could be available for ASR of reuse water. Well 6 was pumped for one year and had increasing salinity from sea water intrusion when pumped.
- Irrigated agricultural crops are more valuable today with the increasing variables of climate change impacting nonirrigated crop yields globally. Recent years of low prices for agricultural products have been more difficult for dryland farmers than irrigated farmers because irrigation allows additional choices of crops and increased yields.
- A goal of this report is to develop recommendations that could increase the harvestable shellfish acreage along beaches and near-shore waters that are currently restricted partly because of the proximity to the WWTP outfall in Penn Cove. The economic value of increased harvestable shellfish acreage for commercial and recreational use will be determined in the next phase of study but is expected to be significant.

The concept for reuse assessed in this report would incorporate reuse of existing pipelines as much as possible rather than all new pipelines and use of an existing abandoned brackish well rather than constructing recharge basins over the potable aquifer. The farmer connections to the pipeline would still be provided by farmers. One deep farm well that extracts from the same deep brackish aquifer, the Engle farm deep well, could have water quality improved with nearby recharge. This brackish well is now owned by the U.S. Department of the Interior and is unused.

The WWTP would be upgraded to create Class A or Class B effluent. The WWTP currently produces Class B effluent, but several improvements and upgrades were recommended in the recent AKART analysis to increase performance reliability. Alternatives 1, 2A, and 3A have reduced costs because peak flows during wet weather storm events would be treated and discharged to Penn Cove, as they currently are, for short durations to reduce the pipe size and pumping requirements needed to convey winter reuse water to Well 6 for storage. The existing reuse pump station at the WWTP and conveyance piping would be sized for about 120 gallons per minute (gpm) continuously (the annual average flow from the WWTP) up to 180 gpm (the dry season maximum monthly average flow is150 gpm). During high water demand in the irrigation season, water could be pumped from the recharge well at up to 300 gpm plus 120 gpm directly from the pipeline. If the WWTP pump station operates year-round at a 120-gpm average flow rate plus pumping most peak flows, it could deliver about 215 acre-feet of reuse water to irrigators or about 70 million gallons. This amount of water could fully irrigate about 215 acres or as partial or supplemental irrigation it could supply about 640 acres. Alternatives 1, 2A, and 2B use Class B reuse water. Alternatives 3A and 3B use Class A reuse water.

Alternative 2B is the same as Alternative 2A except has added capacity to manage all WWTP flows including peak storm flows. The amount of additional water delivered to Well 6 is not significant compared to the volume presented in Alternative 2A since the peak flow only occurs for a few weeks per year. What is significant is the ability to stop use of the Penn Cove outfall, which will help to improve water quality in the cove and potentially reduce the area of shellfish harvest restrictions. According to the DOH Shellfish Safety Information website (Figure 1-1), the primary cause of closure for shellfish harvest at the beaches and near-shore waters is the WWTP outfall. The end of Penn Cove farthest from the WWTP (light brown on the map) is Conditionally Approved. The primary cause is discharge of nondisinfected or untreated sewage from Penn Cove Park WWTP or Coupeville WWTP.

Figure 1-1. Washington State Department of Health Shellfish Safety Information Website Image



An economic analysis of commercial and recreational shellfish harvest will be included in the next phase of more detailed evaluation of reuse. Increasing the harvestable acreage of shellfish is a goal of reuse at Coupeville.

Alternative 2B requires a new pump station at the WWTP with a wet well large enough to buffer instantaneous peak flows and three new pumps of 50 horsepower (hp) each to have capacity to pump the peak flows with two pumps and one additional pump as redundant. The use of the outfall would be eliminated, but it would remain in place as an emergency only relief for an unlikely event such as a failure in the pipelines. Additional standby power generation would be required to operate the larger pump station in the event of a power outage. Alternative 2B will also require a new, larger pipeline from the WTP to Well 6. The existing abandoned 4-inch-diameter steel pipe would be replaced or paralleled with an 8-inch-diameter PVC pipeline.

Alternative 3B is the same as 2B except with Class A reuse water and the additional WWTP upgrades required to produce that quality of effluent.

2. Regulatory Considerations

This section presents State of Washington reclaimed water regulations and Class A and B reclaimed water regulatory requirements. The Town's reuse system update will comply with State regulations. This feasibility assessment describes the regulatory information required.

2.1 WAC 173-219-180 Reclaimed Water Regulations

The Washington State legislature encourages the use of reclaimed water for appropriate beneficial uses (WAC 173-219-180). The following beneficial uses are encouraged:

- Preserve potable water for drinking purposes.
- Contribute to the restoration and protection of instream flows that are crucial to preservation of the state's salmonid fishery resources.
- Contribute to the restoration of Puget Sound by reducing wastewater discharge.
- Provide a drought resistant source of water supply for nonpotable needs.
- Be a source of supply integrated into state, regional, and local strategies to respond to population growth and global warming.

The Town's water reuse project would provide beneficial use by reducing wastewater discharge to Penn Cove, providing an additional water supply source for local irrigators, and potentially reducing irrigation withdrawals from shallow potable aquifers. All alternatives will positively impact shellfish by reducing effluent discharge to Penn Cove. Alternatives 2B and 3B will eliminate the use of the outfall in Penn Cove and have the greatest benefit toward increasing the harvestable shellfish acreage near Coupeville.

This feasibility assessment includes the information required under WAC 173-219-180 (Ecology 2019). Table 2-1 summarizes the WAC requirements and outlines which sections of the report satisfy them.

Table 2-1. Washington Administrative Code 173-219-180

Requirement per WAC 173-219-180	Feasibility Assessment Section
180 (1) (c) (i) Explanation of who will own, operate, and maintain the reclaimed water facility.	Section 7
180 (1) (c) (ii) For a planning period of 20 years, projected capital and operational costs, in terms of total annual cost and present worth, and projected revenues from user fees and other sources, if applicable.	Section 5.1
180 (1) (c) (iii) Estimate of the annual or seasonal volumes of wastewater required and available and proposed production (generation) rate of reclaimed water.	Section 3.1.1 and Appendix A (Production), Section 4.5 and Appendix F (Demand)
180 (1) (c)(iv) Description of the proposed level of reclaimed water quality the project will generate, along with general descriptions of the treatment systems and reliability features used by the proposed facility. The project proponent must demonstrate that the proposed facility concept is capable of meeting and ensuring the minimum requirements for water quality, treatment and reliability for the proposed uses	Section 3.2 and Section 4
180 (1) (c) (v) Description of plans for alternative use, storage, or release of any reclaimed water or inadequately treated water.	Section 4.5

Requirement per WAC 173-219-180	Feasibility Assessment Section
180 (1) (c) (vi) Initial assessment of potential water quality and quantity impairment and potential strategies to prevent, compensate, and/or mitigate for such impairment.	Section 4.6
180 (1) (c) (vii) List of all public potable water suppliers that provide water to the reclaimed water generation, storage, and distribution facilities in addition to proposed reclaimed water use areas. Describe proposed methods to coordinate with potable water suppliers on reclaimed water service including cross connection prevention actions in design and operation of the reclaimed water system. Results of coordination with the listed potable water suppliers must be included in the engineering report under Chapter 173-219-210 (2) (f).	Section 4.7
180 (1) (c) (viii) Description of the contingency plan for both temporary and permanent reversion to domestic wastewater facilities and alternative water supply systems where applicable, if reclaimed water production (generation) is discontinued. Include the impact of increased demand to water purveyors.	Section 4.5
180 (1) (c) (ix) A brief description of the community outreach and public involvement conducted or planned to be conducted, as you determine feasibility, to demonstrate awareness of, and community support for the reclaimed water project.	Section 6 and Appendix H
180 (1) (c) (x) Identification of existing or proposed interlocal or interagency agreements related to reclaimed water, if any, with local governments or local potable water utilities within the area of existing or proposed distribution and use of reclaimed water.	Section 4.7
180 (1) (c) (xi) Statement of compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), where applicable.	To be provided by the Town
180 (3) (a) Proposed reclaimed water facility customers	Section 4.5

2.2 Washington State Class A and B Reclaimed Water Requirements

The study has also been conducted in accordance with Washington State Class A and B Reclaimed Water Regulatory Requirements (Ecology 2008) summarized in Table 2-2. Class B reuse water is currently produced at the WWTP.

Table 2-2. Washington State Class A and B Reclaimed Water Requirements

Class	Characteristics
A	Class A reclaimed water will at all times be oxidized, coagulated, filtered, and disinfected wastewater. State water reclamation and reuse standards call for Class A reclamation water to be filtered to a turbidity level that does not exceed an average operating turbidity of 2 nephelometric units (NTU), determined monthly, and that does not exceed 5 NTU at any time. Filtration can be achieved by passing oxidized wastewater through natural undisturbed soils or through filter media such as sand or anthracite. Class A reclaimed water must be disinfected such that the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as

Class	Characteristics
	determined from the bacteriological results of the last seven days for which analyses have been completed, and such that the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample. Class A reclaimed water is currently the only reclaimed water class for which Ecology requires coagulation and filtration. Further, the disinfection requirements for Class A reclaimed water are more stringent than for Class C or D reclaimed water (the disinfection requirements for Class B reclaimed water are identical to those for Class A). Class A reclaimed water must be used where the potential for direct public exposure to reclaimed water is high.
B	Class B reclaimed water will at all times be oxidized and disinfected wastewater. The wastewater will be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample – the same disinfection standard as Class A reclaimed water.

The WWTP facility discharges to Penn Cove in Puget Sound and is one of more than 50 dischargers that must comply with the Puget Sound Nutrient General Permit (PSNGP) total inorganic nitrogen load reduction requirements. The Town's nitrogen load has been decreasing due to operation improvements implemented by plant staff. In addition, the Town is pursuing a reuse permit to consider further reducing or eliminating the nutrient load to Penn Cove. Coupeville Beach, other nearby beaches, and near-shore waters are currently closed to shellfish harvesting by DOH based on the proximity to the WWTP outfall.

2.3 Permitting

There are basic statutory differences between wastewater discharge permits, water right permits, and reclaimed water permits, and all three may apply to the proposed reclaimed water system (Ecology 2019). The Town of Coupeville would own, operate, and maintain the reclaimed water facility and hold relevant wastewater discharge and reclaimed water permits.

Both the Departments of Ecology and Health have a responsibility to review reclaimed water submittals and develop reclaimed water permits. Either agency may be designated as the lead agency for issuing and maintaining a reclaimed water permit. The designated lead agency will review and approve this Feasibility Analysis along with any other engineering reports, plans, and specifications.

2.3.1 Wastewater Discharge Permits

These include National Pollutant Discharge Elimination System (NPDES) permits and State Waste Discharge Permits. An NPDES Permit is required for a discharge of treated wastewater effluent to waters of the U.S. (surface waters including Penn Cove). Ecology issues this permit by delegated authority of the Clean Water Act. Since waters of the U.S. are also waters of the State, Ecology's NPDES permits are actually NPDES/State Waste Discharge Permits issued under dual authorities. A State Waste Discharge Permit is required for a discharge of treated wastewater effluent to waters of the state, which includes groundwater. Ecology regulates these under Chapter 90.48 of the Revised Code of Washington (RCW), the Water Pollution Control Act.

2.3.2 Water Right Permits

Chapter 90.03 RCW, Water Code and Chapter 90.44 RCW, Groundwater Code authorize Ecology to regulate water rights. They govern the quantity, location, and purpose of water use and its relation to other water rights. A town reclaiming water with a permit issued under RCW 90.46 has the exclusive right to any reclaimed water generated by the wastewater treatment facility and as such does not need a water right for reclaimed water use.

2.3.3 Reclaimed Water Permit

Chapter 90.46 RCW, the Reclaimed Water Use Act, authorized Ecology, in coordination with DOH, to write a rule that establishes standards for all aspects of reclaimed water use, including the distribution and storage. The Reclaimed Water Use Act considers reclaimed water to be a water supply produced for beneficial use(s) outlined in the law and expanded upon in the Rule. The law clearly states that reclaimed water is not a wastewater and that the use, distribution, storage, and the recovery from storage of reclaimed water by the owner of a wastewater treatment facility permitted under Chapter 90.46 RCW is exempt from permit requirements of the Water Code.

Many facilities that generate reclaimed water also have wastewater effluent discharges. Effluent discharge may be an alternative when a reclaimed water facility cannot meet the required reclaimed water quality standards and the facility does not have the ability to store the water for retreatment. Effluent discharge is also an option when the available supply of reclaimed water exceeds the demand by authorized users of the water or if there is only seasonal demand from beneficial users. An NPDES permit is required under the federal Clean Water Act whenever effluent is discharged to surface water for the reasons stated above. While Ecology will typically issue a single permit to authorize effluent discharge (NPDES or State Waste Discharge Permits) along with reclaimed water conditions, it may issue separate discharge, and reclaimed water permits to a facility on a case-by-case basis.

2.4 Conversion of Existing Distribution Systems to Reclaimed Water

The proposed reclaimed water system includes the conversion of abandoned potable water system pipelines connecting the old WTP to the WWTP and Well 6. The Town will need to directly coordinate with Ecology and Health to locate and test the lines to ensure that no cross-connections or unapproved connections to the system currently exist. The lines should be thoroughly tested prior to use, using dye, pressure, or other methods, to ensure there are no cross-connections or unapproved connections. If verification of the existing lines is not possible, the lines should be uncovered, inspected, and identified prior to use. Inspection by internal camera may also be an alternative to confirm potential connection locations and pipeline condition. The lines can be used for reclaimed water distribution if the existing lines are satisfactory to the regulatory agencies. If the lead agency approves the conversion of existing storage and distribution systems to reclaimed water use, all accessible points must be labeled as reclaimed water at the time of conversion and any inaccessible locations must be labeled at the time of repair or replacement (WAC 173-219-360(9)(a)).

The Town will also need to notify the public and other utility employees for the use of reclaimed water in all use areas by signage around and at the entrance of each use area. Signs should be purple in color with white or black lettering. Signs should read “Reclaimed Water – Not Intended for Drinking.”

Groundwater recharge projects include indirect and direct groundwater recharge and storage and may include recovery of reclaimed water stored in an aquifer and other groundwater withdrawal (DOH 2019). The intent of groundwater recharge for this project is to provide reuse water storage and have a value as a salt-water intrusion barrier in the brackish aquifer Well 6 taps in to and to provide future recovery of the aquifer for beneficial use.

2.5 AKART Analysis

In 2023, Jacobs assisted the Town with preparation of an all known, available, and reasonable treatment (AKART) analysis. Section 3.2 summarizes relevant findings for reclaimed water reuse and ASR. Refer to Appendix A for the full AKART report. AKART is more specifically defined as all known, available, and reasonable methods of prevention, control, and treatment. AKART represents the most current methodology that can be reasonably required for reducing effluent total inorganic nitrogen from WWTPs. AKART is defined as an economically feasible method of providing nutrient removal to achieve an effluent total inorganic nitrogen in the range of 8 to 10 milligrams per liter (mg/L) on an annual basis. The Town also produced a report on operational strategies to maximize nitrogen removal from the existing WWTP effluent. That report is available in Appendix B. Economic feasibility may consider the potential financial impact of the nutrient upgrade on ratepayers given the other financial burdens a utility carries, including asset repair and replacement, other capital projects, and inflationary considerations. The WWTP currently produces Class B effluent. Either Class B or Class A water can be reused for irrigation.

2.6 Reuse Water Quality Affecting ASR Wells

Aquifer storage and recovery (ASR, as defined above) wells are regulated through the U.S. Environmental Protection Agency's (EPA's) underground injection control (UIC) program. The State of Washington administers the program for the State through Ecology. The UIC program classifies injection wells into Classes 1 through 6 depending on the nature of the fluid being injected and the characteristics of the underground aquifers. Three of the EPA injection well classes are prohibited in Washington; reuse water ASR wells are part of Class 5, which is allowed.

The water injected into the aquifer through the Class 5 program must comply with the State's groundwater regulations, which include an antidegradation policy. The antidegradation policy states that water injected into the aquifer must be of a quality such that the existing groundwater is not degraded, which means that no water quality constituent in the injected water can exceed that of the existing groundwater. An exception to this policy can be made if:

- An overriding consideration of the public interest (OCPI) will be served.
- All contaminants proposed for entry into said groundwaters will be provided with AKART prior to entry.

The regulations summarized above indicate that if the treated wastewater were treated to Class A standards (WAC 173-219-330) followed by an advanced water treatment method such as reverse osmosis (RO), injection into ASR wells may be allowed without the stated exceptions. Class B reuse water will require the exceptions, and Coupeville should qualify for the exceptions, but these must be approved on a case-by-case basis by state regulators.

Class A treated wastewater includes coagulation, filtration, and disinfection. Jacobs has experienced plugging of ASR wells in other locations during injection using Class A water coagulated with the most common coagulants, aluminum sulfate (alum) or polyaluminum chloride, and filtered immediately before injection. The filtration would need to produce water with very low total suspended solids and turbidity to avoid potential particle plugging of the well. The potential formation of disinfection byproducts could result in violating the State's antidegradation policy if chlorine is used for disinfection. Currently the WWTP uses ultraviolet (UV) light for disinfection, which does not produce disinfection byproducts. RO treatment would likely remove all residual coagulant, solids, and organics from the water and should prevent aquifer clogging. RO treatment is very expensive and has a high energy requirement since it operates at high pressure. Even if regulatory approval for injection of Class A treated wastewater without RO treatment could be obtained, it may not be suitable for direct injection into an ASR well because of the risk of plugging the well.

Class B reuse water is currently produced at the WWTP, and it will be of improved quality when the recommendations of the AKART analysis (Jacobs 2023a) are implemented. The AKART analysis recommended the addition of sensors to improve monitoring and control of the WWTP processes to reduce nitrogen levels in the effluent. The Town has received a grant to assist with installation of the AKART recommendations. Class B water does not require the addition of a coagulant that could reduce the potential of aquifer plugging from residual coagulant that is not filtered out. However, because Class B water is not coagulated and filtered, it contains small residual particles from the treatment process that could also cause potential aquifer clogging. Both Class A and Class B water contain low levels of nutrients that can increase the potential for growth of organic matter in the well and the potential for clogging. Well 6 is abandoned by the Town as a drinking water source and could be used for injection and storage, then withdrawal of either Class A or Class B water with the understanding that the well could become partially plugged over time with either coagulant or particulate matter or organic growth. Pumping the well to extract recharged water may reduce the potential for plugging by purging the well screen and the aquifer adjacent to it.

2.7 WAC Requirements for Direct Groundwater Recharge and Recovery

Reclaimed water used for groundwater recharge by direct injection must meet all the following requirements (Ecology 2019):

- Class A reclaimed water quality requirements found in WAC 173-219-330 (or receive an exception based on public benefit and need)
- The use-based performance standards in WAC 173-219-390 Table 3 for direct groundwater recharge (aquifer recharge). Class A water is required for direct groundwater recharge.
- Sample and test reclaimed water for compliance with the Ecology groundwater quality standards and drinking water standards, at the point of injection in the receiving groundwater or at the end of pipe prior to distribution to the aquifer. For compliance within the aquifer where reclaimed water is stored, evaluate groundwater quality by using groundwater sample analyses results.
- For direct recharge of reclaimed water, registration of the recharge facilities with Ecology under the Underground Injection Control Program (Chapter 173-218 WAC) is required for any injection facility that meets the definition of an Underground Injection Control well.

ASR projects that store water in an aquifer for later recovery require a Reservoir Permit *issued* by Ecology's Water Resource Program (Ecology 2017). A review by the Water Quality Program is required when the concentration of contaminants in the recharge water exceed the Water Quality Standards for Ground Waters of the State of Washington, WAC Chapter173-200 (GWQS) at some point during the recharge cycle. Groundwater samples are collected at the recharge point, in the aquifer (storage), during recovery; and or at downgradient wells. OCPI is a part of the antidegradation policy of WAC 173-200 that allows GWQS exceedances when site-specific conditions are met. ASR proponents can submit an AKART analysis in addition to the project benefits analysis in support of a determination of whether a project is in the OCPI.

2.8 Overriding Consideration of Public Interest

In accordance with *Guidance for Aquifer Storage and Recovery AKART Analysis and Overriding Consideration of the Public Interest Demonstration* (Ecology 2017), Ecology can make a determination of OCPI only when AKART is met, the project benefits exceed the potential risks, and the remaining risks are identified as part of an analysis. If high-quality ground water cannot be maintained and a discharge will also cause a violation of any of the GWQS, then overriding consideration of public interest must be demonstrated through one of the following:

- An alleviation of a public health concern,
- A net improvement to the environment, or
- Socioeconomic benefits to the community.

Detailed justifications, and not generalizations, are required for a recommendation of overriding public interest. This feasibility assessment provides an initial evaluation of whether ASR at Well 6 would provide OCPI, including the identification of potential receptors (Section 3.3) and a comparison of alternative treatment methods and technologies (Section 4).

3. Existing Conditions

This section describes existing conditions at the Coupeville WWTP, summarizes recommended upgrades from the 2023 AKART analysis, and discusses Well 6 hydrogeology suitability for ASR.

3.1 Coupeville Wastewater Treatment Plant

3.1.1 Current WWTP Flows

Per the 2023 AKART analysis, the influent flow volumes, corresponding peaking factors, and rated conditions from 2019 to 2022 are listed in Table 3-1 (Jacobs 2023a).

Table 3-1. Current Coupeville WWTP Influent Flows and Rated Flow Capacity (Jacobs 2023a)

Flow	2019-2022 (mgd)	Rated Flow Capacity (mgd)	2019-2022 Peaking Factor
April – October (Maximum Monthly)	0.215	NA	1.3
Maximum Monthly	0.299	0.44	1.8
Annual Average Daily	0.169	NA	NA

NA = not applicable

Yearly Discharge Monitoring Report (DMR) data from 2022-2024 was compared against the values in Table 3-1 and found to be within the predicted range. The dry weather (April – October) maximum monthly flow in 2023 was 0.166 mgd and the wet weather (November – March) maximum monthly flow was 0.269 mgd. The 2023 average annual daily flow was 0.167 mgd. The dry weather (April – October) maximum monthly flow in 2024 was 0.161 mgd and the wet weather (November – March) maximum monthly flow was 0.222 mgd. The 2024 average annual daily flow was 0.166 mgd or 115 gpm. Refer to Appendix C for the full DMR summaries.

3.1.2 Current Treatment Process

A plant layout with normal flow path is shown on Figure 3-1. A hydraulic profile is shown on Figure 3-2. The treatment process is an activated sludge oxidation ditch WWTP. Treatment includes screening, biological treatment, secondary clarification, and disinfection. The details of the treatment process are included in Appendix A and B.

Secondary effluent is disinfected with a low-pressure UV disinfection system. Disinfected effluent flow is measured via a Parshall flume prior to discharge. Two low head pumps lift the flow into an outfall head box to overcome the variable water elevation in Penn Cove. Plant effluent is discharged to Penn Cove through a 12-inch marine outfall and 60-foot-long diffuser equipped with six 3-inch ports. A chlorine disinfection system is in place as a backup in case the UV disinfection is interrupted.

Figure 3-1. Coupeville Wastewater Treatment Plant Layout and Flow Diagram (Jacobs 2023a)

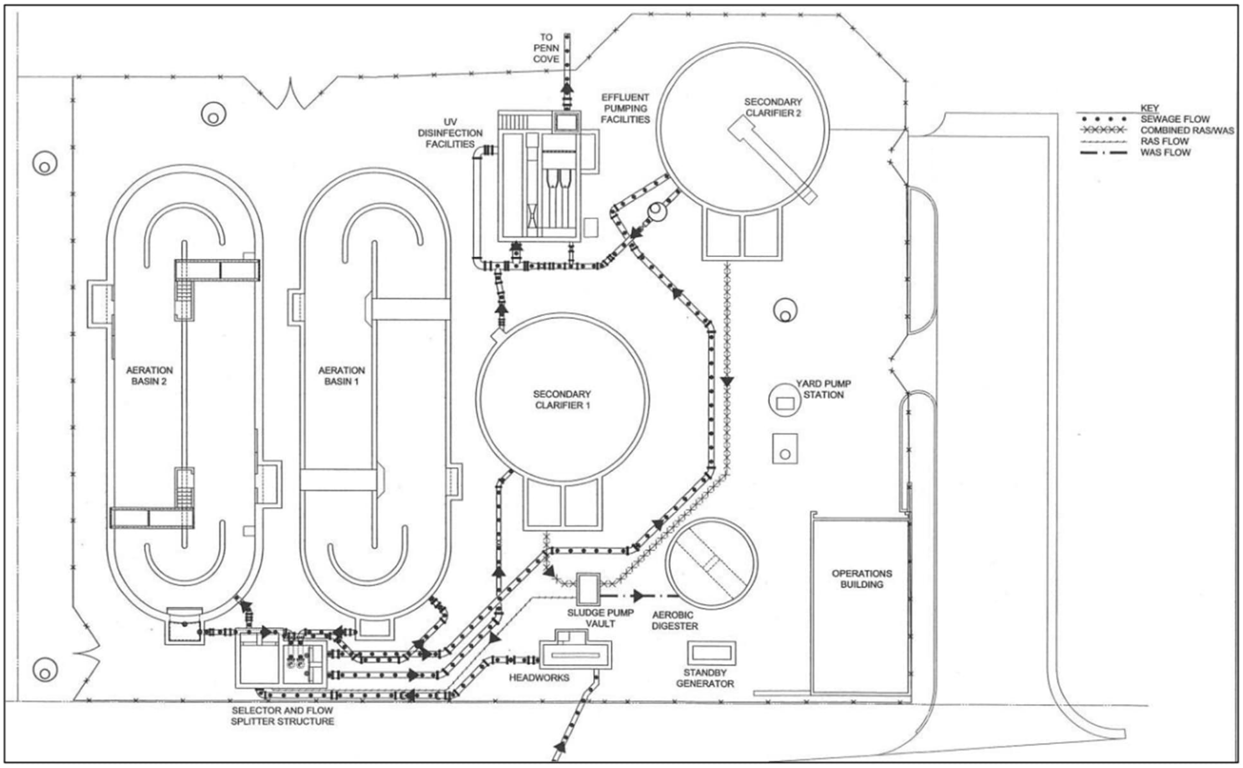
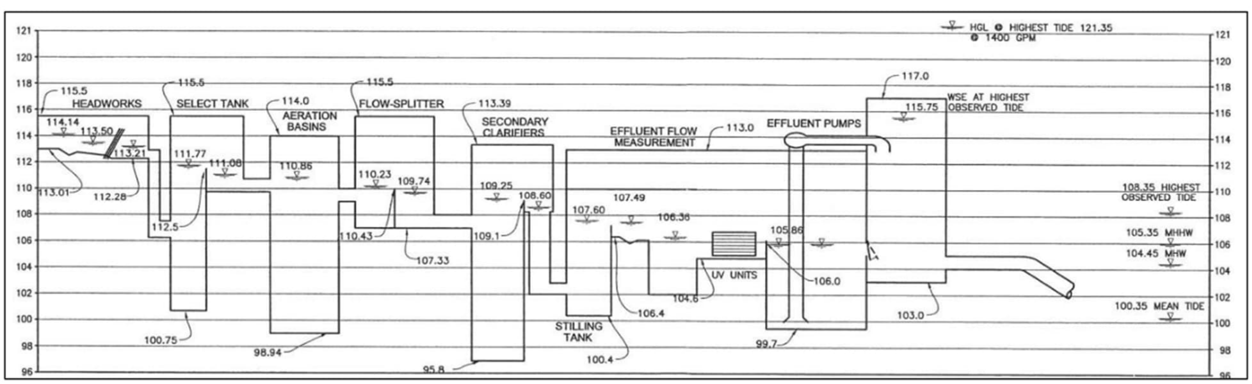


Figure 3-2. Coupeville WWTP Hydraulic Profile (Jacobs 2023a)



3.2 AKART Recommended Upgrades

The AKART analysis (Jacobs 2023a) recommended Alternative 1: Optimization, which adds reliability to the process train to consistently produce class B effluent that meets the permit requirements for nitrogen removal and disinfection. The Town has received a grant to implement the recommended upgrades.

3.2.1 Class B Reclaimed Water Components

To meet Class B reclaimed water standards, a backup method of disinfection may be required when water is delivered directly from the pipeline to farmer. Chlorine would not be used when reuse water is being injected into Well 6 in the winter for storage. The existing back up chlorination injection system would need to be recommissioned to provide reliable disinfection. While Class B reclaimed water is more affordable than Class A, Class B offers less flexibility in terms of end use for human consumption crops or urban uses. Class B and Class A water can be used on livestock feed crops such as pasture, hay, and feed corn. Class B reclaimed water is considered based on affordability and the presence of a brackish aquifer for ASR and nonhuman consumption crops within proximity of the treatment plant. An exception to ASR rules would be required for Class B ASR but no exception is required for Class B reuse water delivered directly to farmers growing livestock feed.

3.2.2 Class A Reclaimed Water Components

In addition to the selected AKART alternative, treatment requirements to meet Class A reclaimed water quality consists of multiple tertiary components. Components selected to satisfy Class A criteria consist of the following:

- Caustic soda chemical dosing and storage
- Vertically mounted pile cloth filters with alum (or coagulant of choice) dosing and storage
- Assessment of existing UV system capacity
- 0.35-million-gallon reclaimed water storage tank

For the AKART analysis (Jacobs 2023a), alum and vertically mounted pile cloth filters with a nominal 10-micron pore size were selected as the preferred coagulant and tertiary filtration system for Class A reuse. In addition to filtration and coagulation, the capabilities of the existing UV system must be further evaluated to ensure Class A reclaimed water standards are satisfied. Caustic soda is provided upstream of the filter to control pH as needed.

Additionally, a reclaimed water storage tank providing 0.35 million gallons (equivalent to 2 days' average annual daily flow) of storage is included as a reclaimed water component. Based on existing site constraints, the storage tank will need to be constructed offsite. This Class A reclaimed water alternative offers more flexibility in terms of end water users, which can include landscape irrigation, industrial uses, and irrigation of all crops. Table 3-2 from the Washington Reclamation and Reuse Standards lists the uses of Class A and Class B water indicating that either water quality can be used for 15 of the 21 listed uses.

Table 3-2. Treatment and Quality Requirements for Reclaimed Water Use (Ecology 1997)

Use	Class A	Class B
Irrigation of Nonfood Crops		
Trees and Fodder, and Seed Crops	YES	YES
Sod, Ornamental Plants for Commercial Use, and Pasture to Which Milking Cows or Goats Have Access	YES	YES
Irrigation of Food Crops		
Spray Irrigation		
All Food Crops	YES	NO
Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy all Pathogenic Agents	YES	YES
Surface Irrigation		
Food Crops Where There is No Reclaimed Water Contact with the Edible Portion of Crop	YES	YES
Root Crops	YES	NO

Use	Class A	Class B
Orchards and Vineyards	YES	YES
Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy all Pathogenic Agents	YES	YES
Landscape Irrigation		
Restricted Access Areas (e.g. Cemeteries and Freeway Landscapes	YES	YES
Open Access Areas (e.g. Golf Courses, Parks, Playgrounds, Schoolyards, and Residential Landscapes	YES	NO
Impoundments		
Landscape Impoundments	YES	YES
Restricted Recreational Impoundments	YES	YES
Nonrestricted Recreational Impoundments	YES	NO
Fish Hatchery Basins	YES	YES
Decorative Fountains	YES	NO
Flushing of Sanitary Sewers	YES	YES
Street Cleaning		
Street Sweeping, Brush Dampening	YES	YES
Street Washing, Spray	YES	NO
Washing of Corporation Yards, Lots, and Sidewalks	YES	YES
Dust Control (Dampening Unpaved Roads and Other Surfaces)	YES	YES
Dampening Soil for Compaction (at construction Sites, Landfills, etc.)	YES	YES

3.2.3 Chlorine Residual

Maintenance of chlorine residual is required in distribution lines that convey reclaimed water from the treatment facility to the end use area. This is an additional pathogen protection barrier. A chlorine residual will also inhibit regrowth that results in fouling or plugging of the irrigation distribution nozzles. A minimum chlorine residual of 0.2 mg/L or greater measured as free chlorine, or 0.5 mg/L or greater measured as total chlorine, is required unless waived or modified by the lead agency. The lead agency might not require a chlorine residual:

- When the hydraulic retention time in the distribution system prevents significant deterioration in water quality from the point of compliance
- When alternative treatment of recycled water maintains water quality comparable to the point of compliance
- When in some other manner the generator demonstrates a benefit from reducing or eliminating the chlorine residual
- Reclaimed water impoundments at the point of use
- Storage ponds at the point of use
- Storage tanks at the point of use

- Distribution lines to groundwater recharge
- Conveyance along natural streams, lakes, or surface waters of the state

3.3 Well 6 Hydrogeology Suitability for Aquifer Storage and Recovery

A report on the Town's existing Well 6 (Ecology Well Tag ID AGA992) was the sole source of the information on the hydrogeology reported here (AGI Technologies 1995). The full report is available in Appendix D and the original drilling report for Well 6 is available in Appendix E. As presented in the report, the aquifer system in the Coupeville area contains five aquifer zones identified as Zones A through E. Zone A is the deepest zone; it appears confined and is about 50 feet thick. Coupeville Well 6 is completed into Zone A and the subject of the report was an assessment and testing of Well 6 regarding potential sea water intrusion. Figure 3-3 shows a site map of Well 6 and surrounding wells. Figure 3-4 shows the shed housing Well 6. The sea water intrusion in Zone A does not appear severe; however, chloride concentrations were seen to exceed drinking water standards (250 mg/L) with extended pumping.

The Zone A aquifer is sand and gravel and has high permeability. The 1994 well test included monitoring and observation of other wells in the area and determined that there are 5 aquifers at different depths near Coupeville (Figure 3-5). Each aquifer is either sand or sand and gravel and each aquifer is separated by layers of clay. Well 6 and the Engel Deep Well (Ecology Well Tag ID unknown) are the only two wells in the deep saline aquifer. The Town pumped 215 gpm for a year in 1994 as a test of the aquifer to determine if it would become fresh enough for potable use. The aquifer became more saline after the pump test and the well was abandoned for potable water.

At the beginning of the pump test, Well 6 had a chloride level of 200 mg/L and after a year of pumping it had increased to 380 mg/L. The Engel Deep Well also had salinity increase during the pump test of Well 6 associated with sea water intrusion into the aquifer. The Engel Deep Well had a chloride concentration of 120 mg/L in 1993 and 220 mg/L in 1994. The apparent connection between Well 6 and the Engel Deep Well may allow both wells to be used to extract reuse water that is injected into Well 6 for storage. Well 6 currently has a submersible pump that has not been used in many years but was only in service for one year and may be in good condition. The pump should be tested as part of the next phase of reuse design.

ASR of fresh reuse water with low salinity in the saline aquifer will create a bubble of freshwater that displaces the saline water as the water is injected from the well into the aquifer. The specific capacity of Well 6 completed into Zone A is reported to range from 0.35 to 22 gpm per foot and hydraulic conductivity values are reported at about 4.8 E -4 feet per second (41 feet per day). It appears that the testing on Well 6 was permitted at a withdrawal rate of 350 gpm and was tested at about 215 gpm.

Based on the information available, it appears that Zone A could be a successful aquifer zone to store freshwater supplies, displace the high chloride water with a freshwater bubble, and recover the stored water for irrigation use. More directly stated, Zone A may provide a suitable aquifer zone for an ASR application. The next phase of reuse design, the engineering report, should further evaluate Well 6 and the Zone A aquifer.

Figure 3-3. Well Site Map (Reproduced from AGI Technologies 1995 Report)

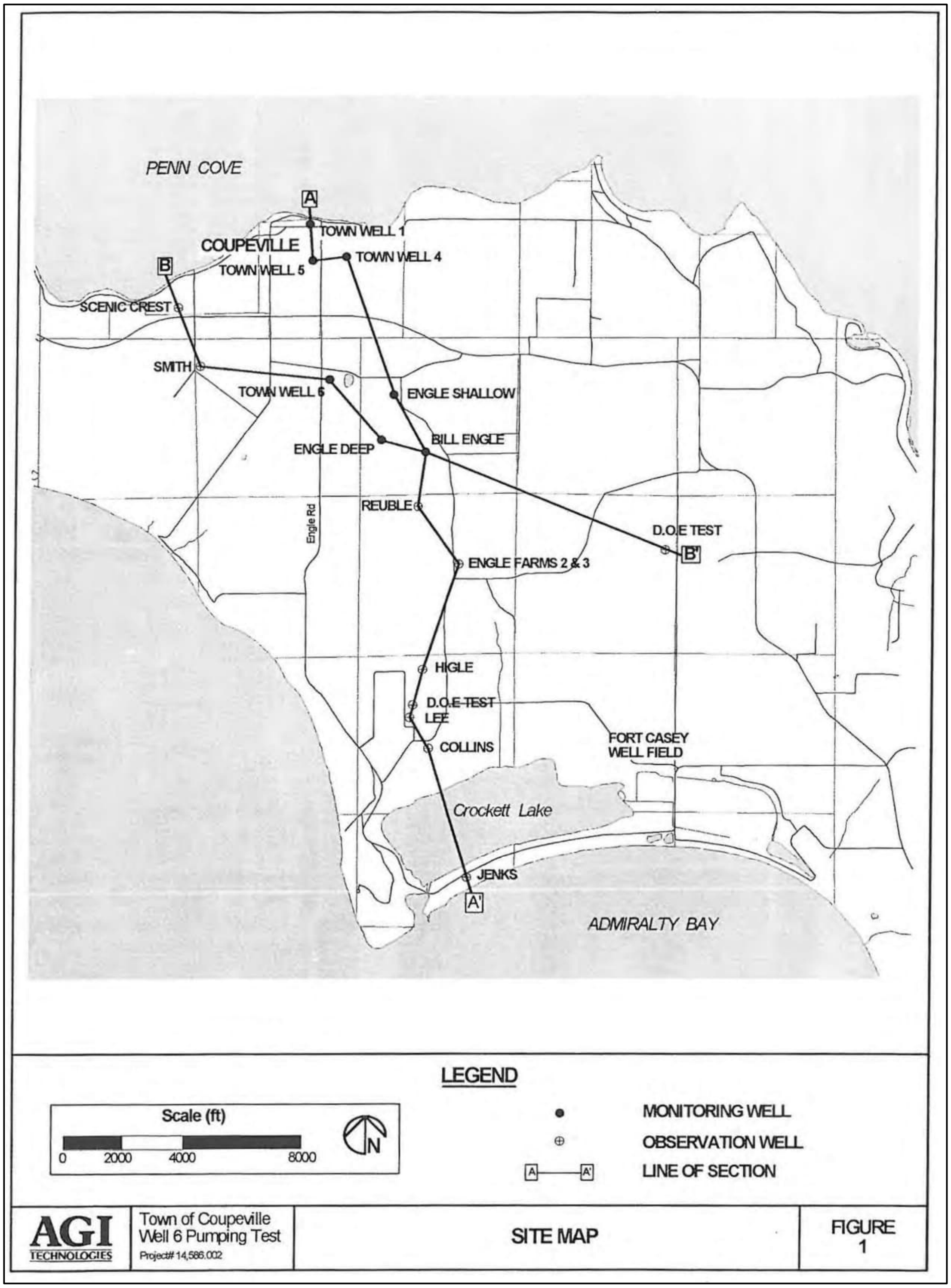
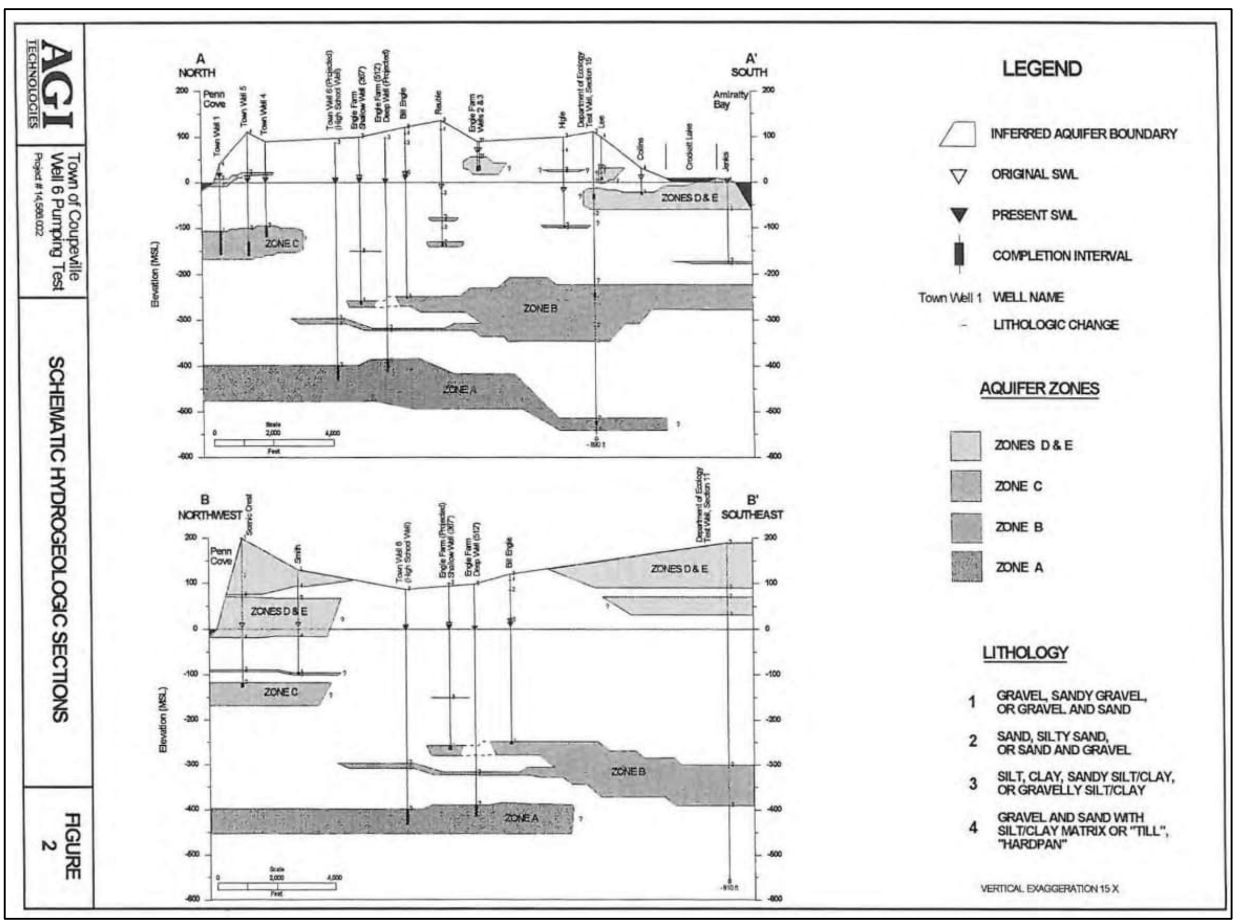


Figure 3-4. Shed Housing Well 6 near the High School Tennis Courts (Looking Southeast)

Figure 3-5. Schematic Hydrogeologic Sections (Reproduced from AGI Technologies 1995 Report)



4. Reuse System Alternatives

This section describes the components of the reuse system with potential alternatives that could spread costs over grant, loan, and other funding sources for years. The alternatives include reuse with low initial capital and operation and maintenance (O&M) cost with a system that can be expanded as more funding becomes available. Alternative 1 is the lowest cost and Alternative 3B is the highest cost. Section 5.1 (Cost Estimates) contains more information on alternative cost estimates.

4.1 Alternative 1 – Class B Reuse Irrigation Water in Summer, Discharge to Penn Cove in Winter

Alternative 1 provides Class B reuse water for irrigation during the summer with continued discharge of WWTP effluent to Penn Cove in the winter when agricultural irrigation demand is low. Alternative 1 will require the implementation of the recommendations of the AKART analysis (Jacobs 2023a) to consistently produce Class B effluent.

Alternative 1 will also require several system improvements and rehabilitation or replacement of existing infrastructure. Two new pumps will be added to the existing outfall pump station at the WWTP to lift effluent about 150 feet to the high point of the Town at the old water treatment plant (WTP) and public works shops near the hospital (Figure 4-1). The WWTP is at about elevation 15 feet and the old WTP is about elevation 165 feet. From the old WTP water could gravity flow to Well 6 near the High School at about elevation 90′.

The new pumps could be installed next to the existing pumps in the existing outfall pump station. The outfall pump station has a spare pump bay that is large enough for two submersible pumps and a manifold to connect them together and to the reuse pipeline. The annual average flow to the WWTP is about 120 gpm (0.173 mgd). The new15 hp pumps could be variable speed to cover a pumping range of about 45 gpm minimum with one pump on low speed up to 180 gpm with two pumps at full speed. The existing outfall discharge permit should be retained for peak storm flows and in the event of a pump failure to allow discharge of peak flows to Penn Cove rather than an additional redundant pump. The two existing 7.5 hp outfall pumps would remain unchanged. The following photos (Figure 4-2 and Figure 4-3) show the existing WWTP effluent pump station and the spare pump bay between the two existing pumps.

Figure 4-1. Distribution System Existing Conditions

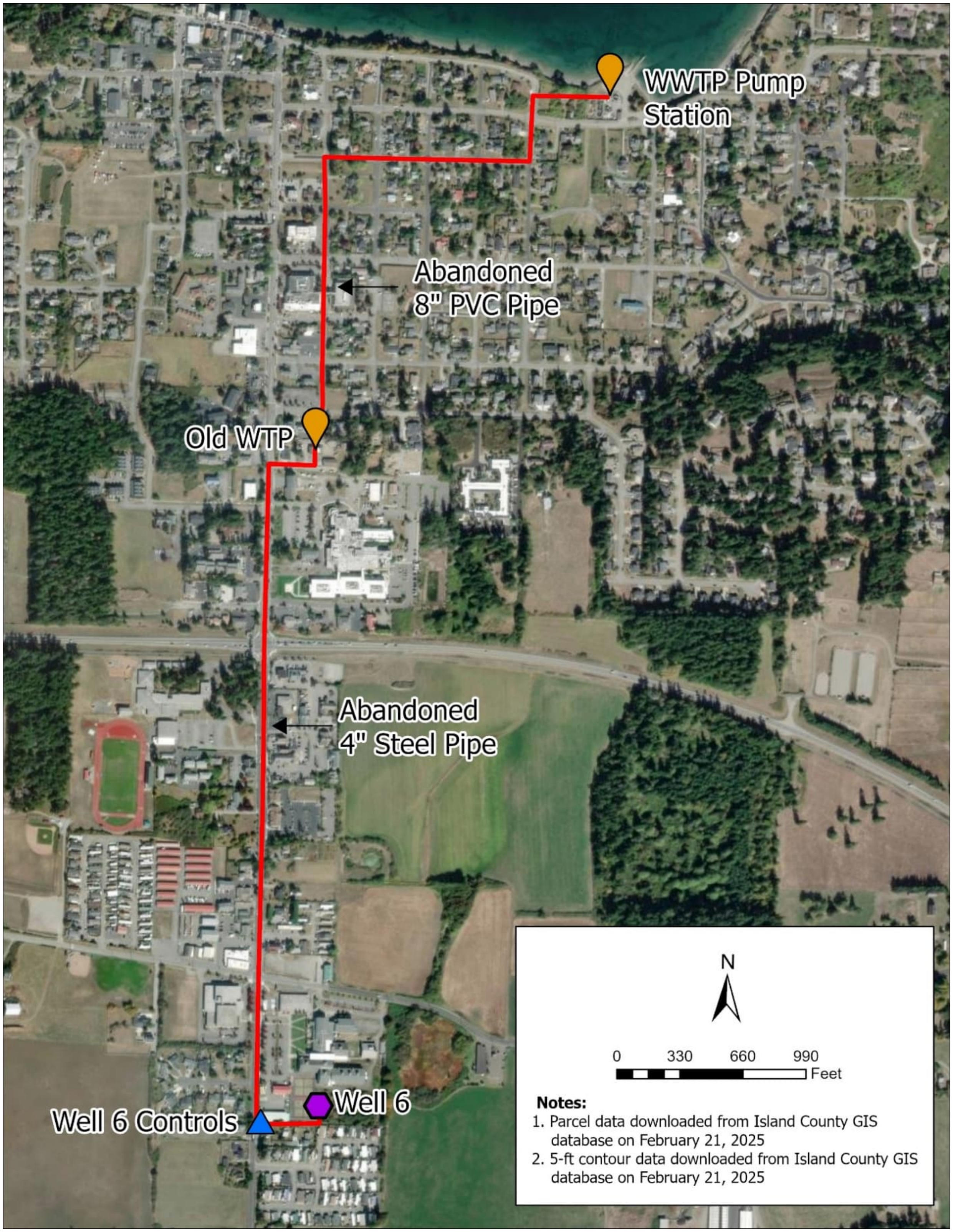
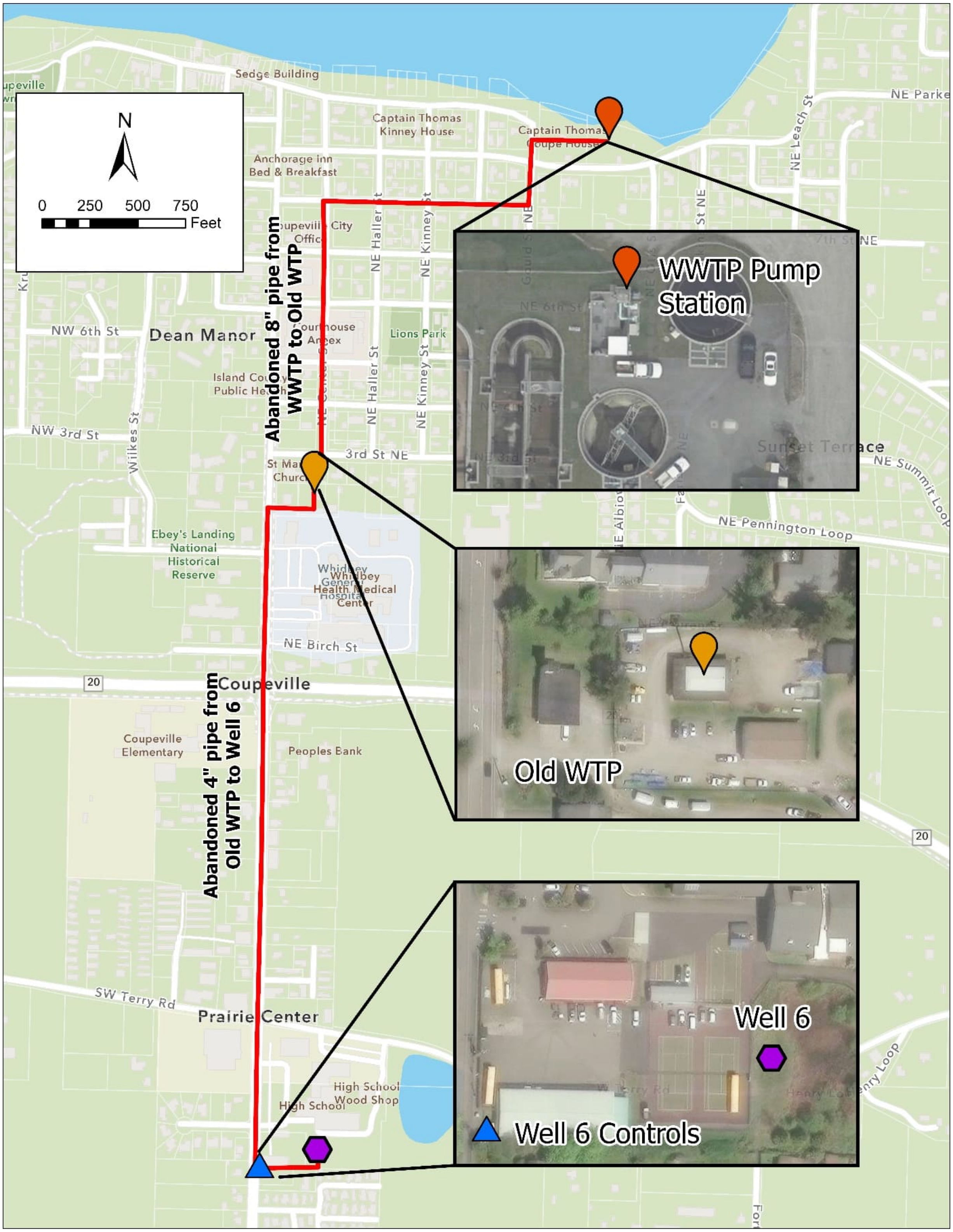


Figure 4-2. Existing WWTF Outfall Pump Station

Figure 4-3. WWTP Outfall Pump Station with a Third Pump Bay between Two Existing Pumps

The existing abandoned 8-inch PVC pipe from the WWTP to the old WTP could be tested and reused for the proposed reclaimed water system. As shown on Figure 4-4, the existing pipe runs along Center and 8th Streets. It was originally installed as the drainpipe for flushing the potable water tank in the basement of the old water plant when the tank was offline and cleaned. The pipe was abandoned in place and should be evaluated as part of design of the reuse system but is expected to be useable. The pipeline does not have any known connections to homes or potable water users. The pipeline will be tested during the next phase of design to confirm that no cross connections exist.

Figure 4-4. Key Locations for Reuse Upgrades



There is also an abandoned 4-inch steel pipe from the old sewer lift station to North Main Street near the WTP. This pipe was also abandoned in place and is expected to be useable. This 4-inch pipe was a pressure mainline near the well to the old WTP and does not connect to homes or potable water users. The 4-inch pipe has a capacity of 180 gpm at 4.6 feet per second velocity and about 2.2 feet of head loss per 100 feet of length. The pipeline from Well 6 to the WTP is about 4,200 feet long so the 4-inch pipe would have about 90 feet (40 pounds per square inch) of friction loss at 180 gpm, but only 45 feet (20 pounds per square inch) of pressure loss at 120 gpm. The 8-inch drainpipe from the WTP to the WWTP is 3,400 feet long and has a capacity of 180 gpm at 1.2 feet per second velocity and about 0.07 foot of head loss per 100 feet of length. The 8-inch pipe would have less than 5 feet of friction loss at 180 gpm. The average flow rate during the dry season is about 100 gpm and the average flow rate during the wet season is about 140 gpm.

Both existing pipes have been unused for years and should be evaluated to determine if they are watertight and suitable for use. If the existing pipes need significant repair an alternative to installing a completely new pipe could be to use the 8-inch drainpipe as a conduit to slip line a 6-inch HDPE pressure pipe inside the 8-inch pipe to avoid excavation through the Town. Similarly, the 4-inch pipe could be used as a conduit for a 4-inch or 6-inch HDPE pipe pulled through it with pipe bursting of the old pipe to minimize excavation in the highway. Testing integrity of the existing pipes could include camera inspection and pressure or dye testing.

To start reuse as soon as possible and for the lowest cost, it is recommended that farmers connect their irrigation water pipe to the effluent pipe near Well 6 to extract water from the pipeline before Well 6 is permitted for ASR. Even after ASR is available, the farmers will need to connect to the Town reuse pipeline to access summer reuse water that is directly available from the pipeline before it is recharged and access the stored winter water that is extracted from the well when it is needed in summer. The benefit to farmers of connecting directly to the pipeline would be that the water could gravity flow to most farms in the prairie from Well 6 with gravity pressure from the WTP and could reduce the amount of water that farmers currently pump from potable groundwater. The WTP is about 75 feet higher elevation than Well 6 so the pipeline would have some pressure available at the point of farmer connections. Each farm connection would require a backflow preventor to isolate the farms from each other and from the well, so water only goes one direction in the pipelines – from the Town to each farm independently. Multiple farmers own land near the well and could access the well pipeline with permanent or temporary piping. A more expensive option would be for the Town to install irrigation supply pipelines to farmers throughout the prairie as outlined in the 2010 study (BHC 2010).

Assuming an average flow of 100 gpm for 6 months of summer, Alternative 1 can deliver about 26 million gallons or about 80 acre-feet of Class B irrigation water. Alfalfa hay could produce about 1 ton per acre of additional livestock feed with about 4-inch of irrigation per acre. The 2025 *Washington-Oregon (Columbia Basin) Direct Hay Report* (USDA 2025) lists premium alfalfa hay for $200/ton and Utility/Fair quality alfalfa hay at $140/ton. The potential value of reuse irrigation without stored water is about $48,000 for premium hay and $33,000 for fair hay. Farmers that use reuse water instead of pumping their wells could make more water available in the shallow aquifers that are used for irrigation by other farmers and as potable water wells, thereby increasing the reliability of groundwater sources.

Alternative 1 benefits Penn Cove water quality in the summertime by reducing or eliminating discharge and may allow a seasonal reduction in shellfish harvest limitations.

4.2 Alternative 2 – Class B Reuse Irrigation Water in Summer and ASR at Well 6 for Winter Storage and Summer Irrigation

Alternative 2 uses Class B reuse water and includes all components of Alternative 1 plus aquifer storage and recovery (ASR, as defined above) of Class B reuse water at Well 6. Section 4.4 (ASR Well Feasibility-level Design) further describes the ASR design. This alternative will store reuse water produced by the WWTP in the winter in the deep saline aquifer and extract the water for irrigation in the summer. Direct reuse will also be available for irrigation during the summer. Alternative 2 has two sub-alternatives: 2A reuses all flow except peak flows, which continue to be discharged to Penn Cove; 2B has added capacity in pumps and pipes to be able to pump all flows for reuse, including peak flows, and will eliminate reliance on the Penn Cove outfall.

For Alternative 2A, the two additional pumps at the WWTP outfall pump station will be 30 hp each rather than the two pumps at 15 hp each as recommended for Alternative 1 so that all flows up to the peak day flow of 360 gpm could be reused. Assuming an average flow of 100 gpm for 6 months of summer and 140 gpm for 6 months of winter plus most peak flows, Alternative 2 can deliver about 70 million gallons or 215 acre-feet of irrigation water. Alfalfa hay could produce about 1 ton per acre of additional feed with about 4 inches of irrigation per acre. The potential value of larger pumps and reuse irrigation with ASR-stored water is about $128,000 for premium hay and $90,000 for fair hay. The reuse water could be used on about 640 acres for supplemental irrigation of hay.

Alternative 2B will add a new larger pump station at the WWTP with enough capacity to deliver all flow including winter peak flow to the old WTP and a new larger pipeline from the old WTP to Well 6. Alternative 2B could eliminate the use of the Penn Cove outfall from the WWTP and would add the benefit of increasing the harvestable acreage of shellfish near Coupeville. The amount of additional water delivered to Well 6 is not significant compared to the volume presented in Alternative 2A since the peak flow only occurs for a few weeks per year. What is significant is the ability to stop use of the Penn Cove outfall, which will help to improve water quality in the cove and potentially reduce the area of shellfish harvest restrictions. According to the DOH Shellfish Safety Information website (Figure 1-1), the primary cause of closure for shellfish harvest at the beaches and near-shore waters is the wastewater treatment plant outfall. An economic analysis of commercial and recreational shellfish harvest will be included in the next phase of more detailed evaluation of reuse. Increasing the harvestable acreage of shellfish is a goal of reuse at Coupeville.

Alternative 2B requires a new pump station at the WWTP with a wet well large enough to buffer instantaneous peak flows and three new pumps of 50 hp each to have capacity to pump the peak flows with two pumps and one additional pump as redundant. The use of the outfall would be eliminated, but it would remain in place as an emergency only relief for an unlikely event such as a failure in the pipelines. Additional standby power generation would be required to operate the larger pump station in the event of a power outage. Alternative 2B will also require a new, larger pipeline from the WTP to Well 6. The existing abandoned 4-inch-diameter steel pipe would be replaced or paralleled with an 8-inch-diameter PVC pipeline.

ASR of fresh reuse water with low salinity in the saline aquifer will create a bubble of freshwater that displaces the saline water as the water is injected from the well into the aquifer. Low-salinity reuse water stored and later extracted from a saline aquifer (even if the aquifer is up to seawater salinity) will be nearly as fresh when extracted as it was when it was injected for approximately 60 percent to 90 percent of the volume of the reuse water injected. The 40 percent to 10 percent of the stored and extracted reuse water that is more saline will still be a blend of the aquifer water salinity level and the fresh reuse water salinity level. The Well 6 deep aquifer is too saline for a public water supply but is suitable for irrigation and the salinity will be more suitable when blended with reuse water.

4.3 Alternative 3 – Class A Reuse Irrigation Water in Summer and ASR at Well 6 for Winter Storage and Summer Irrigation

Alternative 3 includes upgrading the WWTP to produce Class A water. Alternative 3 has two sub-alternatives: 3A reuses all flow except peak flows that continue to be discharged to Penn Cove; and 3B creates added capacity in pumps and pipes to pump all flows for reuse, including peak flows, and added pump redundancy and back-up power supply to eliminate reliance on the Penn Cove outfall.

Alternative 3A includes all components of Alternatives 1 and 2A in addition to upgrading the WWTP to produce Class A reuse water. Section 4.4 (ASR Well Feasibility-level Design) further describes the ASR design. Alternative 3A would also include storage of up to 2 days of WWTP effluent in a tank before ASR at Well 6. This alternative will store reuse water produced by the WWTP in the winter in the deep saline aquifer and extract the water for irrigation in the summer. Direct reuse will also be available for irrigation during the summer.

Alternative 3A will require the addition of a 350,000-gallon tank to hold about 2 days of WWTP effluent flow. There is limited space at the WWTP, so the new storage tank could potentially be installed in the parking area of the old WTP. The tank will help buffer the flow difference between the diurnal flow of the WWTP and a more constant flow for recharging of Well 6. The tank would also allow farmers to stop irrigation at night and irrigate at a higher rate during the day. The 4-inch pipe from the WTP tank to the farm connections could deliver up to 180 gpm by gravity with minimal, but positive pressure at the farm connection.

Adding the storage tank to the system will allow for the Town to capture more of the peak wet weather flow that would otherwise be discharged to Penn Cove but not the largest peaks. The limitation in the system capacity is the pump station capacity and the 4-inch pipe downstream of the tank and not the 8-inch pipe upstream of the tank. The 8-inch pipe between the WWTP and the tank has low friction loss even up to the 440-gpm maximum hydraulic capacity of the WWTP. With larger pumps at the WWTP almost all the effluent could be reused including peak flows.

An additional benefit of the tank could be to use it as a settling basin for alum and particulate before filtration. Class A water will require coagulation and filtration. Coagulation alum or powdered activated carbon added at the WWTP after disinfection would have complete mixing in the pumps and pipeline up to the WTP. Locating the tank at the WTP would allow using the tank as a clarifier for the coagulant. Locating the filter at the WTP to remove the coagulant after about 2 days of settling will produce a lower turbidity water for ASR. This will produce an alum sludge at the WTP that would have to be put into a sewer maintenance hole connection to send it to the WWTP.

For Alternative 3A, the two additional pumps at the WWTP outfall pump station will be 30 hp each rather than the two pumps at 15 hp each as recommended for Alternative 1 so that all flows up to the peak day flow of 360 gpm could be reused. The instantaneous and peak hour flows during large winter storms will continue to be discharged to Penn Cove through the outfall. Assuming an average flow of 100 gpm for 6 months of summer and 140 gpm for 6 months of winter plus peak flows, Alternatives 2 or 3 can deliver about 70 million gallons or 215 acre-feet of irrigation water. Alfalfa hay could produce about 1 ton per acre of additional feed with about 4 inches of irrigation per acre. The potential value of larger pumps and reuse irrigation with ASR-stored water is about $128,000 for premium hay and $90,000 for fair hay. The reuse water could be used on about 640 acres for supplemental irrigation of hay.

Alternative 3B will add a new larger pump station at the WWTP with enough capacity to deliver all flow including winter peak flow to the old WTP and a new larger pipeline from the old WTP to Well 6. Alternative 3B could eliminate the use of the Penn Cove outfall from the WWTP and would add the benefit of increasing the harvestable acreage of shellfish near Coupeville. The amount of additional water delivered to Well 6 is not significant compared to the volume presented in Alternative 3A since the peak flow only occurs for a few weeks per year. What is significant is the ability, with Alternative 3B, to stop use of the Penn Cove outfall, which will help to improve water quality in the cove and potentially reduce the area of shellfish harvest restrictions.

Alternative 3B requires a new pump station at the WWTP with a wet well large enough to buffer instantaneous peak flows and three new pumps of 50 hp each to have capacity to pump the peak flows with two pumps and one additional pump as redundant. The use of the outfall would be eliminated, but it would remain in place as an emergency only relief for an unlikely event such as a failure in the pipelines. Additional standby power generation would be required to operate the larger pump station in the event of a power outage. Alternative 3B will also require a new, larger pipeline from the WTP to Well 6. The existing abandoned 4-inch-diameter steel pipe would be replaced or paralleled with an 8-inch-diameter PVC or HDPE pipeline.

4.4 ASR Well Feasibility-level Design

Groundwater recharge includes direct groundwater recharge and storage and may include recovery of reclaimed water stored in an aquifer with other groundwater withdrawals. The intent of groundwater recharge is planned replenishment of the groundwater for an in situ value (saltwater intrusion barrier, increase base flows for instream flows, maintain geologic structure, preserving potable groundwater replaced with reuse water), for recovery later for beneficial uses, and to maintain a consistent sustainable yield from an aquifer. Direct groundwater recharge introduces reclaimed water directly and immediately into a groundwater aquifer through direct injection using a well completed in the saturated zone.

Static and injection well water levels are important in ASR designs as the injected water must be conveyed to the aquifer without entraining air in the injected water. One cannot simply dump water into the well if the wells water level is not above the ground surface in a pressurized pipe. The simplest method of injection into an ASR well is to inject water back through the well pump. The well pump bowls and impellers will act as a downhole throttling device and will back up the water column to create positive pressure in the top of the pump column. A vertical line shaft turbine pump is required for this type of injection method. The pump shaft and impellers are prevented from spinning in reverse via the pump's nonreverse rachet and a minimum injection flow must be applied to create positive pressure at the top of the pump column.

Submersible well pumps are not suitable for injection back though the pump as the reverse spin of the pump cannot be controlled. Because of the type and design of the submersible pumps thrust bearing, the bearing can be damaged under reverse spin conditions. However, the addition of a recharge valve above the existing submersible pump could allow the pump to be used since the valve would discharge water above the pump to minimize pump rotation. The recharge valve would open and close as the flow to the well varied to maintain positive pressure at the ground surface and prevent air entrainment.

The depth to the top of the aquifer in Zone A is shown in the Well 6 report as about 400 feet below sea level and the aquifer zone appears to be about 50 feet thick (AGI Technologies 1995). Well 6 is drilled 520 feet deep below ground surface (BGS) to 430 feet below sea level and has number 30 slot (.0030-inch opening) screen from 511 feet BGS to 520 feet BGS and a number 20 slot (0.0020-inch opening) screen from 500 feet BGS to 511 feet BGS. The static water level is about 80 feet below ground surface or approximately 9 feet above sea level. The top of casing elevation is 89 feet.

A new vertical turbine pump for the 200 gpm to 300 gpm withdrawal application would be 6-inch diameter at 1,800 rpm. A recharge valve to allow the existing pump to be used would be 4-inch diameter. The Well 6 pump column pipe could be 4- or 6-inch steel pipe, and the pump could be set to about 200 to 300 feet BGS. A 12-inch well casing is recommended for the application using a new 6-inch line shaft turbine pump to provide room in the well for the pump and water level measuring equipment. The existing well casing can be used with a submersible pump and ASR control valve.

The stored water would be recovered by the well pump and discharged into the existing 4-inch piping or a new larger pipe. A check valve, air valve, flowmeter, sampling valves, and isolation valve would be included in the piping design. A piping bypass around the check valve would be equipped with an injection control valve to start, stop, and throttle injection flows.

4.5 Reuse Water Demand

The reuse water program is designed to provide irrigation water to farmers in and nearby the Ebey's Landing National Historical Reserve. The Historical Reserve covers about 19,000 acres of mostly private land. The National Parks Service owns about 200 acres. Approximately 1,000 acres of agricultural land is nearby Well 6 and could feasibly be connected to the reuse water system. More than 1,500 acres of agricultural land is accessible for reuse water if a pipeline is extended to the lands owned by the National Park Service near the Jacob Ebey house, which could supply farmers along its length.

Appendix F contains an excerpt from the 2010 reuse feasibility report *Element 2-B Estimated Demand for Reclaimed Water* that is still pertinent today and provides additional detail on irrigation demands for various crops under full and deficit irrigation practices. The conclusion of Element 2-B is that more land could benefit from reuse irrigation than there is water to supply so deficit irrigation to apply the water to a larger land area will result in the greatest benefit to farmers. The conclusions from the 2010 report remain true in current conditions. Table 4-1 provides an example crop and irrigation strategy for irrigation of 20-acre parcels in Ebey's Prairie.

Table 4-1. Ebey's Prairie Crop Strategy for Irrigation of 20-acre Parcels (BHC 2010)

Crop	Irrigation Strategy	Irrigation Applications	Inches of Water Applied	Total Inches Applied	Acre-feet Applied
Alfalfa	Until second cutting	Three	9	12	20
Apples	Fruit filling	Two	6	8	13
Corn	After tassel	One	3	4	7
Pasture	Until mid-July	Two	6	8	13
Potatoes	Full irrigation	Three	9	12	20

Meetings with farmers in late 2024 and early 2025 have indicated that there is still a high level of interest in using reuse water for irrigation of alfalfa and grass hay, wheat, barley, oats, as well as irrigating pastures and potentially new higher value crops. Section 6 (Public Outreach) provides more information on public outreach. High-value crops that can be grown in this climatic region if irrigation is available include feed corn, orchards, and many seed crops. The reserve area once had multiple dairy farms that created a high demand for hay and pasture. The dairies have primarily been replaced with beef cattle operations that still require hay for winter feed and utilize the grass pastures for summer feed. Irrigation of livestock feed alone could utilize all of the reuse water available.

Irrigation of livestock feed crops is currently done with several types of sprinkler irrigation systems including hand lines, wheel lines, and big gun sprinklers. These systems are well suited for partial or supplemental irrigation since they are mobile and can be moved to multiple fields to apply water over a large area with relatively small equipment cost. The demand and value of reuse water irrigation is estimated based on supplemental or deficit irrigation of alfalfa hay. With deficit irrigation, the crop receives less than the water demand of a fully irrigated crop but still much more than with rainfall alone.

This irrigation method produces the greatest benefit to farmers when there is more land available than is needed to utilize all the reuse water since more land has a boost in yield. The estimated annual irrigation demand for livestock feed crops that produces the most benefit to farmers is 4-inches of irrigation. The full irrigation demand of livestock feed ranges from about 6-inch to 12-inch near Coupeville, as indicated in the 2010 feasibility assessment (BHC 2010). The irrigation demand for reuse water in the prairie exceeds the water source available. Figure 4-5 shows the proposed reuse system delivery point to farmers and Figure 4-6 shows the agricultural land near Coupeville that could potentially be irrigated.

The reuse program is envisioned to have a life expectance of 20 years for planning and permitting purposes. The program could continue beyond that period without an end date if it continues to add value to the end use farmers and reduces the risk that the Town may need to upgrade to a more expensive treatment process for ocean discharge. The environmental benefit of the reuse program includes the potential to allow harvest of shellfish from the shoreline and near-shore areas of the cove. Other aquatic life will also benefit from minimizing the ocean outfall use. The water supply of farms in the Ebey’s Landing Historic Reserve will benefit from reduced use of potable groundwater when the farms irrigate with reuse water instead of existing or new shallow aquifer potable groundwater wells. The total watershed of Ebey’s Landing will have more water available with reuse irrigation, which will result in additional surface water over a longer season than currently exists since crops will use more reuse irrigation water and less rainfall. Perhaps the greatest benefit will be the continuation of successful farming that is the basis of the current and historic landscape around Coupeville.

The contingency plan for both temporary and permanent reversion to domestic wastewater facilities without reuse if the reuse program is ended will be to stop pumping reuse water at the WWTP and allow all treated effluent to discharge to Penn Cove as it currently does. The discharge pump station facilities, ocean outfall, and discharge permit will be kept in place to allow for this contingency. If the reuse program is ended, most farms in Ebey’s Landing will revert to irrigation with potable groundwater or will not irrigate. It is likely that some farms will not be profitable enough without irrigation to survive future droughts or extreme weather events and cease operations. Farms that continue to irrigate with potable groundwater will reduce the potential potable groundwater supply that is relied upon by the community as a whole.

Figure 4-5. Proposed Reuse System Delivery Point to Farmers

Over 1,000 Acres of Agricultural Land near Well 6

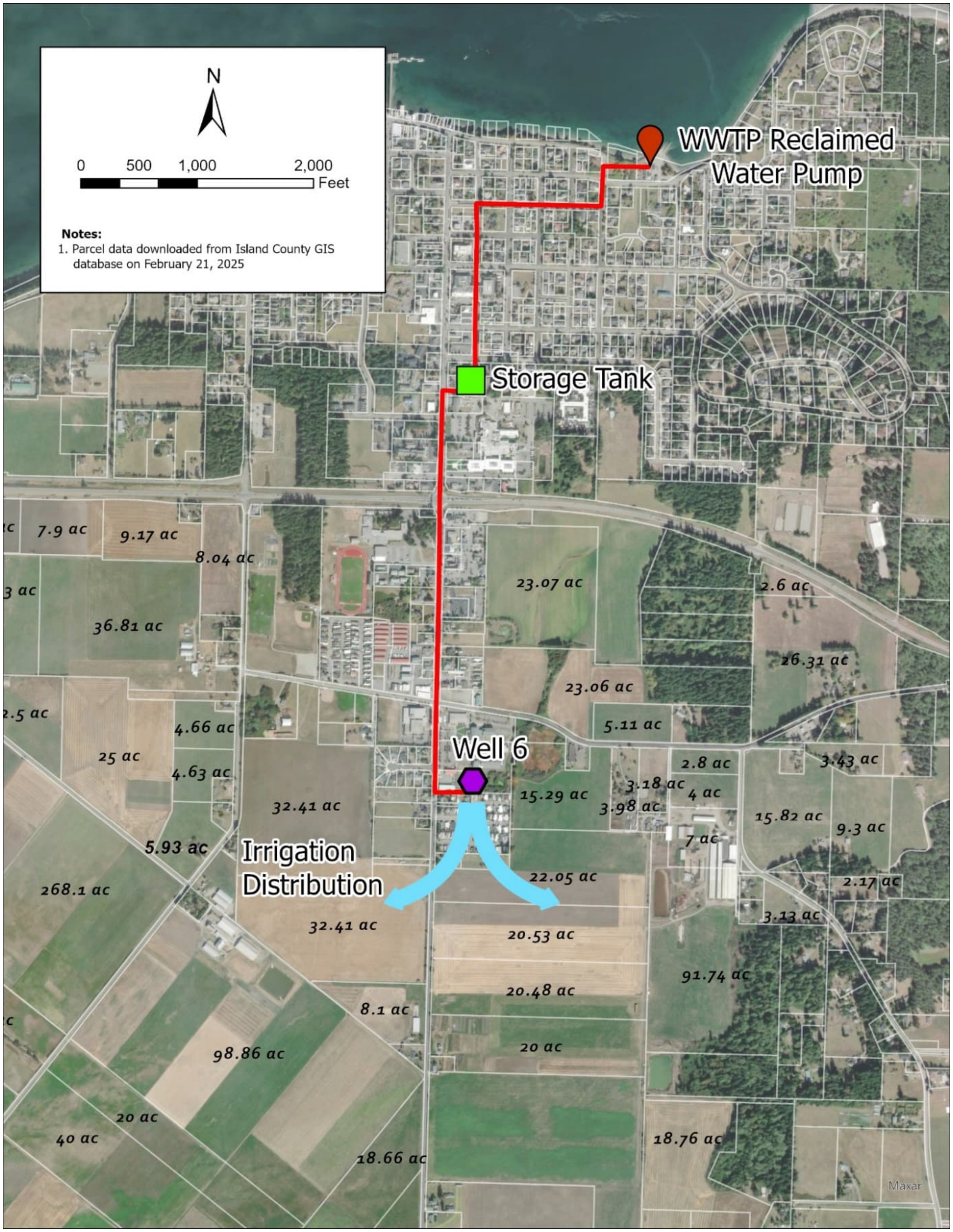
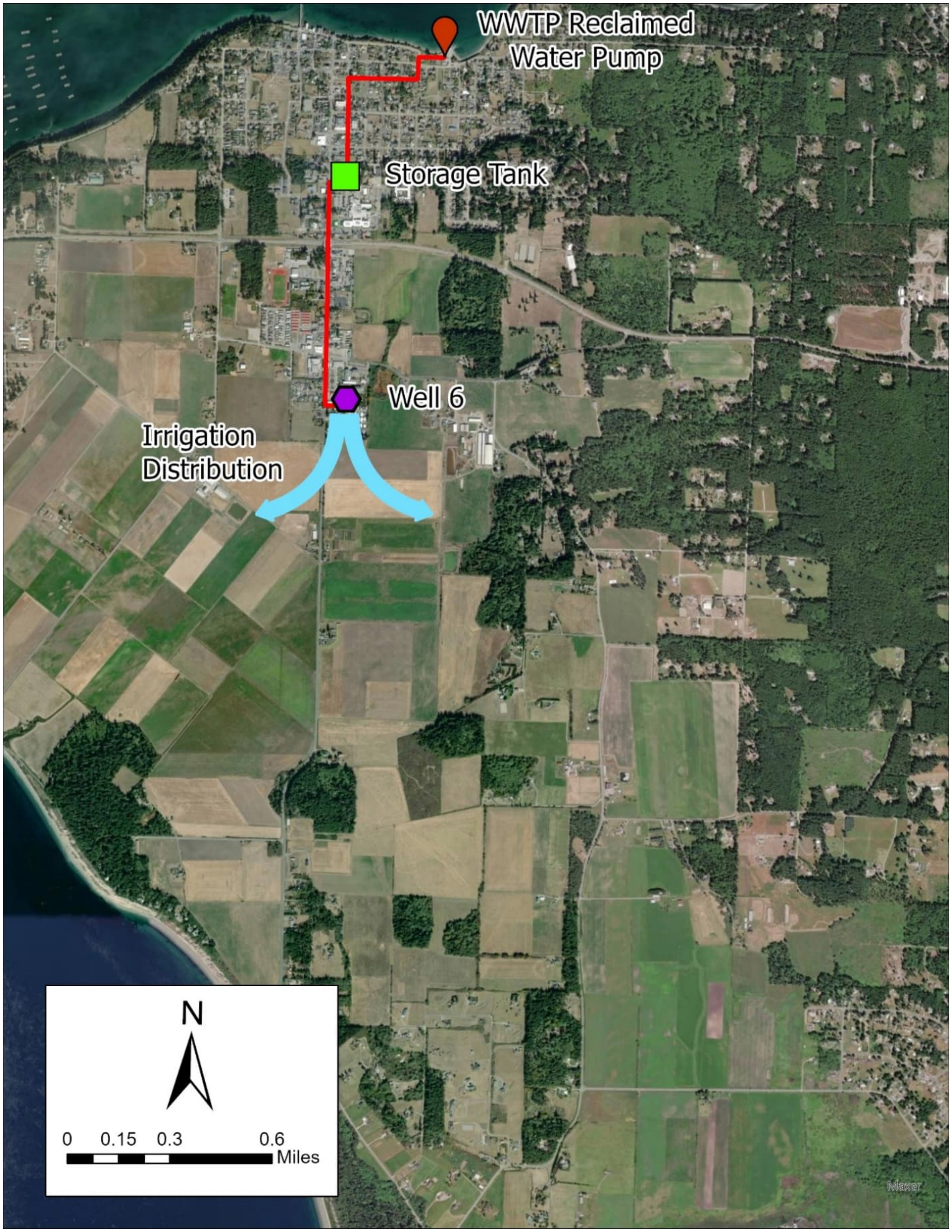


Figure 4-6. Agricultural Land near Coupeville



4.6 Impairment Analysis

WAC 173-219-090(1) requires that an applicant for a reclaimed water permit demonstrate compliance with RCW 90.46.130. This section of the Reclaimed Water Use Act requires that the reclaimed water project not impair existing water rights downstream from any freshwater discharge point unless compensation or mitigation for such impairment is agreed to by the holder of the affected water right. WAC 173-219-090(4) requires of the applicant to prepare the water rights impairment analyses.

As described in the 2010 feasibility assessment (BHC 2010), no impairment of senior water rights is anticipated from the proposed reuse system because current effluent from the Coupeville WWTP is discharged directly to Penn Cove and there are no downstream water rights users (BHC 2010).

4.7 Coordination with Public Potable Water Suppliers

WAC 173-219-180 (1) (c) (vii) requires coordination between the proponent of reclaimed water use with any public potable water suppliers. The Town of Coupeville is the only potable water supplier that provides water to the reclaimed water generation, storage, and distribution facilities through discharge of used potable water as sewage. The Town has recently installed a state-of-the-art carbon treatment filtration system in a new potable water treatment plant that treats the potable groundwater before distribution to residents and businesses. The Town residents have water that is low in constituents of concern, which also reduces the potential for these constituents to be in the reuse water. The farmers and rural residents in the proposed reclaimed water use areas mostly have private wells for potable use and for irrigation use unless they are near Town limits and are connected to the municipal water supply. The coordination with potable water supplies and reclaimed water services including cross connection prevention actions in design and operation of the reclaimed water system is provided by the Town staff, which manages both the potable water system and the reuse water system. Results of coordination with the potable water supply will be included in the engineering report during the next phase of engineering design of the reuse system.

5. Cost Estimates and Funding Sources

5.1 Cost Estimates

The following cost estimates (Table 5-1 to Table 5-5) are based on Class 5 feasibility-level costs with an expected level of accuracy of -50% to +100%. All costs are estimated in terms of total capital, annual cost and present worth over a 20-year planning period. The federal discount rate as of March 2025 of 4.5% was used in present worth and annual cost calculations (Federal Reserve 2025). Refer to Appendix G for more detailed information.

Table 5-1. Alternative 1: Class B Effluent with Direct Reuse Cost Estimate

Capital Costs	
WWTP Outfall Pump Station (Two 15 hp pumps and power supply / controls)	$60,000
Piping Connections (Old WTP)	$20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$50,000
Engineering and Permitting	$100,000
Total Capital Cost	$240,000
Total Capital Cost -50%	$120,000
Total Capital Cost +100%	$480,000
Operation and Maintenance Costs	
Energy (pumping)	$10,000
Annual Pump and Pipe Repair	$5,000
Labor for Increased Monitoring, Reporting, and Repair	$10,000
Total Annual O&M Cost	$25,000
Total Annual O&M Cost -50%	$12,500
Total Annual O&M Cost +100%	$50,000
Net Present Value	$565,198
Annualized Costs	$43,450

Table 5-2. Alternative 2A: Class B Effluent with Direct Reuse and ASR Cost Estimate

Capital Costs	
WWTP Outfall Pump Station (Two 30 hp pumps and power supply / controls)	$120,000
Piping Connections (Old WTP)	$20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$50,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$150,000
Well 6 Pump Testing	$10,000
Engineering and Permitting	$200,000
Total Capital Cost	$560,000
Total Capital Cost -50%	$280,000
Total Capital Cost +100%	$1,120,000
Operation and Maintenance Costs	
Energy (pumping)	$30,000
Annual Pump and Pipe Repair	$10,000
Labor for Increased Monitoring, Reporting, and Repair	$20,000
Total Annual O&M Cost	$60,000
Total Annual O&M Cost -50%	$30,000
Total Annual O&M Cost +100%	$120,000
Net Present Value	$1,340,476
Annualized Costs	$103,051

Table 5-3. Alternative 2B: Class B Effluent with Direct Reuse Including Peak Flows and ASR Cost Estimate

Capital Costs	
WWTP New Pump Station (Three 50 hp pumps and power supply / controls concrete wet well and deck, standby generator)	$200,000
Piping Connections (Old WTP)	$20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections) WTP to Well 6 new 8-inch PVC Pipe (4,000 feet in street right-of-way)	$50,000 $500,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$150,000
Well 6 Pump Testing	$10,000
Engineering and Permitting	$300,000
Total Capital Cost	$1,240,000
Total Capital Cost -50%	$620,000
Total Capital Cost +100%	$2,480,000
Operation and Maintenance Costs	
Energy (pumping)	$50,000
Annual Pump and Pipe Repair	$20,000
Labor for Increased Monitoring, Reporting, and Repair	$30,000
Total Annual O&M Cost	$100,000
Total Annual O&M Cost -50%	$50,000
Total Annual O&M Cost +100%	$200,000
Net Present Value	$2,540,794
Annualized Costs	$195,326

Table 5-4. Alternative 3A: Class A Effluent Upgrades with Direct Reuse and ASR Cost Estimate

Capital Costs	
WWTP Outfall Pump Station (Two 30 hp pumps and power supply / controls)	$120,000
Piping Connections (Old WTP)	$20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$50,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$150,000
Well 6 Pump Testing	$10,000
Class A WWTP Upgrades and Storage Tank	$1,650,000
Engineering and Permitting	$400,000
Total Capital Cost	$2,410,000
Total Capital Cost -50%	$1,205,000
Total Capital Cost +100%	$4,820,000
Operation and Maintenance Costs	
Energy (pumping)	$60,000
Annual Pump and Pipe Repair	$30,000
Labor for Increased Monitoring, Reporting, and WWTP Repair	$80,000
Class A Chemicals and Advanced Operations Labor	$481,500
Total Annual O&M Cost	$651,500
Total Annual O&M Cost -50%	$325,750
Total Annual O&M Cost +100%	$1,303,000
Net Present Value	$10,884,671
Annualized Costs	$836,772

Table 5-5. Alternative 3B: Class A Effluent with Direct Reuse Including Peak Flows and ASR Cost Estimate

Capital Costs	
WWTP New Pump Station (Three 50 hp pumps and power supply / controls concrete wet well and deck, standby generator)	$200,000
Piping Connections (Old WTP)	$20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections) WTP to Well 6 new 8-inch PVC Pipe (4,000 feet in street right-of-way)	$50,000 $500,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$150,000
Well 6 Pump Testing Class A WWTP Upgrades and Storage Tank	$10,000 $1,650,000
Engineering and Permitting	$500,000
Total Capital Cost	$3,090,000
Total Capital Cost -50%	$1,545,000
Total Capital Cost +100%	$6,180,000
Operation and Maintenance Costs	
Energy (pumping)	$80,000
Annual Pump and Pipe Repair	$90,000
Labor for Increased Monitoring, Reporting, and WWTP Repair	$90,000
Class A Chemicals and Advanced Operations Labor	$481,500
Total Annual O&M Cost	$741,500
Total Annual O&M Cost -50%	$370,750
Total Annual O&M Cost +100%	$1,483,000
Net Present Value	$12,735,385
Annualized Costs	$979,047

5.2 Potential Funding Sources

The Department of Ecology recommended that Coupeville apply for the Puget Sound Nutrient Reduction grant that is available this year and next year. Upgrades to the WWTP and reuse projects can qualify for the grant funding. The fund has $5 million available for this year and again for next year. The maximum grant amount is $350,000 per award per year. It is likely that similar funding will continue into the future as the stakeholders of Puget Sound water quality strive to reduce nutrient discharges into the Sound over the long term. Other grant and long term loan opportunities should be pursued. The WWTP is operating within the current permit, and the rate payers are not obligated by permit to improve wastewater treatment. Town bonds and rate increases could be used to fund treatment plant upgrades and reuse as may be required by future permits or the lack of grant funding. The general environmental benefit of removing effluent from Puget Sound and increasing the area of harvestable shellfish may assist with qualifying for grant funding.

6. Public Outreach

Jacobs scheduled and conducted public outreach meetings in coordination with the Town. The purpose of the meetings was to provide the public and tribal members with a forum for input on the feasibility assessment scope and proposed reuse alternatives.

Two outreach meetings with farmers in the Ebey's Landing Reserve were held on December 23, 2024, and March 4, 2025, respectively. Appendix H contains meeting notes from the outreach events. The first meeting was with Bob and Cheryl Engle and included a general discussion of the concept of reuse water irrigation and the use of Well 6 for ASR. The Engles own the land closest to Well 6 on the east side of Engle Road. They previously owned the Engle Deep Well that shares an aquifer with Well 6 and is referenced in the 1995 Well 6 Report (AGI Technologies 1995). The well is currently abandoned and owned by the U.S. Department of the Interior. The Engles were interested in reuse as a way to use the deep well rather than directly pulling from Well 6 as the deep well is already connected to their irrigation pipeline. They would prefer that reuse water from Well 6 be Class A if they were to access it as they sell organic hay and have reservations about Class B water and organic certification.

The March 4 meeting was attended by a group of local farmers. The farmers were interested in reuse water irrigation and agreed that it would add value to their farming operations. Current operations are limited by rainfall and irrigation for fall planting would be a large benefit to the farmers. There might be USDA or Agricultural Research Service grants or cost share programs for farm irrigation improvements that could help with the cost of piping. A challenge will be getting the water piped to their farms. The farmers mostly grow livestock feed and could use either Class B or Class A reuse irrigation water. Perfluorooctane sulfonate (PFOS) were discussed as a potential concern. The Town water system has new carbon filters to remove PFOS and most other chemical contaminants. As a result, the drinking water is low in PFOS and used drinking water makes up most of the volume of the reuse water.

Additional outreach events are anticipated over the next several months including a presentation to the public and Town Council in February 2026.

7. Summary of WAC 173-219-180 Feasibility Assessment Requirements

This feasibility assessment demonstrates that the Town of Coupeville has the long-term technical, management, legal, and financial capacity to design, construct, operate, and maintain the reclaimed water facility, and that distribution and end uses are feasible. A purpose of the feasibility assessment is to ensure that resources are sufficient to provide public health and environmental protection for a planning period of 20 years.

The Town of Coupeville Public Works Director has notified the regulatory agency (agency) that the Town is proposing a new reclaimed water project early in the project-planning phase to discuss the scope of the required feasibility assessment. The agency has been notified that the Town is proposing to potentially modify their facilities and operations, to determine what, if any, additional feasibility information needs to be submitted and approved.

Table 7-1 lists the WAC requirements and summarizes how and where this feasibility assessment addresses them.

Table 7-1. WAC 173-219-190 Requirements and Location in this Feasibility Assessment

Requirement per WAC 173-219-180	Summary and Section
180 (1) (c) (i) Explanation of who will own, operate, and maintain the reclaimed water facility.	The Town of Coupeville will own, operate, and maintain the reclaimed water facility up to the point of connection with private farmer owned irrigation pipelines. The responsible manager is the public works director: Joe Grogan, (360)-678-4461, publicworks@townofcoupeville.org, Town of Coupeville, 4 NE Seventh, Coupeville, WA 98239
180 (1) (c) (ii) For a planning period of 20 years, projected capital and operational costs, in terms of total annual cost and present worth, and projected revenues from user fees and other sources, if applicable.	Section 5.1 and Appendix G contain cost estimates for all three alternatives and two sub-alternatives in terms of annual costs and net present worth. Alternative 1 is the lowest-cost alternative with a total annual cost of $43,560 and a net present worth of $565,198. Alternative 2 has a total annual cost of $103,051 and a net present worth of $1,340,476. Alternative 3 is the most expensive alternative with a total annual cost of $836,772 and a net present worth of $10,884,671. As outlined in Section 5.2, the Town intends to pay for these costs via grant funding or bonds or rate increases.
180 (1) (c) (iii) Estimate of the annual or seasonal volumes of wastewater required and available and proposed production (generation) rate of reclaimed water.	The estimate of the annual or seasonal volumes of wastewater available are provided in Section 3.1.1 and Appendix A and proposed production rate of reclaimed water are provided in Section 4.5 and Appendix F. The demand for reuse water is higher than the rate that the reuse water would be provided by the WWTP.

Requirement per WAC 173-219-180	Summary and Section
180 (1) (c)(iv) Description of the proposed level of reclaimed water quality the project will generate, along with general descriptions of the treatment systems and reliability features used by the proposed facility. The project proponent must demonstrate that the proposed facility concept is capable of meeting and ensuring the minimum requirements for water quality, treatment and reliability for the proposed uses	As described in Section 3.2 and Section 4. the proposed level of reclaimed water quality the project will generate initially is Class B with the potential to produce Class A if additional funding can be secured. Section 4 presents the general descriptions of the treatment systems and reliability features used by the proposed reuse facility. The AKART (Appendix A) (Jacobs 2023a) and Nitrogen Reduction (Appendix B) (Jacobs 2023b) reports previously completed demonstrate that the proposed facility concept is capable of meeting and ensuring the minimum requirements for water quality, treatment, and reliability for the proposed irrigation uses. Two sub-alternatives propose removing the effluent from Penn Cove including peak flows to cease use of the outfall for shellfish and other aquatic life benefits. These sub-alternatives add capacity, redundancy, and backup power supply to reliably cease use of the outfall.
180 (1) (c) (v) Description of plans for alternative use, storage, or release of any reclaimed water or inadequately treated water.	As outlined in Section 4.5, the plan recommends retaining the Penn Cove outfall to be used as the alternative discharge of water not suitable for reuse and nonirrigation season or peak flows. The existing Coupeville NPDES permit should remain in effect to regulate such discharges. Two sub-alternatives propose removing the effluent from Penn Cove including peak flows to cease use of the outfall for shellfish and other aquatic life benefits. These sub-alternatives add capacity, redundancy, and backup power supply to reliably cease use of the outfall. The outfall will remain in place and connected to the WWTP as an emergency only discharge.
180 (1) (c) (vi) Initial assessment of potential water quality and quantity impairment and potential strategies to prevent, compensate, and/or mitigate for such impairment.	As stated in Section 4.6, no impairment of senior water rights is anticipated from the proposed reuse system because current effluent from the Coupeville WWTP is discharged directly to Penn Cove and there are no downstream water rights users. Because the WWTP currently discharges to saltwater, no further impairment analysis is required.
180 (1) (c) (vii) List of all public potable water suppliers that provide water to the reclaimed water generation, storage, and distribution facilities in addition to proposed reclaimed water use areas. Describe proposed methods to coordinate with potable water suppliers on reclaimed water service including cross connection prevention actions in design and operation of the reclaimed water	As described in Section 4.7., the Town of Coupeville is the only potable water supplier that provides water to the reclaimed water generation, storage, and distribution facilities through discharge of used potable water as sewage. The farmers and rural residents in the proposed reclaimed water use areas mostly have private wells for potable use and for irrigation use unless they are near the Town

Requirement per WAC 173-219-180	Summary and Section
system. Results of coordination with the listed potable water suppliers must be included in the engineering report under Chapter 173-219-210 (2) (f).	limits and are connected to the municipal water supply. The coordination with potable water supplies and reclaimed water services including cross connection prevention actions in design and operation of the reclaimed water system is provided by the Town staff, which manages both the potable water system and the reuse water system. Results of coordination with the potable water supply will be included in the engineering report during the next phase of engineering design of the reuse system.
180 (1) (c) (viii) Description of the contingency plan for both temporary and permanent reversion to domestic wastewater facilities and alternative water supply systems where applicable, if reclaimed water production (generation) is discontinued. Include the impact of increased demand to water purveyors.	As outlined in Section 4.5, the plan recommends retaining the Penn Cove outfall to be used as the alternative discharge of water not suitable for reuse and nonirrigation season or peak flows. The existing Coupeville NPDES permit should remain in effect to regulate such discharges. Two sub-alternatives propose removing the effluent from Penn Cove including peak flows to cease use of the outfall for shellfish and other aquatic life benefits. These sub-alternatives add capacity, redundancy, and backup power supply to reliably cease use of the outfall except in emergencies.
180 (1) (c) (ix) A brief description of the community outreach and public involvement conducted or planned to be conducted, as you determine feasibility, to demonstrate awareness of and community support for the reclaimed water project.	Meeting notes from public outreach activities with area farmers are available in Appendix H and summarized in Section 6. Community feedback has been generally positive. The farming community recognizes the potential benefit of reuse irrigation of either Class A or Class B reuse water. The benefit would be greatest with Class A water, but the community recognizes that the cost burden is greater than the benefit to farmers unless a significant portion of the cost could be covered by grant funding. Farmers will be more profitable with either Class A or Class B water for irrigation than without irrigation. The community may regain the benefit of shellfish harvest and other activities in Penn Cove if treated wastewater is reused rather than discharged to the cove. A meeting of the general public, tribes, and Town Council is scheduled for February 2026.
180 (1) (c) (x) Identification of existing or proposed interlocal or interagency agreements related to reclaimed water, if any, with local governments or local potable water utilities within the area of existing or proposed distribution and use of reclaimed water.	No interlocal or interagency agreements related to reclaimed water, are required with local governments or local potable water suppliers within the area of proposed distribution and use of reclaimed water. The Town of Coupeville owns and

Requirement per WAC 173-219-180	Summary and Section
	operates the potable water supply system and the WWTP facilities and the proposed reuse facilities
180 (1) (c) (xi) Statement of compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), where applicable.	SEPA and NEPA compliance will be confirmed in the Engineering Design Report in the next phase of design.
180 (3) (a) Proposed reclaimed water facility customers	As described in Section 4.5, the proposed reclaimed water customers will be local farmers in the Ebey's Landing National Historical Reserve. Signed water use agreements will be included in the engineering report during the next phase of engineering design of the reuse system. Section 3.3 and Appendix D include information about the properties of the Well 6 aquifer including a pilot pumping test. Additional hydrogeological testing will be completed and shared in the engineering report and used to inform estimates of recovery rates and available withdrawal rates.

The use of reclaimed water must be considered and coordinated under other planning requirements in state law as well as local codes and ordinances. Relevant planning documents produced under other planning requirements related to reclaimed water are submitted as references or appendix material in this report. Relevant documents that define aspects of the proposed reuse program are as follows:

1. 1994: *Well 6 Pump Test with Aquifer Cross Section and Well Log* (Appendix D)
2. 2010: *Town of Coupeville Final Reclaimed Water Feasibility Assessment* (Appendix F)
3. 2023: *Coupeville WWTP AKART Analysis* (Appendix A)
4. 2023: *Coupeville WWTP Nitrogen Optimization Plan* (Appendix B)

The Town of Coupeville has capacity to design, construct, operate, and maintain the reclaimed water facility and distribution and end uses are feasible. The Town has recently managed design, construction, and is now operating a multi-million-dollar potable water plant with advanced carbon treatment for removal of PFOS and other contaminants. The components of the reuse program are relatively simple in comparison to this recent project. This feasibility assessment identifies the major components and a description of the proposed reclaimed water facility and its proposed customers.

The Town of Coupeville has over 1,900 citizens and operates a complete administration staff and a public works department with the technical, managerial, administrative, operational, legal, and financial capacity to comply with implementing and managing a reuse program as defined in this report.

The Town of Coupeville has demonstrated the ability to hire and retain certified WWTP operators who will be directly responsible for achieving effective and reliable routine operations. The Town uses contract services as needed to support large projects including subcontracted services such as engineering, legal, and accounting.

8. Recommendations

The Town should start a reuse program as soon as possible, potentially by the summer of 2026, by implementing Alternative 1. The Town should continue to pursue permitting of the ASR well as a long-term solution to minimize the potential risks of discharging to Penn Cove. The Town can expand the reuse program to the levels described in Alternative 2 after a few years of reuse irrigation in summer only. When an ASR permit is available, the Town can fully switch to Alternative 2A, including ASR operations at Well 6.

Alternative 3A is too expensive to justify since the WWTP currently makes Class B water that can be reused or discharged to the Cove. If a future permit requires the WWTP to upgrade to Class A tertiary treated water or if grant money is available to pay for the upgrades, it will be advantageous to have gone through the feasibility-level assessment of this alternative and it could be implemented if needed or funded.

Alternatives 2B and 3B upgrade the reuse system to deliver all flow, including peak flows, to reuse with ASR. These alternatives would remove the use of the outfall and would create the greatest benefit toward expanding the area of harvestable shellfish along beaches and near-shore waters. The increased cost of these alternatives would require additional grant funding. Alternative 3B comes with the greatest environmental benefit but has a cost that is an unreasonable burden for rate payers alone.

The recommendation of starting with Alternative 1 is derived from a comparative assessment of alternative pros and cons, as follows:

- **Alternative 1** is the lowest cost to build and operate, but it only captures summer effluent for reuse and discharges all water in winter to Penn Cove, which reduces the environmental benefit of reuse. This alternative supports irrigation on the smallest amount of farmland, and still provides benefit to nearby farmers. This is the most basic and common type of reuse system.
- **Alternative 2** is still relatively low cost and utilizes primarily existing facilities. It requires more permitting and monitoring than Alternative 1 and uses more energy to recover water from the ASR well. However, it would benefit a much larger community of farmers. The largest number of farmers could become more profitable and sustainable with their existing operations with supplemental irrigation of reuse water. This alternative could essentially eliminate normal discharges to Penn Cove, so it has the greatest environmental benefit. Alternative 2 costs about two-and-a-half times as much to build and operate as Alternative 1, but it produces more than two-and-a-half times as much reuse water.
- **Alternative 3** produces Class A water, which has the most uses in the urban and rural area. However, most of the farms grow livestock feed and do not need Class A water. Producing Class A water is expensive. Alternative 3 costs about four times as much as Alternative 2 and produces about the same volume of reuse water. The benefit to farmers only exists if they plan to convert to human consumption crops, which are higher value but result in a large cost burden on the community. Farmers would need to change operations, including investment in additional specialized equipment, to convert to food crops and it is not certain that they would change if they could also continue to grow livestock feed and be more profitable with irrigation.

Avoid placing a user fee on the end use farmers who irrigate with the reuse water. The reuse of water rather than discharge to Penn Cove benefits the environment and the citizens of Coupeville. The value to the Town is the reliable best management of reuse water that is provided by farmers who are forward-looking enough to recognize the value of reuse irrigation to their increased crop production and profitability. The Town is asking the farmers to use their own funds to build pipelines or purchase portable pipe to connect to Well 6 so that the cost of the reuse program to the citizens ends at Well 6. The Town will provide all power costs and other costs to manage and maintain the facilities from the WWTP to Well 6 including the ASR system.

The next phase of the engineering evaluation of reuse should be started immediately to complete the process of design and permitting. Section 10 outlines next steps for the permitting process.

9. Overriding Public Interest for Aquifer Storage and Recovery Reservoir Permit

As described in Section 21.5, WAC 173-200-030 (2) requires that whenever groundwater is of a higher quality than the criteria assigned for reuse waters, the existing water quality shall be protected, and contaminants that will reduce the existing groundwater quality shall not be allowed to enter ground waters, except in those instances where it can be demonstrated to the department's satisfaction that (Ecology 2019):

- An overriding consideration of the public interest will be served.
- All contaminants proposed for entry into ground waters shall be provided with all known, available, and reasonable methods of prevention, control, and treatment prior to entry.

Coupeville is requesting an overriding consideration of the public interest for the use of ASR. The contaminants in the proposed reuse water are meeting the criteria of the current discharge permit and the WWTP is currently implementing the recommendations of an AKART analysis completed to improve effluent quality (Jacobs 2023a).

Antidegradation is implemented by establishing enforcement limits within a permit to account for site-specific conditions, including background groundwater quality. An enforcement limit is assigned to any contaminant to regulate and to protect existing groundwater quality and prevent groundwater pollution. It will be to meet antidegradation requirements with the Class B water currently produced by the WWTP. The GWQS include six exceptions that allow an enforcement limit to exceed the criterion. The sixth exception may be relevant to Coupeville and allows enforcement limits to exceed a criterion for an activity up to five years with reconsideration of the following occurring every five years:

1. **The activity provides a greater benefit to the environment as a whole and to protect other media such as air, surface water, soil, or sediments.** The Town will be protecting the water quality of Penn Cove by reducing or eliminating discharge. The reuse water will replace the use of potable groundwater for irrigation and will conserve potable water supplies. If recharged water is available for irrigation from the deep aquifer, farmers will be incentivized to use less water from their shallow potable irrigation wells, which will potentially benefit connected surface water bodies. Reducing or eliminating discharge to Penn Cove will benefit shellfish harvest and potentially remove restrictions related to proximity of the outfall.

2. **The activity has been demonstrated to be in the overriding public interest of human health and the environment.** The Town of Coupeville, the Penn Cove Shellfish Company, and the history of the site are all dependent on the health of Penn Cove. It is in the overriding public interest of the Citizens of the community and the surrounding rural area to protect human health and to restore the full health of Penn Cove. The small community is impacted every time a farmer declares bankruptcy or farmland is idled due to low profitability of marginal lands. Reuse water will increase the prosperity of the water users, and the community as a whole will benefit. Reuse would make additional water available for irrigation and could help restore shellfish harvest in the currently closed or conditionally approved areas near Coupeville. Increasing the harvestable acreage of shellfish is a goal of reuse at Coupeville.

3. **The department selects from a variety of control technologies available that minimize impacts to all affected media.** Coupeville is implementing the recommendations of a recent AKART analysis (Jacobs 2023a) to improve the control technologies that will be used to produce reliable quality reuse water.

Well 6 would be utilized for ASR operations. As described in Section 3.3, the Engel Deep Well is the only known well sharing an aquifer for Well 6 and would therefore be the only potential receptor of the injected reuse water. The Engel Deep Well is currently owned by the U.S. Department of the Interior but is no longer used due to the high salinity levels in the aquifer.

Other strategies apart from year-round ASR (Alternative 2A and 3A) could be used to improve water quality in Penn Cove; however, options 2B and 3B would fully eliminate WWTP discharge to the cove and provide the greatest benefit to the environment and potentially remove Penn Cover from its 303(d) impaired status. Alternative 1 can reduce or eliminate WWTP discharge during the irrigation season, but it does not provide benefit during the winter. Antidegradation criteria could potentially be met under Alternative 3A and 3B in which the WWTP is upgraded to produce Class A effluent. However, additional prerecharge treatment such as reverse osmosis still may be required to fully meet antidegradation criteria. Alternative 3 is currently not economically feasible without significant outside funding.

10. Next Steps

The state regulations specify the following order of processes that must be implemented to develop a reuse program (Ecology 2019):

1. **Reuse Water Feasibility Assessment –** Completed.

2. **Engineering Report –** The proponent of a reclaimed water project must submit a project specific engineering report to the regulatory agency for review and approval. The engineering report is the primary document that thoroughly examines the engineering and administrative aspects of the reclaimed water project. It provides the basis for the design of the proposed reclaimed water project including the reclaimed water treatment, storage, and distribution systems up to the meter connection at the potential use areas. It should also include standard design elements that will be required for distribution systems operated by others under distribution and use agreements. This Feasibility Assessment report identifies the major components, but the detail of design and operation is added in the Engineering Report. The engineering report will also assess the benefit of the recommended alternative to reopening shellfish harvest areas.

3. **Plans, Specifications, and Construction Documents –** The reclaimed water project proponent must submit detailed design documents (plans and specifications) to the lead regulatory agency for review and approval prior to the start of construction. No construction may begin before the lead agency is satisfied that the design complies with the requirements of WAC 173-219. Although the discussion in this section assumes a traditional design-bid-build construction delivery, a proponent may use any alternative public works contracting procedures authorized under RCW 39.10 for the proposed project. This includes design/build, design-build-operate, and general contractor/construction manager contracting methods. If the proponent intends to use any alternative contracting methods, it must discuss that intent with the lead agency in order to develop an appropriate schedule for design reviews. Jacobs has recently worked with the Town on the new WTP upgrades and is very familiar with the methods of contracting and constructing listed here. If the Town has a local contractor that they prefer to use it could be cost and time efficient to use alternative contracting to partner with a contractor during design to get their input on most efficient construction. Alternatives 1 and 2 could be designed simply with a contractor to inspect and test existing facilities that have been abandoned but will be reused as part of the project. Alternative 3 is likely best suited for a conventional bid process with large contractors outside the local area.

4. **Operation and Maintenance Manuals –** Chapter 173-219-240 WAC requires that "the Town of Coupeville must at all times properly operate and maintain any facilities or systems of control installed by the Town to achieve compliance with the terms and conditions of the [reclaimed water and ASR] permits." The rule requires the submission of an O&M manual to the lead agency to document how the Town of Coupeville will comply with this requirement. Alternatives 1 and 2 will have a simple document but Alternative 3 is more complex to operate and will have a significant O&M manual.

5. **Use and Distribution Agreements –** The reclaimed water rule regulates the generation, distribution, and use of reclaimed water to ensure all activities comply with the Chapter 90.46 RCW. While the reclaimed water permit issued by the lead agency to the Town of Coupeville includes specific requirements related to the distribution and use of reclaimed water produced at the permitted facility, the rule recognizes that the Town may not always have direct control over these areas. When the Town does not maintain direct control over the reclaimed water from the point of generation to the point of use, the Town must enter into binding agreements with each end user or distributor that receives water from the permitted facility. The rule contemplates the following ownership and agreement. The

Town of Coupeville has operational control over the generation and all distribution systems up to Well 6 but does not have operational control over some or all of the use areas. For all use areas where the Town of Coupeville does not have operational control, they must enter into use agreements with each end user receiving water. The use agreements can be prepared by the Town attorney or the engineer of record. Jacobs has existing similar use agreements from other projects that can be used as examples.

6. **Use Site Evaluations –** The purpose of the evaluation is to verify the site's suitability to accept reclaimed water. While site assessments are an important aspect of all reclaimed water feasibility analyses and engineering reports, evaluations done at this early stage may not provide adequate insight for all potential use sites. This is especially true when the proposed uses involve irrigation uses with multiple types of equipment and on multiple soil types and hydrologic settings. Evaluations done during the early stages for facilities proposing these uses often focus on the general feasibility and suitability to provide water for identified uses over a broad distribution area. Site evaluations for final design and use agreements will sample soils, observe irrigation equipment, collect well logs on home and irrigation wells and provide information that may be included in the end user agreements.

7. **Hydrogeologic Evaluation for Reclaimed Water used to Recharge Groundwater –** The hydrogeologic evaluation for an aquifer recharge project will conform to the requirements established in the Criteria for Sewage Works Design, Section E3-4 Groundwater Quality Standards Checklist (Ecology 2008). This is not required for Alternative 1, which does not use ASR for storage. The hydrogeologic evaluation is intended to establish a conceptual hydrogeologic model that is used to guide the development of the project design, identify data gaps, and to define additional data collection needs. With subsequent characterization work, the hydrogeologic evaluation assesses the potential impact of the project operations on groundwater quality, defines protective measures to minimize or mitigate those impacts, and defines the monitoring needed to assess facility compliance with the permit conditions. The following are the steps to characterize the hydrogeologic system for groundwater recharge and recovery of reclaimed water stored in an aquifer:

   a. **Feasibility Analysis**

      i. Existing data on the proposed receiving aquifer system is assembled into a conceptual model that includes: regional geology (stratigraphy and structure); geology of target reservoir unit(s); hydrogeology: recharge and discharge locations, annual estimates; water level variations; reservoir areal extent and thickness, confined conditions, water levels; reservoir transmissivity, permeability, porosity; location(s) of nearby surface water, wetlands, floodplains, and groundwater wells; locations of existing documented natural hazards potentially impacted by the project.

   b. **Conceptual Model Framework**

      i. Model framework that is flexible enough to guide and incorporate the various data collected for characterization and design of project components (i.e. variations in recharge rates and volumes, agricultural drain interactions, physio-chemical aquifer modeling).

      ii. Model framework allows for iteration between conceptual model, data collection, and numerical model development, and leads to iterations that reduce uncertainty.

         1) Data gaps are clearly identified, such as well locations, construction and depth of wells needed to address specific data needs.

         2) Allows for incorporation of new data and identification of QA/QC criteria for generation of that data.

         3) Facilitates GIS analyses and 3D visualization of model framework and updates to model.

4) Supports the understanding and decision making of technical staff (engineers, hydrogeologists, managers) on the hydrogeologic system response and management of aquifer recharge and recovery operations. Understanding of the groundwater system will increase in specificity and accuracy as the project proceeds. Reclaimed Water Facilities Manual Page 152

c. Pilot Test

i. Test well drilled to receiving aquifer, which collects the following hydrogeologic information: direction and rate of water movement, changes to aquifer properties due to testing; reservoir suitability for injection and storage; estimated areal extent of project impacts. For the target aquifer the potential impact to any nearby waterbody, water users, and mounding, is evaluated, potentially using numerical simulations to estimate travel times. Data addressing existing data gaps is collected and a report submitted with results of testing and refinements to the conceptual model.

d. Engineering Design

i. Incorporate the pilot test aquifer characterization and performance results into the reclaimed water system design. Aquifer storage system design should account for existing water quality in proposed storage geologic unit(s) and water quality of the injected reclaimed water, and the predicted mixing between native and recharged water. Specifically, the following processes should be considered in the design and operation of the aquifer storage system: geochemical changes anticipated; reactions of injected water with aquifer minerals; measures to control metals mobilized during injection; uncertainties in predicted performance.

ii. Additional data needed for effective system design and operation should be identified and collected as part of final Engineering Design Report approval and project permitting.

Hydrogeologic evaluation for reclaimed water used to recharge groundwater is a time-consuming process and will delay startup of the reuse program. This is the primary reason that starting with Alternative 1 and moving to Alternative 2 is recommended. Much of the data needed for this analysis and modeling effort is available but additional testing and data collection will be required.

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Appendix A. Coupeville WWTP AKART Analysis

FINAL

Coupeville Wastewater Treatment Plant All Known, Available, and Reasonable Treatment Analysis

Town of Coupeville, Washington

Association of Washington Cities Technical Assistance Study

November 2023

Jacobs

Coupeville WWTP AKART Analysis

Client name: Town of Coupeville

Project name: Association of Washington Cities Technical Assistance Study

Client reference: Joe Grogan; Utilities Superintendent

Project no: D3695800

Project manager: Amanda McInnis

Prepared by: Jacobs

Doc status: Final

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Acronyms and Abbreviations

AACE	Association for the Advancement of Cost Engineering
AGS	aerobic granular sludge
AKART	all known and reasonable treatment
BOD	biochemical oxygen demand
BOD_5	five-day biochemical oxygen demand
DO	dissolved oxygen
EJ	environmental justice
EPA	U.S. Environmental Protection Agency
lbs/day	pound(s) per day
LQRI	lowest quintile residential indicator
MABR	membrane aerated biofilm reactor
mg/L	milligram(s) per liter
mgd	million gallon(s) per day
MLSS	mixed liquor suspended solids
NOP	Nitrogen Optimization Plan
NPV	net present value
ORP	oxidation reduction potential
PSNGP	Puget Sound Nutrient General Permit
RAS	return activated sludge
RI	residential indicator
ROI	region of interest
SRT	solids retention time
TIN	total inorganic nitrogen
TKN	total Kjeldahl nitrogen
TSS	total suspended solids
UV	ultraviolet

WAS	waste activated sludge
WWTP	wastewater treatment plant

Executive Summary

The Coupeville Wastewater Treatment Plant (WWTP) is in the Town of Coupeville, Washington. The facility discharges to Penn Cove in Puget Sound and is one of more than 50 dischargers that must comply with the Puget Sound Nutrient General Permit (PSNGP) total inorganic nitrogen (TIN) load reduction requirements. The Town's nitrogen load has been decreasing due to operation improvements implemented by plant staff. In addition, the Town is pursuing a reuse permit to consider further reducing its load to Penn Cove.

Since 2007, Penn Cove has been listed as a Category 5 Section 303(d) impaired waterbody for dissolved oxygen. Currently, no total maximum daily load is scheduled to be implemented. Coupeville Beach is currently closed to shellfish harvesting by the Washington Department of Health based on the proximity to the WWTP outfall.

Optimization efforts initiated in 2022 have been successful. Therefore, this analysis focused on process improvement that may be implemented in addition to current practices to increase the reliability of treatment. At the 5.8 percent average annual growth rate observed from 2019 to 2022, the plant has adequate hydraulic capacity to accommodate the 2020 design annual average flow (260,000 gpd) until 2028.The Town of Coupeville received $173,000 in grant funding from the Washington Department of Ecology. That grant funding will be allocated to the selected AKART alternative, eliminating rate impacts for the utility. In addition to TIN reduction at the plant itself, Coupeville is considering effluent reuse to eliminate returning reclaimed water to Penn Cove completely.

Table ES-1 provides information on capital, operational, and 20-year net present value (NPV) costs associated with the selected AKART alternative.

Table ES-1. Preferred Alternative Costs Summary

Preferred Alternative	Capital Cost Range[a]	Annual Operational and Maintenance Cost[b]	20-year NPV[b]
AKART			
Increased monitoring and control via DO, ORP, and nitrogen probes	$34,500–$138,000	$4,300–$17,200	$113,000–$450,000

[a]Costs are Association for the Advancement of Cost Engineering (AACE) Class 5 planning level estimates with a -50 percent to +100 percent accuracy range.

[b] Operational cost details ae included in Section 3.0.

[c] Assumes a 20-year life cycle with a 4 percent interest rate.

$ = 2023 U.S. dollars

DO = dissolved oxygen

ORP = oxidation reduction potential

1. Background

1.1 Purpose and Need

The Coupeville Wastewater Treatment Plant (WWTP) discharges to Penn Cove in the Puget Sound and is regulated under the Puget Sound Nutrient General Permit (PSNGP). Under the PSNGP, the Town of Coupeville needs to submit an all known, available, and reasonable treatment (AKART) analysis. This document satisfies that requirement.

1.2 Level of Nitrogen Reduction

AKART is defined as all known, available, and reasonable methods of prevention, control, and treatment; in this case, this represents the most current methodology that can be reasonably required for reducing effluent total inorganic nitrogen (TIN) from WWTPs. AKART has been used in individual permits where a technology or best management practice has been previously accepted by the Washington State Department of Ecology (Ecology). It is not clear exactly how AKART will be applied to nutrient removal in the PSNGP or to individual permits. Ecology defines an intermediate step between biochemical oxygen demand (BOD) removal and 3 milligrams per liter (mg/L) seasonal effluent TIN in the PSNGP as 10 mg/L annual average effluent TIN. In addition, *Puget Sound Nutrient Source Reduction Project Volume 1: Model Updates and Bounding Scenarios* (Ecology 2019) defines point sources achieving biological nutrient removal as being at 8 mg/L dissolved inorganic nitrogen. For the purposes of this study, AKART is defined as an economically feasible method of providing nutrient removal to achieve an effluent TIN in the range of 8 to 10 mg/L on an annual basis. Economic feasibility may consider the potential financial impact of the nutrient upgrade on ratepayers given the other financial burdens a utility carries, including asset repair and replacement, other capital projects, and inflationary considerations.

1.3 Wastewater Characterization

Permit Requirement: *The AKART analysis must include the following elements: wastewater characterization (PSNGP S6.C.3.a), current volumes, flow rates, and growth trends (PSNGP S6.C.3.a.i), current influent and effluent quality (PSNGP S6.C.3.a.ii).*

Existing Conditions

Influent flow volumes, corresponding peaking factors, and rated conditions from 2019 to 2022 are listed in Table 1-1.

Table 1-1. Current Coupeville Wastewater Treatment Plant Influent Flows and Rated Flow Capacity

Flow	2019–2022 (mgd)	Rated Flow Capacity (mgd)	2019–2022 Peaking Factor
April–October (Maximum Monthly)	0.215	NA	1.3
Maximum Monthly	0.299	0.44	1.8
Annual Average Daily	0.169	NA	NA

mgd = million gallon(s) per day

NA = not applicable

Average annual flow volumes have steadily increased since 2019, with a peak average annual flow of 0.18 mgd reached in 2022. Design criteria listed in the 2017 revision of the *Town of Coupeville Operations and Maintenance Manual* (Town of Coupeville 2017) lists the 2020 annual average flow of 260,000 gallons per day.

Influent five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) conditions, corresponding peaking factors, and rated capacity are listed in Table 1-2.

Table 1-2. Current Coupeville Wastewater Treatment Plant Influent Loads and Rated Capacity

Parameter	Average Annual Daily	Maximum Monthly	April–October Maximum Monthly
Influent BOD_5 (mg/L)	176.7	234.2	261.7
Influent BOD_5 (lbs/day)	236	322	311
Influent BOD_5 Load Peaking Factor	NA	1.4	1.3
NPDES rated BOD_5 (lbs/day)	NA	648	NA
Influent TSS (mg/L)	172.4	247.9	267.1
Influent TSS (lbs/day)	230	366	333
Influent TSS Load Peaking Factor	NA	1.6	1.4
NPDES rated TSS (lbs/day)	NA	488	NA

Values presented reflect available influent data for the reporting period.

lbs/day = pound(s) per day

NPDES = National Pollutant Discharge Elimination System

Average daily effluent quality for 2022 is listed in Table 1-3. TIN removal rate is a percentage based on 2022 influent and effluent TIN loads. As shown in the table, data suggest the plant can achieve nitrification, but denitrification improvements are needed to further reduce TIN.

Table 1-3. Coupeville Wastewater Treatment Plant 2022 Effluent Quality

Parameter	Unit	Average Daily Value
Effluent Ammonia	Concentration (mg/L)	1.6
Effluent TIN	Concentration (mg/L)	9.1
Effluent TKN	Concentration (mg/L)	10
Effluent BOD_5	Concentration (mg/L)	6.1
Effluent TSS	Concentration (mg/L)	4.4
Current TIN Removal Rate	%	77

TKN = total Kjeldahl nitrogen

Projected Conditions

The AKART analysis was performed based on the current capacity for the plant established to meet the growth needs of the service area. Table 1-4 shows plant loading capacity. The dry and wet weather maximum month conditions are based on peaking factors observed from 2019 to 2022. To be conservative, the design criteria chosen for this analysis are the wet weather maximum month conditions.

Table 1-4. Design Influent Loading Conditions at Plant Capacity

Parameter	Maximum Monthly	Dry Weather Maximum Monthly	Wet Weather Maximum Monthly
Influent Flow (mgd)	0.44[a]	0.14	0.51
Influent BOD (lbs/day)	648[a]	261	978

Parameter	Maximum Monthly	Dry Weather Maximum Monthly	Wet Weather Maximum Monthly
Influent TSS (lbs/day)	488[a]	300	1,031
Influent Ammonia (lbs/day)	133	44	147
Influent TIN (lbs/day)	134	44	149
Influent TKN (lbs/day)	183	56	214
Minimum Temperature (°C)	14	14	13

[a]NPDES capacity rating

Dry and wet weather conditions consider trends observed in 2019 through 2022 influent flow data.

Values presented reflect plant NPDES rated maximum monthly flow and loading conditions in conjunction with peaking factors reported in Table 1-1.

°C = degree(s) Celsius

1.4 Current Treatment Process

Permit Requirement: *The AKART analysis must include the following elements: description of current treatment processes (PSNGP S6.C.3.b.i).*

A process flow diagram of the Coupeville WWTP is shown on Figure 1-1. A plant layout with normal flow path is shown on Figure 1-2. A hydraulic profile is shown on Figure 1-3.

Liquid Stream

The Town of Coupeville operates an activated sludge oxidation ditch WWTP. Treatment includes screening, biological treatment, secondary clarification, and disinfection.

Preliminary and Primary Treatment

Influent wastewater flow is measured via a Parshall flume and then enters the headworks, where it is screened through a vertical screw-type micro screen. Following screening, flow is routed to a selector tank to combine with return activated sludge (RAS). The selector tank serves to split flow to the two oxidation ditches and select against the formation of filamentous bacteria. Flow is mixed with a course air diffuser.

Biological Treatment

Biological treatment is accomplished through use of extended aeration oxidation ditches. The facility is equipped with two ditches, although it usually only operates a single ditch at a time. Each ditch is 225,000 gallons in capacity and equipped with two mechanical brush aerators to maintain solids suspension and provide aeration within the ditch.

Following biological treatment, mixed liquor is routed to a splitter box prior to entering the two 35-foot-diameter, 12-foot-deep secondary clarifiers. Historically, Coupeville operated a single secondary clarifier but, in quarter three of 2020, it began operating two secondary clarifiers to reduce effluent TSS concentrations. Both clarifiers have been operational year-round since then.

RAS and WAS Handling

RAS and waste activated sludge (WAS) is pumped from the bottom of the secondary clarifiers and either returned to the selector tank or pumped to the aerobic digester for further treatment and storage. The RAS pumps are fixed speed and controlled using a timer to run for a set number of minutes per hour. The timer can be manually changed as influent flows vary, but it does not change automatically.

Disinfection and Outfall

Secondary effluent is disinfected with a low-pressure ultraviolet (UV) disinfection system. Disinfected effluent flow is measured via a Parshall flume prior to discharge. Plant effluent is discharged to Penn Cove through a 12-inch marine outfall and 60-foot-long diffuser equipped with six 3-inch ports. A chlorine disinfection system is in place as a backup in case the UV disinfection is interrupted.

Solids Treatment

The treatment facility removes solids during the treatment of the wastewater at the headworks (screenings) and secondary clarifiers, in addition to incidental solids (rags and other debris), which are removed as part of the routine maintenance of the equipment. Grit, rags, and screenings are drained and disposed of at the local landfill. Solids removed from the secondary clarifiers are treated in the 46,000-gallon aerobic digester, which can be decanted to the onsite yard pump station. Digested solids are pumped out and hauled to the Island County septage receiving station.

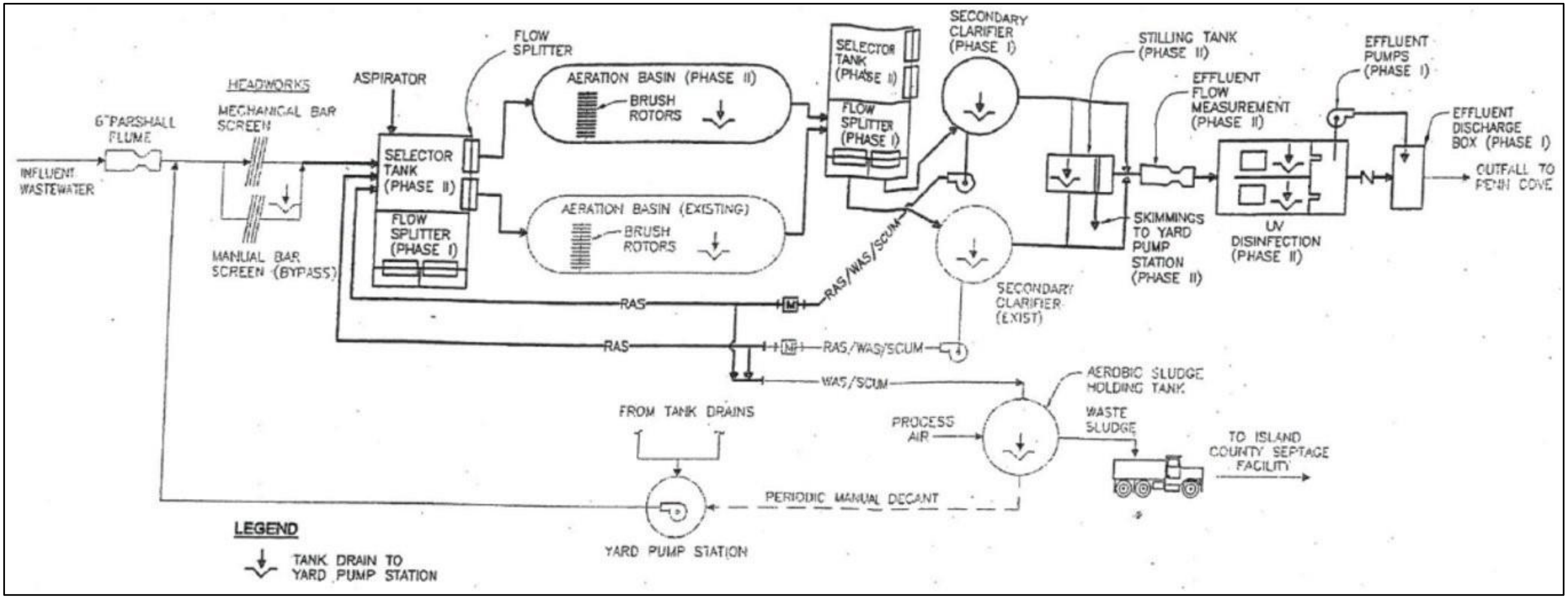


Figure 1-1. Coupeville Wastewater Treatment Plant Process Flow Diagram

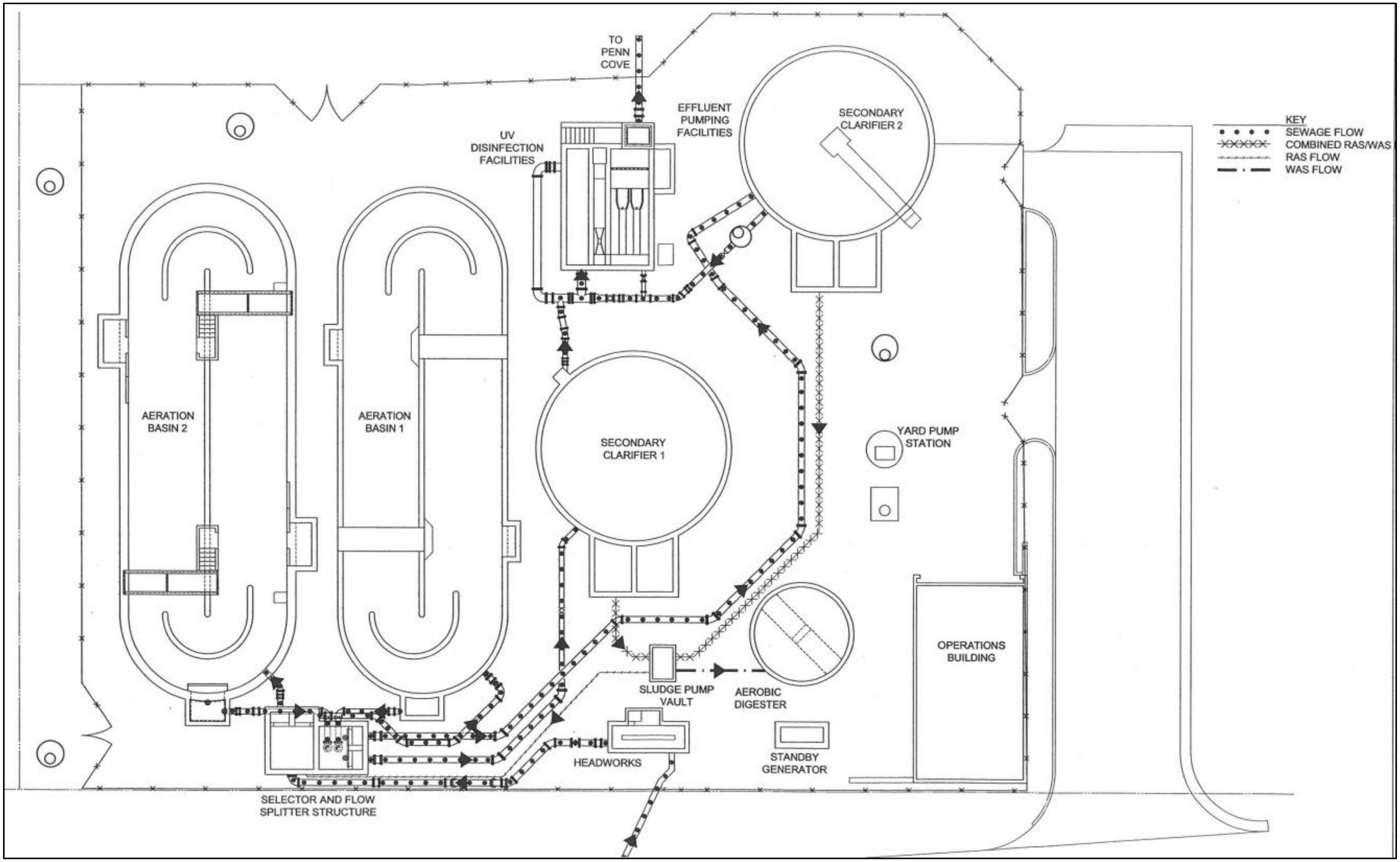


Figure 1-2. Coupeville Wastewater Treatment Plant Layout and Flow Diagram

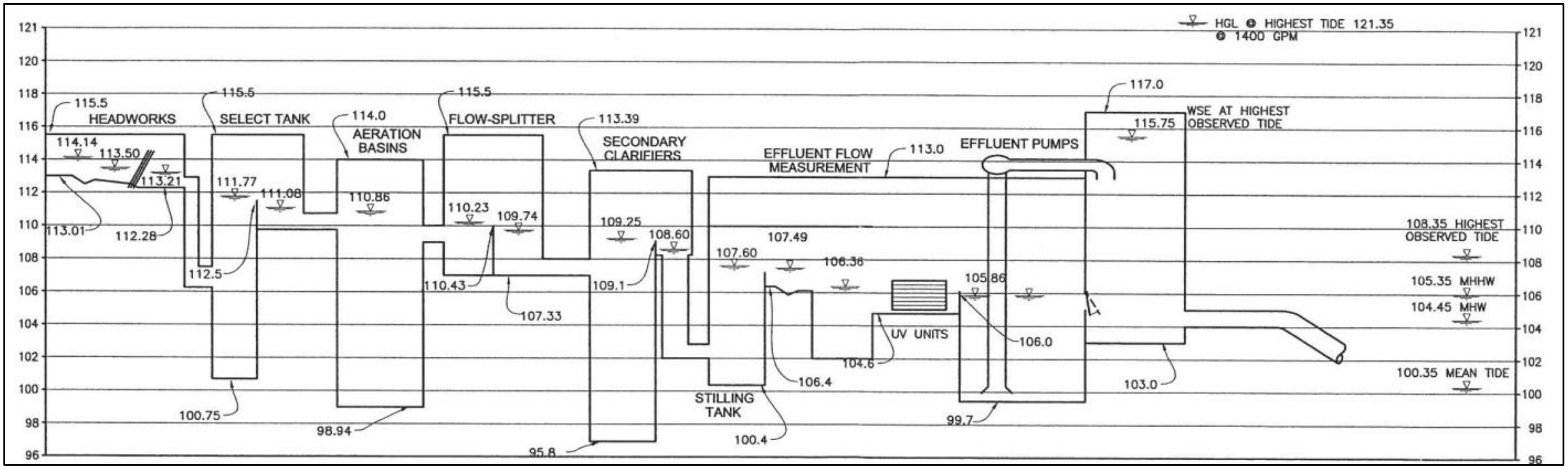


Figure 1-3. Coupeville Wastewater Treatment Plant Hydraulic Profile

2. Identification and Screening of Potential Treatment Technologies

Permit Requirement: *The AKART analysis must include: identification and screening of potential treatment technologies for TIN reduction that achieves AKART nitrogen removal (PSNGP S6.C.3.b.ii).*

Methodology for determining AKART alternatives to be considered first entailed considering a variety of treatment technologies known to reduce TIN year round. A variety of treatment technologies were considered for application at the Coupeville WWTP. Appendix A presents a decision tree and qualitative selection matrix used to identify and select viable treatment alternatives. Technologies that logically added to the existing treatment train were considered for AKART evaluation. The most attractive AKART alternative for the Coupeville WWTP is optimization.

2.1 AKART Alternatives

The most attractive alternatives were identified in consideration of Coupeville's existing infrastructure. The following alternatives/subalternatives were considered for AKART analysis:

- Alternative1: Optimization
  - Alternative 1.a: Optimization with hydrocyclone wasting
  - Alternative 1.b: Optimization with membrane aerated biofilm reactor (MABR) retrofit
  - Alternative 1.c: Optimization with hydrocyclone wasting and MABR retrofit
- Alternative 2: Aerobic granular sludge (AGS)

Additional alternatives considered and reasons for exclusion include the following:

- Integrated fixed film activated sludge retrofit – Significant infrastructure needs to accommodate wet weather flows
- Moving bed biofilm reactor – Significant infrastructure needs to accommodate wet weather flows
- Sequencing batch reactor retrofit – Significant infrastructure needs to accommodate wet weather flows
- Satellite membrane bioreactor – High capital and operational costs

The selected alternative (optimization) consists of:

- Optimize DO
- Continuous DO monitoring, optional oxidation reduction potential (ORP) monitoring
- Operate two ditches in parallel
- Continuous nitrogen monitoring

The Coupeville WWTP achieved an annual average effluent TIN concentration of 9.1 mg/L in 2022. Because optimization has been successful, further optimization is considered the best compliance strategy. The Nitrogen Optimization Plan (NOP) for Coupeville includes more detailed description of the candidate optimization strategies. With proper implementation and adaptive management, the plant can likely maintain an effluent 8 mg/L TIN, meeting the AKART threshold.

In addition to the recommended optimization strategies, Coupeville may consider either or both of the following additional process refinement alternatives:

- InDENSE™ hydrocyclone skid package
- ZeeLung™ MABR system retrofit

The identified process refinement alternatives were considered for their ability to increase treatment reliability and reduce influent ammonia loads, respectively.

2.1.1 AKART Alternative 1.a: Optimization with Hydrocyclone Wasting

Incorporation of this process refinement involves passing biomass (mixed liquor suspended solids [MLSS] or WAS) through an array of InDENSE™ hydrocyclones to separate the flow stream into heavier and lighter fractions. Through gravimetric separation, the hydrocyclone underflow predominantly contains denser, heavier material and the hydrocyclone overflow contains lighter, flocculent material. The hydrocyclone underflow is returned to the bioreactors while the overflow is wasted to solids treatment. The solids retention time (SRT) of the denser (more settleable) fraction of sludge is decoupled from the flocculent mixed liquor, thereby selecting against lighter fractions, and promoting the formation of dense flocs and granular formations in the mixed liquor to improve sludge settleability. The objective of hydrocyclonic wasting is to provide a balance of flocs and granules to maintain good colloidal and particulate removal in secondary clarifiers via entrainment, while enmeshing denser granule forms into flocs to provide rapid settling and selective biomass retention.

Promotion of granular biomass formation and improved settleability allows a greater biomass inventory to be maintained within the oxidation ditches, thus intensifying the biological activity and nutrient removal capacity of the system.

A hydrocyclone skid requires a minimal footprint (approximately 9 square feet), as shown on Figure 2-1.

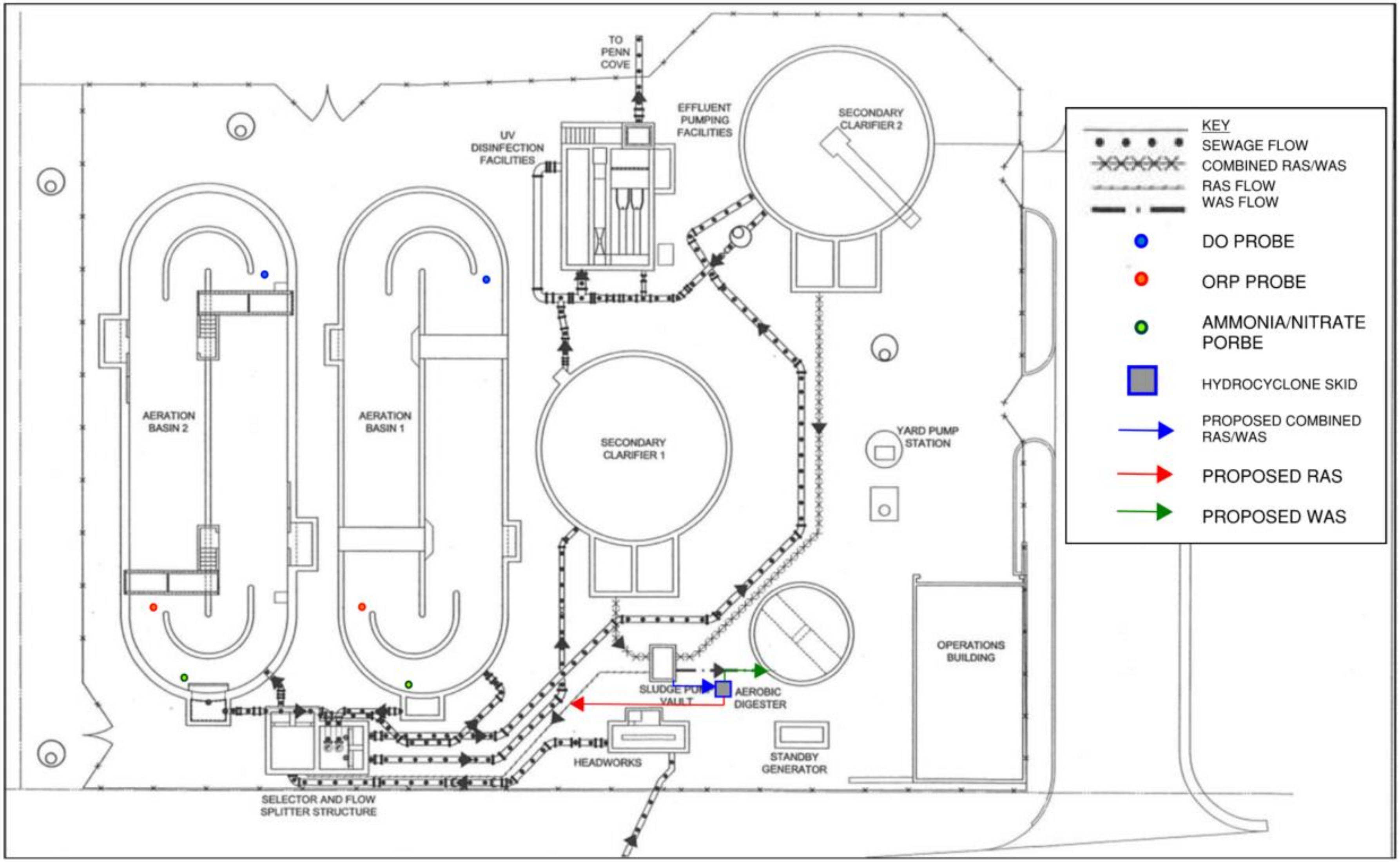


Figure 2-1. AKART Alternative 1.a: Optimization with Hydrocyclone Wasting

2.1.2 AKART Alternative 1.b: Optimization with MABR Retrofit

A MABR was identified as an intensification technology that could logically be added to the Coupeville oxidation ditches. Intensification technologies can increase treatment capacity, reduce energy and chemical consumption, and help meet stringent effluent nutrient limits with a reduced overall facility footprint as compared to conventional treatment facility expansion.

The MABR process leverages the synergy between a gas transfer membrane and an attached growth biofilm. Oxygen is delivered by diffusion to the biofilm with very high efficiency, while substrate such as ammonia and organics diffuses from the bulk solution into the biofilm. Installing this technology in an activated sludge system improves the oxygen transfer efficiency, reduces energy consumption, increases the secondary treatment capacity, and improves biological treatment performance (ammonia removal).

A ZeeLung™ MABR (supplied by Veolia) retrofit at Coupeville would include installation of a single cassette within the selector box to maximize nitrification and denitrification capacity of the facility. The MABR cassette is designed to reduce ammonia loading to the oxidation ditch within the MABR selector box, allowing the oxidation ditch to be leveraged for denitrification. Considering the nitrate reduction Coupeville has accomplished by manipulating rotor brush operation and water surface elevation within the ditches, additional manipulation of the upstream rotor brush is expected to reduce nitrates even further. It is recommended that RAS flow be rerouted to enter the oxidation ditches directly to maintain an anoxic environment and avoid solids overload within the selector box.

This alternative is designed to achieve 8 mg/L TIN. A site layout of this alternative is presented on Figure 2-2.

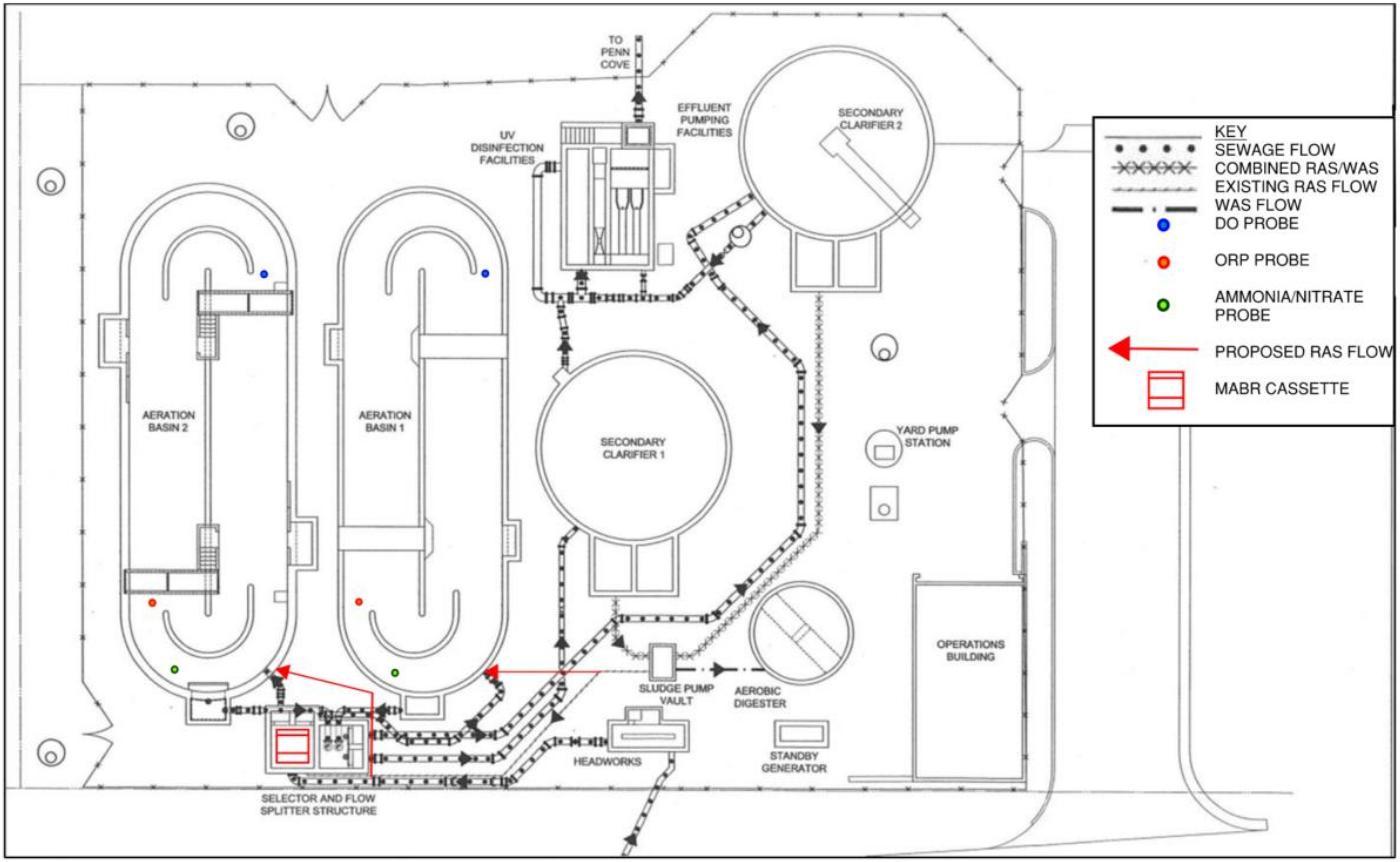


Figure 2-2. AKART Alternative 1.b: Optimization with MABR Retrofit

Preliminary process modeling results indicate that up to 7.7 percent of influent ammonia can be reduced with a single MABR cassette retrofit within the selector box. The remaining TIN removal would be achieved within the existing oxidation ditch. To achieve the AKART TIN target level of 8 mg/L, an average of 0.5 mg/L dissolved oxygen (DO) was assumed as the target concentration within the ditch.

2.1.3 AKART Alternative 1.c: Optimization with Hydrocyclone Wasting and MABR Retrofit

This alternative would include installation of both the Hydrocyclone skid and MABR cassette in addition to the scoped optimization efforts.

2.1.4 AKART Alternative 2: AGS

AGS consists of the following elements:

- Demolition of oxidation ditch #1
- Upgraded headworks to include grit removal
- Influent buffer system with mixing
- 2 AGS reactors

The AquaNereda® AGS system is a compact biological treatment system capable of reducing TIN. The system develops aerobic biomass granules to intensify activated sludge processes. The granules form micro aerobic and anoxic zones to facilitate simultaneous nitrification and denitrification reactions. The system operates in a sequencing batch reactor configuration, with three main process cycles – refer to Figure 2-3. Duration of phases is specific to wastewater characterization, flow, and effluent requirements. Online instrumentation may be installed to monitor the cycle phases based on ammonia, ORP, DO, and/or nitrate setpoints. The design cycle duration for Coupeville is 5 hours at a 25-day SRT.

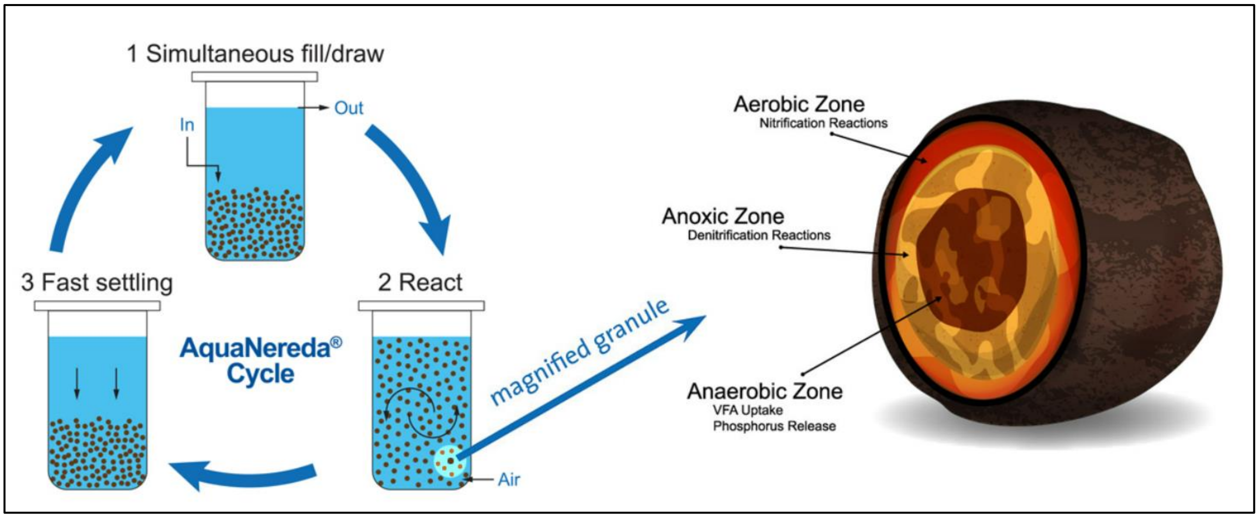


Figure 2-3. Aerobic Granular Sludge Technology
Source: Aqua-Aerobic Systems Inc.

Aerobic granules are much denser than conventional activated sludge flocs, resulting in enhanced settling rates. This allows aerobic granular systems to operate at much higher MLSS concentrations (up to 8,000 mg/L), further intensifying the nutrient removal capacity of the system.

Based on the inability of this technology to separate solids, it is recommended the existing headworks be upgraded to include grit removal. The batch configuration of the system will require an influent buffer system to allow the facility to equalize flows to each AGS reactor. In the case of large wet weather peak flows, the remining oxidation ditch may need to be used to accommodate buffer basin overflows. This alternative is designed to achieve 8 mg/L TIN. A site layout of this alternative is presented on Figure 2-4.

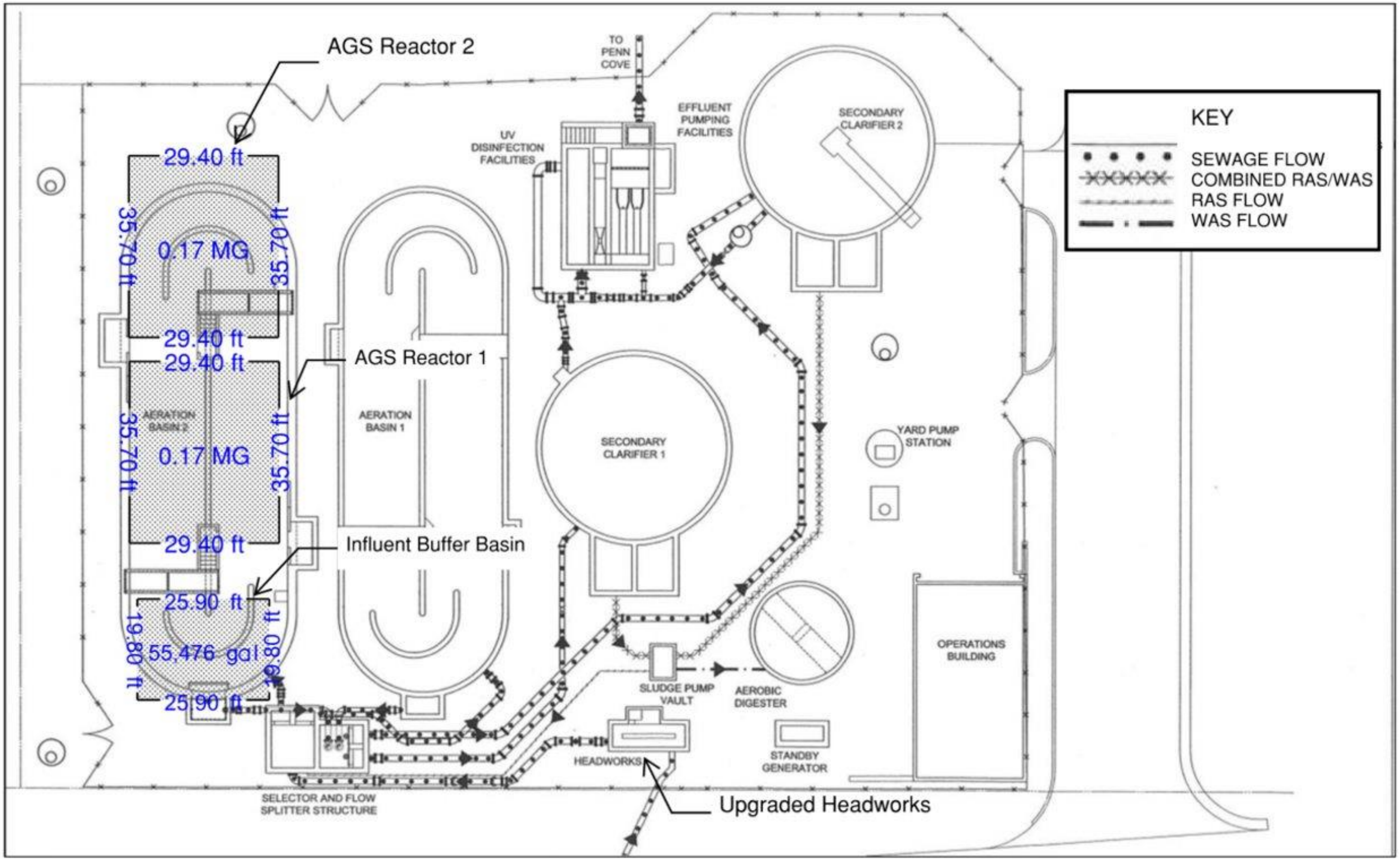


Figure 2-4. AKART Alternative 2: Aerobic Granular Sludge

Table 2-2 lists the TIN reduction estimates developed for the AKART alternatives.

Table 2-1. Estimated TIN Reduction Performance of AKART Alternatives

AKART Alternative	Current Effluent TIN (mg/L)	Achievable Effluent TIN (mg/L)	Estimated TIN Reduction (%)
AKART Alternative 1 – Optimization	9.1	8 – 10	0 – 12%
AKART Alternative 1.a – Optimization with Hydrocyclone Wasting	9.1	8	12%
AKART Alternative 1.b – Optimization with MABR Retrofit	9.1	8	12%
AKART Alternative 1.c – Optimization with Hydrocyclone Wasting and MABR Retrofit	9.1	8	12%
AKART Alternative 2- Aerobic Granular Sludge (AquaNereda®)	9.1	8	12%

Anticipated effluent TIN concentrations were determined using plant process models (if available), or literature reviews. The performance values are representative of potential performance if optimization strategies are fully and properly implemented or operated. Given normally occurring variations in wastewater characteristics, temperatures, service area characteristics, and other parameters, the actual TIN reduction achieved may differ from the projected values. The Town should carefully monitor and proactively adapt its TIN optimization efforts based on the WWTP performance achieved.

Estimated TIN reduction percentages are based on the existing effluent TIN concentration listed in Table 1-3.

2.2 Nutrient Reduction through Reuse

Coupeville has a long-term goal to divert effluent flows from Penn Cove to reuse. Coupeville completed a reuse feasibility assessment in 2010 (BHC 2010) in which reuse was identified as feasible, but not economically viable. The recommended alternative included a reuse pump station at the WWTP, new pressure pipeline to the water treatment plant, and a new gravity pipeline to near Well #6. Recharge and storage basins were evaluated for winter use and farmer owned pipelines were evaluated for water distribution and reuse in the summer. At the time of the feasibility assessment, the recommendations were cost prohibitive, and not implemented. However, the following new conditions exist that make reuse more feasible now than in 2010:

- The Town has two abandoned pipelines that could be used to reduce the cost of conveyance as compared with the previous study.
- Well #6 in the brackish aquifer approximately 500 feet deep is abandoned for domestic water use and could be available for groundwater recharge.
- Power generation from recharge wells is now a well-developed technology in Penn Cove; where the Town discharges all effluent is a Section 303(d) listed impaired water body and a shellfish aquiculture zone.
- Irrigated agricultural crops are more valuable today with the increasing variables of climate change impacting non-irrigated crop yields globally.

- The new concept for reuse would incorporate reuse of existing pipelines as much as possible rather than all new pipelines and use of an existing well rather than constructing recharge basins. The farmer connections to the pipeline would still be provided by farmers.
- PSNGP issuance requires the WWTP to reduce effluent nutrients to create Class A or Class B effluent.

Costs associated with additional technologies capable of achieving Washington State Class A and B Reclaimed Water Standards (listed in Table 2-2) were considered. These technologies could be used in addition to any of the optimization alternatives to meet the designated class of reclaimed water.

Table 2-2. Washington State Class A and B Reclaimed Water Regulatory Requirements

Class	Characteristics
A	Class A reclaimed water will at all times be oxidized, coagulated, filtered, and disinfected wastewater. State water reclamation and reuse standards call for Class A reclamation water to be filtered to a turbidity level which does not exceed an average operating turbidity of 2 nephelometric units (NTU), determined monthly, and which does not exceed 5 NTU at any time. Filtration can be achieved by passing oxidized wastewater through natural undisturbed soils or through filter media such as sand or anthracite. Class A reclaimed water must be disinfected such that the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and such that the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample. Class A reclaimed water is currently the only reclaimed water class for which Ecology requires coagulation and filtration. Further, the disinfection requirements for Class A reclaimed water are more stringent than for Class C or D reclaimed water (the disinfection requirements for Class B reclaimed water are identical to those for Class A). Class A reclaimed water must be used where the potential for public exposure to reclaimed water is high.
B	Class B reclaimed water will at all times be oxidized and disinfected wastewater. The wastewater will be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample.

Source: Washington State *Department of Ecology Criteria for Sewage Works Design, August 2008*

Components of each reclaimed water alternative are discussed in the following sections.

2.2.1 Class A Reclaimed Water Components

In addition to the selected AKART alternative, treatment requirements to meet Class A reclaimed water quality consist of multiple tertiary components. Components selected to satisfy Class A criteria consist of the following:

- Caustic soda chemical dosing and storage
- Vertically mounted pile cloth filters with alum (or coagulant of choice) dosing and storage
- Assessment of existing UV system
- 0.35-million-gallon reclaimed water storage tank

For this study, alum and vertically mounted pile cloth filters with a nominal 10-micron pore size were selected as the preferred coagulant and tertiary filtration system. In addition to filtration and coagulation, the capabilities of the existing UV system must be further evaluated to ensure Class A reclaimed water standards are satisfied. Caustic soda is provided upstream of the filter to control pH as needed.

Additionally, a reclaimed water storage tank providing 0.35 million gallons (equivalent to 2 days' average annual daily flow) of storage is included as a reclaimed water component. Based on existing site constraints, the storage tank will need to be constructed offsite.

This reclaimed water alternative offers more flexibility in terms of end water users. At the time this AKART was prepared, Coupeville identified groundwater injection as the preferred reuse application.

2.2.2 Class B Reclaimed Water Components

To meet Class B reclaimed water standards, a backup method of disinfection is required to carry a chlorine residual. The existing back up chlorination injection system would need to be recommissioned to provide reliable disinfection.

While end use of Class B reclaimed water is more affordable than Class A, Class B offers much less flexibility in terms of end use. Class B reclaimed water was considered based on affordability and the presence of a brackish aquifer and non-human consumption crops within proximity of the treatment plant. Class B is ultimately not recommended because of uncertainty associated with groundwater injection permitting.

Cost estimates associated with the Class A reclaimed water alternative are summarized in Table 2-3.

Table 2-3. Costs Associated with Class A Reclaimed Water

Reclaimed Water Alternative	Capital Cost Range	Annual Operational Cost	NPV
Class A Components	$800,000–$3,100,000	$482,000–963,000	$9,600,000–$16,000,000

Costs estimates are considered Association for the Advancement of Cost Engineering (AACE) Class 5 with an expected level of accuracy of -50 percent to +100 percent.

NPV = net present value

Because reuse evaluation is not required by the PSNGP, these costs are not included in the affordability evaluation.

3. Economic Evaluation

3.1 Cost of Alternatives

Permit Requirement: *Develop capital, operation and maintenance costs and 20 year net present value using real discount rate in the most current Appendix C to Office of Management and Budget Circular No. A-94 for each technology alternative evaluated (PSNGP S6.C.3.c.i), provide cost per pound of nitrogen removed (PSNGP S6.C.3.c.ii).*

Capital, operational, and NPV costs were developed for the selected alternatives. Capital and annual operational costs are calculated as 2023 dollars. NPV costs are on a 20-year basis and calculated using the real discount rate of 0.4 percent listed in the most current Office Management and Budget Circular.

Table 3-1 presents costs associated with AKART alternative implementation. Additionally, the estimated cost on a dollar per pound ($/lb) of TIN removed basis is listed. Pounds of TIN removed is calculated based on effluent TIN reduction over a 20-year period using the current and achievable effluent TIN concentration values listed in Table 2-1. The dollar value refers to the NPV in Table 3-1.

Table 3-1. AKART Alternative Costs

AKART Alternative/ Reclaimed Water Alternative	Capital Cost Range	Annual Operational Cost	NPV ($)	$/lb TIN Reduced
AKART Alternative 1 – Optimization	$34,500–$138,000	$4,300–$17,200	$113,000–$450,000	$4.00–$16.00
AKART Alternative 1.a – Optimization with Hydrocyclone Wasting	$126,000–$505,000	$4,500–$18,300	$210,000–$840,000	$7.00–$29.00
AKART Alternative 1.b – Optimization with MABR Retrofit	$280,000–$1,200,000	$5,000–$20,000	$370,000–$1,600,000	$13.00–$53.00
AKART Alternative 1.c – Optimization with Hydrocyclone Wasting and MABR Retrofit	$372,000–$1,500,000	$6,000–$22,000	$480,000–$1,900,000	$16.00–$65.00
AKART Alternative 2 – AGS	$3,000,000–$11,700,000	$43,000–$175,000	$3,800,000–$15,000,000	$128.00–$503.00

Costs estimates are considered AACE Estimate Classification Class 5 with an expected level of accuracy of -50 percent to +100 percent

Dollars per pound value considers the current and achievable effluent TIN concentrations (Table 2-1) for the maximum monthly flow at capacity (Table 1-4) in conjunction with the calculated NPV cost.

3.2 Coupeville Wastewater Utility Rate Structure

Permit Requirement: *Provide details on basis for current wastewater utility rate structure, including: How utilities allocate and recover costs from customers (PSNGP S6.C.3.c.iii.1), how frequently rate structures are reviewed (PSNGP S6.C.3.c.iii.2), the last time rates were adjusted and the reason for that adjustment (PSNGP S6.C.3.c.iii.3).*

The Coupeville WWTP recovers costs through utility rates. Residential and commercial sewer rates include a monthly fixed charge, including reserve capacity and sewer service charge (applicable to any service connection). Additional sewer service charges are issued for every cubic foot of drinking water consumed, as determined by the actual water meter reading. All residential, commercial, governmental, and nonresidents within the Coupeville service area must pay the monthly sewer rates summarized in Table 3-2.

Table 3-2. Coupeville Residential Monthly Sewer Rates

Year	Reserve Capacity	Sewer Service
2021	$10.00	$0.1002
2022	$12.00	$0.1082
2023	$14.00	$0.1179
2024	$16.00	$0.1285
2025	$18.00	$0.1311

In addition to the monthly reserve capacity, sewer service, and consumption-based sewer service charge, commercial, governmental, and nonresident customers may be subject to BOD surcharges. This surcharge helps the Coupeville utility recover the actual cost of treating higher strength wastewater. Customers subject to BOD surcharges typically are medical service providers, restaurants, or other high-rate water users. BOD surcharges are issued and assessed annually by the Town; annual BOD surcharges are listed in Table 3-3.

Table 3-3. Coupeville Annual BOD Surcharges

Year	BOD Surcharge 5,000 cubic feet and higher		BOD Surcharge under 5,000 cubic feet	
Year	Capacity Charge	Service Charge	Capacity Charge	Service Charge
2021	$27.50	$0.0135	$8.75	$0.0135
2022	$33.00	$0.0145	$10.50	$0.0145
2023	$38.50	$0.0158	$12.25	$0.0158
2024	$44.00	$0.0173	$14.00	$0.0173
2025	$49.50	$0.0176	$15.75	$0.0176

Sewer rate tables reflect the most current rate adjustment, effective as of October 1, 2021. Currently, annual Coupeville sewer rates are reviewed and adjusted every 5 years.

3.2.1 Rate Impacts

Permit Requirement: *Provide impact to current rate structure for each alternative assessed (PSNGP S6.C.3.c.iv).*

Large capital improvements and potential changes to operating expenses associated with nitrogen removal may result in rate increases. However, through strategic planning, Coupeville has raised rates and treatment levels in small increments, improving nitrogen removal with small rate increases through the years. Thus, a rate increase will not be required to meet AKART level nitrogen removal requirements.

According to the latest utility rate outlook, the Town of Coupeville is projected to raise wastewater rates by 42 percent by 2030, while the construction cost index for the Seattle area has increased by approximately 61 percent over the last 10 years. While a nitrogen driven rate increase will not be implemented, the wastewater utility without the addition of a new nutrient project is underfunded.

To finance a nutrient improvement at the WWTP, capital expenditures presented in Table 3-1 would be funded by grants awarded by Ecology. This use of grant funding would eliminate the need for Coupeville to raise rates.

4. Environmental Justice

The U.S. Environmental Protection Agency (EPA) defines environmental justice (EJ) as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." The PSNGP requires all dischargers to conduct an EJ review to ensure the fair treatment and meaningful involvement of all people.

This EJ review identifies potential low-income and minority populations, considers potential adverse impacts to those populations, proposes potential alternative rate structures, and identifies potential recreational and commercial improvement opportunities associated with treatment improvements.

4.1 Environmental Justice Evaluation

Permit Requirement: *Evaluate the demographics within the sewer service area to identify communities of color, Tribes, indigenous communities, and low income populations (PSNGP S6.C.3.d.i). Identify areas within service area that exceed the median household income (PSNGP S6.C.3.d.ii).*

This section discusses the methodology used for the EJ analysis, presents the data, and summarizes the results. For this analysis, the region of interest (ROI) is the entire service area. The analysis uses EPA's EJScreen (version 2.1) to assess the demographics; specifically, the presence of minority and low-income populations, as follows:

- **Minority Populations.** A minority population is determined to be present if greater than 50 percent of the ROI is minority or if the minority population percentage of the ROI is meaningfully greater than the minority population percentage in the general population of the county or state. EPA defines minority populations based on who list their racial status as a race other than white alone or list their ethnicity as Hispanic or Latino. The U.S. Census Bureau provides the following definitions for race:
  - Black – a person having origins in any of the black racial groups of Africa
  - Hispanic – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race
  - Asian American – a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands
  - American Indian or Alaskan Native – a person having origins in any of the original people of North America who maintains cultural identification through tribal affiliation or community recognition
  - Native Hawaiian and Other Pacific Islander – a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands
- **Low-Income Populations.** A low-income population is determined to be present if greater than 50 percent of the ROI is low income or if the low-income population percentage of the ROI is meaningfully greater than the low-income population percentage in the general population of the county or state. EPA defines low-income populations are defined as those whose median household income is less than or equal to twice the federal poverty threshold. In 2022, the U.S. federal poverty threshold was $27,750 for a four-person household on an annual basis.

This section describes the findings of the EJScreen, including a discussion and summary of the minority and low-income populations in the ROI. EJScreen was used to generate population estimates in the ROI using the U.S. Census Bureau American Community Survey 2017–2021 survey data. Table 4-1 summarizes the ROI economic demographics compared to the county and state; Table 4-2 does the same for race-related demographics.

Table 4-1. Summary of ROI Economic Demographics Compared to the County and State

Economic Indicators	Service Area[a] or County[b] Value	Island County Value	Washington State Value	United States Percentile
Low Income	28%[a]	22%	24%	35%
Upper Limit Lowest Quintile (2021)	$38,456[b]	$38,456	$36,110	$28,336
Median Household Income (2021)	$75,628[b]	$75,628	$84,247	$69,717
Household income less than $15,000	9%	7%	7%	10%
Household income between $15,000 to $25,000	16%	7%	6%	8%
Household income between $25,000 to $50,000	18%	19%	17%	19%
Household income between $50,000 to $75,000	13%	20%	16%	17%
Household income greater than $75,000	44%	47%	54%	47%

Source: U.S. Census Bureau, American Community Survey 2017 – 2021.

[a]Coupeville Sewer Service Area

[b]This is the County value, data are not available for service area.

Table 4-2. Summary of ROI Racial Demographics Compared to the County and State

Demographic Indicators	Service Area (%)	Island County (%)	Washington State (%)
People of Color	14%	21%	33%
American Indian or Indigenous American	1%	1%	2%

Source: U.S. Census Bureau, American Community Survey 2017–2021.

Approximately 1,937 people live within the service area. The percentage of people of color within the service area is 14 percent, which is less than Island County (21 percent) and less than Washington state (33 percent). The number of individuals who identify as American Indian or Indigenous Americans within the service area is 1 percent, which is equal to Island County (1 percent) and less than Washington state (2 percent). The percentage of low-income people in the service area is 28 percent, which is greater than Island County (22 percent) and greater than Washington state (24 percent).

Figure 4-1 illustrates the percentile of a census block group population, compared to the state average, where household income is less than or equal to twice the federal poverty level.

This analysis demonstrates that there is not a disproportionate amount of low-income or minority populations in the service area.

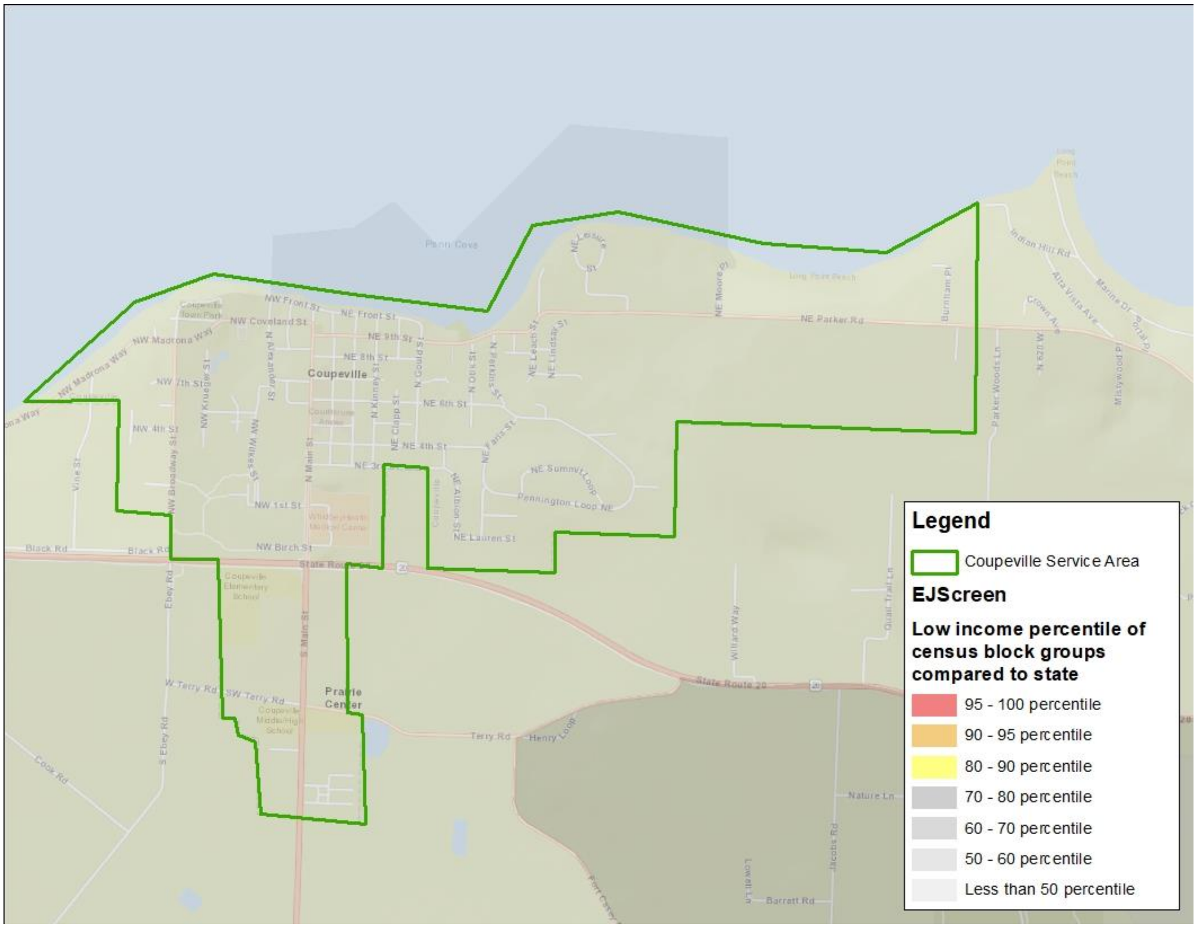


Figure 4-1. Demographics of the Coupeville Sewer Service Area and Surrounding Area

The Coupeville sewer service area contains portions of census block groups. To protect individuals' privacy, census block groups are the most granular data available for EJScreen use. The Coupeville sewer service area is located within a 60 to 70 percentile and 50 to 60 percentile census block group.

4.2 Affordability Analysis

Permit Requirement: *Include an affordability assessment to identify how much overburdened communities identified in S6.C.3.d.i can afford to pay for the wastewater utility (PSNGP S6.C.3.d.iii).*

An affordability assessment was conducted to identify how much these overburdened communities can feasibly afford to pay the Coupeville wastewater utility. The affordability assessment is limited to the potential financial impact of the point source treatment upgrades. Estimating the opportunity cost of limited financial resources not being spent on non-point sources (agricultural and livestock practices), septic/onsite systems, and other community needs (mental health, challenges with the unhoused) is outside the scope of this assessment. Also, the full economic feasibility of the proposed treatment alternative does not consider other utility costs that are not funded by current rates and are outside the scope of this study. These other costs include asset repair and replacement, other capital project needs, and inflation. It also should be noted that in other states where stringent nitrogen limits have been imposed for entire water bodies/watersheds, significant state funding has been made available for the impacted utilities.

To estimate the potential impact, the analysis calculated two metrics of affordability: the residential indicator (RI) and the lowest quintile residential indicator (LQRI). The EPA provides guidance on calculating affordability indices that are based on a customer's annual wastewater bill as a percentage of household income, referred to as the RI. The rate impacts are considered low if annual sewer bills are less than 1.0 percent of household income, mid-range if bills are 1.0 to 2.0 percent of household income, and high if annual sewer bills are greater than 2.0 percent of household income. The affordability assessment considers average incomes of these communities in conjunction with the current and projected sewer rates. For the low-income customers, the average income is the upper limit of the lowest quintile household income for Coupeville residents as reported by the U.S. Census. The LQRI is calculated by dividing the estimated annual sewer bill divided by the upper limit of the lowest quintile household income. Under existing rates, annual sewer utility bills are 1.6 percent of a low-income family's household income. The use of grant funds will allow this percentage to be maintained (that is, it will have no impact on rate payers), as shown in Table 4-3.

Table 4-3. Affordability Analysis Results

Treatment Alternative	Metric	Income[a]	Estimated Rate Increase	Annual Bill Estimate	Annual Sewer Bill as Percent of Household Income	Affordability Impact [b]
Optimization	RI	$75,628	0%	$0	0%	NA
	LQRI	$38,456	0%	$0	0%	NA

[a] Income for Residential Indicator is the Median Household Income. Income for the Lowest Quintile Residential Indicator is the Upper limit of the Upper Limit Lowest Quintile Household Income.

[b] Based on EPA metric: low impact -less than 1.0 percent of household income, medium impact - 1.0 to 2.0 percent of household income, high impact - greater than 2.0 percent of household income.
Note that data from Table 4-1 is used for rate increase calculations.
NA = not applicable

4.3 Alternative Rate Structures or Affordability Programs

Permit Requirement: *Propose alternative rate structures or measures that can be taken to prevent adverse effects of rate increases on populations with economic hardship identified in S6.C.3.d.i (PSNGP S6.C.3.d.iv).*

The utility may address affordability by developing alternative rate structures to prevent the adverse effects (i.e., rate increases) on the overburdened communities identified in this EJ review. Such structures may include budget-based rates or value of service pricing. Budget-based rates establish rate blocks based on specific characteristics. This could be put in place for the communities included in this study. Value of service-based pricing reflects customer perceptions of the value of the utility service and their own willingness to pay for different levels of service or types of service.

Alternative rate structures can require changes to the utility's billing system and additional resources to administer the program.

4.4 Recreational and Commercial Improvement Opportunities

Permit Requirement: *Provide information on how recreational and commercial opportunities may be improved for communities identified in S6.C.3.d.i as a result of the treatment improvements identified (PSNGP S6.C.3.d.v).*

Recreational and commercial improvement opportunities related to treatment improvements may include the following:

- Improved water quality for human recreation in the discharge waters
- Incorporation of open space (for example, parks)
- Synergies with planned commercial development within the service area
- Visual aesthetic improvements appropriate to the surrounding community

The improvements contemplated here are specific to the treatment plant site, with no immediate recreational and/or commercial improvement opportunities within the community. All proposed irrigation areas are privately owned, thus eliminating public access recreation opportunities regardless of reclaimed water quality.

5. Treatment Alternative Selection

Permit Requirement: *Selection of the most reasonable treatment alternative (PSNGP S6.C.3.e). Attainable implementation schedule that includes funding, design, and construction of infrastructure improvement capable of achieving and maintain AKART (PSNGP S6.C.3.f).*

Based on the technology assessment described previously, optimization was selected to meet the AKART requirements specified in the PSNGP.

Table 5-1 summarizes selection, associated costs, rate impacts, and EJ affordability assessment.

Table 5-1. Summary of Preferred Alternative

Preferred Alternative	NPV Cost (Million $)	Estimated Rate Increase (%)	Annual Sewer Bill as Percent of Household Income	Affordability Impact [c]
Optimization	$113,000–$450,000	0%	RI[a] = 0% LQRI[b] = 0%	RI[a] = NA LQRI[b] = NA

[a] Residential Indicator: wastewater rates as a percentage of median household income.

[b] Lowest Quintile Residential Indicator: wastewater rates as a percentage of lowest quintile household income.

[c] Based on EPA metric: low impact -less than 1.0 percent of household income, medium impact - 1.0 to 2.0 percent of household income, high impact - greater than 2.0 percent of household income.

NA = not applicable

Implementation timelines for the preferred alternatives have not been prepared because permit provisions requiring these steps have not been implemented. In addition, there are many variables and issues that need to be resolved that impact development of specific implementation timelines for the preferred alternatives, including the following:

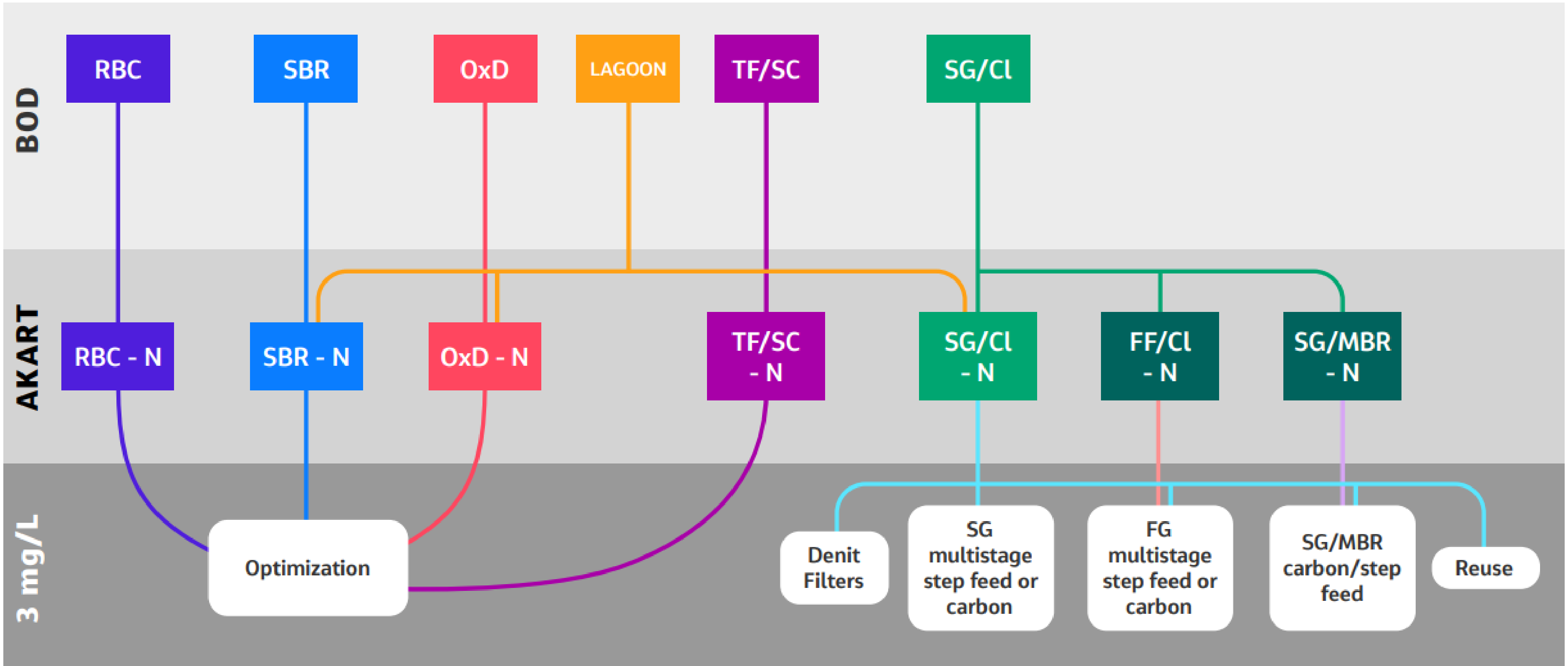
- Repair and replacement of aging assets
- Overall plant hydraulic and loading capacity needs based on growth and climate change
- Detailed rate study to understand when improvements can be funded affordably
- Potential impacts of biosolids regulations for per-and polyfluoroalkyl substances
- Integrating nutrient upgrade requirements with other water quality plans and needs

6. References

BHC Consultants (BHC). 2010. *Final Reclaimed Water Feasibility Assessment*. Prepared for the Town of Coupeville. May.

Washington State Department of Ecology (Ecology). 2019. *Puget Sound Nutrient Source Reduction Project Volume 1: Model Updates and Bounding Scenarios*. Publication No. 19-03-001. January.

Appendix A
AKART Decision Tree and Rate Impact Analysis



LEGEND:
RBC - Rotating Biological Contactor designed for BOD removal;
SBR - Sequencing Batch Reactor designed for BOD removal;
OxD - Oxidation Ditch designed for BOD removal;
TF/SC - Trickling Filter Solids Contact designed for BOD removal
SG/Cl -Suspended Growth with Clarifiers
FF/Cl - Fixed Film with Clarifers
SG/MBR - Suspended Growth with MBR
_____-N - Designed for nitrogen Removal

Final selection was completed with a matrix to systematically evaluate selection criteria of each considered alternative. Rankings were developed for each alternative based on scoring of each criterion. A score of 5 represents the best and 1 the worst (for example, the most expensive option would be awarded a 1 for the capital cost criterion). Matrix results are shown in Table A-1.

Table A-1. AKART Qualitative Selection Matrix

Alternative	Capital Cost	Operational Cost	Footprint	Operational Complexity	Site Applicability	Total
Optimization and Process Refinements	5	5	5	4	5	**24**
IFAS retrofit	2	2	4	3	2	**13**
MABR retrofit	2	1	4	3	2	**12**
MBBR	3	3	3	2	4	**16**
SBR retrofit	3	3	4	4	4	**18**
Aerobic granular sludge	2	2	4	3	2	**13**
Satellite MBR	1	1	1	4	1	**8**

Alternative(s) presented reflect AKART alternative(s) capable of reducing TIN and are suitable for implementation at the facility.

IFAS = integrated fixed film activated sludge

MABR = membrane aerated biofilm reactor

MBBR = moving bed biofilm reactor

MBR = membrane bioreactor

SBR = sequencing batch reactor

Appendix B. Coupeville WWTP Nitrogen Optimization Plan

FINAL

Coupeville Wastewater Treatment Plant Nitrogen Optimization Plan

Town of Coupeville, Washington

Association of Washington Cities Technical Assistance Study

November 2023

Jacobs

Coupeville WWTP Nitrogen Optimization Plan

Client name:	Town of Coupeville, Washington		
Project name:	Association of Washington Cities Technical Assistance Study		
Client reference:	Joe Grogan; Utilities Superintendent	Project no:	D3695800
Project manager:	Amanda McInnis	Prepared by:	Jacobs
Date:	November 2023	File name:	Coupeville_Nitrogen_Optimization Plan
Doc status:	Final		

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Acronyms and Abbreviations

AN-ISE	ammonium-nitrate ion-selective electrode
BOD	biochemical oxygen demand
BOD_5	5-day biochemical oxygen demand
CEPT	chemically enhance primary treatment
DMR	discharge monitoring report
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
I&I	infiltration and inflow
ISE	Ion selective electrode
lbs/day	pound(s) per day
mg/L	milligram(s) per liter
mgd	million gallon(s) per day
mL	milliliter(s)
MLR	mixed liquor return
NOP	Nitrogen Optimization Plan
NO_x	nitrate + nitrite nitrogen (oxidized ammonia)
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
ORP	oxidation reduction potential
PSNGP	Puget Sound Nutrient General Permit
RAS	return activated sludge
TIN	total inorganic nitrogen (Nitrate + nitrite + ammonia/ammonium)
TKN	total Kjeldahl nitrogen
TSS	total suspended solids
WAS	waste activated sludge
UV	ultraviolet
WWTP	wastewater treatment plant

Executive Summary

The Washington State Department of Ecology's final Puget Sound Nutrient General Permit (PSNGP) became effective on January 1, 2022. The PSNGP limits nitrogen loading to Puget Sound at current levels. The PSNGP applies to all 58 domestic wastewater treatment plants (WWTPs) discharging to Puget Sound, including the Coupeville WWTP.

The PSNGP requires that all treatment plants with total inorganic nitrogen (TIN) discharges covered by the PSNGP "develop, implement, and maintain a Nitrogen Optimization Plan to evaluate operational strategies for maximizing nitrogen removal from the existing treatment plant during the permit term." Coupeville must document its actions taken, annual TIN removal rates, and whether annual effluent TIN loads are increasing (or decreasing), then apply an adaptive management (evaluate and improve) approach. In addition, a One-Time Report is required that involves reporting annual effluent TIN levels.

The Coupeville WWTP is an oxidation ditch facility. It initiated efforts to optimize treatment performance in 2020, prior to PSNGP. To optimize overall treatment plant performance, the facility began operating two clarifiers (rather than one) to reduce effluent suspended solids and particulate total nitrogen. In 2022, the WWTP adjusted the mechanical brush rotors to optimize the dissolved oxygen (DO) within the oxidation ditch and improve nitrogen removal. These efforts cut effluent TIN loading nearly in half.

The recommended optimization strategies to be implemented for this reporting period (January 1, 2022, through December 31, 2025) are listed in Table ES-1.

Table ES-0-1: Coupeville Preferred Optimization Strategies

Optimization Strategy	Implementation Cost[a]
Optimize DO	$0
Continuous DO and ORP monitoring	$22,000–$24,000
Continuous nitrogen monitoring	$16,500–$44,500

[a] Estimated implementation costs are Association for the Advancement of Cost Engineering International Class 5 estimates with a -50% to +100% accuracy range. Given the range, the costs could vary up to 2 times the listed implementation cost.

$ = 2023 U.S. dollars

ORP = oxidation reduction potential

1. Introduction

The Puget Sound Nutrient General Permit (PSNGP) requires the Coupeville Wastewater Treatment Plant (WWTP) to develop, implement, and maintain a Nitrogen Optimization Plan (NOP) to evaluate operational strategies for maximizing nitrogen removal from the existing treatment plant effluent. This document satisfies the permit requirements. Permit language, requirements, and associated section citations have been embedded in this NOP for ease of permit compliance review and are shown in *blue italics* starting in Section 4.

2. Facility Background

2.1 Location

The Coupeville WWTP is in the Town of Coupeville, Washington (Town), on Whidbey Island. The WWTP discharges to Penn Cove in the Puget Sound (Figure 2-1). The treatment plant serves approximately 655 connections within the Town limits. There are no significant industrial users within the service area; however, fluctuations in flow and loading are observed during the warmer months as the seasonal population increases. Larger contributors to the treatment plant include restaurants and the Whidbey General Hospital.

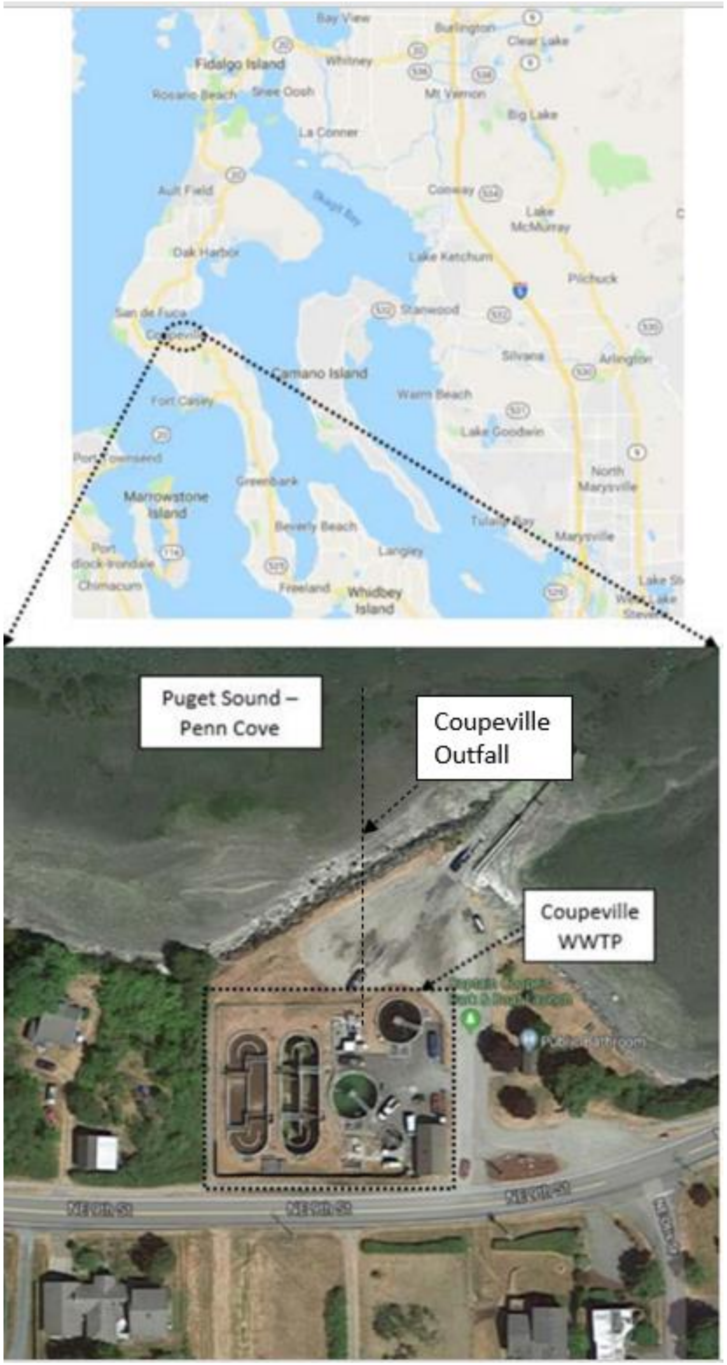

Figure 2-1. Coupeville Wastewater Treatment Plant and Discharge Locations

2.2 NPDES Permit, Effluent Limits

The Coupeville WWTP operates under the conditions of National Pollutant Discharge Elimination System (NPDES) Permit WA0029378. This permit expires on June 30, 2024. The plant has an approved maximum monthly design flow of 440,000 gallons per day (gpd) and regularly sees flows between 120,000 and 310,000 gpd.

The current NPDES permit includes limitations for 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), pH, fecal coliform bacteria, and total residual chlorine. Coupeville successfully complies with these permit limits; no violations or triggers have been recorded during the existing permit cycle.

Currently, effluent ammonia, nitrate + nitrite nitrogen (NOx), and total Kjeldahl nitrogen (TKN) concentrations are monitored quarterly per NPDES permit requirements. Influent nitrogen monitoring is not required by the current NPDES permit. NPDES effluent limits and maximum influent loading criteria issued for Coupeville are listed in Table 2-1.

Table 2-1. Coupeville NPDES Effluent Limits and Rated Influent Loading Capacity

Parameter	Average Monthly	Average Weekly
BOD_5	30 mg/L 110 lbs/day 85% removal of influent BOD_5	45 mg/L 165 lbs/day
TSS	30 mg/L 110 lbs/day 85% removal of influent TSS	45 mg/L 165 lbs/day
	Minimum	**Maximum**
pH	6.0 Standard Units	9.0 Standard Units
	Monthly Geometric Mean	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200/100 mL	400/100 mL
	Average Monthly	**Maximum Daily**
Total Residual Chlorine	0.20 mg/L	0.39 mg/L
Rated Capacity	**Maximum Monthly Influent**	
Design Flow	0.44 mgd	
BOD_5 Influent Loading	648 lbs/day	
TSS Influent Loading	488 lbs/day	

lbs/day = pound(s) per day; mg/L = milligram(s) per liter; mL = milliliter(s)

In addition to NPDES-issued monitoring requirements, all dischargers identified in the PSNGP also must monitor influent and effluent quality in accordance with the PSNGP. Influent and effluent monitoring requirements for nitrogen species are listed in Table 2-2. The additional sampling is sent out to an outside certified lab.

Table 2-2. PSNGP Nitrogen Monitoring Requirements for Small TIN Dischargers

Parameter	Units & Specifications	Minimum Sampling or Calculation Frequency[a]	Sample Type[a]
Influent			
Total Ammonia	mg/L as N	2/month	24-hour composite
NOx	mg/L as N	1/month	24-hour composite
TKN	mg/L as N	1/month	24-hour composite
Effluent			
Total Ammonia	mg/L as N	2/month	24-hour composite
Nitrate + Nitrite Nitrogen	mg/L as N	2/month	24-hour composite
TKN	mg/L as N	1/month	24-hour composite

[a] For details on monitoring requirements, refer to the PSNGP.

N = nitrogen

3. Process Description

A process flow diagram of the Coupeville WWTP is shown on Figure 3-1.

3.1 Liquid Stream

The Town of Coupeville operates an activated sludge oxidation ditch WWTP. Treatment includes screening, biological treatment, secondary clarification, and disinfection.

Preliminary and Primary Treatment

Influent wastewater flow is measured via a Parshall flume and then enters the headworks, where it is screened through a vertical screw-type micro screen. Following screening, flow is routed to a selector tank to combine with return activated sludge (RAS). The selector tank serves to split flow to the two oxidation ditches and select against the formation of filamentous bacteria. Flow is mixed with a course air diffuser.

Biological Treatment

Biological treatment is accomplished through use of extended aeration oxidation ditches. The facility is equipped with two ditches, although it usually only operates a single ditch at a time. Each ditch is 225,000 gallons in capacity and equipped with two mechanical brush aerators to maintain solids suspension and provide aeration within the ditch.

Following biological treatment, mixed liquor is routed to a splitter box prior to entering the two 35-foot-diameter, 12-foot-deep secondary clarifiers. Historically, Coupeville operated a single secondary clarifier but, in quarter three of 2020, it began operating two secondary clarifiers to reduce effluent TSS concentrations. Both clarifiers have been operational year-round since then.

RAS and WAS Handling

RAS and waste activated sludge (WAS) is pumped from the bottom of the secondary clarifiers and either returned to the selector tank or pumped to the aerobic digester for further treatment and storage. The RAS pumps are fixed speed and controlled using a timer to run for a set number of minutes per hour. The timer can be manually changed as influent flows vary, but it does not change automatically.

Disinfection and Outfall

Secondary effluent is disinfected with a low-pressure ultraviolet (UV) disinfection system. Disinfected effluent flow is measured via a Parshall flume prior to discharge. Plant effluent is discharged to Penn Cove through a 12-inch marine outfall and 60-foot-long diffuser equipped with six 3-inch ports. A chlorine disinfection system is in place as a backup in case the UV disinfection is interrupted.

3.2 Solids Treatment

The treatment facility removes solids during the treatment of the wastewater at the headworks (screenings) and secondary clarifiers, in addition to incidental solids (rags and other debris) removed as part of the routine maintenance of the equipment. Grit, rags, and screenings are drained and disposed of at the local landfill. Solids removed from the secondary clarifiers are treated in the 46,000-gallon aerobic digester, which can be decanted to the onsite yard pump station. Digested solids are pumped out and hauled to the Island County septage receiving station.

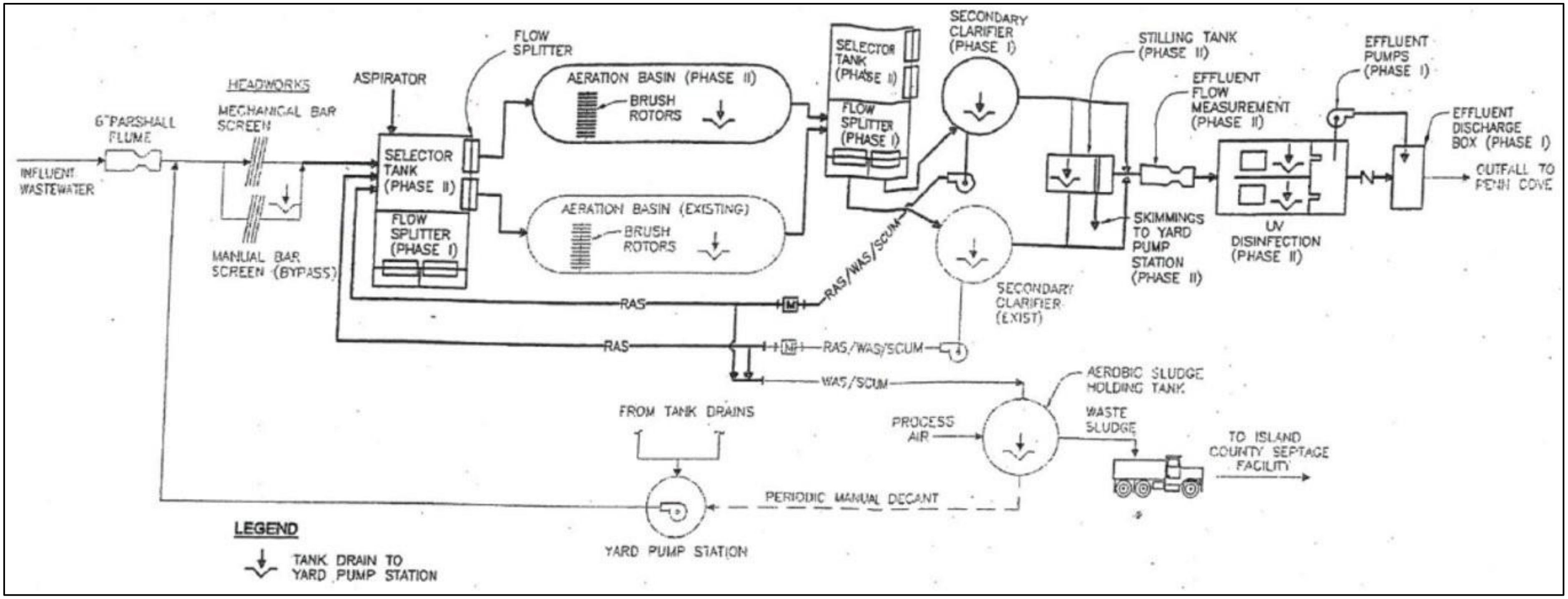

Figure 3-1. Coupeville WWTP Process Flow Diagram

4. Optimization Assessment Method

Permit Requirement: *Assess the nitrogen removal potential of the current treatment process and have the ability to evaluate optimization strategies prior to implementation (PSNGP S6.B.1). Develop a treatment process assessment method for purposes of evaluating optimization approaches during the permit term (PSNGP S6.B.1.a).*

The nitrogen removal potential of the current treatment process and optimization were assessed using the approach and steps shown in Table 4-1.

Table 4-1. Coupeville WWTP Optimization Assessment

Step	Approach	Comment
Review existing treatment process	Virtual and in-person site visit	Extended aeration oxidation ditch
Compare plant metrics to benchmarks	Certified operator review of plant performance	Plant is nitrifying
Set optimization goal	Based on current performance and potential for modification	Increase denitrification
Review and select potential strategies	Meet with operations staff to review optimization strategies; choose cost-effective and realistic strategies	Complete
Next steps	Check in quarterly to review progress	

4.1 Current Optimization Efforts

The Coupeville WWTP plant staff has made efforts in recent years to reduce effluent TIN loads. Adjusting the water surface level within the oxidation ditches to manipulate the submergence of the mechanical aeration brushes within the ditches cut effluent TIN nearly in half. Less submergence of the brush rotors lowers the amount of oxygen transfer. Only one brush is operated continuously, and the second brush runs on an adjustable timer, currently set to run for 5 minutes per hour. This operation has effectively lowered dissolved oxygen (DO) within the oxidation ditch and has increased nitrate removal through additional denitrification in 2021 and 2022.

The Coupeville WWTP is subject to infiltration and inflow (I&I) from precipitation and aging infrastructure. The Public Works Department has made efforts to reduce effects of I&I on the wastewater collection system via collection system repairs, cleanouts, smoke testing, and installation of manhole rain stopper inserts.

Optimization strategies implemented in recent years have been strategically implemented by plant staff and Town personnel. The team continues to be proactive in evaluating optimization to inform AKART[1] strategies.

4.2 Current Process Performance

Permit Requirement: *Evaluate current (pre-optimization) process performance. Determine the empirical TIN removal rate for the WWTP (PSNGP S6.B.1.a.i).*

The oxidation ditches have historically performed well oxidizing biochemical oxygen demand (BOD) and ammonia. Plant staff started to optimize biological treatment in 2021 by reducing DO in the ditch to encourage simultaneous nitrification-denitrification. Quarterly data collected since these optimization efforts indicate a decreasing TIN trend.

[1] AKART stands for all known, available, and reasonable methods of prevention, control, and treatment.

Figures 4-1 and 4-2 show Coupeville WWTP effluent flow, ammonia, NOx, and TIN concentrations and loads, respectively. Effluent ammonia and NOx are monitored quarterly. The 10 mg/L line on the graph indicates a PSNGP benchmark for AKART analysis. Above 10 mg/L small dischargers are required to submit an AKART analysis, below 10 mg/L an AKART analysis is not required.

Permit Language: *Permittees that maintain an annual TIN average of <10 mg/L and do not document an increase in their load throughout their DMRs [discharge monitoring reports] do not have to submit the AKART analysis (PSNGP S6.C.1).*

The average of the four quarterly effluent samples in 2021 was 14 mg/L TIN. Through optimization in 2022, the average of twenty-three samples was reduced to 9 mg/L TIN. Before optimization, the average annual TIN was consistently greater than 10 mg/L and there were large seasonal variations in 2022; therefore, an AKART analysis will be conducted.

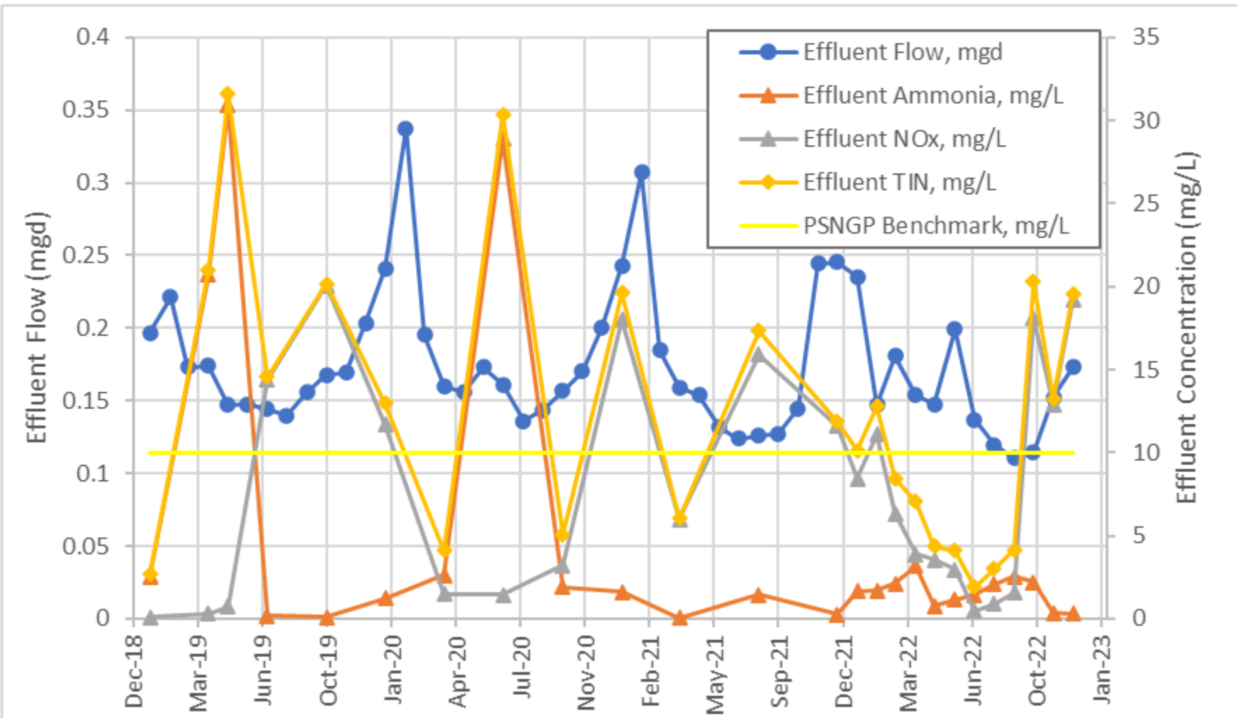

Figure 4-1. Effluent Coupeville Flow and Nitrogen Concentrations

Prior to 2021, nitrification was sporadic with little to no denitrification. Quarterly sampling frequency may account for some of the significant differences in recorded TIN concentrations.

In November 2020, the plant was reliably nitrifying and continued nitrifying through the end of 2022. The oxidation ditch is not reliably denitrifying, so the effluent TIN is regularly reflective of effluent nitrate/nitrite concentrations. Denitrification performance improved in the first three quarters of 2022 based on actively decreasing the oxidation ditch dissolved oxygen by adjusting water elevations to change the disk aerator submergence. Effluent TIN increased in quarter four of 2022, presumably due to colder temperatures.

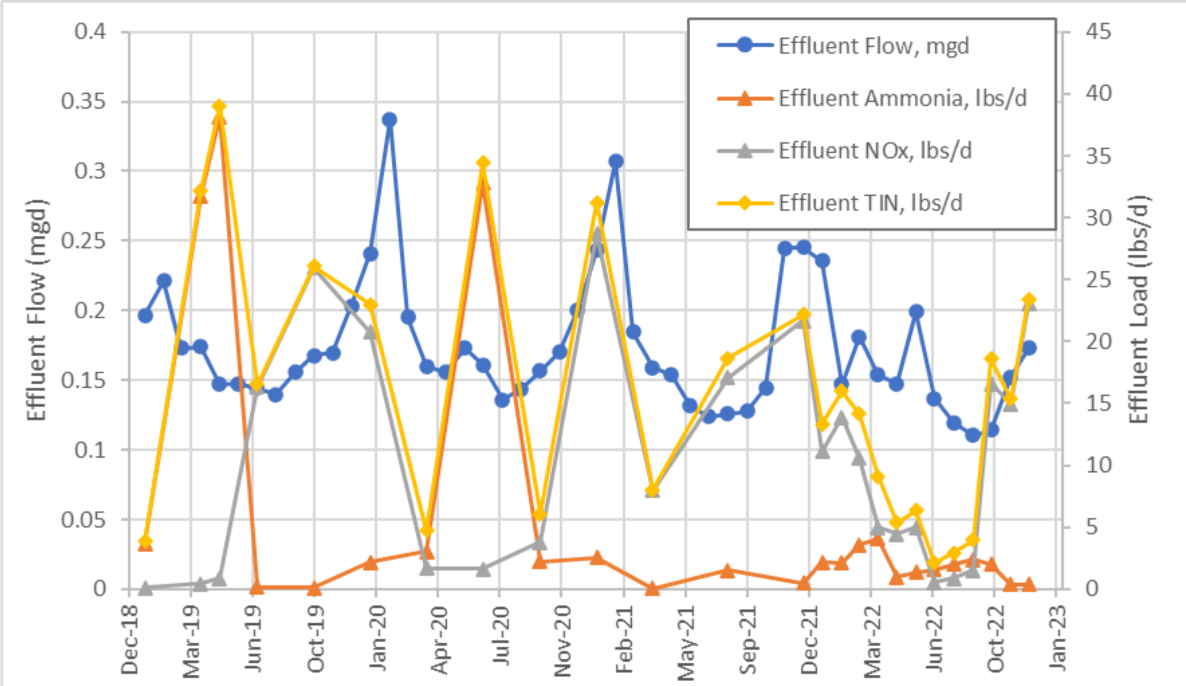

Figure 4-2. Effluent Coupeville Flow and Nitrogen Loads

As required by the PSNGP, Coupeville has monitored influent TIN beginning in 2022. Average monthly influent and effluent TIN loads are displayed on Figure 4-3.

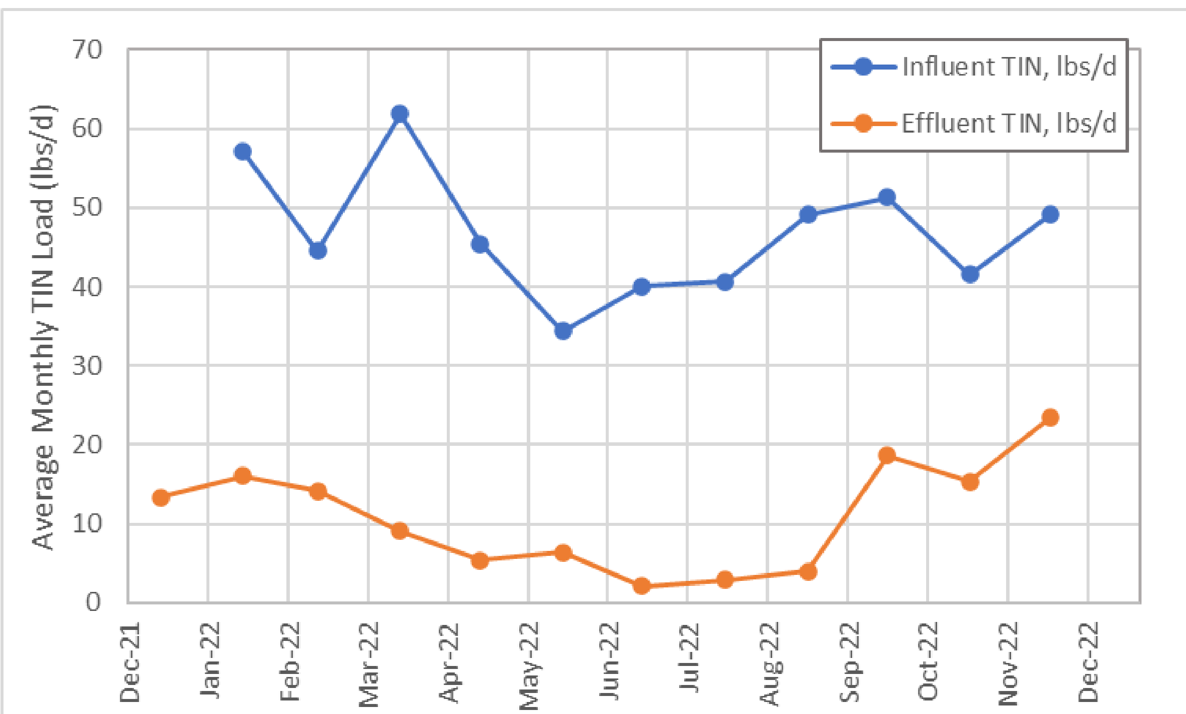

Figure 4-3. 2022 Influent and Effluent TIN Loads

Annual TIN loads have been calculated using PSNGP methodology outlined in Section S7.E, applied to quarterly (2019–2021) or monthly (2022) data. Figure 4-4 presents these annual TIN loads for recent years.

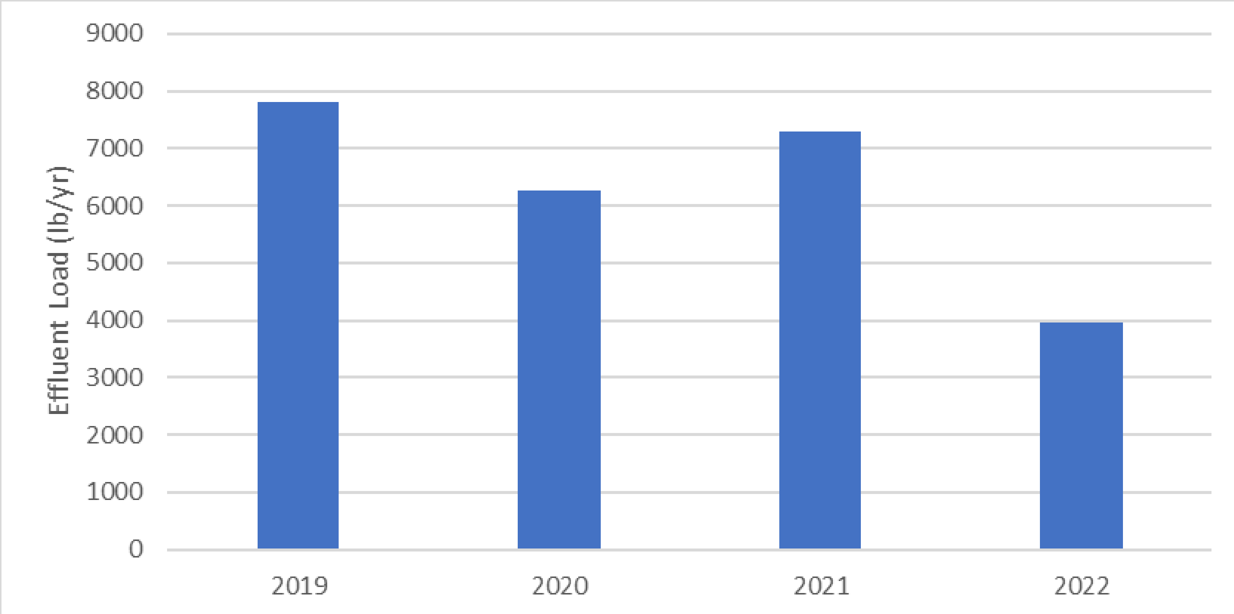

Figure 4-4. Estimated Annual Average Effluent TIN Loads

Effluent TIN loads have remained steady during recent years, with an approximately 45 percent decrease in annual TIN load observed between 2021 and 2022 from recent optimization.

Table 4-2 presents effluent TIN loads, concentrations, and associated removal rates based on 2022 influent nitrogen data.

Table 4-2. Coupeville Pre- and Post- Optimization Removal Rates

Year	Annual Average Influent TIN Concentration (mg/L)	Annual Average Influent TIN (lbs/year)	Average Annual Effluent TIN (mg/L)	Annual Average Effluent TIN (lbs/year)	Annual Average TIN Removal Rate (%)
2021[a] (Pre-Optimization)	-	-	13.7	7,300[b]	-
2022 (Post-Optimization)	34	14,500	9.1	4,000	72[c]

Data presented are based on available influent monitoring for the reporting period.

[a] TIN is not monitored for influent flows in 2021.

[b] Note that the load calculation is based on quarterly average data.

[c] Annual average TIN removal rate is load based for available February 2022 to December 2022 data.

4.3 Determine Optimization Goal

Permit Requirement: *Determine the optimization goal for the WWTP. Develop and document a prioritized list of optimization strategies capable of achieving the optimization goal for each WWTP owned by the Permittee. Update this list as necessary to continuously maintain a selection of strategies for achieving each optimization goal identified (PSNGP S.B.1.a.iii).*

Coupeville has maintained nitrification; however, denitrification is not reliable. The optimization goal is to increase denitrification.

4.4 Potential Optimization Strategies

Permit Requirement: *Develop an initial assessment approach to evaluate possible optimization strategies at the WWTP prior to and after implementation (PSNGP S6.B.1.a.ii).*

In 2020, the U.S. Environmental Protection Agency (EPA) created a combined list of possible nutrient optimization strategies based on optimization plans published from June 2020 to May 2021. Based on those studies, a list of possible optimization categories was considered for the Coupeville WWTP. Those categories are summarized in Table 4-3.

Table 4-3. EPA Developed Optimization Categories

Optimization Category
Intensify/optimize biological process
Optimize clarifier performance
Improve instrumentation
Optimize controls
Equalize/reduce sidestreams
Add carbon
Chemically enhance primary treatment (CEPT)
Change blower operation
Add baffles to existing basins
Reduce influent loading

4.4.1 Assessment of Optimization Strategies

Two optimization workshops were conducted to develop and analyze alternatives from the EPA-listed categories. Discussions were held with the Town, plant site visits were conducted, and meetings began to focus on nitrogen removal optimization.

From those workshops, an assessment of potential optimization strategies to increase denitrification is presented in Table 4-5 (strategies are listed in order of priority). Categories considered for optimization include:

- Optimize biological process
- Improve instrumentation
- Optimize controls
- Equalize sidestreams
- Add carbon
- Change blower operation [in the case of this oxidation ditch process change brush aerators]

Optimize clarifier performance and CEPT were not considered because of a lack of primary clarifiers at the Coupeville facility. Optimizing secondary clarifier performance reduces effluent total nitrogen by increasing solids removal but does not reduce dissolved nitrogen species making up TIN. Refer to Table 4-4 for an overview of nitrogen components, adapted from the *Nutrient Management Terminology Reference Guide* (WRF, 2019).

Table 4-4. Overview of Nitrogen Compounds

<table>
<tr><td colspan="5">Total Nitrogen</td></tr>
<tr><td colspan="4">Total Soluble Nitrogen</td><td>Total Particulate Nitrogen</td></tr>
<tr><td>Nitrate</td><td>Nitrite</td><td>Ammonia</td><td>Soluble Organic Nitrogen</td><td>Particulate Organic Nitrogen</td></tr>
</table>

<table>
<tr><td>Total Oxidized Nitrogen</td><td colspan="2">Total Kjedahl Nitrogen</td></tr>
<tr><td colspan="2">Total Inorganic Nitrogen</td><td>Total Organic Nitrogen</td></tr>
</table>

Addition of baffles was not considered because of the negative impacts on mixing and velocity in the ditches. Reduction of influent loading was not considered because of a lack of industrial dischargers and septage receiving.

Table 4-5. Potential Optimization Strategies

Potential Optimization Strategy (Category)	Cost[a]	Description	Advantages	Disadvantages	Assessment	Include in Initial (2023) NOP Selection	Consider for Adaptive Management?	Consider for AKART Analysis?
Optimize dissolved oxygen (Optimize biological process)	Low	• Change water surface elevation. OR • Change timer for second brush aerator.	• Balance nitrification and denitrification within existing ditch structures and improve simultaneous nitrification and denitrification. • Effectiveness demonstrated in prior years.	• Lack of designated zones • Influent and RAS have only one feed point upstream of first aeration brush • As influent loads increase, aerobic capacity will need to be increased to fully oxidize ammonia and BOD_5	Successful in 2022, continue in future years.	Yes	Yes	Yes
Continuous DO and ORP monitoring (Improve instrumentation)	Medium	• Install continuous DO and ORP probes in the oxidation ditches. OR • Install continuous DO probes and use handheld ORP probes for routine profiles.	• Control ditch brushes and water elevation based on DO trends. • Use ORP to confirm anoxic conditions and denitrification efficiency.	Requires calibration, cleaning, and maintenance to be reliable.	Handheld DO profiles are conducted currently, continuous DO probes would track diurnal trends and treatment disruptions in greater detail.	Yes	Yes	Yes
Add VFD to brush aerators (Optimize biological process)	Medium	• Add variable frequency drive to current brush aerator	• Automated DO control • Potential for energy savings • Increase denitrification	• Requires VFD integration of brush rotors • Control is reliant on DO probe accuracy	Plant has been successful in controlling DO with existing methods. Plant may consider VFD operation if	No	Yes	Yes

Potential Optimization Strategy (Category)	Cost[a]	Description	Advantages	Disadvantages	Assessment	Include in Initial (2023) NOP Selection	Consider for Adaptive Management?	Consider for AKART Analysis?
		• Pace brush aerator speed off continuous DO probe			increased DO control is desired.			
Continuous nitrogen monitoring (Improve instrumentation)	Medium-High	Install continuous ammonia and nitrate probes at the oxidation ditches or secondary effluent.	• Greater level of process monitoring and control for TIN removal. • Identify process upsets of trends in the wrong direction immediately.	Requires calibration, cleaning, and maintenance to be reliable.	• High level of ongoing maintenance • Low level of plant control available based on feedback from continuous probes (such as DO control based on ammonia and nitrate measurements)	Yes	Yes	Yes
Operate two ditches in parallel (Optimize biological process)	Medium	• Place both ditches in service when TIN removal falls below targets. • More likely needed during cold temperature/high flow season only.	• Increased SRT and inventory supports more stable nitrifier growth and denitrification; increased contact time reduces the impact of possible short circuit. • Compensate for decreased performance at colder temperatures.	• Increased electrical consumption and maintenance. • Decreased opportunities for major repair and replacements within the ditches	The second offline ditch needs to be empty during the I&I season; this option will be more viable as I&I is reduced in the collection system.	No	Yes	Yes
Modify RAS flow rate (Improve controls)	Medium-High	Pace RAS return to influent flow by upgrading RAS pumps to VFDs and	• Match biological inventory to influent TIN loads.	Dependent on capital projects to upgrade pumps and controls or	Include in future capital project.	No	Yes	Yes

Potential Optimization Strategy (Category)	Cost[a]	Description	Advantages	Disadvantages	Assessment	Include in Initial (2023) NOP Selection	Consider for Adaptive Management?	Consider for AKART Analysis?
		layering PLC flow paced control of pump speed.	• Improve consistency of MLSS concentration. • Less fluctuation in secondary clarifier blankets.	rehabilitate secondary clarifiers.				
Carbon addition (Add carbon)	High	Introduce external carbon source to anoxic zone of oxidation ditch or selector tank.	Increased denitrification.	• External carbon requires storage and pumping system, ongoing chemical costs. • Influent requires pumping. • Potential carbon bleed-through to ditch effluent if overdosing.	Consider for AKART only if the influent is low in easily biodegradable carbon.	No	No	Yes
Return decant during off peak hours (Equalize sidestreams)	Low	• Sample decant to determine nitrogen content. • Vary return of stream to treatment process.	Return of sidestream nitrogen loads during off peak decreases nitrogen bleed-through to the plant.	• Decant has to be monitored to avoid return of excess solids, hard to accomplish during unstaffed hours. • May result in or exacerbate carbon deficiency during off peak, if influent is relatively low in easily biodegradable carbon.	Decanting is conducted during staffed hours and is not easily automated.	No	Yes	Yes

Potential Optimization Strategy (Category)	Cost[a]	Description	Advantages	Disadvantages	Assessment	Include in Initial (2023) NOP Selection	Consider for Adaptive Management?	Consider for AKART Analysis?
Operate aerobic digester to decrease nitrogen return (Change blower operation)	Low-Medium	Modify aeration within aerobic digester to decrease ammonia in digester effluent.	Reduce sidestream nitrogen return.	May require cyclic aeration or reducing SRT at the digester, monitoring, and process changes.	• Aerobic digester does not have DO monitoring. • Average solids retention time at digesters depends on dewatering frequency and cannot be easily increased.	No	Yes	Yes
Replace aeration system in oxidation ditches (Change Blower Operation)	High	• Replace brush aerators with fine bubble diffusers and add submersible mixers	• Improved DO control • Ability to cycle aeration on and off • Balance of nitrification and denitrification	Requires large capital upgrades including continuous DO probes	• DO control and mixing are currently achieved with brush aerators • Decoupling DO and mixing will allow plant to better balance nitrification and denitrification	No	No	Yes
Improve mixing in anoxic selector (Optimize biological process)	Medium-High	The anoxic selector/splitter box upstream of the oxidation ditches may have more potential to denitrify with improved mixing such as adding a submersible mixer.	Increase removal of nitrates in the RAS.	• Capital cost of mixer upgrades. • Will not work if excess DO is present preventing anoxic conditions from occurring.	Measure DO and ORP in the splitter box to evaluate potential for optimization.	No	Yes	Yes

[a] Low is < 0.5% annual plant maintenance cost; Medium is between 0.5% and 1% annual plant maintenance cost; High is > 1% annual plant maintenance cost

MLSS = mixed liquor suspended solids; ORP = oxidation reduction potential; PLC = programmable logic controller; SRT = solids retention time; VFD = variable frequency drive

4.5 Initial Strategy Selection and Predicted Performance

Permit Guidance: *The Permittee may exclude from the initial selection any optimization strategy considered but found to exceed a reasonable implementation cost or timeframe. Documentation must include an explanation of the rationale and financial criteria used for exclusion determination (PSNGP S6.B.1.a.iv).*

For purposes of this assessment, an upper cost limit of 1 percent of the annual plant operation and maintenance (O&M) cost has been established for optimization alternatives. Restated, optimization strategies costing more than 1 percent of the annual plant O&M cost are removed from current consideration. Reasonable implementation timeframes are defined as capable of starting implementation within 1 year of initial selection. The following strategies with high implementation costs and/or unreasonable implementation timeframes were excluded from initial selection:

- Carbon addition – High Cost
- Modify RAS return flow rate – High Cost

Permit Guidance: *By December 31, 2022, identify the optimization strategy selected for implementation. Document the expected percent TIN removal (or the expected reduction in effluent load) for the optimization strategy prior to implementation (PSNGP S6.B.1.b).*

Improved instrumentation and optimizing the biological process were chosen as the initial optimization strategies for implementation because they cost-effectively build on previous optimization efforts and process control abilities.

Strategy 1: Optimize DO

Continue the prior optimization efforts in the oxidation ditches to lower the DO to favor denitrification after meeting permit BOD limits and providing stable and complete nitrification. Control is based on brush aerator submergence by increasing and lowering the ditch effluent weir gate. The primary brush aerator runs continuously, and the secondary brush aerator runs based on a timer to prevent settling and foam accumulation. The brush aerators also function to prevent adverse amounts of solids settling in the ditches. Denitrification may be limited by the required brush aerator run time to maintain adequate solids suspension.

Strategy 2: Continuous DO Monitoring, Optional ORP Monitoring

To understand diurnal daily abnormalities and seasonal changes, in situ continuous instrumentation is more effective than spot checks using handheld instrumentation and grabs. The installation of DO probes will allow a more fine-tuned adjustment of the aeration that will adjust more quickly when concentrations stray outside of desired ranges. The plant will have to choose a range for DO because of changes in loading and changes in oxidation ditch water levels as plant flows change. Installing DO probes upstream of the second ditch brush and ORP probes just upstream of the influent feed is recommended. While DO probes can be used to meet oxidation and nitrification targets, ORP can be used to measure whether portions of the ditch have low enough DO to be anoxic, and when low to no DO is present, indicate the removal of nitrates could be considered in the future.

A future alternative to consider that combines both strategies 1 and 2, the brush aerators may be controlled by variable frequency drives and integrated with the plant SCADA system. This will allow operators to maintain fluid velocities within the ditch while automating DO control.

Strategy 3: Continuous Nitrogen Monitoring

Similar to continuous DO and ORP monitoring, continuous nitrogen monitoring helps understand the impact of process changes on TIN removal and any trends toward worsening performance. Generally, the key nitrogen indicators in a conventional activated sludge plant are ammonia and nitrate. The nitrate and ammonia measurements can inform the DO set point at the oxidation ditches and the brush aerator operation. There are several main approaches to continuously measure nitrogen: the use of ion selective electrodes (ISE), UV absorption, or wet chemistry. Nitrate can be measured using ISE or UV absorption and ammonia can be measured using ISE or wet chemistry (such as an amtax/filtrax setup). The ISE type probes would be more cost effective and easier to maintain, provided probe installation is done in an area of the basin in which ammonia and nitrates are not constantly depleted.

4.5.1 Predicted Performance

When implemented, selected strategies may achieve an effluent TIN concentration of less than or equal to 10 mg/L annually. It is predicted that existing TIN removal performance can be maintained, as observed daily plant loading is approximately 40 percent of the rate maximum monthly loads. Table 4-6 outlines associated TIN effluent loading relative to PSNGP requirements for the Coupeville WWTP.

Table 4-6. Expected Performance of Selected Optimization Strategies

Anticipated Effluent TIN Concentration (mg/L)	Anticipated Effluent TIN Load (lbs/year)	Pre-Optimization Effluent TIN Load (lbs/year)	Reduction in Effluent TIN Load (%)
≤ 10.0	6,500 – 7,000	7,300[a]	5–10%

Note: Anticipated effluent TIN concentrations were determined using plant process models (if available), or literature reviews. The performance values are representative of potential performance if optimization strategies are fully and properly implemented or operated. Given normally occurring variations in wastewater characteristics, temperatures, service area characteristics, and other parameters, the actual TIN reduction achieved may differ from the projected values. The Town should carefully monitor and proactively adapt its TIN optimization efforts based on the WWTP performance achieved.

[a] Reflective of 2021 estimated annual TIN load, optimization started in 2022.

Implementation of this strategy will span the entire reporting period. After year one, this strategy may be modified or improved following observation and analysis of TIN and supporting metrics.

5. Optimization Implementation

5.1 Implementation Cost and Timeline

Permit Requirement: *Permittee must document implementation of the selected optimization strategy as it applied to the existing treatment process during the reporting period. Permittees must document adaptive management applied to the optimization strategies following initial implementation through the permit term (PSNGP S6.B.2).*

Describe how the strategy was implemented during the reporting period, following permit coverage. Including: initial implementation costs, length of time for full implementation, start date, anticipated and unanticipated challenges, any impacts to the overall treatment performance as a result of process changes (PSNGP S6.B.2.a).

Table 5-1 lists costs and dates associated with implementation actions accomplished for this reporting period.

Table 5-1. Implementation Cost and Timeline for Actions of this Reporting Period

Optimization Strategy	Initial Implementation Cost[a]	Implementation Start	Implementation Duration
Optimize DO	$0	2022	Ongoing[b]
Continuous DO and ORP monitoring	$22,000–$24,000[c]	2023	3 months[b]/ongoing[d]
Continuous nitrogen monitoring	$16,500–44,500[e]	2024	3 months[b]/ongoing[d]

[a] Estimated implementation costs are Association for the Advancement of Cost Engineering International Class 5 planning level estimates with a -50% to +100% accuracy range.

[b] Duration corresponds to the time period over which performance will be studied and evaluated.

[c] Cost is reflective of two controllers, two DO probes, two ORP probes, and installation.

[d] Duration corresponds to the time required to implement the change.

[e] Assumes ammonium-nitrate ion-selective electrode (AN-ISE) plus controller or wet chemistry probes.

$ = 2023 dollars

5.2 Additional Implementation Considerations

5.2.1 Adaptive Management Practices

The optimization strategies selected will be evaluated on an annual basis. If selected options do not achieve the expected results, additional strategies may be selected from this NOP or in addition to the plan. Understanding the nitrogen removal effectiveness of the plant will help guide both optimization and capital planning, including alternative effluent discharge locations and uses.

Permit Requirement: *If the TIN loading increased, apply adaptive management, re-evaluate the optimization strategies and the resulting performance to identify the reason. Select a new optimization strategy for implementation and/or revise implementation for better performance. Document any updates to the implementation schedule and overall plan (PSNGP S6.B.2.c).*

5.2.2 Anticipated and Unanticipated Challenges

Before implementation, the following challenges were identified:

- Cost of purchasing and maintaining instrumentation
- Limitations to DO control by oxidation ditch brush-style aerators
- Growth in service area above current projections
- Continued abnormally high inflation
- Extreme climate events related to precipitation and temperature

These challenges will exist throughout the deployment of this strategy.

6. Influent Nitrogen Reduction Measures and Source Control

Permit Requirement: *Investigate opportunities to reduce influent TIN loads from septage handling practices, commercial, dense residential and industrial sources (PSNGP S.B.3).*

To further reduce TIN loads to Puget Sound, investigations to reduce influent TIN loads received by the Coupeville WWTP were conducted. Influent TIN sources investigated included septage hauling practices, dense residential areas, and industrial sources.

6.1 Review of Non-Residential Nitrogen Sources

Permit Requirement: *The investigation must review non-residential sources of nitrogen and identify any possible pretreatment opportunities (PSNGP S6.C.3.a).*

The Coupeville WWTP does not serve any significant industrial or commercial dischargers.

6.2 Review of Dense Residential and Commercial Areas

Permit Requirement: *The investigation must identify potential strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings (PSNGP S6.C.3.b).*

According to the *Town of Coupeville Comprehensive Plan*, a maximum of 21.1 percent of Coupeville land is zoned as high-density residential areas, with 5.9 percent of land zoned for commercial and/or mixed-use development areas (Town of Coupeville 2011). While flows and loading may increase with high-density residential areas, composition will remain domestic municipal sewage. Considering the small percentage of land allocated to commercial activities and no anticipation of higher strength wastewaters from high-density residential areas, addressing these sources is not practical to reduce influent TIN loads.

6.3 Septage

The Coupeville WWTP does not receive septage or other outside solids.

7. References

Town of Coupeville. 2011. *Town of Coupeville Comprehensive Plan*. 1994, revised October 2011.

Water Research Foundation. 2019. *Nutrient Management Terminology Reference Guide*. March. (WRF, 2019)

Appendix A
One Time Report Questions for Small TIN Dischargers

Washington State Department of Ecology One-Time Report Questions for Small TIN Dischargers

Coupeville Wastewater Treatment Plant, 2026

One-Time Report questions to which responses are currently recorded are included in Appendix A. Questions that have to be filled out by the Permittee in the future are included under Table B-2 in Appendix B.

1. Attach a document describing your initial assessment process **(Table 4-1)**, your optimization goal **(Section 4.3)**, the list of prioritized optimization strategies identified **(Table 4-5)**, and the strategy implemented in 2022. If any optimization strategies were found to not have a reasonable implementation cost or timeframe, include description of the feasibility and cost analysis that led to the exclusion of any approach(es) **(Section 4.5).**

3. Did your facility stay below a 10 mg/L annual average TIN concentration? **Refer to Table 4-2.**

   If Q2 = Y and Q3 = Y, then no further questions. (Q2 in Appendix B, Table B-2)

4. What is your pre-optimization empirical total inorganic nitrogen (TIN) removal rate? **Refer to Table 4-2.**

5. Did you maintain your assessment approach after year 1? If no, attach a document describing assessment revisions that occurred each year over the permit term.

6. What is your expected TIN removal with the preferred optimization strategy? **Refer to Table 4-6.**

7. Attach a document describing optimization implementation, including costs, time for full implementation, start date, challenges, and impacts to treatment performance. **Refer to Sections 5.1 and 5.2.**

8. What was the TIN removal rate observed each year during the reporting period? **Refer to Table B-1.**

9. Attach a document describing your ongoing investigations to reduce influent TIN loads from septage handling practices and commercial, dense residential, and industrial sources. **Refer to Section 6.**

Appendix B
Future Worksheet for Small TIN Dischargers

B.1 Load Evaluation

Permit Requirement: *Each Permittee listed in Table 11 must review effluent data collected during the reporting period to determine whether TIN loads are increasing. (PSNGP S6.B.2.b.). Using all accredited monitoring data, determine facility's annual average TIN concentration and load from the reporting period (PSNGP S6.B.2.b.i). Determine the treatment plant's TIN removal rate at the end of each year. Compare the removal rate with the pre-optimization rate identified in Table 4-4 (PSNGP S6.B.2.b.ii).*

To measure the success of selected optimization strategies relative to PSNGP requirements, all accredited monitoring data for this reporting period (January 1, 2022, to December 31, 2025) will have to be compiled by the permittees on an annual basis to populate Table B-1.

Table B-1. Evaluation of Annual Average Effluent TIN Metrics

Monitoring Period	Annual Average Influent TIN Concentration (mg/L)	Annual Average Influent TIN Load (lbs/year)	Annual Average Effluent TIN Concentration (mg/L)	Annual Average Effluent TIN Load (lbs/year)	Annual Average TIN Removal Rate (%)	Pre-Optimization Empirical TIN Removal Rate (%)
January 1, 2022 – December 31, 2022	34	14,500	9.1	4,000	72[a]	72[b]
January 1, 2023 – December 31, 2023						72[b]
January 1, 2024 – December 31, 2024						72[b]
January 1, 2025 – December 31, 2025						72[b]

[a] Annual average TIN removal rate is based on load.

[b] Note that the monitoring period from February 2022 to December 2022 is considered for the pre-optimization TIN removal rate.

% = percent; lbs/year = pound(s) per year; mg/L = milligrams per liter; TIN = Total Inorganic Nitrogen

Permit Requirement: *Strategy Assessment. Quantify the results of the implemented strategy and compare to the performance metric identified in S6.B.1.b. If the TIN loading increased, apply adaptive management, re-evaluate the optimization strategies and the resulting performance to identify the reason. Select a new optimization strategy for implementation and/or revise implementation for better performance. Document any updates to the implementation schedule and overall plan. (PSNGP S6.B.2.c.).*

Tables B-1a through B-1c provide a review of effluent TIN data listed in Table B-1 and documents revised strategy implementation for better performance, if required. Permittees will have to populate this on an annual basis.

Table B-1a. Review of 2023 TIN Data and Revised Strategy Implementation

Description	Permittee Input
According to accredited data in Table B-1, in 2023 TIN loads have:	[Increased/Decreased**/Remained Constant]**
According to accredited data in Table B-1, the 2023 empirical TIN removal rate met or exceeded the pre-optimization removal rate.	[Yes/No]
List the optimization strategy the plant is currently implementing.	
If the pre-optimization TIN removal rate was not met or exceeded, and TIN loads have increased, then populate the next three rows:	
List reasons for the TIN load increase.	
List modified or new optimization strategy or strategies that will be implemented.	
List updates to the implementation schedule.	

Table B-1b. Review of 2024 TIN Data and Revised Strategy Implementation

Description	Permittee Input
According to accredited data in Table B-1, in 2024 TIN loads have:	[Increased/Decreased**/Remained Constant]**
According to accredited data in Table B-1, the 2024 empirical TIN removal rate met or exceeded the pre-optimization removal rate.	[Yes/No]
List the optimization strategy the plant is currently implementing.	
If the pre-optimization TIN removal rate was not met or exceeded, and TIN loads have increased, then populate the next three rows:	
List reasons for the TIN load increase.	
List modified or new optimization strategy or strategies that will be implemented.	
List updates to the implementation schedule.	

Table B-1c. Review of 2025 TIN Data and Revised Strategy Implementation

Description	Permittee Input
According to accredited data in Table B-1, in 2025 TIN loads have:	[Increased/Decreased**/Remained Constant]**
According to accredited data in Table B-1, the 2025 empirical TIN removal rate met or exceeded the pre-optimization removal rate.	[Yes/No]
List the optimization strategy the plant is currently implementing	
If the pre-optimization TIN removal rate was not met or exceeded, and TIN loads have increased, then populate the next three rows:	
List reasons for the TIN load increase.	
List modified or new optimization strategy or strategies that will be implemented.	
List updates to the implementation schedule.	

B.2 Report Questions

Permittees are required to submit the single report online, pursuant to Special Condition S9.E. Appendix A contains questions already completed. Table B-2 provides One-Time Report questions for small loaders that have to be filled out by the permittee after the development of the optimization report.

Table B-2. One-Time Report Questions

Question	Response (Yes/No)
2. Did your plant meet or exceed the pre-optimization empirical TIN removal rate in each year of this permit and also maintain or reduce TIN loads? Also refer to Tables B-1a through B-1c.[a]	
10. Did you submit the required AKART analysis on or before 12/31/2025?[b]	
11. Did you submit discharge monitoring reports according to the required schedule?[c]	
12. Are you retaining all applicable records ?[d, e]	
13. Did you follow noncompliance notification requirements?[f]	

[a] If "No," then attach a document describing how you revised your optimization strategy in response to the evaluation in each of the prior permit years, and document your adaptive management steps, your assessment process, and the new optimization strategy or strategies you identified, and your updated optimization goal(s) and performance metric(s).

[b] If "No," date document was or will be provided.

[c] If "No," attach a document describing the missed monitoring activities and the corrective action taken.

[d] If "No," attach a document descripting the missing records and the corrective action taken and/or planned.

[e] Permit Requirement: *"The Permittee must retain records of all monitoring information (field notes, sampling results, etc.), optimization documents submitted with the one-time report, and any other documentation of compliance with permit requirements for a minimum of five years following the termination of permit coverage. This period of retention must be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology. (PSNGP S9.F.)*

[f] If "No," attach a document describing the noncompliance and the corrective actions taken and/or planned.

Appendix C. 2022-24 DMR Yearly Summaries

TOWN OF COUPEVILLE **WASTEWATER TREATMENT PLANT** **YEAR: 2022**

	PLANT LOADING - Influent							PLANT EFFLUENT DISCHARGE																						Biosolids Removed Gallons	Rain Fall Inch
	P.E. BOD	P.E. Flow	Total Flow MG	Avg. Daily Flow MGD	Peak Flow MGD	Avg BOD PPD	Avg SS PPD	Avg. Daily Flow MGD	Peak Flow MGD	Wkly BOD		Wkly SS		Monthly BOD			Monthly SS			Monthly D.O.		Fecal #/ 100 ml		pH Range		Temp. °C		Cl2 mg/l			
										mg/l Max	PPD Max	mg/l Max	PPD Max	mg/l Avg	PPD Avg	% Rem Avg	mg/l Avg	PPD Avg	% Rem Avg	Max	Avg	Wkly Max	Monthly Avg	Min	Max	Max	Avg	Daily Max	Monthly Avg		
Design Loading				0.44 MGD	1.56 MGD	648	488			7-day	7-day	7-day	7-day									Geom.	Geom.								
Discharge Limit		Min		Min. Avg after 1998												85%			85%												
Discharge Limit		Max			85%	551	415			45	165	45	165	30	63		30	63				400	200	6.0	9.0			0.43	0.20		
Jan	1653	2574	7.98	0.257	0.633	331	299	0.235	0.552	11	30	10	29	10	18	94%	9	17	93%	7.23	6.33	50	8	7.1	7.4	12.3	10.8	0	####	32,204	1.89
Feb	1666	1719	4.81	0.172	0.290	333	273	0.147	0.222	10	19	5	6	8	10	96%	4	5	98%	6.92	5.87	2	1	7.1	7.5	13.2	11.3	0	####	25,839	0.91
Mar	1921	2408	7.46	0.241	0.413	384	297	0.181	0.245	8	12	5	7	7	10	96%	4	6	97%	6.76	5.94	2	1	7.1	7.6	13.9	12.2	0	####	28,000	1.56
Apr	2042	1881	5.64	0.188	0.235	408	294	0.154	0.194	7	10	4	6	6	8	97%	3	4	98%	6.26	5.26	2	1	7.3	7.6	15.4	13.7	0	####	29,220	0.00
May	1138	1705	5.28	0.170	0.290	228	260	0.148	0.225	9	13	8	11	7	9	95%	4	5	98%	5.86	5.18	2	1	7.3	7.7	16.9	15.4	0	####	30,626	1.52
Jun	1060	2134	6.40	0.213	0.691	212	228	0.199	0.542	9	11	8	9	6	8	96%	5	7	97%	5.79	5.15	1	1	7.3	7.7	19.5	17.8	0	####	35,993	1.38
Jul	1377	1527	4.74	0.153	0.314	275	266	0.137	0.173	9	11	4	5	7	4	97%	3	4	99%	5.09	4.21	6	2	7.2	7.6	21.8	20.0	0	####	32,122	0.23
Aug	1337	1256	3.89	0.126	0.140	267	224	0.120	0.216	7	7	5	5	6	3	97%	4	1	98%	4.65	3.87	2	1	7.4	7.7	22.5	21.0	0	####	30,162	0.11
Sep	1169	1222	3.67	0.122	0.143	234	252	0.111	0.127	5	5	5	5	5	4	98%	4	3	98%	5.02	4.17	1	1	7.4	7.6	21.1	19.6	0		48,377	0.00
Oct	1460	1356	4.20	0.136	0.237	292	290	0.114	0.197	4	5	5	6	4	4	98%	4	4	98%	5.21	4.28	3	2	7.3	7.6	18.9	17.5			25,000	1.11
Nov	1185	1799	5.40	0.180	0.383	237	290	0.152	0.299	4	6	5	8	3	4	98%	4	5	98%	6.14	5.22	1	1	7.2	7.7	14.9	13.2			32,525	3.21
Dec	1261	2180.6	6.76	0.218	0.559	252	276	0.173	0.414	4	11	8	14	5	7	97%	6	9	96%	6.53	5.90	3	2	7.1	7.7	11.7	11.0			40,744	2.08
Total	17270	21761	66.24	2.176	4.328	3202	3249	1.871	3.406	86	139	72	112	73	90		53	70				76	22	86.8	91.4			0.00	####	390,812	14.0
Min	1060	1222	3.67	0.122	0.140	212	224	0.111	0.127	4	5	4	5	3	3	94%	3	1	93%	4.65	3.87	1	1	7.1	7.4	**WIN**	**SUM**	0.00	####	25,000	0.00
Max	2042	2574	7.98	0.257	0.691	408	299	0.235	0.552	11	30	10	29	10	18	98%	9	17	99%	7.23		50	8	7.4	7.7	14.0	20.8	0.00	####	48,377	3.21
Avg	1439	1813	5.52	0.181	0.361	288	271	0.156	0.284	7	12	6	9	6	7	97%	4	6	97%		5.12	6	2	7.2	7.6	12.5	19.2	0.00	####	32,568	1.17

Definitions:

P.E. = Population Equivalent
PPD = Pounds Per Day

Month	Notes and Operation changes

Quartly Results							
Qrtly	NH3	NO3+NO2	TKN	Phosphorus	TDS	Hardness	Oil & Grease
1st	1.67	8.46	2.91	2.38	645	270	5
2nd	2.87	4.72	4.38	2.97	490	216	5.8
3rd	0.94	0.3	2.1	1.11	694	275	5.6
4th	2.3	17.40	3.82	6.49	832	278	ND
Max	2.87	17.4	4.38	6.49	832	278	5.8
Avg	1.95	7.72	3.30	3.24	665	260	4.7

TOWN OF COUPEVILLE **WASTEWATER TREATMENT PLANT** **YEAR: 2023**

	PLANT LOADING - Influent							PLANT EFFLUENT DISCHARGE																						Biosolids Removed Gallons	Rain Fall Inch
	P.E. BOD	P.E. Flow	Total Flow MG	Avg. Daily Flow MGD	Peak Flow MGD	Avg BOD PPD	Avg SS PPD	Avg. Daily Flow MGD	Peak Flow MGD	Wkly BOD mg/l Max	Wkly BOD PPD Max	Wkly SS mg/l Max	Wkly SS PPD Max	Monthly BOD mg/l Avg	Monthly BOD PPD Avg	Monthly BOD % Rem Avg	Monthly SS mg/l Avg	Monthly SS PPD Avg	Monthly SS % Rem Avg	Monthly D.O. Max	Monthly D.O. Avg	Fecal #/ 100 ml Wkly Max	Fecal #/ 100 ml Monthly Avg	pH Range Min	pH Range Max	Temp. °C Max	Temp. °C Avg	Cl2 mg/l Daily Max	Cl2 mg/l Monthly Avg		
Design Loading				0.44 MGD	1.56 MGD	648	488			7-day	7-day	7-day	7-day									Geom.	Geom.								
Discharge Limit		Min		Min. Avg after 1998												85%			85%												
Discharge Limit		Max			85%	551	415			45	165	45	165	30	63		30	63				400	200	6.0	9.0			0.43	0.20		
Jan	1314	2168	6.72	0.217	0.485	263	302	0.156	0.228	13	17	8	10	6	8	96%	6	8	97%	6.30	5.70	2	1	7.1	7.7	12.9	11.7	0	0.00	26,550	1.08
Feb	1448	2690	7.53	0.269	0.737	290	294	0.186	0.511	8	14	10	14	7	9	95%	7	10	95%	6.82	6.02	7	3	7.3	7.6	12.5	10.9	0	0.00	26,441	2.25
Mar	1535	2553	7.91	0.255	0.390	307	351	0.194	0.333	6	10	5	10	5	8	96%	5	8	97%	6.34	5.78	5	1	7.3	7.6	12.5	11.4	0	0.00	35,689	1.88
Apr	1165	1565	4.70	0.157	0.198	233	230	0.147	0.172	7	8	5	6	5	6	97%	4	5	98%	6.13	5.46	3	2	7.3	7.7	15.4	13.0	0	0.00	20,295	1.18
May	1217	1655	5.13	0.166	0.309	243	247	0.148	0.259	9	12	7	10	7	9	96%	6	8	96%	5.62	5.12	1	1	7.3	7.7	18.3	16.8	0	0.00	30,348	0.77
Jun	1193	1479	4.44	0.148	0.199	239	235	0.123	0.135	7	7	4	4	5	5	97%	3	4	98%	5.67	4.86	1	1	7.4	7.6	19.3	18.4	0	0.00	37,438	0.39
Jul	1200	1348	4.18	0.135	0.175	240	253	0.117	0.131	6	6	7	7	6	5	97%	5	5	98%	4.97	4.36	3	1	7.3	7.7	20.6	19.9	0	0.00	47,414	0.29
Aug	1055	1165	3.61	0.116	0.133	211	169	0.117	0.129	8	8	10	10	7	7	97%	7	1	96%	4.65	4.02	2	1	7.4	7.7	22.1	20.6	0	0.00	28,000	0.48
Sep	857	1175	3.52	0.117	0.132	171	160	0.115	0.125	5	5	6	6	4	4	98%	4	4	98%	4.78	4.34	2	1	7.4	7.8	20.2	19.1	0	0.00	40,827	0.79
Oct	852	1234	3.83	0.123	0.179	170	171	0.120	0.180	5	5	5	5	4	4	97%	3	3	98%	5.86	4.89	1	1	7.4	7.7	17.9	16.9	0	0.00	28,000	1.74
Nov	733	1432	4.30	0.143	0.198	147	171	0.144	0.197	4	6	5	5	4	4	97%	4	4	98%	6.05	5.39	2	1	7.3	7.6	15.2	13.7	0	0.00	33,134	2.24
Dec	765	1632	5.06	0.163	0.244	153	170	0.167	0.252	4	7	7	11	4	6	96%	5	7	96%	6.08	5.48	4	2	7.2	7.7	13.1	12.9	0	0.00	32,344	2.33
Total	13333	20095	60.92	2.009	3.379	2514	2754	1.733	2.652	81	104	78	98	63	75		58	65				33	16	87.7	92.1			0.00	0.00	386,480	15.42
Min	733	1165	3.52	0.116	0.132	147	160	0.115	0.125	4	5	4	4	4	4	95%	3	1	95%	4.65	4.02	1	1	7.1	7.6	**WIN**	**SUM**	0.00	0.00	20,295	0.29
Max	1535	2690	7.91	0.269	0.737	307	351	0.194	0.511	13	17	10	14	7	9	98%	7	10	98%	6.82		7	3	7.4	7.8	14.3	20.0	0.00	0.00	47,414	2.33
Avg	1111	1675	5.08	0.167	0.282	222	230	0.144	0.221	7	9	7	8	5	6	97%	5	5	97%		5.12	3	1	7.3	7.7	12.9	19.0	0.00	0.00	32,207	1.29

Definitions:

P.E. = Population Equivalent

PPD = Pounds Per Day

Month	Notes and Operation changes

Quartly Results

Qrtly	NH3	NO3+NO2	TKN	Phosphorus	TDS	Hardness	Oil & Grease	TOC
1st	0.11	11.80	2.17	1.11	564	222.7	2.5	12.18
2nd	0.73	5.98	3.18	2.72	636	265	2.5	8.54
3rd	2.19	0.466	3.29	1.25	748	230	2.5	7.93
4th	0.66	4.50	2.17	3.43	746	253	2.5	8.12
Max	2.19	11.8	3.29	3.43	748	265	2.5	12.18
Avg	0.92	5.69	2.70	2.13	674	243	2.5	9.19

TOWN OF COUPEVILLE **WASTEWATER TREATMENT PLANT** **YEAR: 2024**

	PLANT LOADING - Influent							PLANT EFFLUENT DISCHARGE																						Biosolids Removed Gallons	Rain Fall Inch
	P.E. BOD	P.E. Flow	Total Flow MG	Avg. Daily Flow MGD	Peak Flow MGD	Avg BOD PPD	Avg SS PPD	Avg. Daily Flow MGD	Peak Flow MGD	Wkly BOD mg/l Max	Wkly BOD PPD Max	Wkly SS mg/l Max	Wkly SS PPD Max	Monthly BOD mg/l Avg	Monthly BOD PPD Avg	Monthly BOD % Rem Avg	Monthly SS mg/l Avg	Monthly SS PPD Avg	Monthly SS % Rem Avg	Monthly D.O. Max	Monthly D.O. Avg	Fecal #/ 100 ml Wkly Max	Fecal #/ 100 ml Monthly Avg	pH Range Min	pH Range Max	Temp. °C Max	Temp. °C Avg	Cl2 mg/l Daily Max	Cl2 mg/l Monthly Avg		
Design Loading				0.44 MGD	1.56 MGD	648	488			7-day	7-day	7-day	7-day									Geom.	Geom.								
Discharge Limit		Min		Min. Avg after 1998												85%			85%												
Discharge Limit		Max			85%	**551**	**415**			45	165	45	165	30	63		30	63				400	200	6.0	9.0			0.43	0.20		
Jan	1018	2220	6.88	0.222	0.463	204	234	0.225	0.445	6	12	7	16	4	8	96%	5	10	95%	7.26	5.81	4	2	7.3	7.7	13.1	11.1	0	0.00	38,061	3.27
Feb	1052	1833	5.32	0.183	0.498	210	273	0.188	0.506	8	13	4	7	5	8	96%	4	6	98%	5.65	5.35	2	1	7.4	7.7	13.0	12.0	0	0.00	38,799	2.38
Mar	1058	1954	6.06	0.195	0.324	212	257	0.201	0.323	6	15	8	20	5	9	96%	6	10	96%	5.94	5.49	5	2	7.5	7.7	14.6	12.2	0	0.00	31,763	1.34
Apr	1024	1537	4.61	0.154	0.242	205	236	0.164	0.250	8	15	8	11	7	10	95%	6	9	96%	5.71	5.28	3	2	7.5	7.7	15.2	13.8	0	0.00	0	1.77
May	1012	1613	5.00	0.161	0.227	202	321	0.170	0.224	9	13	8	12	7	10	95%	6	9	97%	5.65	5.12	4	2	7.5	7.8	17.3	15.7	0	0.00	0	1.98
Jun	1015	1392	4.18	0.139	0.187	203	299	0.143	0.191	8	8	7	8	7	8	96%	6	7	98%	5.60	4.97	3	2	7.7	7.8	19.5	17.7	0	0.00	0	1.17
Jul	981	1257	3.90	0.126	0.144	196	295	0.132	0.143	10	11	15	16	7	9	96%	8	9	96%	5.33	4.82	6	2	7.5	7.8	20.9	20.0	0	0.00	0	0.18
Aug	1028	1424	4.41	0.142	0.406	206	291	0.143	0.393	8	9	12	13	7	10	96%	9	1	97%	5.42	4.68	4	2	7.4	7.8	21.2	20.1	0	0.00	0	2.15
Sep	896	1250	3.75	0.125	0.231	179	268	0.125	0.228	6	6	7	7	4	5	97%	4	4	98%	5.43	4.84	1	1	7.4	7.8	20.7	19.3	0	0.00	0	1.13
Oct	825	1412	4.38	0.141	0.259	165	256	0.138	0.241	6	6	6	6	5	5	97%	5	5	98%	5.36	4.87	1	1	7.4	7.7	17.3	16.8	0	0.00	16,991	2.12
Nov	1075	1945	5.84	0.195	0.330	215	256	0.193	0.330	4	7	3	8	3	5	97%	3	4	98%	6.89	5.79	11	3	7.3	7.7	15.0	14.0	0	0.00	0	2.68
Dec	1115	2029	6.29	0.203	0.437	223	271	0.202	0.430	4	10	8	14	4	7	97%	5	10	96%	6.58	5.94	3	1	7.3	7.7	12.9	12.4	0	0.00	0	2.24
Total	12099	19867	60.61	1.987	3.748	2197	3256	2.023	3.704	82	124	93	137	65	94		67	84				47	20	89.2	92.9			0.00	0.00	125,614	22.41
Min	825	1250	3.75	0.125	0.144	165	234	0.125	0.143	4	6	3	6	3	5	95%	3	1	95%	5.33	4.68	1	1	7.3	7.7	**WIN**	**SUM**	0.00	0.00	0	0.18
Max	1115	2220	6.88	0.222	0.498	223	321	0.225	0.506	10	15	15	20	7	10	97%	9	10	98%	7.26		11	3	7.7	7.8	14.4	19.9	0.00	0.00	38,799	3.27
Avg	1008	1656	5.05	0.166	0.312	202	271	0.169	0.309	7	10	8	11	5	8	96%	6	7	97%		5.25	4	2	7.4	7.7	13.0	18.8	0.00	0.00	10,468	1.87

Definitions:

P.E. = Population Equivalent

PPD = Pounds Per Day

Month	Notes and Operation changes

Quartly Results								
Qrtly	NH3	NO3+NO2	TKN	Phosphorus	TDS	Hardness	Oil & Grease	TOC
1st	2.53	0.62	3.04	0.523	548	216	2.5	8.92
2nd	2.4	0.22	3.82	1.2	639	244	2.5	9.69
3rd	12.5	0.18	9.52	1.74	709	266	2.5	10.7
4th	0.34	1.33	2.48	3.25	716	235	1.6	8.27
Max	12.5	1.33	9.52	3.25	716	266	2.5	10.7
Avg	4.44	0.59	4.72	1.68	653	240	2.3	9.40

Appendix D. Well 6 Groundwater Report

Schaefer & Bratton Engineers
P.O. Box 607
Coupeville, WA 98239

AGI
TECHNOLOGIES

TOWN OF COUPEVILLE WELL 6 GROUND WATER EVALUATION

Coupeville, Washington

March 15, 1995

Prepared for:

Schaefer & Bratton, Engineers
P.O. Box 607
Coupeville, Washington 98239

AGI Project No. 14,586.002.01

A Report Prepared For

Schaefer & Bratton, Engineers
Post Office Box 607
Coupeville, Washington 98239

Town of Coupeville Well 6
Ground Water Evaluation
Coupeville, Washington

March 15, 1995

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AGI TECHNOLOGIES

Table of Contents

1.0 Introduction

This report presents the results of testing the Town of Coupeville's Well 6 (high school well). The test was required by the Washington Department of Ecology (Ecology) revised preliminary/temporary permit #G1-26236. Ecology was concerned that the Well 6 aquifer is subject to seawater intrusion and that the pumping of Well 6 would further increase the extent of that intrusion. The purpose of the test was to assess Well 6's potential for inducing seawater intrusion. A two phase pumping test was conducted:

- **Phase 1: Initial Pumping Test** consisted of continuously pumping Well 6 for four weeks at a constant rate no less than the maximum proposed pumping rate.
- **Phase 2: Long-term Pumping Test** consisted of using Well 6 for one year at the maximum proposed pumping rate as the primary source of water for the Town of Coupeville.

The Phase 1 test was conducted from April 20, 1994 through May 18, 1994 following the protocols established with Tom Culhane of Ecology. Phase 2 pumping began immediately on cessation of Phase 1. During the early stages of Phase 2, chloride concentrations began to increase, and in early July 1994, all testing ceased when the increase exceeded 40 milligrams per liter (mg/L).

2.0 Background

Well 6 is located near the high school in Prairie Center, south of the Town of Coupeville on Whidbey Island in Island County, Washington. The well was drilled during the summer of 1991 to a depth of 520 feet and screened between depths of 485 and 520 feet. A pumping test was conducted during November, 1992 while water levels in the deep Robert Engle Well (Engle Farm Deep Well) were monitored. During the test, water levels were measured and water samples collected and analyzed for chlorides. The results of these studies are presented in reports by Richard Threet (1991) and Schaefer and Bratton (1991).

The water chemistry data collected during the 1992 pumping test indicated chloride concentrations in excess of 100 mg/L in both Well 6 and the Engle Farm Deep Well. The data were ambiguous, because the chloride concentrations in Well 6 decreased during the pumping test while those of the Engle Farm Deep Well increased slightly. Ecology expressed concern about these data, because water with chloride concentrations in excess of 40 mg/L can indicate potential seawater intrusion.

The potential for seawater intrusion was analyzed in a report by AGI (1992). It concluded that seawater intrusion probably existed in the deep aquifer serving Well 6 and the Engle

Farm Deep Well, but the extent of that intrusion could not be assessed from the available data. If the seawater/fresh water interface was relatively sharp and located far from the wells, several years of withdrawals could be possible before it reached the wells.

3.0 Test Protocol

The test protocol was defined by Ecology in the Permit (**Appendix A**) and modified during subsequent communications. Some of the original requirements of the Permit were modified as the hydrogeology and the availability of monitoring wells in the study area became better understood. The Permit specified that WRIS Information Bulletin 30 would serve as a guideline for designing and conducting the test and that the Phase 1 test would employ the following:

- Ten monitoring wells: Well 6, the Engle Farm Deep Well, and 8 wells completed in overlying aquifers.
- Monitoring parameters: water level measurements following specified periods of non-pumping and chloride and specific conductance analysis following the purging of three casing volumes.
- Laboratory analysis: initial, final, and three intermediate water samples analyzed by a state certified laboratory and other samples analyzed by field testing procedures.
- Sample frequency: Well 6 -- initial 60 minutes, 3 additional times during the first 24 hours, and every third day thereafter; the Engle Farm Deep Well -- 24 hours prior to initiation of the test and on every third day thereafter; the network of observation wells -- once prior to, during, and after the test.
- Ecology notification: increases in chloride of 40 mg/L or more concentration during the test.
- Report: well construction reports, tables summarizing water levels and water quality data, a graph depicting tidal influences, analysis of aquifer properties, two cross-sections, data trend analysis, and a discussion of recharge to Well 6.

Some of the specifications in the Permit were modified because of the lack of suitable wells for the monitoring network and the inaccessibility of the Engle Farm Deep Well for water level measurements. The casing of the Engle Farm Deep Well developed a leak prior to the test. The leak was sealed with a small diameter liner. The lined casing would not permit the passage of a water level sounder below 15 feet. The modified requirements were described in a letter to Ecology dated March 29, 1993 (**Appendix A**) and in telephone conversations with Tom Culhane (April 26 and 28, 1993) and are as follows:

- Monitoring wells: the 8 monitoring wells were reduced to 5, which include Town Wells 1, 4, and 5; the Engle Farm Shallow Well; and one well to the east (if available).
- Water levels: measurements were not possible in the Engle Farm Deep Well.
- Monthly monitoring: Coupeville should consider a monthly monitoring program which includes analyzing water samples from the Engle Farm Deep and Shallow Wells for chloride, specific conductance, and hardness and measuring water levels in Well 6.
- Water chemistry: Coupeville should consider analyzing the initial and final water samples from Well 6 and the Engle Farm Deep Well for the common cations (calcium, magnesium, sodium, and potassium) and anions (sulfate, chloride, nitrate, bicarbonate, and carbonate).
- Aquifer parameters: Because of the inaccessibility of deep monitoring wells, the aquifer parameters and tidal analysis produced by the pumping test of October 2, 1991 could be used.

4.0 Hydrogeology

An understanding of the hydrogeology of the Coupeville area is necessary to determine the relationship between Well 6 and the monitoring wells and to assess the degree of potential impact of Well 6 on the adjacent wells.

Whidbey Island, south of Coupeville, is approximately five miles wide in an east-west direction and rises from sea level to about 200 feet above sea level. The island is underlain by up to 3,000 feet of unconsolidated sediments. Information describing the uppermost 600 feet of sediments is summarized in the Department of Water Resources, Bulletin 25, **Pleistocene Stratigraphy of Island County** (Easterbrook, 1968); **Ground-water Resources of Island County** (Anderson, 1968, with a section on water quality by Van Denburgh); the United States Geological Survey, Water Resources Investigations Report 87-4182, **Ground-water Resources and Simulation of Flow in Aquifers Containing Fresh water and Seawater, Island County, Washington** (Sapik, 1988); and the **Island County Ground Water Management Program** (1992).

The sediments in the Coupeville area consist of glacial deposits -- outwash and till -- and marine clays and silts. The outwash forms a series of aquifers which Sapik (1988) has designated zones A through E from deepest to shallowest. These aquifer zones are separated by silty aquitards. The two upper aquifer zones, E and D, are unconfined, whereas the lower three aquifer zones; C, B, and A; are confined. According to this model, the aquifers in the Coupeville area have the hydrogeologic characteristics described in **Table 1**.

The aquifer system is recharged by infiltration into aquifer zones E and D in the Smith Prairie area southeast of Coupeville. Approximately four to eight inches of water infiltrate into aquifer zones C, D, and E, and about two percent of this recharge may reach aquifer zones B and A (Sapik and others, 1988).

Where an aquifer is in contact with marine waters, a dynamic balance is established between the fresh ground water flowing seaward and the saline marine waters. The location of the boundary between these waters is controlled by the relative pressure exerted by each. The boundary moves inland when seawater exerts the greater pressure and seaward when the fresh water exerts the greater pressure. Portions of coastal aquifers can contain saline ground water resulting from seawater intrusion, the inland extent of this intrusion being controlled by the fresh water pressure. Sapik (1988) estimated the degree of seawater intrusion using available data and a sophisticated computer model. The model assumes all recharge to the aquifer is free to discharge to the sea, that is, no ground water withdrawals occur. It estimates a lens of fresh water exists below Coupeville which decreases in width with depth and bottoms out at a depth between 400 and 600 feet below sea level. Additional seawater intrusion into the aquifer will occur as ground water withdrawals reduce the fresh water pressure.

This hydrogeologic model was verified in the Coupeville area by constructing two hydrogeologic cross-sections through Well 6, as required by the Permit. **Figure 1** shows the location of cross-sections A-A' and B-B'. The sections are oriented in as nearly a north-south and east-west direction as allowed by the distribution of deep wells. The cross-sections shown as **Figure 2** indicate multiple aquifer zones at different depths underlying the Coupeville area. Those aquifer zones, occurring at the elevations described by the conceptual model (**Table 1**), are designated A through E.

The cross-sections indicate Well 6 and the Engle Farm Deep Well are completed in aquifer zone A. The extension of aquifer zone A to the south and southeast of Coupeville is conjectural because of limited data. No deep aquifers were reported in logs of Ecology's test wells in sections 11 and 15. No other deep wells penetrate aquifer zone A in this area, and its extension to Penn Cove and Puget Sound is inferred based on observed water level response to tidal changes.

The Engle Farm Shallow Well and the Bill Engle Well are completed in aquifer zone B, and Town Wells 1, 4, and 5 are completed in aquifer zone C.

5.0 Baseline Data

Background water quality (specific conductance, chloride, and hardness) and water level analyses were made from March 23, 1993 to the start of the Well 6 test on April 20, 1994 and provide more than one year of baseline data. Water quality and/or water level data were collected from 6 wells, including the Engle Farm Deep and Shallow Wells, the Bill Engle Well, and Town Wells 1, 4, and 5.

The baseline data are included in **Appendix B** and **Figures 3** through **6**. The baseline water quality data for Town Well 1 (**Figures 3** through **5**) include a pumping test which occurred in April, 1993. This test intentionally induced seawater intrusion into a small portion of aquifer zone C (AGI, 1993). The monthly field data sheets and laboratory analysis are included in **Appendix C**.

Figures 3, 4, and **5** provide insights into the longer-term variations in water quality parameters and a baseline for assessing the impacts of the test. They indicate some significant short-term fluctuations in chloride, specific conductance, and hardness. **Figure 4** shows an increase in specific conductance in the Engle Farm Deep and Bill Engle Wells prior to the initiation of testing.

5.1 Water Quality

Chloride

As shown in **Figure 3**, chloride concentrations fluctuated between 100 and 165 mg/L in aquifer zones B and C and between 140 and 225 mg/L in aquifer zone A. Natural fluctuations in chloride in the Engle Farm Deep Well exceeded the 40 mg/L, established by Ecology as an indicator of potential seawater intrusion. Following recommendations from Ecology, water samples showing large fluctuations in field results were submitted to a certified laboratory for duplicate analysis. The laboratory analyses generally confirmed the reality of the fluctuations.

Specific Conductance

Long-term specific conductance results are listed in **Appendix B** and illustrated in **Figure 4**. As described above, the specific conductance in the Bill Engle and Engle Farm Deep Wells increased during the baseline monitoring. During 1993, conductance in aquifer zones B and C ranged between 850 and 1,200 micromhos per centimeter (μmhos/cm). In aquifer zone A, it ranged between 1,000 and 1,400 μmhos/cm.

Hardness

Hardness is a increase of the calcium and magnesium content of water and is reported as $CaCO_3$ equivalents in mg/L. Long-term hardness values are summarized in **Figure 5**. As shown, hardness varies between aquifers and remains relatively constant within an aquifer over the duration of the study. Hardness was lowest in aquifer zone A at about 80 mg/L, more than three times this in aquifer zone B, and highest in aquifer zone C at 400 to 500 mg/L.

5.2 Water Levels

Long-term water levels, measured in wells completed in aquifer zones B and C, are shown in **Figure 6**. The data indicate little or no seasonal changes in water levels in these aquifers. Short-term water level fluctuations are a response to in-well pumping.

6.0 Well 6 Test Data

During the test, water samples were collected and analyzed in the field according to the test protocol previously described. Selected samples were submitted to a certified laboratory for more complete chemical analysis. The test protocol required that Ecology be notified if chloride concentrations increased by more than 40 mg/L during any portion of the test. During the test, this limit was relaxed, because the long-term background data indicated variations in excess of this amount. The steady increase in chloride concentrations observed in late June and early July caused Ecology to be notified and the test to be halted. The water quality data collected during the test are illustrated in **Figures 7** and **8** and summarized in **Appendix B**. The field data sheets and laboratory analysis sheets are included in **Appendix C**.

6.1 Water Quality

Aquifer Zone A

Figure 8 illustrates water quality changes in aquifer zone A during the pumping test. Well 6 and the Engle Farm Deep Well are completed in aquifer zone A. Data for the Engle Farm Deep Well indicate its water quality remained relatively constant with fluctuations similar to those of the baseline data. However, significant water quality changes occurred in Well 6. These are described below.

Chloride: As shown in **Figure 8**, chloride concentrations in Well 6 decrease from nearly 300 mg/L at the start of the test on April 20, to 200 mg/L and remain at this level until the end of the Phase 1 test on May 18. About six weeks into early June during the Phase 2 test, chloride concentrations began increasing steadily, reaching 300 mg/L by mid July.

Specific Conductance: Specific conductance in Well 6 decreased from over 1,400 μmhos/cm at the start of the Phase 1 test to about 1,200 μmhos/cm in mid April and then immediately began increasing until it exceeded 1,300 μmhos/cm at the end of the Phase 1 test. Specific conductance continued increasing during Phase 2 to a peak of 1,500 μmhos/cm in late June.

Hardness: Hardness increased slightly from around 150 mg/L at the beginning of the Phase 1 test to over 200 mg/L in June and July.

Aquifer Zones B and C

Water quality data for the monitoring wells in aquifer zones B and C are summarized in **Figure 7**. The data indicate differences in the water quality between the two aquifers, but no significant changes in quality during the test.

6.2 Water Levels

Water levels measured during the pumping test are illustrated in **Figure 6**. The abrupt changes in water levels in Well 6 indicate the beginning of the Phase 1 and end of phase 2 testing. The water level response in the other aquifers to Well 6 pumping indicates the extent of hydrogeologic connection between aquifers.

Water levels in aquifer zone C were not effected by pumping in aquifer zone A. The gradual increase in the water level of Town Well 4 indicates its recovery after being turned off at the beginning of the test. The water level in Town Well 5 remained relatively constant throughout the period of record.

As shown, water levels in aquifer zone B responded to pumping aquifer zone A. The water levels in the non-pumping Engle Farm Shallow Well began to decrease several days after the beginning of pumping and remained depressed about five feet by pumping Well 6.

7.0 Interpretation

The test protocol requires the analysis of water levels and water quality data. Water levels are analyzed to evaluate the potential connection between aquifer zones, and water quality is assessed for indications of seawater intrusion.

7.1 Water Level Interpretation

The water level response described in 6.2 indicates that aquifer zones A and B are in hydrogeologic connection. The exact nature and location of this connection is unknown. It could be direct, such as the merging of the two aquifers, or indirect and occur by increased leakage through the aquitard separating them. The delay of several days between the start of Well 6 pumping and the observed response in aquifer zone B, and the great difference in magnitude of response suggests the connection is by slow leakage through an aquitard.

7.2 Water Quality

The water quality data are analyzed using three types of comparisons -- Van Denburgh graphs, Stiff diagrams, and Piper diagrams. These comparisons were used by Culhane (1993) in his study of high chloride wells on Whidbey Island.

7.2.1 Van Denburgh Analysis

The Van Denburgh graphs (Van Denburgh, 1968) compare specific conductance with hardness (the hardness graph) and specific conductance with chloride concentrations (the chloride graph). The analysis was developed to distinguish very hard ground water and seawater influenced ground water, which both have elevated chloride concentrations. It recognizes that specific conductance is directly influenced by the concentration of dissolved solids, but that seawater's influence on hardness is less than that of very hard ground water.

The graphs show the relationships between these parameters for three blends of water -- seawater with fresh river water (seawater line), very hard ground water with dilute ground water (very hard ground water line), and seawater with dilute ground water (seawater encroachment line). The mixing lines illustrate that for the same specific conductance, seawater influenced ground water has a has a higher chloride concentration and a lower hardness than non-influenced ground water.

Van Denburgh graphs were constructed for aquifer zone A and aquifer zones B and C using water quality data from samples collected during Phase 1 and 2 testing. The data are illustrated in **Figures 7** and **8**. **Figures 9** and **10** are Van Denburgh hardness and chloride graphs for aquifer zones B and C, and aquifer zone A respectively.

The Van Denburgh hardness graphs for aquifer zones B and C (**Figure 9**, upper) show two groups of samples. Here, samples from Town Wells 4 and 5 (aquifer zone C) fall along the very hard ground water line, while the Bill Engle Well (aquifer zone C) and Town Well 1 (aquifer zone B) fall below the line, suggesting the mixing of hard ground water with seawater.

The chloride graph (**Figure 9**, lower) places all samples in an elongate cluster in the lower encroachment field between the very hard ground water and seawater encroachment lines. Town Wells 4 and 5 are at the lower hard ground water end of the cluster, and Town Well 1 is at the upper seawater end of the cluster.

This interpretation indicates Town Well 1 is susceptible to induced seawater intrusion from Penn Cove into aquifer zone C. The water quality data for Town Well 1 probably represent the mixing of Penn Cove seawater with the hard ground water encountered in Town Wells 4 and 5. The similarity of Town Well 1 and Bill Engle Well data indicates that aquifer zone C also is influenced by seawater intrusion.

Comparison of the Van Denburgh graphs for aquifer zone A (**Figure 10**) to those for aquifer zones B and C (**Figure 9**) indicates the water quality of aquifer zone A shows a greater seawater impact than either aquifer zones A or B. Within aquifer zone A, the water quality of the Engle Farm Deep Well shows less seawater impact than Well 6.

7.2.2 Stiff Diagrams

Stiff diagrams compare equivalents per unit volume for common cations -- sodium (Na), calcium (Ca), potassium (K), and magnesium (Mg) -- and anions -- chloride (Cl), bicarbonate (HCO_3), and sulfate (SO_4). Waters with different chemical compositions produce Stiff diagrams with distinctly different shapes. Culhane (1993) plotted Van

Denburgh's three basic ground water types -- normal dilute ground water, very hard ground water, and seawater influenced ground water -- as Stiff diagrams. **Figure 11a** illustrates the common shapes for three types of ground water. Stiff diagrams were constructed for selected water samples from the monitoring wells in aquifer zones B and C (**Figure 11b**) and aquifer zone A (**Figure 12**).

The water samples from aquifer zones B and C (**Figure 11b**) produce Stiff diagrams with very similar shapes. The diagrams for Town Wells 4 and 5 have a HCO_3 anion peak and nearly equal cations and are similar to the diagram for normal dilute ground water. Town Well 5 has slightly harder ground water than Town Well 4, as indicated by its higher magnesium peak. The Stiff diagrams for Town Well 1 and the Bill Engle Well are similar, with a high HCO_3 anion peak and a high Na + K cation peak. The Stiff diagram for water from these two wells has a shape between the diagrams for very hard ground water and seawater influenced ground water.

The water samples from aquifer zone A (**Figure 12**) produce Stiff diagrams that are distinctly different from those in **Figure 11b**. Here higher Na + K cation values create a distinctive cation peak. Some diagrams also have a Cl anion peak. The Stiff diagram for Well 6 prior to the pumping test is similar in shape to seawater influenced ground water. As the test progressed, both the Cl and Na + K peaks decreased, while the HCO_3 anion peak increased. The Stiff diagrams for the Engle Farm Deep Well also have a high Na + K peak, but differ from Well 6 in that the HCO_3 peak exceeds the Cl peak. Again, the water quality changed during the pumping test.

The Stiff diagrams for aquifer zone A are a composite of those produced by hard ground water and seawater influenced ground water.

7.2.3 Piper Diagrams

Piper diagrams show the relative percentages of the same ions used in a Stiff diagram and allow numerous samples to be compared at once. Van Denburgh's three ground water types and seawater were plotted on Piper diagrams by Culhane (1993) and are reproduced in **Figures 13** and **14**. They form two distinct groups on each of the graphs. Piper diagrams were developed for the water samples collected during the pumping test from the monitoring wells in aquifer zones B and C (**Figure 13**) and aquifer zone A (**Figure 14**).

Two distinct groups of results appear in **Figure 13**. Town Wells 4 and 5 plot near Van Denburgh's normal and hard ground water, whereas Town Well 1 and the Bill Engle Well plot midway between ground water and seawater-influenced ground water.

Figure 14 for aquifer zone A shows a distinctly different pattern. Both Well 6 and the Engle Farm Deep Well have cation compositions similar to seawater and seawater-influenced ground water and anion compositions that fall between very hard ground water and seawater-influenced ground water.

7.3 Discussion

The three methods of analyses produce very similar results. The data distribution in the Van Denburgh graphs (**Figure 10**) indicates the water in aquifer zone C is normal to hard ground water. The water in aquifer zone B is slightly influenced by seawater intrusion, and water in aquifer zone A is more influenced by seawater intrusion. The Stiff diagrams likewise indicate the ground water in aquifer zone A is a mixture of dilute ground water and seawater and that the degree of seawater influence is greater in aquifer zone A than in either aquifer zones B or C. The Piper diagrams indicate the seawater influence appears as increased Na + K and Cl concentrations.

8.0 Summary and Conclusions

The following summary and conclusions are based on the findings and analysis presented in this report and our best professional judgement.

1. Ecology's original criterion for seawater intrusion -- an increase of 40 mg/L in chloride -- is part of the "normal" chemical variation within aquifer zone A.

2. The long-term data demonstrate that the continued pumping of the Engle Farm Deep Well has not caused an increase in the monthly mean values for chloride, hardness, or specific conductance in aquifer zone A.

3. Aquifer zones B and A are probably hydraulically connected by induced leakage through the aquitard separating them.

4. The water quality data from Well 6, collected at the beginning of November, 1992 and April, 1993, probably represent the background water quality of aquifer zone A at approximately 300 mg/L chloride.

5. The pumping of Well 6 initially caused an increased flow of hard ground water into the portion of aquifer zone A yielding water to the Engle Farm Deep Well and Well 6. This flow reduced chloride concentration to approximately 200 mg/L. This concentration was maintained for over four weeks.

6. Analysis of Van Denburgh, Stiff, and Piper diagrams indicates that aquifer zone C consists of hard ground water. It also indicates aquifer zone B has hard ground water with some seawater influence, and aquifer zone A has ground water with a greater seawater influence.

7. Continued production from aquifer zone A at the Well 6 pumping rates will probably induce seawater intrusion.

8. Continuous production from the Engle Farm Deep Well did not noticeably increase chloride levels in aquifer zone A during the test period. Continued use of the well at historic or lower rates should not significantly increase seawater intrusion in the near future.

9.0 Recommendations

Based on the findings described in this report and our best professional judgement, we recommend the following:

1. Well 6 should be reserved for peak or emergency uses, with pumping at high rates restricted to intervals of two weeks or less. Well 6 water can be mixed with water from other Town wells to reduce chloride concentrations.

2. The continued use of aquifer zone A by the Engle Farm Deep Well should be encouraged, as it reduces the potential demand on the Town's water system and does not appear to increase the degree of seawater intrusion.

3. Aquifer zone B is probably not a viable source of additional ground water because of the indications of seawater intrusion.

10.0 Limitations

This report has been prepared for the Town of Coupeville. The analyses, conclusions, and recommendations in this report are based upon conditions encountered at the time of our investigation, information provided to us, published articles and data summaries, and our experience and professional judgement. AGI can not be responsible for the interpretation of the data contained herein by others.

AGI's work has been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the area. No other warranty, expressed or implied, is made.

Table 1: Summary of hydrologic characteristics for hydrogeologic units in Island County. Depth, thickness, and head data estimated from computer model (after Sapik and others, 1988).

UNIT	TEXTURE	ELEVATION OF TOP* (feet)	THICKNESS* (feet)	HEAD ELEVATION* (feet)	SPECIFIC CAPACITY (gpm/ft)	K (ft/sec)
E	S & G	+200	0 - 90	NA	10.5 - 135	5.7×10^{-2}
e						1.0×10^{-7}
D	S	+100	0 - 150	+50 - 150	0.04 - 27	9.4×10^{-4}
d						1.0×10^{-7}
C	S	- 50	50	+12	0.03 - 42	7.9×10^{-4}
c						1.0×10^{-7}
B	S	-250	45	+10	0.30 - 25	4.9×10^{-4}
b						1.0×10^{-7}
A	S & G	- 300	NA	+8	0.35 - 22	4.8×10^{-4}

*	Data specific to Coupeville area; all other data general to Island County
gpm	Gallons per minute
A	Designation of aquifer zone
a	Designation of aquitard zone (confining unit)
S & G	Sand and gravel
NA	Not applicable

FIGURES

LEGEND

Scale (ft)

0 2000 4000 8000

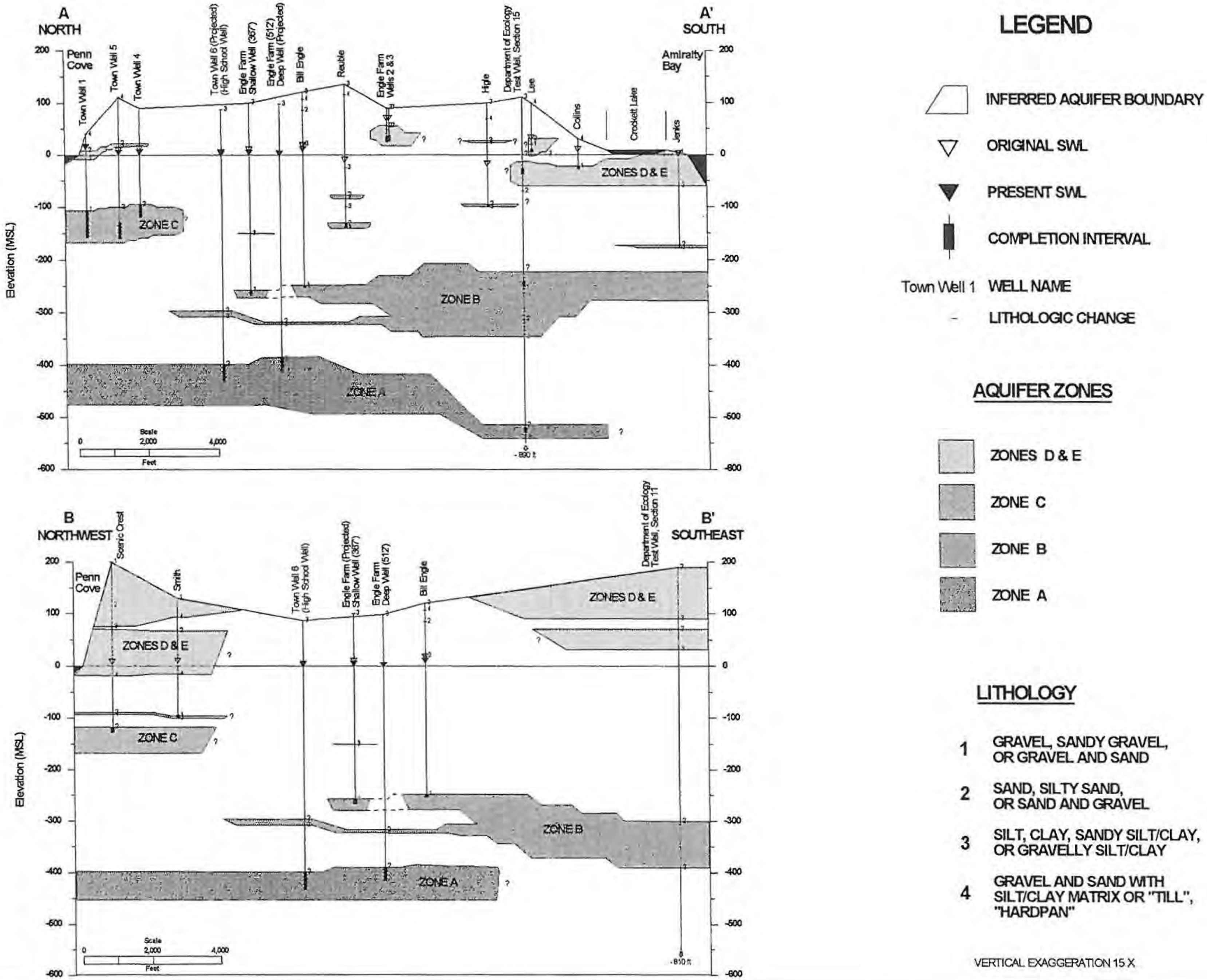
N

● MONITORING WELL

⊕ OBSERVATION WELL

A——A' LINE OF SECTION

AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project# 14,586.002	SITE MAP	FIGURE 1



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Town of Coupeville
Well 6 Pumping Test
Project # 14,586.002

SCHEMATIC HYDROGEOLOGIC SECTIONS

FIGURE 2

AGI TECHNOLOGIES

Town of Coupeville
Well 6 Pumping Test
Project # 14,586.002

LONG-TERM CHLORIDE

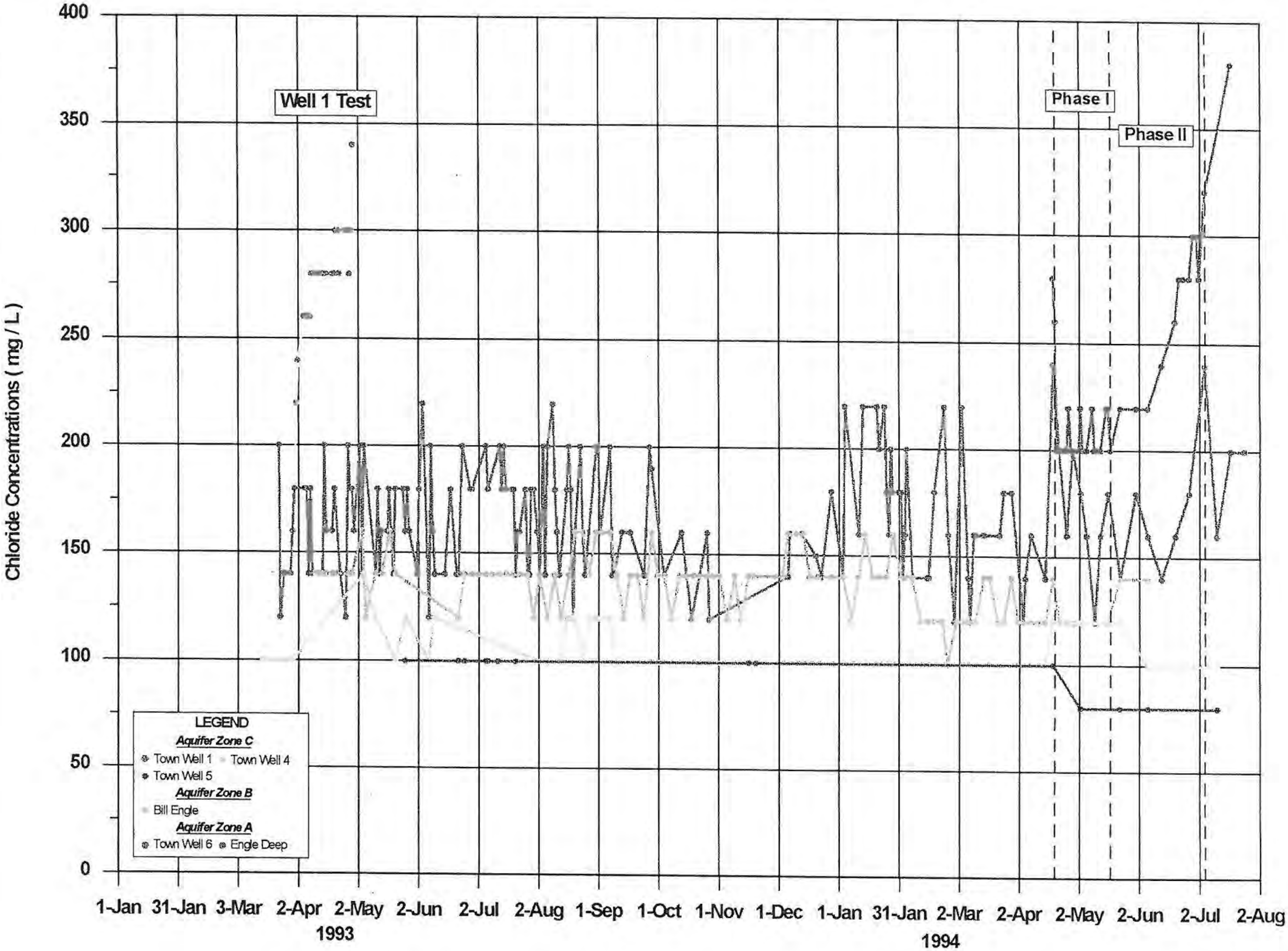

FIGURE 3

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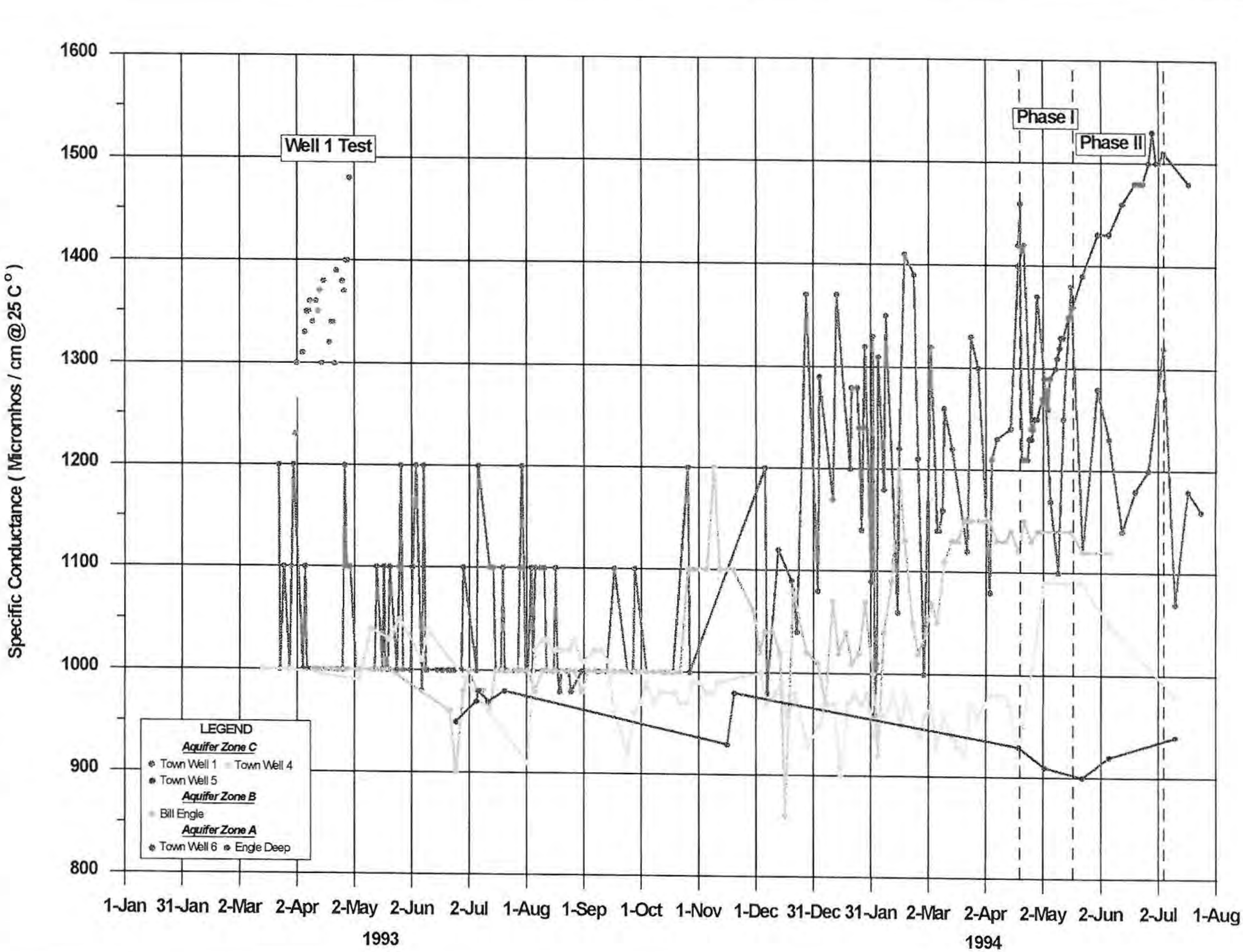
Well 6 Pumping Test
Project # 14,586.002

LONG-TERM SPECIFIC CONDUCTANCE

FIGURE 4

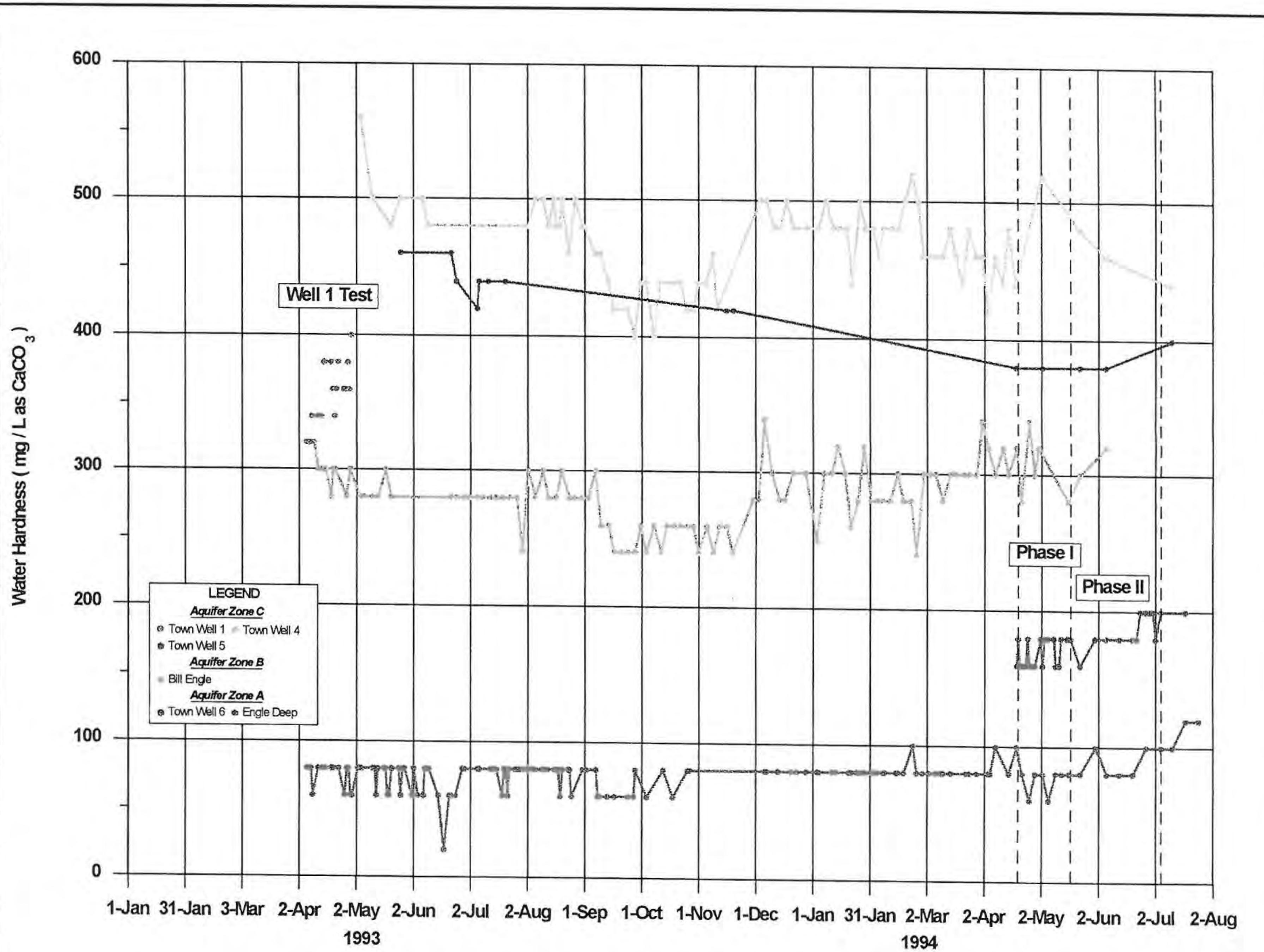


AGI TECHNOLOGIES

Town of Coupeville
Well 6 Pumping Test
Project # 14,586.002

LONG-TERM HARDNESS

FIGURE 5



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Town of Coupeville
Well 6 Pumping Test
Project # 14,586.002

LONG-TERM WATER LEVELS

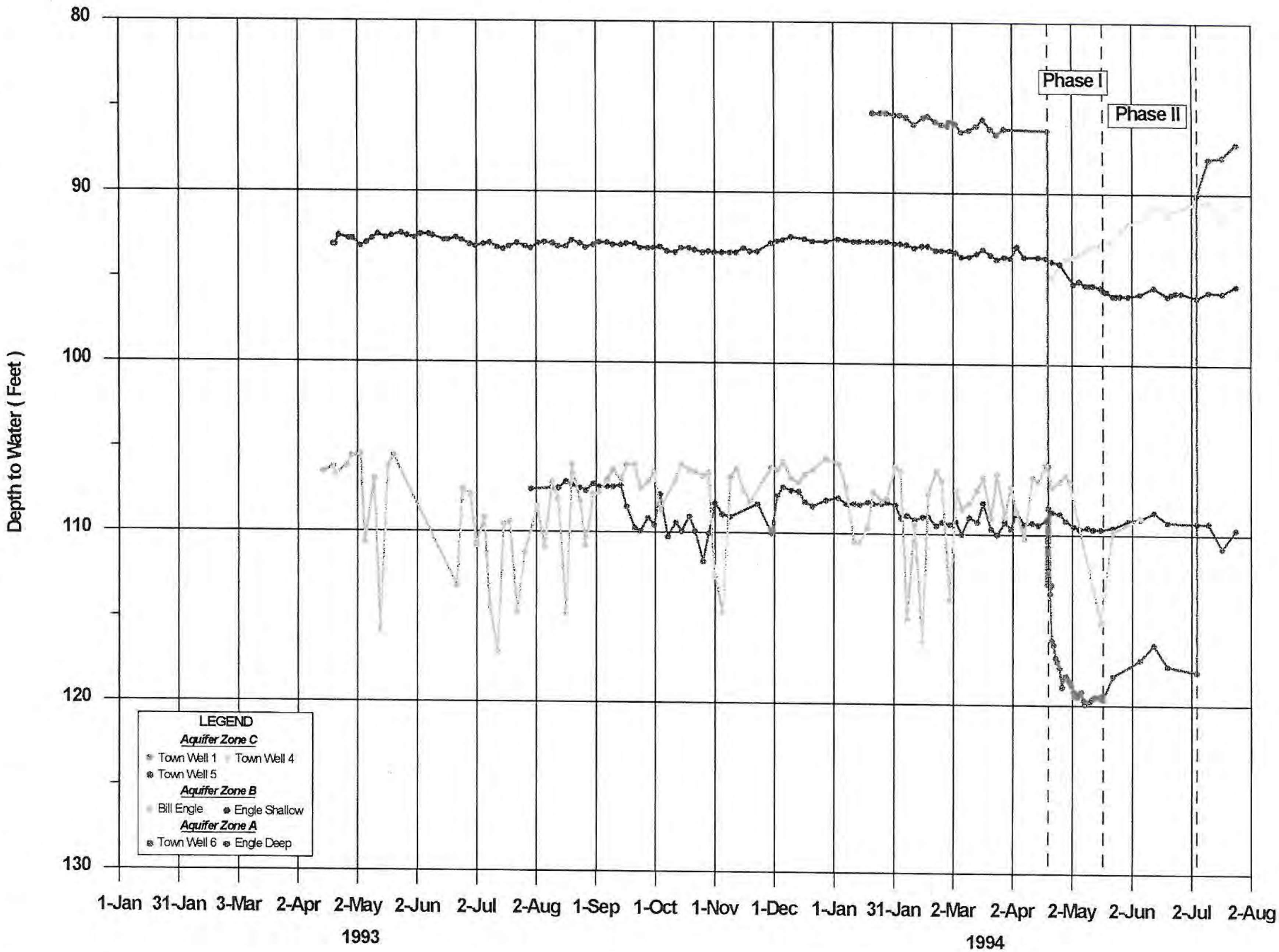
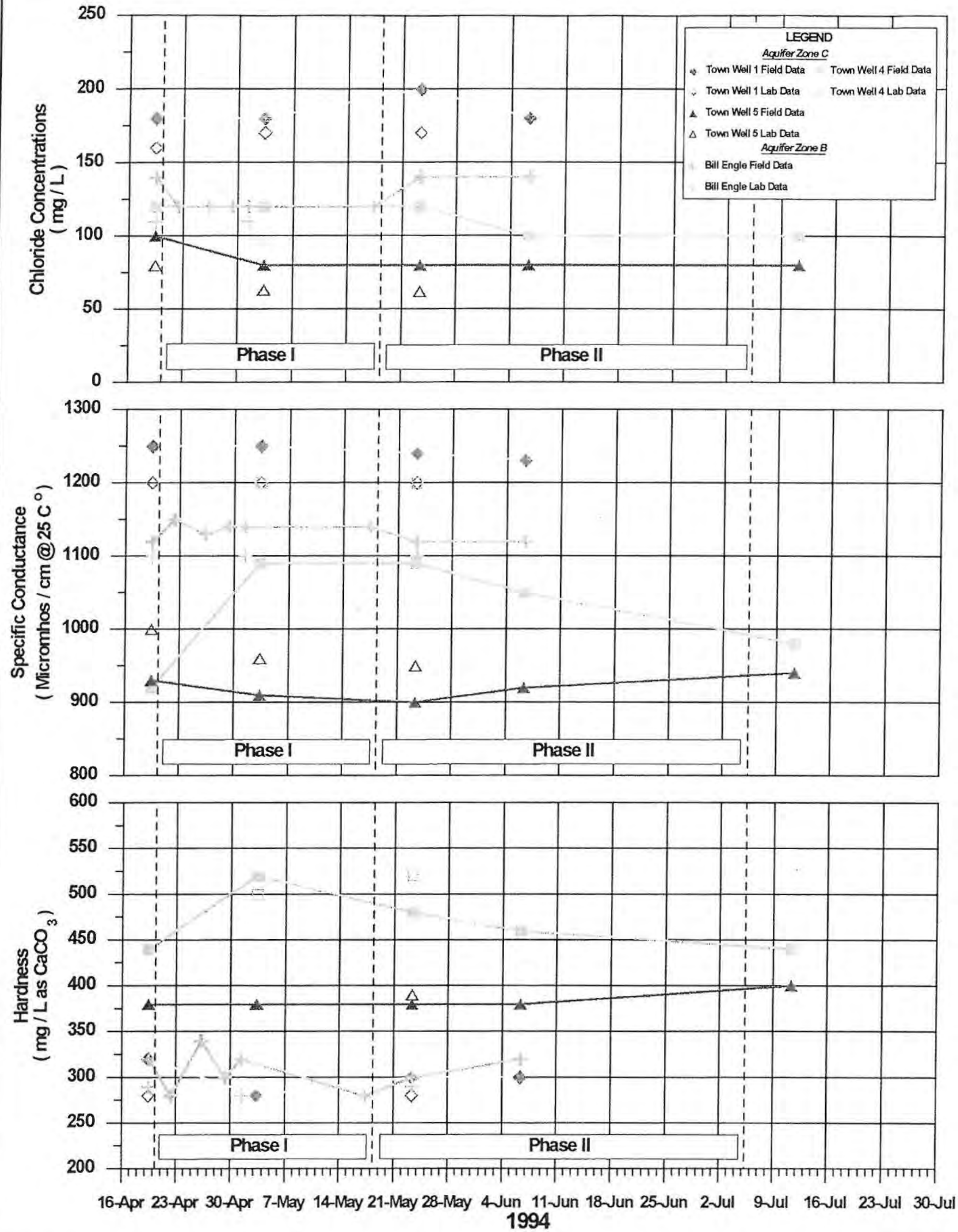
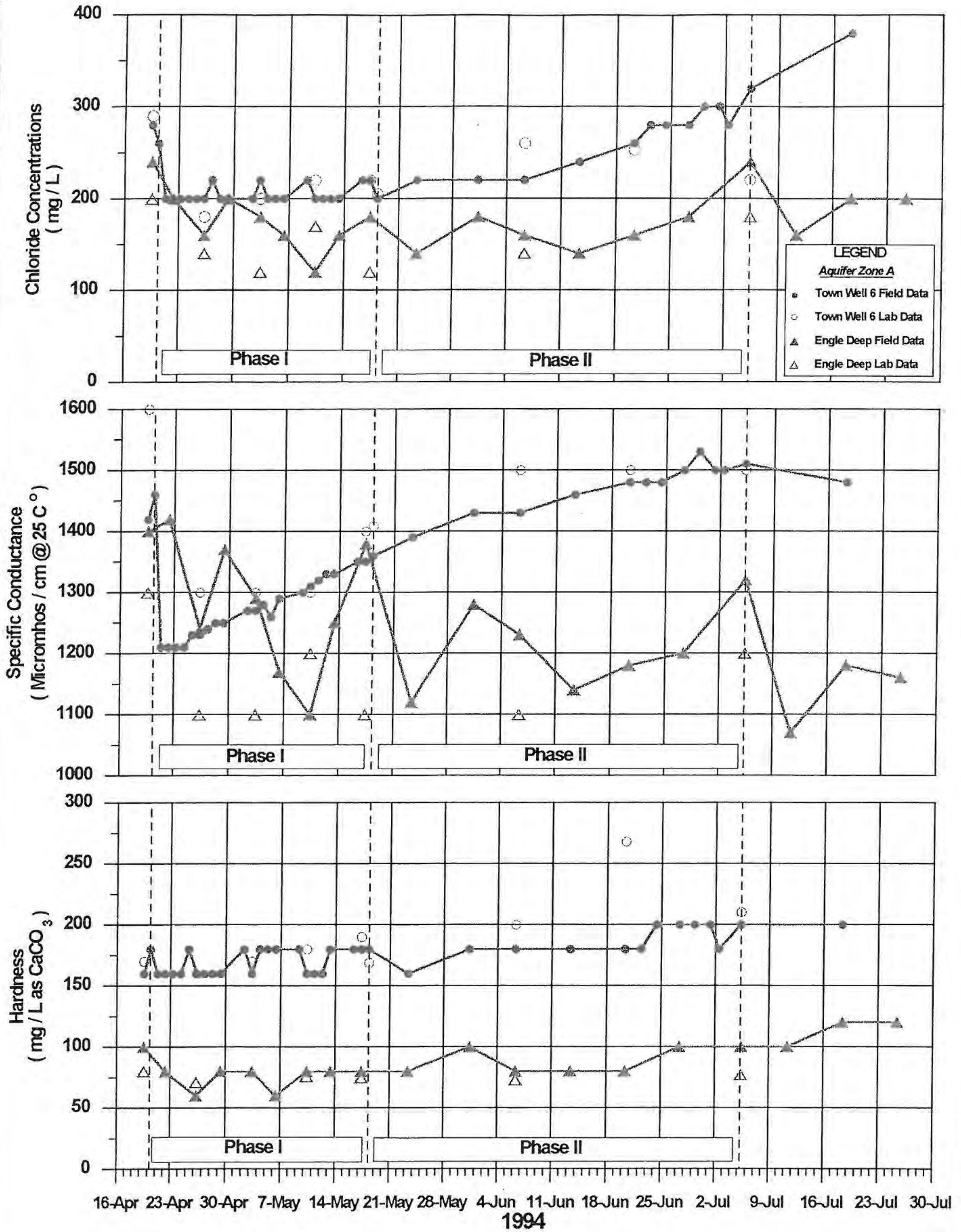


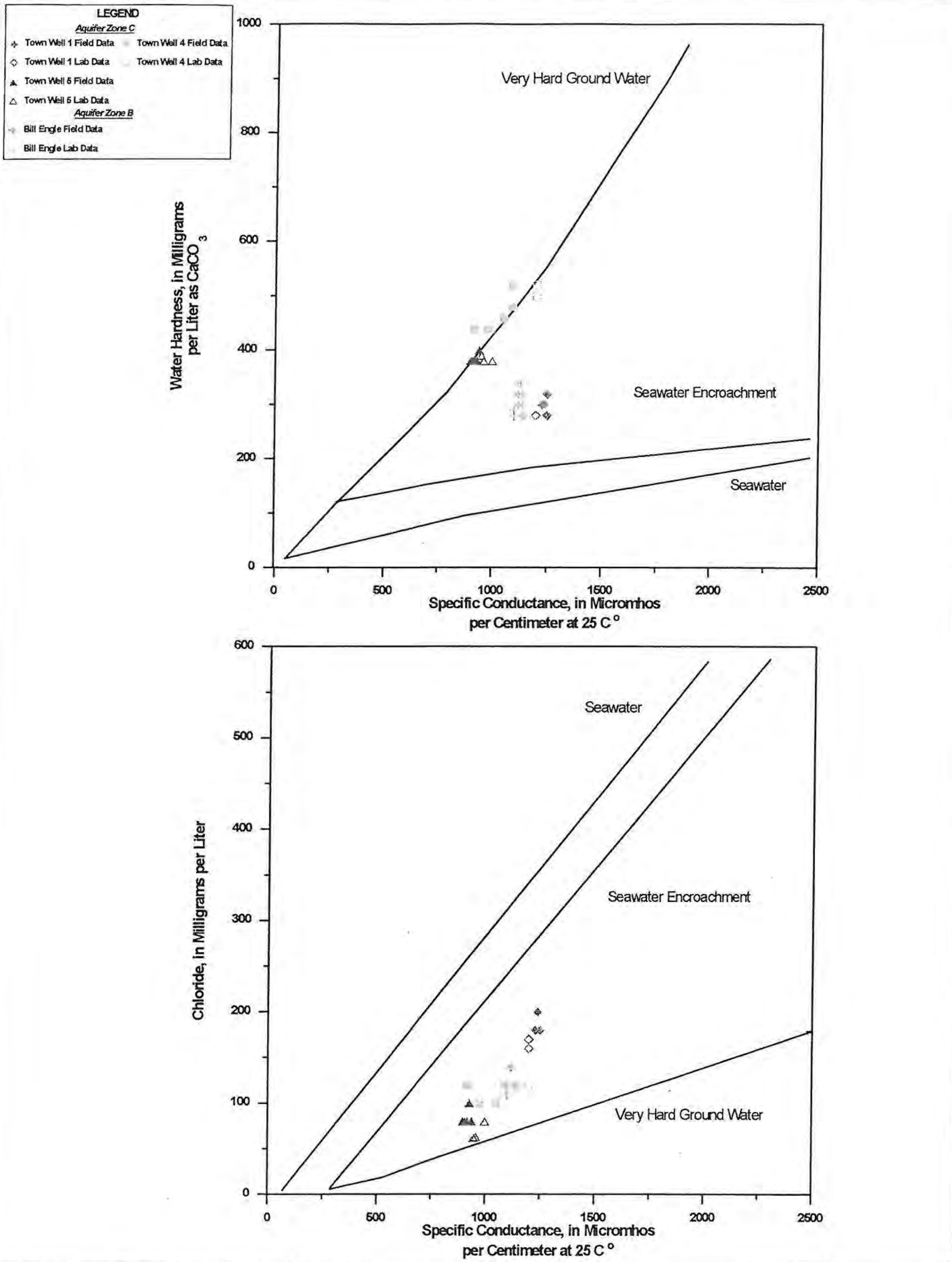
FIGURE 6



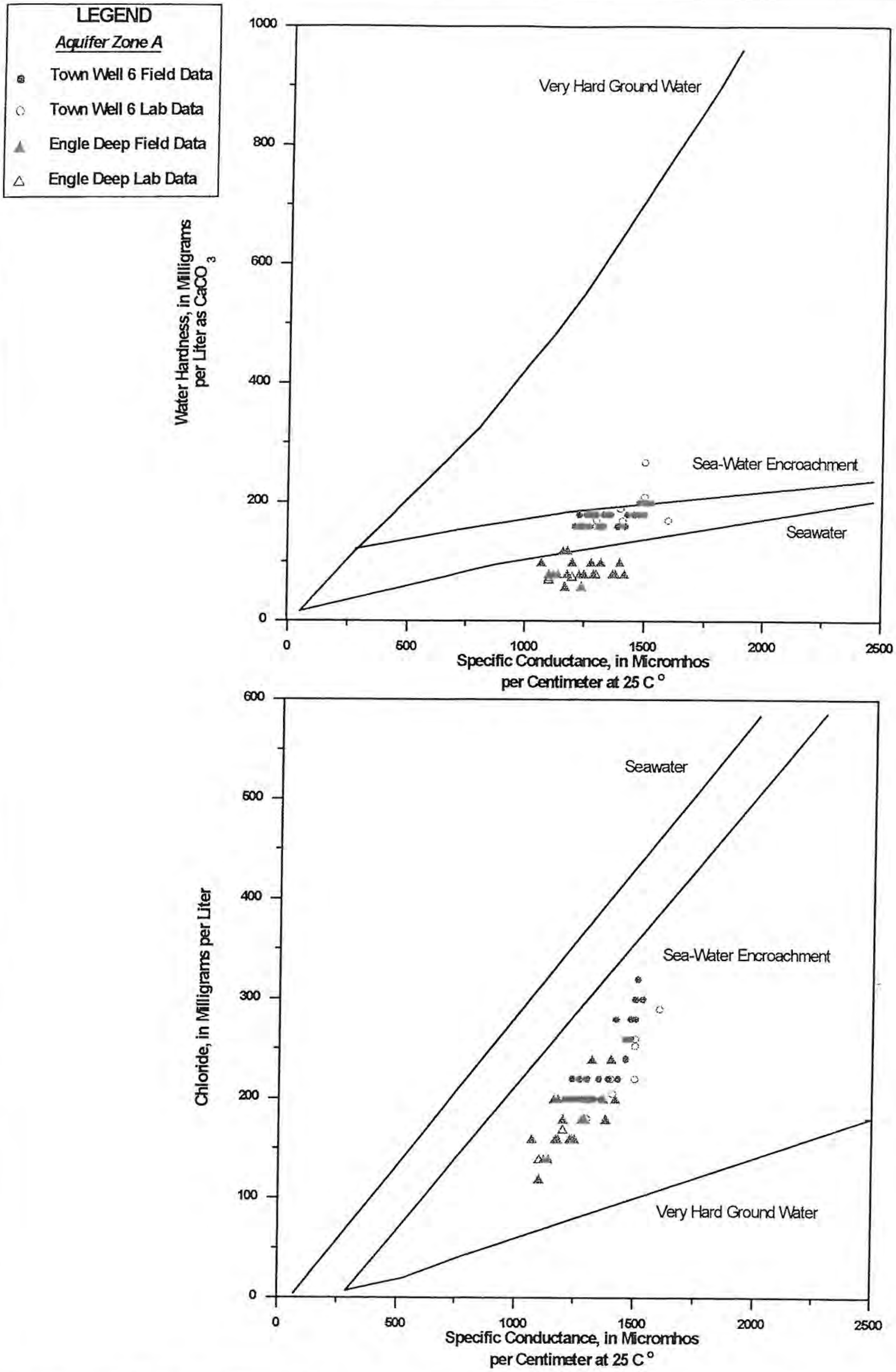
AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project # 14,586.002	CHLORIDE, SPECIFIC CONDUCTANCE, AND HARDNESS IN AQUIFER ZONES B & C	FIGURE 7



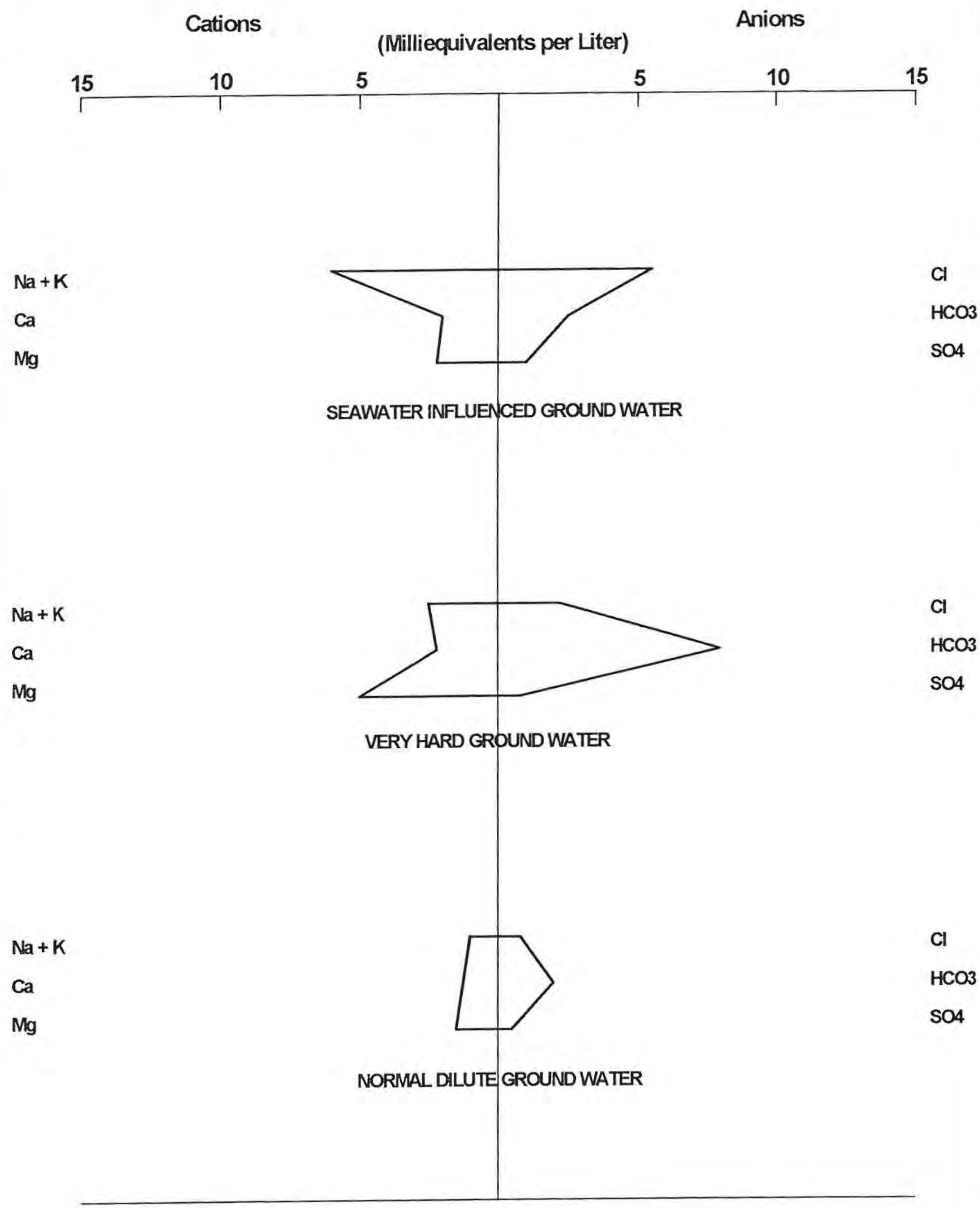
AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project # 14,586.002	CHLORIDE, SPECIFIC CONDUCTANCE, AND HARDNESS IN AQUIFER ZONE A	FIGURE 8



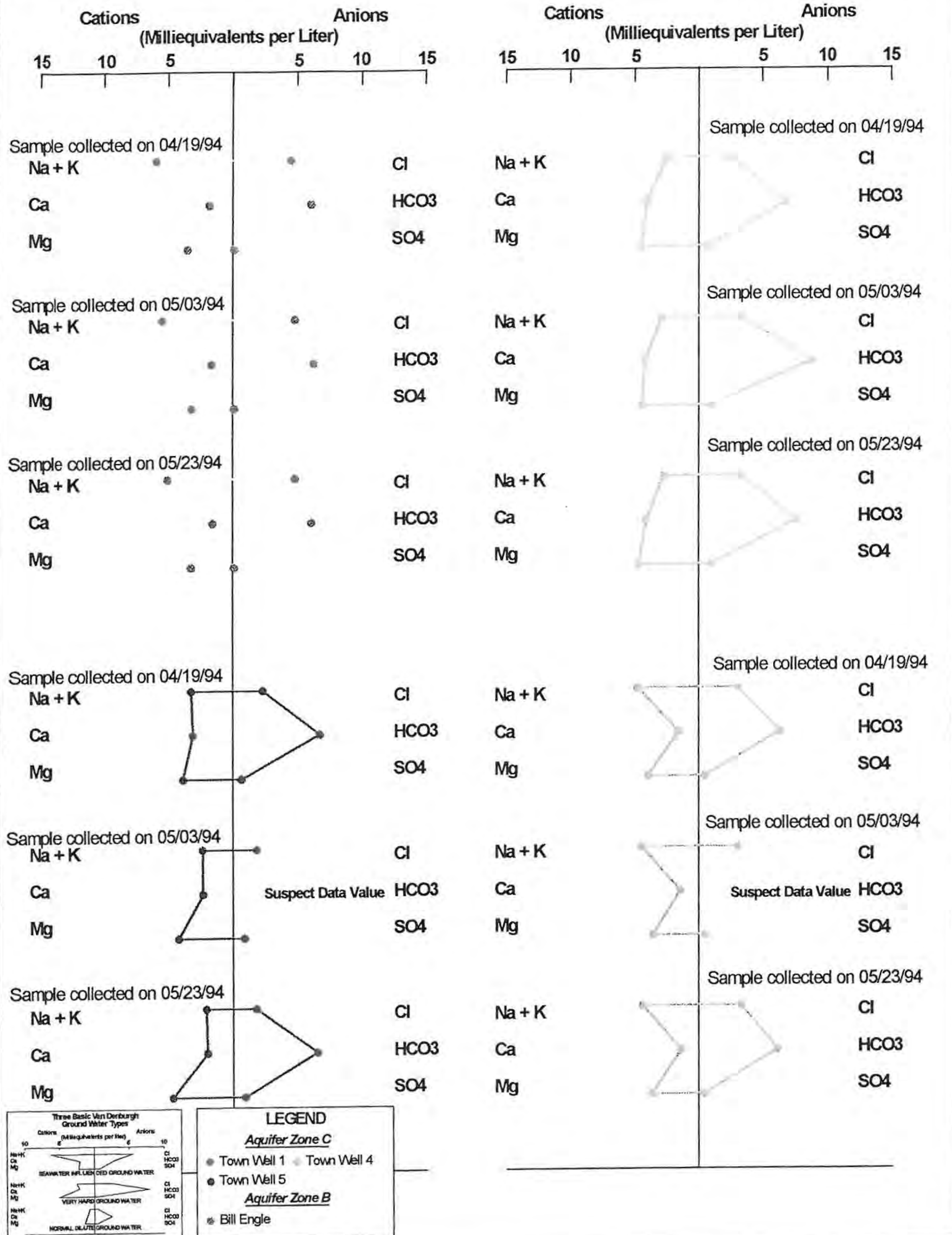
AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project # 14,586.002	VAN DENBURGH GRAPHS AQUIFER ZONES B & C	FIGURE 9



AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project # 14,586.002	VAN DENBURGH GRAPHS AQUIFER ZONE A	FIGURE 10



AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project# 14,586.002	THREE BASIC VAN DENBURGH GROUND WATER TYPES	FIGURE 11 a

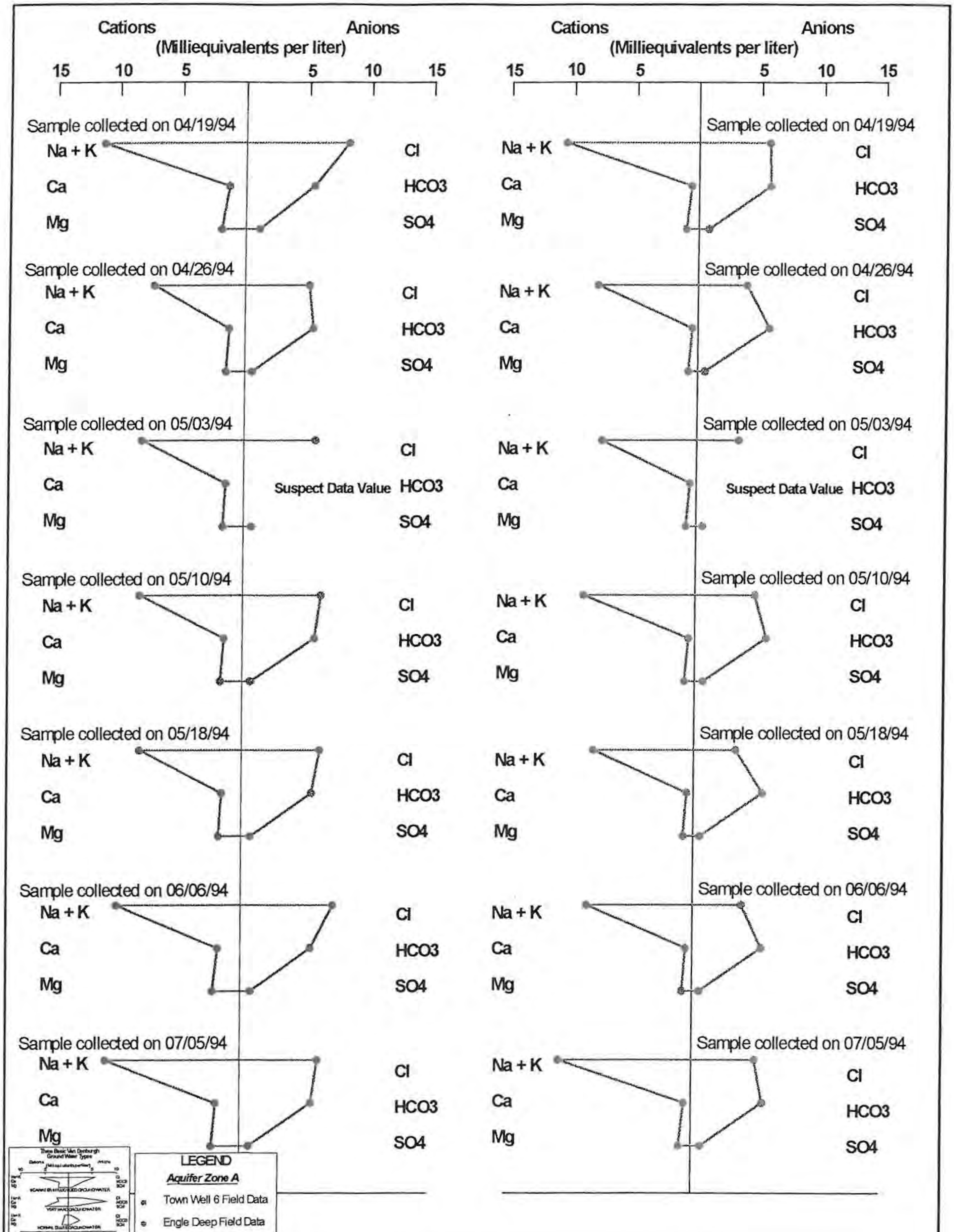


AGI TECHNOLOGIES

Town of Coupeville
Well 6 Pumping Test
Project # 14,586.002

STIFF DIAGRAMS
AQUIFER ZONES B & C

FIGURE
11 b

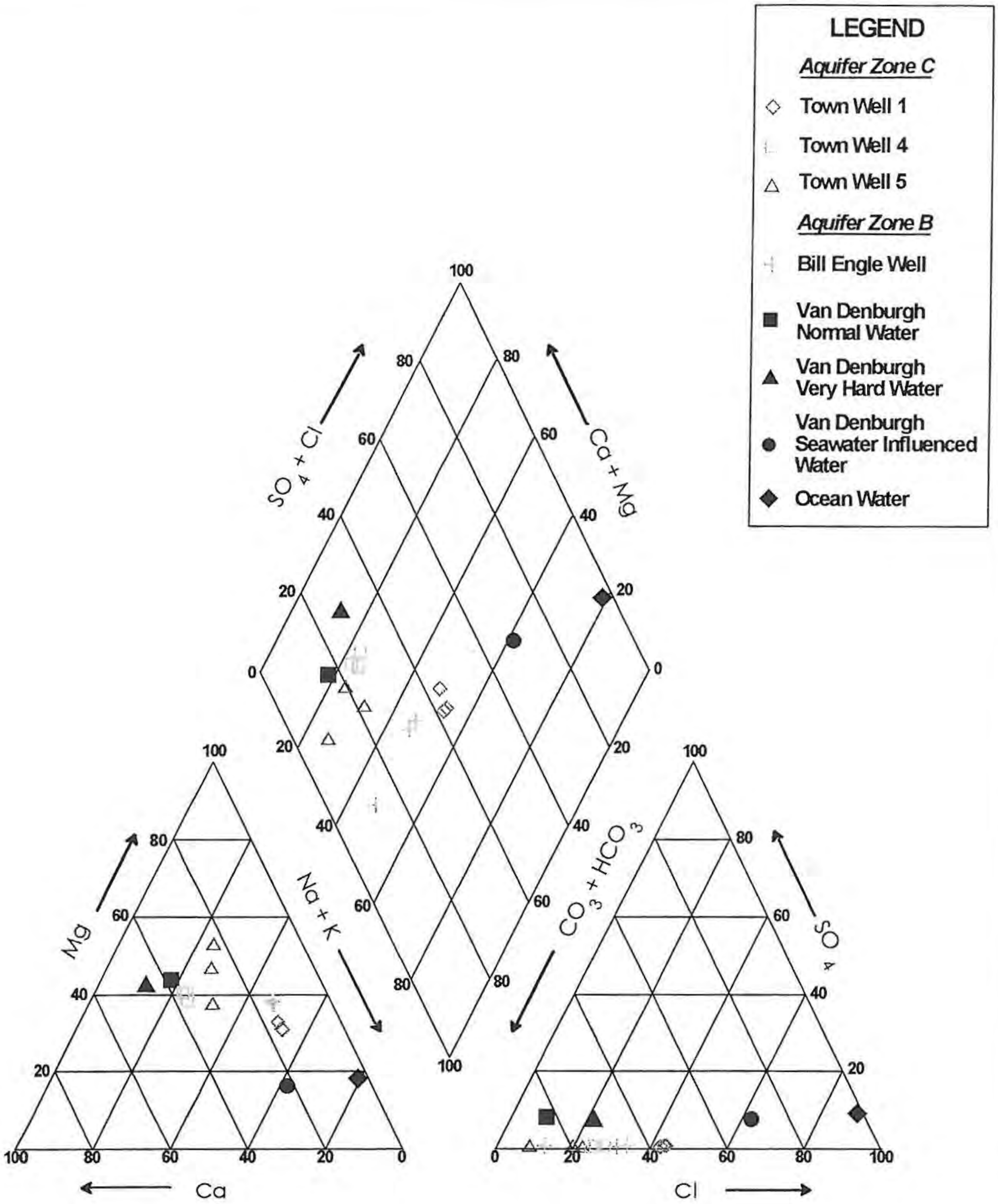


AGI TECHNOLOGIES

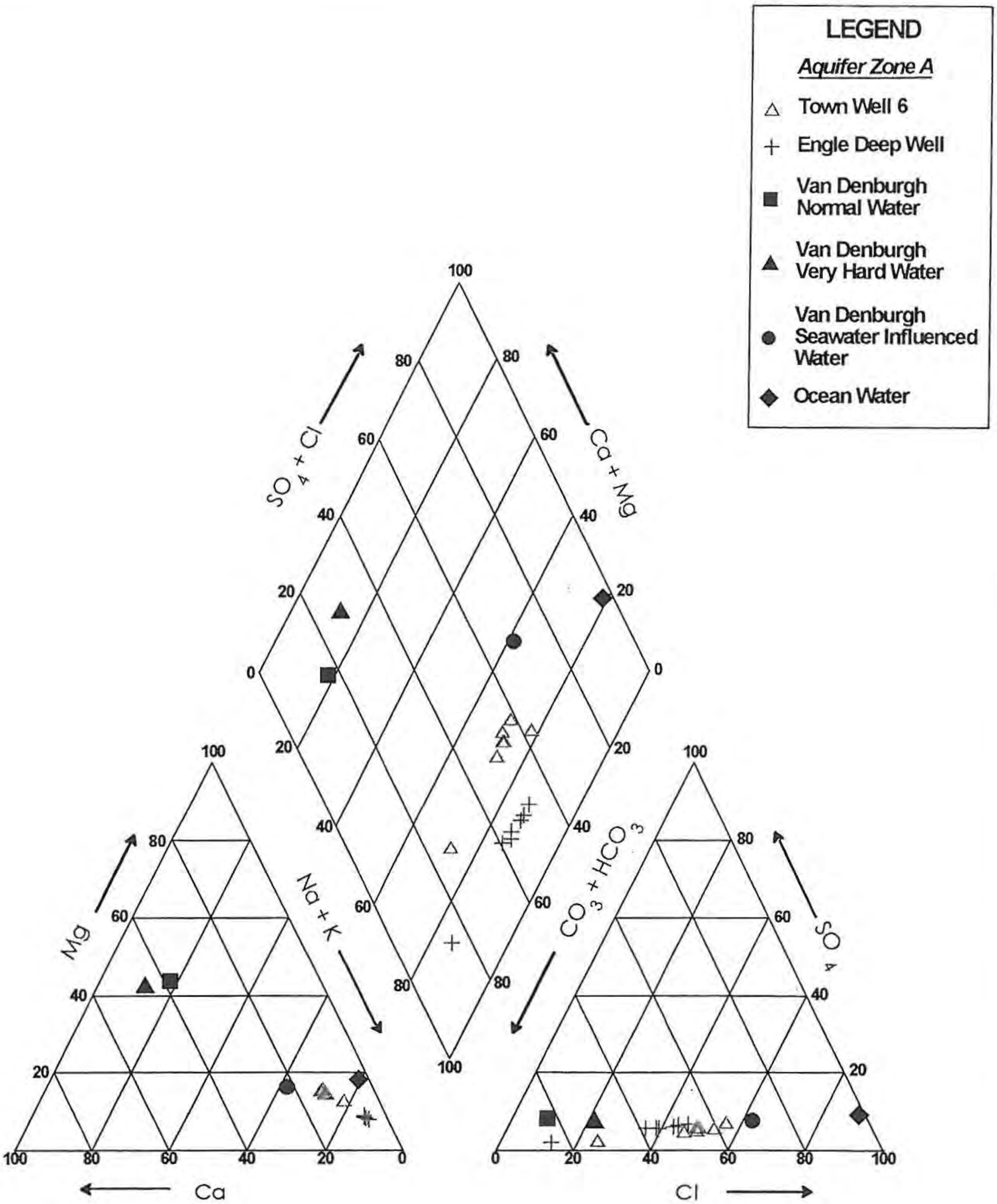
Town of Coupeville
Well 6 pumping test
Project # 14,586.002

STIFF DIAGRAMS
AQUIFER ZONE A

FIGURE 12



AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project # 14,586.002	PIPER DIAGRAM AQUIFER ZONES B & C	FIGURE 13



AGI TECHNOLOGIES	Town of Coupeville Well 6 Pumping Test Project # 14,586.002	PIPER DIAGRAM AQUIFER ZONE A	FIGURE 14

APPENDIX A

AGI TECHNOLOGIES

APPENDIX A

COMMUNICATIONS
DEPARTMENT OF ECOLOGY

Revised Copy

Pollution Control Hearings Board
Shorelines Hearings Board
Forest Practices Appeals Board
Hydraulics Appeals Board

(206) 459-6327
(SCAN) 585-6327
(FAX) (206) 438-7699

STATE OF WASHINGTON
ENVIRONMENTAL HEARINGS OFFICE
4224 - 6th Avenue SE, Bldg. 2, Rowe Six
P.O. Box 40903, Lacey, WA 98504-0903

June 11, 1993

Charles B. Roe, Jr.
PERKINS COIE
1100 Capitol Way South
Suite 405
Olympia, WA 98501

Tom McDonald
Assistant Attorney General
Department of Ecology
P. O. Box 40117
Olympia, WA 98504-0117

RE: PCHB No. 92-117
TOWN OF COUPEVILLE v. DOE

Dear Parties:

Enclosed is the Stipulation and Agreed Order of Remand in this matter.

Sincerely,

Hal Zimmerman

Hal Zimmerman Presiding

HZ/jg/COUPEV
Enc.
cc: Gary Hanson - DOE

4/14/94

Eric,

Copy of signed agreement re. Well #6 (high school)

George

I certify that I mailed a copy of this document to the attorneys and addresses listed above, postage prepaid, in a receptacle for United States mail at Lacey, WA on 6/11/93.

Judy [illegible]

POLLUTION CONTROL HEARINGS BOARD
STATE OF WASHINGTON

TOWN OF COUPEVILLE, Appellant, v. STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY, Respondent.	)	PCHB No. 92-117 STIPULATION AND AGREED ORDER OF REMAND

COMES NOW the appellant, Town of Coupeville (Coupeville), through its attorney Charles B. Roe, Jr., and the respondent, State of Washington, Department of Ecology (Ecology), through its attorney Tom McDonald, Assistant Attorney General, and stipulate to the following.

STIPULATION

1. This appeal relates to Coupeville's request for establishment of a new water right for the use of groundwater as reflected [redacted] ("Application"). Ecology denied the Application based on a finding of lack of available water as set forth in its Report of Examination. This action results from Coupeville's appeal of Ecology's denial of the Application.

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (206) 438-7743

2. Pursuant to further review and discussions between the parties, Ecology agrees that an additional study, including testing from the well which was constructed for Application No. G1-26236, will be helpful. For the purposes of this study, Ecology agrees to issue a preliminary permit to Coupeville. The preliminary permit shall be issued for a period not to exceed 390 days. The permit shall be issued 60 days from the date the Department of Health issues its written approval to use the well. Coupeville shall exercise due diligence in obtaining Department of Health's written approval. Ecology may extend the preliminary permit for good cause shown by Coupeville. The preliminary permit is attached hereto as Appendix A and incorporated herein by reference. Coupeville shall provide Ecology with the data and final report required in the preliminary permit within 60 days after the preliminary permit expires.

3. Coupeville and Ecology further agree that the attempt to establish a sufficient water supply for Coupeville is worthy of pursuit and, consistent therewith, the parties are willing to cooperate in attempting to develop a suitable water supply program to satisfy Coupeville's present and future needs. This cooperative effort will include, among other activities, the further study and evaluation of groundwater availability and the integration of Coupeville's existing water rights. The water supply program shall be developed in consultation with the State Department of Health

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(DOH).

For the purposes of this water supply program, Ecology agrees to issue Coupeville a temporary permit to beneficially use water which it [redacted] and for the [redacted] and make a decision on the Application. [redacted] and [redacted] Ecology may extend the temporary permit for good cause shown by Coupeville.

The temporary permit shall be limited to provide a supplemental source of water to Coupeville's existing water rights and said permit shall not be used or relied upon by Coupeville to expand its existing uses and demands. Coupeville shall not allow additional hook-ups based on this temporary water supply permit. The temporary permit is attached hereto as Appendix B and incorporated herein by reference.

4. Unless the aforementioned studies conclude to the contrary, the parties recognize that based on United States Geologic Survey (USGS) delineation of aquifers, the well constructed for Application No. G1-26236 withdraws water from a different water bearing zone than the wells constructed and used under Coupeville's existing water rights. By recognizing the USGS findings, Coupeville does not stipulate that the

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wells withdraw water from different aquifers as defined and recognized under the law.

5. The parties agree that this Stipulation resolves all disputes and issues in this appeal and that the Board may enter the following Order of Remand.

DATED this 16 day of June, 1993.

PERKINS COIE

CHARLES B. ROE, JR.
Attorney for Appellant

CHRISTINE O. GREGOIRE
Attorney General

TOM McDONALD, WSBA #17549
Assistant Attorney General
Attorneys for Respondent
State of Washington
Department of Ecology
(206) 459-6162

ATTORNEY GENERAL OF WASHINGTON
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ORDER

Based on the foregoing stipulation and the files and pleadings herein, it is hereby

ORDERED that:

1. This cause is remanded to Ecology for further consideration and processing of and ruling on Coupeville's Application No. G1-26236 for a permit to withdraw groundwater. In relation thereto, Ecology is directed;

a. To issue to Coupeville a preliminary permit, pursuant to RCW 90.44.060 and RCW 90.03.290, for 390 days for the purpose, as set forth in the above stipulation, of obtaining additional pertinent information and data of the groundwater, including availability of public water and risks of salt water intrusion.

b. To issue Coupeville a temporary permit, pursuant to RCW 90.44.060 and RCW 90.03.250, for 540 days for the purpose, as set forth in the above stipulation, of allowing water pumped to be put to existing beneficial use, i.e., municipal use, by Coupeville.

2. Ecology is directed, upon receipt from Coupeville of the studies described above, to take all reasonable steps to rule on (1) Coupeville's water right Application No. G1-26236 within three months of receipt of said studies or, upon receipt of written notice from Coupeville that studies will not be completed as agreed, and (2) any applications for changes in existing rights that Coupeville may submit to

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STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Northwest Regional Office, 3190 - 160th Ave. S.E. • Bellevue, Washington 98008-5452 • (206) 649-7000

1993

The Honorable Mayor Bob Lappin
Town of Coupeville
P.O. Box 725
Coupeville, WA 98239

Dear Mayor Lappin:

Re: PRELIMINARY/TEMPORARY PERMIT to Test a Well Under Ground Water Application G1-26236

The above application requested the withdrawal of public ground water at the ~~rate of 350 gallons per minute~~ (gpm) for municipal water system supply. The well is located within the SE ¼ NE ¼, Section 4, T. 31 N., R. 1 E., W.M., of Island County. The application was denied and that denial was appealed by the Town of Coupeville. This preliminary permit and temporary use permit is part of a stipulated settlement between the Town of Coupeville and the Department of Ecology (Ecology).

The Town of Coupeville is granted a preliminary permit and a temporary permit to proceed with testing of the well and use of the water withdrawn during the test. This letter serves as both a preliminary permit and a temporary permit subject to existing rights and the following conditions:

1. This PRELIMINARY/TEMPORARY PERMIT will become effective upon issuance. The date issued will be the date the document is signed by Ecology. The preliminary permit portion will be effective for 390 days from issuance, unless sooner revoked by Ecology. The temporary permit portion will be effective for 540 days from issuance, unless sooner revoked by Ecology.

   A 40 mg/l or greater increase in chlorides detected during the pump test phase in either the Coupeville High School well or the Engle Farm deep well, is an indication that seawater intrusion is occurring. ~~If a 40 mg/l or greater increase in the chlorides is detected during the pump test phase, Ecology should be consulted before the test continues.~~

   The long-term continuation of this aquifer test is contingent upon the results obtained in the first four weeks of the test. [redacted] of [redacted]

APPENDIX A

No permanent use of the water is authorized by this PRELIMINARY/TEMPORARY PERMIT

The place of use for water withdrawn during this test shall be limited to the service area defined in the Town of Coupeville's Water System Plan.

2. The Town of Coupeville shall employ a hydrogeology consultant to work with Ecology to select suitable monitoring wells and develop specific testing procedures. Said consultant shall be responsible for overseeing all testing, data/information gathering, analysis, and report writing. Testing shall occur in two phases:

   a. Initial Pump Test - This test shall be conducted by continuously pumping the Coupeville High School well for four weeks, at a constant rate no less than the maximum rate at which the well is expected to be used.

   b. Long-term Temporary Use - This test shall be conducted by placing the Coupeville High School well in use for one (1) year at the maximum daily rate of use anticipated for the primary source of water for the Town of Coupeville.

   WRIS Information Bulletin No. 30 shall be used as a guideline for designing and conducting the pump test. At the completion of the pump test, recovery data shall be collected from the Coupeville High School well and the Engle Farm deep well until the former achieves either 95% recovery, or its water level is within 0.5 feet of static water level, whichever takes longer.

3. All testing shall be conducted with monitoring of the Coupeville High School well, the Engle Farm deep well, and a network of approximately 8 (subject to availability) wells completed in the overlying aquifers. Monitoring of all wells shall follow an established protocol. This protocol shall include measuring the static water level following specified periods of non-use and purging a minimum of three well casing volumes prior to sample collection. For the Coupeville High School well and the Engle Farm deep well sampling shall occur only toward the conclusion of extended periods of pumping. All laboratory analysis shall be performed by a laboratory certified by the Washington State Department of Health.

   During the Initial Pump Test phase monitoring shall occur as follows:

   a. For the Coupeville High School well, chloride and conductivity analysis must be conducted for samples collected during the initial 60 minutes of pumping, three additional times in the first 24-hours, and every third day thereafter. The above sample constituents may be determined by using a field test kit. However, sample duplicates shall be analyzed by a laboratory for the initial sample, and three of the samples collected after the first 24-hours. The final sample duplicate analyzed by a laboratory shall be the last sample collected during this phase of the test. Water level monitoring shall occur with decreasing frequency at a rate similar to that described in Bulletin 30, with a measurements occurring at least on a daily basis.

b. For the Engle Farm deep well, chloride and conductivity analysis must be conducted for samples collected within 24-hours prior to initiation of pumping (of the Coupeville High School well) and on an every third day basis (on the same schedule as the Coupeville High School well) thereafter. The above sample constituents may be determined by using a field test kit. Sample duplicates shall be analyzed by a laboratory for the initial sample, and three of the samples collected after the first 24-hours. The final sample duplicate analyzed by a laboratory shall be the last sample collected during this phase of the test. Water level monitoring shall occur with decreasing frequency at a rate similar to that described in Bulletin 30, with measurements occurring at least on an every fourth day basis.

c. For the network of observation wells completed in the overlying aquifers, collection of static water level measurements and sampling for chloride and conductivity analysis shall occur as follows: once prior to initiation of the test, once during the middle of the four week initial pump test, and once shortly following completion of pumping.

During the [redacted] monitoring shall occur as follows:

a. For the [redacted] In addition to the above, [redacted].

b. For the network of [redacted] completed in the [redacted]s, [redacted] constituent determination may be made with a [redacted]

4. Duplicate sample analysis by a laboratory is being required to assure sample constituent determination accuracy. Results of field test kit determinations shall be compared to laboratory determinations as soon a practical, to ensure proper testing methodology with the field test kit. If there is a significant difference between the results obtained by the two different methods, the permittee shall notify Ecology.

5. When aquifer testing is complete, the data shall be analyzed and all pertinent information compiled into a completion report submitted to the Department of Ecology, Northwest Regional Office. This report shall include the following:

[redacted] For all monitored wells, a well construction report, a table summarizing well information (total depth, screened interval depths, land surface elevations, method used for determining land surface elevations, type of use, and pumping rate), and a map indicating all locations.

[redacted] A table summarizing static water level measurements, and chloride/conductivity results. Copies of all laboratory test results should be available to Ecology upon request.

[redacted] A graph depicting tidal influence on the pumping well. In order to produce this, data on pumping water levels, chlorides, and tidal fluctuations must be plotted on a single graph with respect to time. (See attached graph for example)

The report shall also include/address the following:

a. An analysis to determine aquifer transmissivity and storage coefficient. This shall include copies of the field data sheets and a discussion of the methods and calculations employed during the analysis.

b. A copy of well construction reports (for existing wells in the vicinity), surface elevation data, and a well location map, in order to best construct 2 geologic cross sections passing within relevant distance to the Coupeville High School well. These cross sections shall be constructed such that their lines trend roughly 90 degrees to one another, roughly north-south and east-west. The north-south section shall extend to the coast on both sides of Whidbey Island. The cross sections shall attempt to delineate subsurface geology as deep as Aquifer A, as well as the boundary between fresh water and saline water.

c. A data trend analysis performed to determine whether/ how chloride and static water levels have changed over time. This shall include hydrographs presenting all data collected during the testing phases, as well as a discussion of trends of both chlorides and static water levels within the subject aquifers.

d. A discussion of the recharge for water withdrawn by the Coupeville High School well. This shall include a discussion of the leakage between the various aquifers within the vicinity.

6. All expenses, risks, and liabilities incurred during well testing shall be borne by the applicant. If the exercise of any senior water right is adversely affected during any portion of the aquifer test, the test shall be terminated immediately.

7. The granting of this PRELIMINARY/TEMPORARY PERMIT shall not be construed, by inference or otherwise, that subject application will ultimately be approved.

Please contact Tom Culhane at (206) 649-7081 for assistance in selection of suitable monitoring wells and development of testing protocol. Should you have any questions or concerns, please give me a call at (206) 649-7066.

Sincerely,

Stephen J. Hirschey
Section Supervisor
Water Resources

SH:
Enclosures: WRIS Information Bulletin 30
Graph Example

March 29, 1993

Mr George Bratton
Schaefer and Bratton Engineers
Post Office Box 607
Coupeville, Washington 98239

Dear George:

Town of Coupeville
Groundwater Evaluation

14,586,002.01

On March 25, 1993, I met with Mr. Tom Culhane of the Water Resources Program at Ecology's Bellevue office to discuss the forthcoming aquifer test of the High School Well. This letter summarizes my understanding of that meeting and its implications for the aquifer test.

Mr. Culhane and I exchanged information and opinions on the hydrogeology of Whidbey Island in the vicinity of Coupeville. We noted in the driller's logs of the four wells penetrating the deepest aquifer (aquifer A) that fine-grained sediments separate deep aquifers A and B from the overlying shallow aquifers. However, the data are widely spaced thus we can not preclude the possibility that the fine-grained sediments are discontinuous and connections to overlying aquifers exist.

Mr. Culhane reviewed for me his study of the high chloride wells that are completed above sea level. His preliminary results indicate many of the high chloride concentrations within some portions of middle and northern Whidbey Island are related to either hard groundwater or to hard groundwater perhaps impacted by human activities. Many of the high chloride wells near Coupeville were included in his study. It was the presence of these wells in conjunction with the studies by the US Geological Survey and the results of the initial pump test that caused Ecology to be concerned about the potential for sea water intrusion in the Coupeville area. I indicated the city wells appear to tap hard groundwater and that well #1 appears to be influenced by sea water intrusion during pumping.

We discussed the chloride concentrations in the water samples collected from the High School and Engle wells during the 1991 pump test. I noted that the opposing changes in chloride concentrations (concentrations in the High School well decreased while those in the Engle well increased) may be within the realm of laboratory variation. We also speculated that the changes in chloride concentration at the High School well could indicate local contamination from drilling or from leakage along the casing. Moreover, we noted that chloride concentrations within the aquifer could vary temporally as the result of tidal and seasonal influences. We concluded the water quality data from the 1991 pump test were ambiguous and do not provide a clear understanding of the water quality in aquifer A at the time of the test.

Our discussion included several aspects of the forthcoming aquifer test; we reached the following understandings:

1. the monitoring network of 8 wells in overlying aquifers will be

reduced to 5 which include the three city wells (1, 3, and 5), a shallow Engle well, and one well to the east of the Engle wells (if one can be located). The resulting monitoring network encompasses the area of concern with respect to sea water intrusion.

2. static water levels in pumping monitoring wells should be measured after a 12 hour recovery time.

3. Coupeville should consider a monthly monitoring program which includes analyzing water samples from the Engle shallow and deep wells for chloride, specific conductance, and hardness, and measuring static water levels in the High School well. This program should begin immediately to develop a data base on longer-term variations in chloride concentrations and water levels in aquifer A and chloride concentrations in aquifer b.

4. Coupeville should consider analyzing the initial and final water samples from the Engle and High School monitoring wells for common cations (calcium, magnesium, sodium, and potassium) and anions (sulfate, chloride, nitrate, bicarbonate, and carbonate), as well as for specific conductance and hardness. Such an analysis could provide additional data to distinguish between hard groundwater and sea water impacted groundwater.

I left the meeting with the strong belief that Ecology is concerned about Coupeville's water shortage and is working with us to solve that problem. Tom and I agreed the lack of hydrogeologic data for the deeper aquifers will limit our ability to fully evaluate the potential for sea water intrusion and the potential quantity of recharge to aquifer A. Tom believes it is quite possible that the test may give a strong indication one way or the other of the sea water intrusion risk.

I recommend Coupeville immediately initiate the monitoring program described in item 3 and have analyzed by Lauck's Laboratory one water sample from the deep Engle well and from the shallow Engle well for the ions described in item 4.

AGI looks forward to working with the Town on this very important aquifer test.

If you have any questions please do not hesitate to contact me.

Yours Truly:

APPLIED GEOTECHNOLOGY INC.

Robert C. Palmquist
Senior Geologist

cc Tom Culhane

D:\Coupeville\Bratsum.rev

APPENDIX B

AGI TECHNOLOGIES

APPENDIX B

DATA SUMMARY
WATER LEVELS
WATER QUALITY

AGI Technologies Inc.
AGI # 15,586.002

WELL 6 PUMPING TEST
DATA SUMMARY
TOWN WELL 1

STATIC WATER LEVELS			WATER QUALITY ANALYSES					
DATE	TIME	DEPTH (feet)	Field Sp. Cond.	Field Chloride	Field Hardness	Lab Sp. Cond.	Lab Chloride	Lab Hardness
03/30/93	07:30	24.92	1100	160				
04/01/93	12:10		1230	220				
04/02/93	07:02		1300	240				
04/05/93	11:25		1310	260				
04/06/93	11:40		1330	260	320			
04/07/93	11:25		1350	260	320			
04/08/93	10:35		1350	260	320			
04/09/93	07:02		1360	280	340			
04/10/93	15:15		1340	280				
04/12/93	09:50		1360	280	340			
04/13/93	11:15		1350	280	340			
04/14/93	10:45		1370	280	340			
04/15/93	11:25		1300	280	380			
04/16/93	09:05		1380	280	380			
04/19/93	11:40		1320	280	380			
04/20/93	11:30		1340	280	360			
04/21/93	10:55		1340	300	340			
04/22/93	08:45		1300	300	360			
04/23/93	07:07		1390	280	380			
04/26/93	07:03		1380	300	360			
04/27/93	06:55		1370	300	360			
04/28/93	07:05		1400	280	380			
04/29/93	07:03		1400	300	360			
04/30/93	06:54		1480	340	400			
PUMPING TEST DATA								
04/19/94	10:48 AM		1250	180	320	1200	160	280
05/03/94	07:26 AM		1250	180	280	1200	170	280
05/23/94	07:55 AM		1240	200	300	1200	170	280
06/06/94	08:09 AM		1230	180	300			

AGI Technologies Inc.

AGI # 15, 586.002

WELL 6 PUMPING TEST
DATA SUMMARY
TOWN WELL 4

STATIC WATER LEVELS			WATER QUALITY ANALYSES					
		DEPTH	Field	Field	Field	Lab	Lab	Lab
DATE	TIME	(feet)	Sp. Cond.	Chloride	Hardness	p. Cond.	Chloride	Hardness
03/15/93	07:05		1000	100				
03/30/93	07:20		1000	100				
05/05/93	13:40		990	140	560			
05/11/93	10:45		1040	120	500			
05/21/93	11:35		1030	100	480			
05/26/93	14:40		1050	120	500			
06/07/93	09:15		1010	100	500	1000	91	470
06/10/93	07:20		1040	120	480			
08/02/93	12:55		910	100	480	1000	86	440
08/06/93	13:20		1020	100	500			
08/10/93	07:50		1030	100	500			
08/13/93	07:40		1030	100	480			
08/16/93	07:40		1020	120	500			
08/17/93	07:18		1020	120	480			
08/19/93	07:24		1020	120	480			
08/20/93	11:30		1020	120	500			
08/24/93	09:50		1020	100	460			
08/27/93	08:50		1030	120	500			
08/31/93	09:10		1010	120	480			
09/01/93	07:38		1010	120	480			
09/07/93	07:50		1020	120	460	1000	81	430
09/10/93	07:22		1020	100	460			
09/14/93	08:55		1010	100	440			
09/17/93	08:45		960	100	420			
09/24/93	13:30		920	100	420			
09/28/93	08:40		960	100	400			
10/01/93	08:55		970	100	440			
10/04/93	07:45		990	100	440	1000	81	440
10/08/93	08:50		970	100	400			
10/12/93	08:30		980	100	440			
10/19/93	09:10		980	100	440			
10/22/93	08:55		970	100	440			
10/26/93	07:10		970	100	420			
10/29/93	09:00		990	100	420			
11/01/93	09:10		990	100	440	91	490	
11/05/93	07:20		980	100	440			
11/09/93	07:10		980	100	460			
11/11/93	07:15		990	100	420			
12/04/93	07:16		1000	100	500			
12/07/93	07:45		970	100	500	810	88	470
12/11/93	23:17		980	100	480			
12/15/93	07:13		990	100	480			

12/18/93 07:18		950	100	500			
12/22/93 07:20		980	100	480			
12/29/93 06:55		930	100	480			
01/04/94 07:47		950	100	480	1000	84	440
01/08/94 07:30		970	100	500			
01/12/94 07:07		970	100	480			
01/15/94 07:14		900	100	480			
01/19/94 07:35		970	100	480			
01/22/94 07:12		980	100	440			
01/26/94 07:12		970	100	500			
01/29/94 07:19		980	100	480			
02/02/94 07:15		940	100	480			
02/05/94 07:19		960	100	460			
02/08/94 07:35		960	100	480	1084	88.6	494
02/12/94 07:15		980	100	480			
02/16/94 07:15		950	100	480			
02/19/94 07:17		980	100	500			
02/23/94 08:02		950	100	520			
02/26/94 07:16		940	100	500			
03/01/94 07:15		960	100	460			
03/04/94 07:14		970	100	460			
03/07/94 07:38		930	100	460	1111	105.1	446
03/11/94 07:00		960	100	460			
03/15/94 07:10		940	100	480			
03/18/94 07:10		930	100	460			
03/22/94 07:03		920	100	440			
03/25/94 07:20		970	100	480			
03/29/94 07:05		960	100	460			
04/01/94 07:10		970	100	460			
04/04/94 07:50		980	100	420	1105	91.94	514.2
04/08/94 07:05		980	100	460			
04/12/94 07:05		980	100	440			
04/15/94 07:00		970	100	480			
04/19/94 10:55		920	120	440			
04/22/94 09:00	94.9						
04/26/94 06:55	94.1						
04/29/94 07:06	93.8						
05/03/94 07:15	93.7	1090	120	520	1200	120	500
05/06/94 07:15	93.6						
05/10/94 07:00	93.3						
05/13/94 07:02	93.1						
05/17/94 07:17	92.9						
05/23/94 07:45	92.7	1090	120	480	1200	120	520
05/31/94 07:37	91.8						
06/06/94 07:52	91.4	1050	100	460			
06/13/94 07:44	90.7						
06/20/94 07:30	91.1						
07/05/94 07:30	90.5						
07/11/94 07:30	90.5	980	100	440			
07/18/94 07:30	91.5						

07/27/94 07:30	90.6

AGI Technologies Inc

AGI # 15, 586.002

WELL 6 PUMPING TEST
DATA SUMMARY
TOWN WELL 5

STATIC WATER LEVELS			WATER QUALITY ANALYSES					
		DEPTH	Field	Field	Field	Lab	Lab	Lab
DATE	TIME	(feet)	p. Cond.	Chloride	Hardness	p. Cond.	Chloride	Hardness
05/26/93	13:50			100	460			
06/22/93	11:20			100	460			
06/25/93	11:35		950	100	440			
07/06/93	09:30		970	100	420	1000	75	420
07/07/93	07:10		980	100	440			
07/12/93	07:30		970	100	440			
07/21/93	07:20		980	100	440			
07/30/93	07:30	107.5	930	100	420			
08/10/93	07:15	107.42	980	100	420			
08/13/93	07:22	107.42	930	100	380			
08/17/93	07:28	107.08				1000	80	380
08/20/93	07:12	107.25	910	80	380			
08/24/93	07:20	107.42				960	63	380
08/27/93	07:10	107.58	900	80	380			
08/31/93	07:18	107.17	920	80	380	950	62	390
09/03/93	07:15	107.34						
09/07/93	07:58	107.34	940	80	400			
09/10/93	07:31	107.34						
09/14/93	07:43	107.25						
09/17/93	07:12	108.5						
09/21/93	07:30	109.75						
09/24/93	07:18	109.92						
09/28/93	07:15	109.17						
10/01/93	07:20	109.58						
10/04/93	07:55	107.75						
10/08/93	07:20	110.25						
10/12/93	07:13	109.42						
10/15/93	07:30	109.92						
10/19/93	07:36	109.08						
10/22/93	07:17	109.92						
10/26/93	07:20	111.67						
10/29/93	07:15	110.08						
11/01/93	07:38	108.25						
11/05/93	07:20	108.92						
11/09/93	07:20	109.08						
11/23/93	07:15	108.33						
11/30/93	07:15	110						
12/03/93	07:25	107.83						
12/06/93	07:55	107.33						
12/10/93	07:25	107.5						
12/14/93	07:25	107.58						
12/17/93	07:25	108.17						

12/21/93 07:35	108.42						
12/28/93 07:05	108.08						
01/03/94 08:00	107.92						
01/07/94 07:37	108.25						
01/11/94 07:18	108.25						
01/14/94 07:24	108.33						
01/18/94 07:45	108.17						
01/21/94 07:19	108.25						
01/25/94 07:25	108.25						
01/28/94 07:29	108.17						
02/01/94 07:25	108.33						
02/04/94 07:28	109.08						
02/07/94 07:44	108.92						
02/11/94 07:26	109.17						
02/15/94 08:25	109						
02/18/94 07:27	109						
02/22/94 07:13	109.5						
02/25/94 07:28	109.33						
03/01/94 07:25	109.42						
03/04/94 07:25	109.25						
03/07/94 07:50	110						
03/11/94 07:11	109						
03/15/94 07:20	109.3						
03/18/94 07:20	108.17						
03/22/94 07:14	109.67						
03/25/94 07:34	110						
03/29/94 07:18	109.3						
04/01/94 07:24	109.67						
04/04/94 08:05	108.67						
04/08/94 07:15	109.42						
04/12/94 07:15	109.33						
04/15/94 07:10	109.42						
04/19/94 11:00	109.17	930	100	380	1000	80	380
04/22/94 07:07	108.67						
04/26/94 06:57	108.75						
04/29/94 07:12	109.17						
05/03/94 07:40	109.5	910	80	380	960	63	380
05/06/94 07:26	109.67						
05/10/94 07:12	109.58						
05/13/94 07:12	109.67						
05/17/94 07:26	109.67						
05/23/94 07:55	109.58	900	80	380	950	62	390
05/31/94 07:40	109.17						
06/06/94 07:40	109.08	920	80	380			
06/13/94 07:40	108.67						
06/20/94 07:40	109.25						
07/05/94	109.33						
07/11/94	109.33	940	80	400			
07/18/94	110.75						
07/25/94	109.67						

AGI Technologies
AGI # 14,586.002

WELL 6 PUMPING TEST
DATA SUMMARY
TOWN WELL 6

STATIC WATER LEVELS

DATE	TIME	DEPTH (feet)
01/21/94	08:30	85.33
01/25/94	08:45	85.33
01/28/94	08:20	85.33
02/01/94	08:35	85.42
02/04/94	08:45	85.42
02/07/94	09:05	85.58
02/11/94	08:55	86
02/16/94	07:45	85.58
02/18/94	08:45	85.5
02/22/94	09:25	85.83
02/25/94	09:00	86
02/28/94	09:05	86.08
03/01/94	08:35	85.83
03/04/94	08:55	85.92
03/07/94	09:00	86.42
03/11/94	09:45	86.33
03/15/94	08:35	86.08
03/18/94	08:30	85.67
03/22/94	08:20	86.25
03/25/94	08:50	86.58
03/29/94	08:30	86.25
04/20/94	08:10	86.33
04/20/94	08:15	106
04/20/94	08:16	108.42
04/20/94	08:17	109
04/20/94	08:18	109.25
04/20/94.	08:19	109.5
04/20/94	08:20	109.58
04/20/94	08:21	109.72
04/20/94	08:22	109.83
04/20/94	08:23	109.83
04/20/94	08:24	109.92
04/20/94	08:25	110
04/20/94	08:26	110
04/20/94	08:27	110.08
04/20/94	08:28	110.13
04/20/94	08:29	110.17
04/20/94	08:30	110.3
04/20/94	08:35	110.38
04/20/94	08:40	110.67
04/20/94	08:45	110.83
04/20/94	08:50	111
04/20/94	08:55	111.13
04/20/94	09:00	111.33

WATER QUALITY ANALYSES

DATE	Field p. Cond.	Field Chloride	Field Hardness	Lab p. Cond.	Lab Chloride	Lab Hardness
04/19/94	1420	280	160	1600	290	170
04/20/94	1460	260	180			
04/21/94	1210	200	160			
04/22/94	1210	200	160			
04/23/94	1210	200	160			
04/24/94	1210	200	160			
04/25/94	1230	200	180			
04/26/94	1230	200	160	1300	180	160
04/27/94	1240	220	160			
04/28/94	1250	200	160			
04/29/94	1250	200	160			
05/02/94	1270	200	180			
05/03/94	1270	220	160	1300	200	170
05/04/94	1280	200	180			
05/05/94	1260	200	180			
05/06/94	1290	200	180			
05/09/94	1300	220	180			
05/10/94	1310	200	160	1300	220	180
05/11/94	1320	200	160			
05/12/94	1330	200	160			
05/13/94	1330	200	180			
05/16/94	1350	220	180			
05/17/94	1350	220	180	1400	220	190
05/18/94	1360	200	180	1409	205	169
05/23/94	1390	220	160			
05/31/94	1430	220	180			
06/06/94	1430	220	180	1500	260	200
06/13/94	1460	240	180			
06/20/94	1480	260	180	1500	253	268
06/22/94	1480	280	180			
06/24/94	1480	280	200			
06/27/94	1500	280	200			
06/29/94	1530	300	200			
07/01/94	1500	300	200			
07/02/94	1500	280	180			
07/05/94	1510	320	200	1500	220	210
07/18/94	1480	380	200			

04/20/94	09:05	111.5
04/20/94	09:15	111.63
04/20/94	09:25	111.75
04/20/94	09:35	111.88
04/20/94	09:45	111.97
04/20/94	10:15	112.17
04/20/94	10:45	112.3
04/20/94	11:15	112.42
04/20/94	11:45	112.55
04/20/94	12:15	112.58
04/20/94	12:45	112.63
04/20/94	13:15	112.7
04/20/94	02:15	112.88
04/20/94	15:15	113
04/20/94	04:15	112.92
04/21/94	07:05	113.42
04/22/94	07:20	116.17
04/23/94	06:35	116.42
04/24/94	08:30	117.17
04/25/94	07:50	117.42
04/26/94	07:15	117.75
04/27/94	07:30	118.92
04/28/94	07:30	118.42
04/29/94	07:30	118.25
04/30/94	08:45	118.42
05/01/94		118.58
05/02/94		118.83
05/03/94		119.17
05/04/94		119.42
05/05/94		119.5
05/06/94		119.33
05/07/94		119.17
05/08/94		119.67
05/09/94		119.92
05/10/94		119.83
05/11/94		119.83
05/12/94		119.67
05/13/94		119.58
05/14/94		119.5
05/15/94		119.5
05/16/94		119.5
05/17/94		119.42
05/18/94		119.67
05/23/94		118.25
06/06/94		117.33
06/13/94		116.42
06/20/94		117.67
07/05/94		90.08
07/11/94		87.92
07/18/94		87.83

AGI Technologies Inc.

AGI # 15,586.002

WELL 6 PUMPING TEST
DATA SUMMARY
ENGLES FARM DEEP WELL

WATER QUALITY ANALYSES							
DATE	TIME	Field Sp. Cond	Field Chloride	Field Hardness	Lab Sp. Cond.	Lab Chloride	Lab Hardness
03/23/93	12:45	1200	200				
03/24/93	08:40	1000	120				
03/26/93	07:50	1100	140				
03/29/93	08:40	1000	140				
03/31/93	08:55	1200	180				
04/05/93	11:10	1000	180		1100	140	80
04/06/93	12:08	1100	180	80			
04/07/93	11:53	1000	140	80			
04/08/93	13:18	1000	180	80			
04/09/93	13:25	1000	140	60			
04/12/93	12:30	1000	140	80			
04/14/93	11:00	1000	140	80			
04/15/93	12:45	1000	200	80			
04/16/93	12:00	1000	160	80			
04/19/93	10:40	1000	160	80	1100	110	70
04/20/93	12:00	1000	180	80			
04/23/93	08:30	1000	140	80			
04/26/93	08:10	1000	120	60	1000	99	70
04/27/93	11:45	1200	200	80	1300	160	82
04/28/93	12:25	1100	180	80			
04/29/93	12:25	1100	180	60			
04/30/93	08:15	1100	160	60			
05/03/93	14:40	1000	200	80	1200	150	76
05/04/93	07:55	1000	140	80			
05/05/93	13:25	1000	200	80			
05/11/93	11:25	1000	140	80			
05/12/93	10:40	1000	180	80			
05/13/93	08:05	1000	140	60			
05/14/93	08:25	1100	160	80			
05/17/93	11:15	1000	160	80			
05/18/93	08:00	1100	180	80			
05/19/93	08:15	1000	160	60			
05/20/93	08:20	1000	140	60			
05/21/93	08:10	1100	180	80			
05/25/93	08:30	1000	180	80			
05/26/93	08:13	1100	160	60			
05/27/93	08:05	1200	180	80			
05/28/93	08:25	1000	160	80			
06/01/93	09:55	1000	140	60			
06/02/93	07:55	1100	180	80			
06/04/93	08:15	1200	220	60			
06/07/93	09:00	980	120	60	990	100	72
06/08/93	08:00	1200	200	80			

06/09/93 08:40	1000	160	80			
06/10/93 08:10	1000	140	80			
06/15/93 07:55	1000	140	60			
06/18/93 08:20	1000	180	20			
06/21/93 08:30	1000	140	60			
06/22/93 07:51	1000	140	60			
06/24/93 08:05	1000	200	60			
06/28/93 08:35	1000	180	80			
06/29/93 08:20	1100	180	80			
07/06/93 09:00	1000	200	80	1200	160	80
07/07/93 08:15	1200	180	80			
07/13/93 07:50	1100	200	80			
07/14/93 07:55	1100	180	80			
07/15/93 08:20	1100	200	80			
07/16/93 10:20	1000	180	80			
07/19/93 08:35	1000	180	60			
07/20/93 08:10	1100	180	80			
07/21/93 08:20	1000	140	80			
07/22/93 08:30	1000	160	60			
07/23/93 08:35	1000	160	80			
07/26/93 08:30	1000	180	80			
07/27/93 08:55	1000	140	80			
07/28/93 08:30	1000	140	80			
07/29/93 08:30	1100	180	80			
07/30/93 09:25	1200	180	80			
08/01/93 08:30	1000	160	80			
08/02/93 13:05	1000	140	80	1100	110	120
08/04/93 08:25	1100	200	80			
08/05/93 08:10	1000	140	80			
08/06/93 09:15	1100	200	80			
08/09/93 09:15	1100	220	80			
08/10/93 09:40	1100	180	80			
08/11/93 08:20	1100	160	80			
08/12/93 08:20	1000	140	80			
08/16/93 08:40	1000	180	80			
08/17/93 08:45	1100	200	80			
08/18/93 08:13	1000	180	80			
08/19/93 08:40	980	120	60			
08/20/93 08:40	1000	160	80			
08/23/93 08:40	1000	200	80			
08/24/93 08:50	1000	160	80			
08/25/93 09:10	980	140	60			
08/31/93 08:45	1000	200	80			
09/01/93 08:35	1000	200	80			
09/02/93 08:20	1000	160	80			
09/07/93 09:25	1000	200	80	1100	120	75
09/08/93 08:15	1000	140	60			
09/09/93 08:25	1000	140	60			
09/13/93 08:40	1000	160	60			
09/17/93 08:20	1100	160	60			

09/24/93	08:20	1000	140	60			
09/27/93	08:40	1000	200	60			
09/28/93	08:20	1100	190	80			
10/04/93	09:25	1000	140	60	1000	99	78
10/13/93	08:10	1000	160	80			
10/18/93	09:20	1000	120	60			
10/26/93	08:25	1200	160	80			
10/27/93	08:10	1000	120	80			
12/06/93	10:00	1200	140	80	900	140	100
12/07/93	08:30	980	160	80			
12/13/93	08:30	1120	160	80			
12/20/93	09:20	1090	150	80			
12/23/93	08:15	1040	140	80			
12/28/93	08:00	1370	180	80			
01/03/94	09:05	1080	140	80	980	95	73
01/04/94	08:00	1290	220	80			
01/11/94	08:25	1170	160	80			
01/13/94	08:00	1370	220	80			
01/20/94	08:15	1200	220	80			
01/21/94	08:20	1280	200	80			
01/24/94	08:40	1280	220	80			
01/25/94	08:30	1240	180	80			
01/26/94	08:15	1140	160	80			
01/27/94	08:15	1240	200	80			
01/28/94	09:00	1320	180	80			
01/31/94	09:07	1090	180	80			
02/01/94	08:25	1330	180	80			
02/02/94	08:05	960	140	80			
02/03/94	07:50	1010	160	80			
02/04/94	08:25	1310	200	80			
02/07/94	08:50	1180	140	80	1015	110	84
02/08/94	08:05	1350	NA	80			
02/14/94	08:40	1060	140	80			
02/15/94	08:40	1220	140	80			
02/18/94	08:30	1410	180	80			
02/23/94	08:05	1390	220	100			
02/25/94	08:40	1210	160	80			
02/28/94	08:50	1000	120	80			
03/04/94	08:40	1320	220	80			
03/07/94	08:45	1140	140	80	1156	166	72
03/08/94	08:15	1140	120	80			
03/10/94	07:34	1160	160	80			
03/11/94	08:20	1260	160	80			
03/15/94	08:20	1220	160	80			
03/23/94	07:55	1120	160	80			
03/25/94	08:35	1330	180	80			
03/29/94	08:15	1300	180	80			
04/04/94	09:15	1080	120	80	1192	136	82.1
04/05/94	08:00	1210	140	80			
04/08/94	08:15	1230	160	100			

04/15/94 08:15	1240	140	80			
04/19/94 12:30	1400	240	100	1300	200	80
04/22/94 08:30	1420	200	80			
04/26/94 08:15	1240	160	60	1100	140	71
04/29/94 08:55	1370	200	80			
05/03/94 09:25	1290	180	80	1100	120	80
05/06/94 09:25	1170	160	60			
05/10/94 09:25	1100	120	80	1200	170	76
05/13/94 09:25	1250	160	80			
05/17/94 09:25	1380	180	80	1100	120	75
05/23/94 09:25	1120	140	80			
05/31/94 09:25	1280	180	100			
06/06/94 09:25	1230	160	80	1100	140	73
06/13/94 09:25	1140	140	80			
06/20/94 09:25	1180	160	80			
06/27/94 09:25	1200	180	100			
07/05/94 08:45	1320	240	100	1200	180	77
07/11/94 08:45	1070	160	100			
07/18/94 08:45	1180	200	120			
07/25/94 08:45	1160	200	120			

AGI Technologies Inc.
AGI # 15,586.002

WELL 6 PUMPING TEST
DATA SUMMARY
ENGLE FARM SHALLOW WELL

STATIC WATER LEVELS			WATER QUALITY ANALYSES						
		DEPTH	Field	Field	Field	Field	Lab	Lab	Lab
DATE	TIME	(feet)	p. Cond.	Chloride	Hardness	pH	p. Cond.	Chloride	Hardness
04/19/93	11:15		1000	60	20	7.5	1000	46	23
04/20/93	14:30	93.08							
04/21/93	12:30	93.08							
04/23/93	08:20	92.58							
04/28/93	12:30	92.75							
04/30/93	08:25	92.75							
05/04/93	12:45	93.17							
05/07/93	12:10	93.00							
05/10/93	14:55	92.75							
05/13/93	08:15	92.50							
05/17/93	11:25	92.67							
05/20/93	08:30	92.58							
05/25/93	08:35	92.42							
05/28/93	08:35	92.58							
06/01/93	10:00	92.67							
06/04/93	08:25	92.50							
06/08/93	08:05	92.50							
06/10/93	08:15	92.58							
06/16/93	08:15	92.83							
06/18/93	08:25	92.83							
06/22/93	07:57	92.67							
06/25/93	08:15	92.83							
06/29/93	08:25	93.08							
07/02/93	08:20	93.17							
07/06/93	09:10	93.08							
07/09/93	08:45	93.00							
07/13/93	07:55	93.25							
07/16/93	08:25	93.34							
07/19/93	08:15	93.17							
07/23/93	08:40	93.00							
07/27/93	09:00	93.17							
07/30/93	09:25	93.30							
08/03/93	08:25	93.00							
08/06/93	09:25	92.92							
08/10/93	09:50	93.00							
08/13/93	08:55	93.17							
08/17/93	08:50	93.17							
08/20/93	08:45	92.83							
08/24/93	09:00	93.00							
08/27/93	08:35	93.25							
08/31/93	09:00	93.08							
09/03/93	08:50	92.92							
09/07/93	09:35	92.92							
09/10/93	08:55	93.08							
09/14/93	08:50	93.08							

09/17/93	08:30	93.00
09/21/93	08:40	93.00
09/24/93	08:35	93.25
09/28/93	08:25	93.25
10/01/93	08:45	93.25
10/04/93	09:40	93.17
10/08/93	08:45	93.42
10/12/93	08:20	93.50
10/15/93	09:10	93.25
10/19/93	09:05	93.25
10/22/93	08:40	93.34
10/26/93	08:35	93.50
10/29/93	08:40	93.42
11/01/93	09:00	93.50
11/05/93	08:55	93.50
11/09/93	08:30	93.50
11/12/93	08:50	93.50
11/16/93	08:25	93.25
11/19/93	08:35	93.42
11/23/93	08:35	93.42
11/30/93	09:00	92.92
12/03/93	08:45	92.83
12/06/93	10:05	92.75
12/10/93	08:35	92.58
12/17/93	08:30	92.67
12/21/93	08:45	92.83
12/28/93	08:10	92.83
01/03/94	09:15	92.67
01/07/94	08:45	92.75
01/11/94	08:30	92.83
01/14/94	08:45	92.83
01/18/94	08:55	92.83
01/21/94	08:25	92.83
01/25/94	08:40	92.83
01/28/94	09:05	92.83
02/01/94	08:30	92.92
02/04/94	08:35	92.92
02/07/94	09:00	93.00
02/11/94	08:35	93.17
02/15/94	08:50	93.08
02/18/94	08:35	93.08
02/22/94	09:20	93.33
02/25/94	08:50	93.33
03/01/94	08:30	93.3
03/04/94	08:45	93.4
03/07/94	08:55	93.7
03/11/94	08:40	93.7
03/15/94	08:30	93.5
03/18/94	08:25	93.3
03/22/94	08:10	93.6
03/25/94	08:45	93.8
03/29/94	08:25	93.7
04/01/94	08:55	93.8
04/04/94	09:25	93.1
04/08/94	08:25	93.7
04/15/94	08:25	93.7
04/19/94	12:40	93.8
04/22/94	08:40	93.9
04/26/94	08:25	94.1

05/03/94	08:25	95.3
05/06/94	08:25	95.1
05/09/94	08:25	95.3
05/10/94	08:25	95.3
05/11/94	08:25	95.3
05/13/94	08:25	95.3
05/17/94	08:25	95.4
05/18/94	08:25	95.6
05/19/94	08:25	95.7
05/20/94	08:25	95.7
05/23/94	08:25	95.9
05/25/94	08:25	95.9
05/27/94	08:25	95.9
05/31/94	08:25	95.9
06/06/94	08:25	95.8
06/13/94	08:25	95.4
06/20/94	08:25	95.9
06/22/94	08:25	95.8
06/24/94	08:25	95.8
06/27/94	08:25	95.8
07/05/94	08:55	96
07/11/94	08:55	95.7
07/18/94	08:55	95.8
07/25/94	08:55	95.3

AGI Technologies Inc
AGI # 14,586.002

WELL 6 PUMPING TEST
DATA SUMMARY
ROBERT ENGLES WELL

STATIC WATER LEVELS			WATER QUALITY ANALYSES					
		DEPTH	Field	Field	Field	Lab	Lab	Lab
DATE	TIME	(feet)	Sp. Cond	Chloride	Hardnes	Sp. Cond	Chloride	Hardness
04/10/93	14:45		1000	140	320			
04/12/93	12:45		1000	140	300			
04/14/93	10:50		1000	140	300			
04/15/93	13:00	106.5	1000	140	300			
04/16/93	10:00		1000	140	300			
04/19/93	11:00		1000	140	280	1000	100	280
04/20/93	10:10	106.2	1000	140	300			
04/21/93	12:15	106.7	1000	140	300			
04/27/93	11:30	106.2	1000	140	280			
04/29/93	12:15	105.6	1000	140	300			
05/04/93	12:30	105.5	1000	160	280			
05/06/93	12:55	110.7	1000	120	280			
05/11/93	10:22	106.9	1000	140	280			
05/14/93	13:30	115.8	1000	140	280			
05/18/93	11:45	106.2	1000	160	300			
05/21/93	11:10	105.6	1000	140	280			
06/22/93	12:05	113.2	960	120	280			
06/25/93	12:00	107.5	900	140	280			
06/29/93	12:15	107.8	980	140	280			
07/02/93	11:05	110.8	1000	140	280			
07/06/93	13:15	109.2	980	140	280	1000	100	290
07/09/93	11:30	114.4	980	140	280			
07/13/93	12:25	117.1	960	140	280			
07/16/93	11:10	109.6	1000	140	280			
07/19/93	15:00	109.4	1000	140	280			
07/23/93	08:20	114.8	1000	140	280			
07/27/93	08:35	111.3	1000	140	280			
07/30/93	09:15		1000	120	240			
08/02/93	13:20	108.5	1000	140	300	1000	98	280
08/06/93	09:00	110.9	980	120	280			
08/10/93	08:30	107.1	1000	140	300			
08/13/93	08:40	108.1	1000	120	280			
08/17/93	08:30	114.8	1000	140	280			
08/20/93	08:25	106.1	1000	160	300			
08/24/93	08:40	108.2	1000	160	280			
08/27/93	08:20	110.8	1000	140	280			
08/31/93	08:30	107.8	980	160	280			
09/03/93	08:40	107.7	1000	160	280			
09/07/93	09:15	106.9	1000	160	300	1000	100	280
09/10/93	08:40	106.3	1000	140	260			
09/14/93	08:40	106.9	1000	120	260			
09/17/93	08:10	106.1	1000	140	240			
09/21/93	08:30	106	1000	140	240			

09/24/93 08:15	107.4	1000	120	240			
09/28/93 08:05	107	1000	160	240			
10/01/93 08:30	106.5	1000	140	260			
10/04/93 09:15	108.7	1000	140	240	1000	99	280
10/08/93 08:35		1000	120	260			
10/12/93 08:10	106.9	1000	140	240			
10/15/93 08:55	106	1000	140	260			
10/19/93 08:40	106.3	1000	140	260			
10/22/93 08:25	106.4	1000	140	260			
10/26/93 08:15	106.7	1100	140	260			
10/29/93 08:30	106.5	1100	140	260			
11/01/93 08:40	112.6	1100	140	240	1000	150	280
11/05/93 12:40	114.7	1100	120	260			
11/09/93 08:15	106.8	1200	140	240			
11/12/93 08:35	106.3	1100	120	260			
11/16/93 08:10	107.6	1100	140	260			
11/19/93 08:20	108.2	1100	140	240			
11/30/93 08:45	106.2	1060	140	280			
12/03/93 08:35	106.3	1020	140	280			
12/06/93 08:55	105.8	1040	160	340	810	100	320
12/10/93 08:28	106.8	1040	160	300			
12/14/93 08:15	107.1	1020	160	280			
12/17/93 08:20	106.6	860	140	280			
12/21/93 08:30	106.3	1080	140	300			
12/28/93 07:55	105.7	1020	140	300			
01/03/94 08:50	105.9	1010	140	250	1000	100	310
01/07/94 08:30	107.3	970	120	300			
01/11/94 08:15	110.5	1070	140	300			
01/14/94 08:30	110.5	1020	160	320			
01/18/94 08:40	109.7	1040	140	300			
01/21/94 08:10	107.6	1010	140	260			
01/25/94 08:25	108.1	1020	140	280			
01/28/94 08:50	107.9	1070	160	320			
02/01/94 08:15	106.1	1000	140	280			
02/04/94 08:15	106.3	920	140	280			
02/07/94 08:45	115	1040	140	280	1098	105.5	298
02/11/94 08:20	109.4	1090	120	280			
02/15/94 08:30	116.3	1200	120	300			
02/18/94 08:15	107.7	1130	120	280			
02/22/94 09:05	106.3	1050	120	280			
02/25/94 08:30	106.9	1020	100	240			
03/01/94 08:10	113.8	1040	120	300			
03/04/94 08:25	107.4	1070	120	300			
03/07/94 08:30	108.5	1050	120	300	1107	122.6	274
03/11/94 08:10	108.2	1110	120	280			
03/15/94 08:10	107.4	1130	140	300			
03/18/94 08:15	106.7	1130	140	300			
03/22/94 07:55	109.1	1150	120	300			
03/25/94 08:25	106.5	1150	120	300			
03/29/94 08:05	109	1150	140	300			

04/01/94 08:45	107.3	1150	120	340			
04/04/94 09:00	108.7	1150	120	320	1099	100.7	334.7
04/08/94 08:05	110.3	1130	120	300			
04/12/94 08:15	106.7	1130	120	320			
04/15/94 08:05	106.9	1140	120	300			
04/19/94 12:05	105.9	1120	140	320	1100	110	290
04/22/94 08:20	107.3	1150	120	280			
04/26/94 08:00	106.9	1130	120	340			
04/29/94 08:40	106.6	1140	120	300			
05/01/94	106.9	1140	120	320	1100	110	280
05/17/94	115.2	1140	120	280			
05/23/94	109.8	1120	140	300	1100	120	290
06/06/94	109	1120	140	320			

APPENDIX C

AGI
TECHNOLOGIES

APPENDIX C

FIELD SHEETS
LAB ANALYSIS FORMS

WELL 4 RECORD NO. 3 YR. 94

DAY	LAST MONTH TIME	462336 METER/~~HOURS~~	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0715	472138		960	100	460			
2									
3									
4	0714	479042		970	100	460			
5									
6									
7	0736	484867		930	100	460 X	1111	105.1	446
8									
9									
10									
11	0700	491141		960	100	460			
12									
13									
14									
15	0710	500984		940	100	480			
16									
17									
18	0710	506935		930	100	460			
19									
20									
21									
22	0703	516182		920	100	440			
23									
24									
25	0720	524183		970	100	480			
26									
27									
28									
29	0705	529968		960	100	460			
30									
31									
TOTALS	**********		**********	**********	**********	**********	**********	**********	**********

04-05-1994 11:30AM FROM TOWN OF ...

WELL 5 RECORD MO. 3 YR. 94

DAY	TIME	METER/~~HOURS~~	FIELD REST ~~STATIC~~ LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
LAST MONTH		74461							
1	0725	74559	109' 5" .42						
2									
3									
4	0725	74612	109' 3" .25						
5									
6									
7	0750	76314	110' 0"						
8									
9									
10									
11	0711	77004	109' 0"						
12									
13									
14									
15	0720	77082	109' 4" .3						
16									
17									
18	0720	77107	108' 2" .17						
19									
20									
21									
22	0714	79419	109' 6" .67						
23									
24									
25	0734	79577	110' 0"						
26									
27									
28									
29	0718	79668	109' 4" .2						
30									
31									
TOTALS									

WELL # 6 HIGH SCHOOL RECORD NO. 3 YR. 94

LAST MONTH									
DAY	TIME	METER/~~HOURS~~	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0835	Ø	85' 10" .83						
2									
3									
4	0855	Ø	85' 11" .92						
5									
6									
7	0900	Ø	86' 5" .41						
8									
9									
10									
11	0945	77	86' 4" .33						
12									
14									
15	0835	77	86' 1" .1						
16									
17									
18	0840	77	85' 8" .67						
19									
20									
21									
22	0820	77	86' 3" .25						
23									
24									
25	0850	78	86' 7" .54						
26									
27									
28									
	0830	79	86' 3" .25						
30									
31									
TOTALS									

WELL ENGLE DEEP RECORD NO. 3 YR. 94

DAY	LAST MONTH TIME	12648.4 METER/HOURS	~~FIELD~~ STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0825	12656.4	off	no water					
2	0758	12666.6	//	//	//				
3	0808	12674.2	//	//	//				
4	0840	12683.7	off	1320	220	80			
5									
6									
7	0845	12705.4	running	1140	140	80	X 1150	166.4	72
8	0615	12713.2	//	1140	170	80			
9	0756	12721.2	off	no water					
10	0734	12731.0	running	1160	160	80			
11	0820	12740.6	//	1260	160	80			
12									
13									
14	0835	12764.8	off	no Water					
15	0820	12772.7	running	1220	160	80			
16	0740	12783.0	off	no Water					
17	0800	12792.0	//	//	//				
18	0820	12798.7	//	//	//				
19									
20									
21	0831	12827.2	off	no water					
22	0805	12836.2	//	//	//				
23	0755	12845.4		1120	160	80			
24	0755	12854.6	off	no water					
25	0835	12864.7		1330	180	80			
26									
27									
28	0820	12893.2	off	no water					
29	0815	12902.8		1300	180	80			
30	0802	12912.3	off	no water					
31	0813	12922.0		//	//				
TOTALS									

WELL ENGLE SHALLOW RECORD NO. 3 YR. 94

DAY	LAST MONTH TIME	~~METER/HOURS~~	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
	0830		93'4".33						
	0845		93'5".42						
	0855		93'8".67						
	0840		93'8".67						
	0830		93'6".5						
	0825		93'3".25						
	0810		93'7".58						
	0845		93'10".43						
	0825		93'8".67						
TOTALS									

✓

WELL BILL ENGLES RECORD NO. 3 YR. 94

LAST MONTH DAY	TIME	~~METER/HOURS~~	FIELD ~~STATIC~~ REST LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0810		113' 10" .83	1040	120	300			
2									
3									
4	0825		107' 5" .42	1070	120	300			
5									
6									
7	0830		108' 6" .5	1050	120	300 X	1107	122.6	274
8									
9									
10									
11	0810		108' 2" .17	1110	120	280			
12									
14									
15	0810		107' 5" .42	1130	140	300			
16									
17									
18	0815		106' 8" .67	1130	140	300			
19									
20									
21									
22	0755		109' 1" .08	1150	120	300			
23									
24									
25	0825		106' 6" .5	1150	120	300			
26									
27									
29	0805		109' 0"	1150	140	300			
30									
31									
TOTALS	XXXXXXXXXX		XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX

WELL 1 RECORD NO. 4 YR. 74

LAST MONTH			FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19	1043	1449.7	—	1250 uS/l	180 mg/l	320 mg/l X	1200	160	280 ✓
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
TOTALS									

WELL 4 RECORD NO. 4 YR. 94

LAST MONTH		529988	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/~~HOURS~~	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1	0710	537378		970	100	460			
2									
3									
4	0750	540382		980	100	420	X 1185	91.9✓	514.24
5									
6									
7									
8	0705	550176		980	100	460			
9									
10									
11									
12	0705	554033		980	100	440			
13									
14									
15	0700	560748		970	100	480			
16									
17									
18									
19	1055	567174		920	120	440	X 1100	88	440 ✓
20									
21									
22	0900	569397	94' 11".92						
23									
24									
25									
26	0655	569397	94' 1".08						
27									
28									
29	0706	569397	93' 10".83						
30									
31									
TOTALS									

WELL 5 RECORD NO. 4 YR. 94

LAST MONTH		79668	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/~~HOURS~~	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1	0724	79962	109'8"						
2									
3									
4	0805	79962	108'8"						
5									
6									
7									
8	0715	80261	109'5"						
9									
10									
11									
12	0715	80451	108'4"						
13									
14									
15	0710	80477	109'5"						
16									
17									
19 ~~18~~	0719	80477	109'4"						
19	1100	"	109'2"	930 [illegible]	100 mg/L	350 mg/L	1000	80	380 /
20									
21									
22	0707	80501	108'8"						
23									
24									
25									
26	0857	80501	108'9"						
27									
28									
29	0712	80501	109'2"						
30									
31									
TOTALS									

WELL #6 RECORD MO. 4 YR. 94

LAST MONTH		79	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER ~~HOURS~~	~~STATIC~~ LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
20	1605	1141		1230	200	180			
20	2345	2114		1220	220	160			
13									
14									
15									
16									
17									
18									
19	1315	131		1420 uS/cm	280 mg/L	160 mg/L	1600	290	170
20	0915	257		1460	260	140			
21	0710	3050	113'5"	1210	200	160			
22	0725	6096	116'2"	1210	200	160			
23	0635	9004	116'5"						
24	0830	12234	117'2"	[illegible]					
25	0750	15153	117'5"	1230	200	180			
26	0715	18098	117'9"	1230	200	160	1300	180	160
27	0730	21197	118'11"	1240	220	160			
28	0730	24258	118'5"	1250	200	160			
29	0730	27278	118'3"	1250	200	160			
30	0845	30448	118'5"						
31									
TOTALS									

TOWN OF COUPEVILLE, WELL NO. 6 (HIGH SCHOOL SITE) 4/20/94 ✓

DRAWDOWN TEST

TIME AFTER START OF TEST	CLOCK TIME	WATER DEPTH (ft./in.)	WATER METER READING (gallons)	CALC. FLOW RATE (gpm)	REMARKS
Start Apr. 4-20-94	8:10am	86'-4"	132 00		
30 sec.	8:15	106'-0"			
1 min.		108-5			
2 min.		109-0			
3 min.		109-3			
4 min.		109-6			
5 min.		109-7			
6 min.		109-8½			
7 min.		109'-10"			
8 min.		109-10"			
9 min.		109-11"			
10 min.		110'-0"			
11 min.		110'-0			
12 min.		110'-1"			
13 min.		110'-1½"			
14 min.		110'-2"			
15 min.		110'-3½"			
20 min.		110'-4½			
25 min.		110'-8"			
30 min.		110'-10"			Wtr sample 1
35 min.		111'-0"			
40 min.		111'-1½			

Schaefer & Bratton, Engineers

TOWN OF COUPEVILLE, WELL NO. 6 (HIGH SCHOOL SITE)

DRAWDOWN TEST

TIME AFTER START OF TEST	CLOCK TIME	WATER DEPTH (ft./in.)	WATER METER READING (~~cu.ft.~~) gallons	CALC. FLOW RATE (gpm)	REMARKS
45 min.	9:00 am	111'-4"			
50 min.		111'-6"	24700 @ 9:09 am	215 gpm	
60 min.		111'-7 1/2"			
70 min.		111'-9"			
80 min.	9:35 am	111'-10 1/2			
90 min.	9:45	111'-11 1/2	33400 @ 9:49	215 gpm	
2 hrs.		112'-2"			
2.5 hrs.	10:45	112-3 1/2			
3 hrs.	11:15	112-5"			
3.5 hrs.	11:45	112-6 1/2			
4 hrs.	12:15	112'-7"			
4.5 hrs.	12:45	112'-7 1/2	71800	215 gpm	
5 hrs.	1:15	112'-8 1/2			Hyd flow test at H.Sch.
6 hrs.	2:15	112'-10 1/2"			Wtr sample 2
7 hrs.	3:15	113'-0"			
8 hrs.	4:15	112'-11"			
4/21 ~~9 hrs.~~	0705	113'-5"			
4/22 10 hrs.	0720	116'2"			
11 hrs.					
12 hrs.					Wtr sample 3
13 hrs.					
14 hrs.					

Schaefer & Bratton, Engineers

WELL ENGLE DEEP RECORD NO. 4 YR. 94

DAY	TIME	METER/HOURS (LAST MONTH 12922.0)	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0850	12932.1	off no Water						
2									
3									
4	0915	12960.4	RUNNING	1080	120	80 X	1192	135.72	82.10
5	0800	12969.2	//	1210	140	80			
6	0810	12978.4	off						
7	0800	12987.3	off						
8	0815	12996.9	Running	1230	160	100			
9									
10									
11	0835	13025.2	off						
12	0825	13034.6	off						
13	0815	13043.9	off						
14	0813	13053.4	off						
15	0815	13062.9	Running	1240	140	80			
16									
17									
18	0831	13092.1	off	[illegible]					
19	1230	13103.9	RUNNING	1400	240	100 X	1300	200	80 ✓
20									
21									
22	0830	13131.4	RUNNING	1470	200	80			
23									
24									
25									
26	0815	13170.4	—	1240	160	60 X	1100	140	71 ✓
27									
28									
29	0855	13200.2	—	1370	200	80			
30									
31									
TOTALS									

WELL ENGLE SHALLOW RECORD NO. 4 YR. 94

LAST MONTH DAY	TIME	~~METER HOURS~~	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0855		93'9"						
2									
3									
4	0925		93'10"						
5									
6									
7									
8	0825		93'8"						
9									
10									
11									
12	0830		DOGS						
13									
14									
15	0825		93'8"						
16									
17									
18									
19	1240		93'9"						
20									
21									
22	0840		93'11"						
23									
24									
25									
26	0825		94'1"						
27									
28									
29	0905		DOGS						
30									
31									
TOTALS									

WELL Bill Engles RECORD NO. 4 YR. 94

LAST MONTH DAY	TIME	~~METER/HOURS~~	FIELD ~~STATIC~~ REST LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1	0845		107' 3"	1150	120	340			
2									
3									
4	0900		108' 8"	1150	120	320 X	1099	100.70	334.72
5									
6									
7									
8	0805		110' 3"	1130	120	300			
9									
10									
11									
12	0815		106' 8"	1130	120	320			
13									
14									
15	0805		106' 11"	1140	120	300			
16									
17									
18									
19	1205		105' 11"	1120	140	320 X	1100	110	290 ✓
20									
21									
22	0820		107' 3"	1150	120	280			
23									
24									
25									
26	0800		106' 11"	1130	120	340			
27									
28									
29	0840		106' 7"	1140	120	300			
30									
31									
TOTALS									

(8)

✓

WELL / RECORD MO. 5 YR. 94

LAST MONTH		174498	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3	0730	174542	—	1250	180	280 ✗	1200	170	280
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23	0800	174580	—	1240	200	300 ✗	1250	[illegible]	[illegible] ✓
24									
25									
26									
27									
28									
29									
30									
31									
TOTALS									

WELL 4 RECORD NO. 5 YR. 94

LAST MONTH		569397	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3	0715	569397	93'8"	1090	120	520 X	1200	120	500✓
4									
5									
6	0715	569419	93'7"	1140	120	520			
7									
8									
9									
10	0700	569419	93'3"						
11									
12									
13	0702	569419	93'1"						
14									
15									
16									
17	0717	569505	92'11"						
18									
19									
20									
21									
22									
23	0745	569521	92'8"	1090	120	480 X	1200	120	520✓
24									
25									
26									
27									
28									
29									
30									
31	0737	569660	91'9"						
TOTALS									

WELL 5 RECORD MO. 5 YR. 94

LAST MONTH		80501	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3	0745	80501	109'6"	910	80	380 ×	960	63	380✓
4									
5									
6	0725		109'8"						
7									
8									
9									
10	0705	80511	109'7"						
11									
12									
13	0706	80521	109'8"						
14									
15									
16									
17	0722	80521	109'8"						
18									
19									
20									
21									
22									
23	0750	80521	109'7"	900	80	380 ×	940	62	390✓
24									
25									
26									
27									
28									
29									
30									
31	0744	80536	109'2"						
TOTALS									

WELL #6 RECORD NO. 5 YR. 94

LAST MONTH		30448	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/~~HOURS~~	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1	0730	33282	118' 7"						
2	0755	36343	118' 10"	1270	200	180			
3	0810	39383	119' 2"	1270	220	160	X 1300	200	170 ✓
4	0730	42323	119' 5"	1280	200	180			
5	0745	45383	119' 6"	1260	200	180			
6	0745	48410	119' 4"	1290	200	180			
7	0805	51468	119' 2"						
8	0940	54691	119' 8"						
9	[illegible]	[illegible]	119' 1"	1300	220	[illegible]			
10	0720	60319	119' 5"	1310	200	160	X 1300	220	180 ✓
11	0730	63613	119' 10"	1320	200	160			
12	0730	66681	119' 8"	1330	200	160			
13	0725	69734	119' 7"	1330	200	180			
14	0822	72922	119' 6"						
15	0715	75954	119' 6"						
16	0755	79017	119' 6"	1350	220	180			
17	0740	82057	119' 5"	1350	220	180	X 1400	220	190
18	0735	85113	119' 8"	1360	200	180	X 1409	205	169 ✓
19									
20									
21									
22									
23	0855	95824	118' 3"	1390	220	160			
24									
25									
26									
27									
28									
29									
30									
31	0800	[illegible]97	99' 11"	1430	220	180			
TOTALS									

WELL ENGLE DEEP RECORD MO. 5 YR. 94

LAST MONTH		13200.2	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~[illegible]~~/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3	0925	13239.9	—	1290	160	80 X	1100	120	80
4									
5									
6	0840	13270.4	—	1170	160	60			
7									
8									
9									
10	0815	13312.0	—	1100	120	80 X	1200	170	76
11									
12									
13	0815	13343.7	-	1250	160	80	-		-
14									
15									
16									
17	0845	13362.8	—	1380	180	80 X	1100	120	75
18									
19									
20									
21									
22									
23	1000	13442.7	—	1120	140	80			
24									
25									
26									
27									
28									
29									
30									
31	0920	[illegible]	-	1280	160	100			
TOTALS									

WELL ENGLE SHALLOW RECORD NO. 5 YR. 94

LAST MONTH			FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~METER/HOURS~~	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3	0935		95' 3"						
4									
5									
6	0845		95' 1"						
7									
8									
9	0845		95' 4"						
10	0820		95' 4"						
11	0810		95' 4"						
12	0812		DOGS						
13	0825		95' 4"						
14									
15									
16									
17	0655		95' 5"						
18	0815		95' 7"						
19	0745		95' 8"						
20	0745		95' 8"						
21									
22									
23	1010		95' 11"						
24									
25	0745		95' 11"						
26									
27	0800		95' 11"						
28									
29									
30									
31	0930		95' 11"						
TOTALS									

WELL *BILL ENGLES* RECORD MO. *5* YR. *94*

LAST MONTH			FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.	
DAY	TIME	~~[illegible]~~	*REST* ~~STATIC~~ LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS	
1										
2										
3	0910	—	106'11"	1140	120	320	X 1100	110	280	✓
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17	0830	IN USE	115'2"	1140	120	280				
18										
19										
20										
21										
22										
23	0940	—	109'10"	1120	140	300	X 1100	120	290	✓
24										
25										
26										
27										
28										
29										
30										
31										
TOTAL										

entered

WELL 1 RECORD MO 6 YR 94

LAST MONTH		174580	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6	0810			1230	180	300			
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
TOTALS									

WELL 4 RECORD NO. 6 YR. 94

LAST MONTH		569660	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6	0752	569673	91' 5"	1050	100	460			
7									
8									
9									
10									
11									
12									
13	0744	569673	90' 8"						
14									
15									
16									
17									
18									
19									
20	0730	[illegible]	91' 1"						
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
TOTALS	**********		**********	**********	**********	**********	**********	**********	**********

WELL 5 RECORD NO. 6 YR. 94

DAY	TIME	80536 METER/HOURS	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
LAST MONTH									
1									
2									
3									
4									
5									
6		80559	109'1"	92	80	380			
7									
8									
9									
10									
11									
12									
13	0749	80559	108'8"						
14									
15									
16									
17									
18									
19									
20	[illegible]	[illegible]	[illegible]						
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
TOTALS									

WELL 6 RECORD NO. 6 YR. 94

LAST MONTH		114297	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	[redacted] LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6	0835	127319	117' 4"	1430	220	180	X 1500	260	200 ✓
7									
8									
9									
10									
11									
12									
13	0805	142512	116' 5"	1460	240	160			
14									
15									
16									
17									
18									
19									
20	0755	159060	117' 8"	1480	260	180	X 1500	253.7	267.97
21									
22	0905	164031		1480	280	180			
23									
24	0815	168757		1480	280	200			
25									
26									
27	0751	176369	89' 11"	1500	280	200			
28									
29	0714	182181		1530	300	200			
30									
31									
TOTALS	**********								

WELL *ENGLE DEEP* RECORD NO. *6* YR. *94*

LAST MONTH		*13522.8*	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~METER~~/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6	*0935*	*13585.1*	*—*	*1230*	*160*	*80*	*X 1100*	*140*	*73* ✓
7									
8									
9									
10									
11									
12									
13	*0655*	*13657.7*		*1140*	*140*	*80*			
14									
15									
16									
17									
18									
19									
20	*0845*	*13740.4*		*1180*	*160*	*80*			
21									
22									
23									
24									
25									
26									
27	*0845*	*13820.3*		*1200*	*180*	*100*			
28									
29									
30									
31									
TOTALS	**********								

✓

WELL *ENGLE SHALLOW* RECORD NO. *6* YR. *94*

LAST MONTH			FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~METER HOURS~~	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6	0945		95'10"						
7									
8									
9									
10									
11									
12									
13	0900		95'5"						
14									
15									
16									
17									
18									
19									
20	0850		95'11"						
21									
22	0755		95'10"						
23									
24	0810		95'9"						
25									
26									
27	0850		95'9"						
28									
29									
30									
31									
TOTALS	xxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx

WELL Bill Engles RECORD MO. 6 YR. 94

LAST MONTH			FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~METER/H~~OURS	~~STATIC~~ REST LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5									
6	0925	—	109'0"	1120	140	320			
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
TOTALS									

WELL 4 RECORD NO. 7 YR. 94

LAST MONTH		569779	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5	0735	586779	90' 6"						
6									
7									
8									
9									
10			RUNNING						
11	0725	580358	153' 5"	980	100	440			
12									
13									
14									
15									
16									
17									
18	0719	586804	91' 6"						
19									
20									
21									
22									
23									
24									
25									
26									
27	1200	586972	90' 7"						
28									
29									
30									
31									

WELL 5 RECORD NO. 7 YR. 94

DAY	LAST MONTH TIME	60559 METER/~~HOURS~~	FIELD STATIC LEVEL	FIELD CONDUCTIVITY	FIELD CHLORIDES	FIELD HARDNESS	LAB. CONDUCTIVITY	LAB. CHLORIDES	LAB. HARDNESS
1									
2									
3									
4									
5	0740	60559	109' 4"						
6									
7									
8									
9									
10									
11	0735	off 82850	109' 4"	940	80	400			
12									
13									
14									
15									
16									
17									
18	0724	off 87407	110' 9"						
19									
20									
21									
22									
23									
24									
25	0750	off 95595	109' 8"						
26									
27									
28									
29									
30									
31									
TOTALS	xxxxxxxxxx		xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx

WELL 8 RECORD NO. 7 YR. 94

LAST MONTH		182181	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	METER/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1	0735	187918		1500	300	200			
2	1117	190550		1500	240	180			
3									
4									
5	0757	197754	90' 1"	1510	320	200 X	1500	220	210
6						MTC X	1468	223.4	248
7									
8									
9									
10									
* 11	0800	198477	87' 11"		dry 5/18/94 @ 0800				
12									
13									
14									
15									
16									
17									
18	0755 / 0857	198477 / 198605	off 87' 10"	1480	380	200			
19									
20									
21									
22									
23									
24									
25	0814	198605	off 87' 1"						
26									
27									
28									
29									
30									
31									
TOTALS									

WELL ENGLE SHALLOW RECORD NO. 7 YR. 94

LAST MONTH			FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~METER HOURS~~	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5	0855		96'1"						
6									
7									
8									
9									
10									
11	0850		95'8"						
12									
13									
14									
15									
16									
17									
18	0835		95'9"						
19									
20									
21									
22									
23									
24									
25	0900		95'4"						
26									
27									
28									
29									
30									
31									
TOTALS	xxxxxxxxxx		xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx

✓

WELL ENGLE DEEP RECORD NO. 7 YR. 94

LAST MONTH		13820.3	FIELD	FIELD	FIELD	FIELD	LAB.	LAB.	LAB.
DAY	TIME	~~METER~~/HOURS	STATIC LEVEL	CONDUCTIVITY	CHLORIDES	HARDNESS	CONDUCTIVITY	CHLORIDES	HARDNESS
1									
2									
3									
4									
5	0845	13916.0		1320	240	100	1200	180	77
6									
7									
8									
9									
10									
11	0840	13989.7		1070	160	100			
12									
13									
14									
15									
16									
17									
18	0825	14079.6		1180	200	120			
19									
20									
21									
22									
23									
24									
25	0850	14172.1		1160	200	120			
26									
27									
28									
29									
30									
31									
TOTALS									

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS
4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville

Date: July 18, 1994
Revised: August 5, 1994

Report On: Analysis of Water

Lab No.: 41616

IDENTIFICATION:
Samples received on 07-07-94

Collected 7/5/94

ANALYSIS:

Lab Sample No. 41616-1

Client ID: Well #6

ICP Metals Per EPA Method 6010
Date Analyzed: 7-11-94
Units: mg/L

Parameter	Result	PQL
Calcium	38	0.50
Magnesium	27	0.50
Potassium	12	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	350	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	350	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.90	0.05
Total Phosphate, mg/L	EPA 365.1	0.25	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

RECEIVED
JUL 21 1994
TOWN OF COUPEVILLE

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-00713

DATE RECEIVED: 07-07-94

1. Date Collected: 7-5-94
2. System Name: WELL #6
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface, **Well** (circled), Spring, Purchase
7. Sample Taken (circle): **Before Treatment** (circled), After Treatment
8. Source No.: Source Name:
10. Collected By: [signature]
Telephone: (206) 6786695
11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other ____, Water Softener Type
12. If taken from distribution, indicate address
Name:
13. Party to pay for testing:
Name: TOWN OF COUPEVILLE
Address: POB 725 COUPEVILLE 98239
Telephone: (206) 6786695
14. Remarks: SEE ATTACHED 41616-1

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		240	mg/L			SP
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		210	mg/L			LF
Conductivity		700		1,500	umhos		N	LF
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		220	mg/L	Y		LK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		37	mg/L	Y		LK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: Stan Palmquist

Date of Report: 07-18-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 41616
July 18, 1994
Revised: August 5, 1994

Collected 7/5/94

Lab Sample No. 41616-2

Client ID: Engle Deep

ICP Metals Per EPA Method 6010
Date Analyzed: 7-11-94
Units: mg/L

Parameter	Result	PQL
Calcium	12	0.50
Magnesium	~~12~~	0.50
Potassium	9.5	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	350	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	350	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.59	0.05
Total Phosphate, mg/L	EPA 365.1	0.46	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC. JUL 21 1994

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

TOWN OF COUPEVILLE

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-00714

DATE RECEIVED: 07-07-94

1. Date Collected: 7-5-94
2. System Name: ENGLE DEEP
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface, **Well** (circled), Spring, Purchase
7. Sample Taken (circle): **Before Treatment** (circled), After Treatment
8. Source No.: Source Name:
10. Collected By: H. Dill
Telephone: (206) 678-6695
11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other ____, Water Softener Type ____
12. If taken from distribution, indicate address
Name:
13. Party to pay for testing:
Name: TOWN OF COUPEVILLE
Address: POB 725 COUPEVILLE 98239
Telephone: (206) 678-6695
14. Remarks: SEE ATTACHED 41616-2

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		240	mg/L			SP
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		77	mg/L			LE
Conductivity		700		1,200	umhos		N	LE
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		180	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		36	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 07-18-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville — Date: June 16, 1994

Report On: Analysis of Water — Lab No.: 40812

IDENTIFICATION:
Samples received on 06-07-94

ANALYSIS: *Sampled on 6/6/94*

Lab Sample No. 40812-1 — Client ID: Well #6

ICP Metals Per EPA Method 200.7
Date Analyzed: 6-9-94
Units: mg/L

Parameter	Result	PQL
Calcium	36	0.50
Magnesium	27	0.50
Potassium	13 220	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	340	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	340	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.91	0.05
Total Phosphate, mg/L	EPA 365.1	0.22	0.01

ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 40812 - 1

DATE RECEIVED: 06-07-94

1. Date Collected: 06-06-94

2. System Name:

3. System ID   4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface / **Well** (circled) / Spring / Purchase

7. Sample Taken (circle): **Before Treatment** (circled) / After Treatment

8. Source No.:   Source Name:

10. Collected By: H. DILL
Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address
Name:

13. Party to pay for testing:
Name: TOWN OF COUPEVILLE BOX 725
Address: COUPEVILLE, W 98239
Telephone: (206) 678-6695

14. Remarks: CLIENT ID WELL #6

LABORATORY REPORT (Do Not Write Inside This Box) — Well 6

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		220	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		200	mg/L			MC
Conductivity		700		1500	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		260	mg/L		N	RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		39	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST   Date of Report: 06-10-94

MCL - Maximum Contaminant Level   Reference SOP #SAS-0513

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 40812
June 16, 1994

Lab Sample No. 40812-2 Client ID: Engle Deep

ICP Metals Per EPA Method 200.7
Date Analyzed: 6-9-94
Units: mg/L

Parameter	Result	PQL
Calcium	11	0.50
Magnesium	10	0.50
Potassium	9.2	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	340	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	340	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.15	0.05
Total Phosphate, mg/L	EPA 365.1	0.43	0.01

ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-40812-2

DATE RECEIVED: 06-07-94

1. Date Collected: 6-6-94

2. System Name:

3. System ID — 4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface (Well) Spring Purchase

7. Sample Taken (circle): (Before Treatment) After Treatment

8. Source No.: Source Name: H Well

10. Collected By: — Telephone: 206)678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address — Name:

13. Party to pay for testing: Name: TOWN OF COUPEVILLE Address: POB 725 COUPEVILLE WA Telephone: (206) ...

14. Remarks: CLIENT ID: ENGLE DEEP SEE ATACHED

LABORATORY REPORT (Do Not Write Inside This Box) — Engle Deep

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium ✓	Na	None		190	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness ✓		None		73	mg/L			MC
Conductivity ✓		700		1,100	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride ✓	Cl	250		140	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate ✓	SO_4	250		2.8	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 06-14-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

DRINKING WATER REQUEST FOR ANALYSIS

CONTACT HAROLD DILL
COMPANY TOWN OF COUPEVILLE
ADDRESS POB 725
CITY/ STATE/ COUNTY COUPEVILLE, WA 98239
PHONE 206 / 678-6695

Sound Analytical Services, Inc.
4813 Pacific Hwy. E.
Tacoma, WA 98424
(206) 922-2310

SAMPLE INFORMATION
SAMPLED BY ______

SEND REPORT TO STATE HEALTH DEPARTMENT? YES NO
SEND REPORT TO COUNTY HEALTH DEPARTMENT? YES NO

REQUESTED ANALYSIS

	SYSTEM ID	DATE	TIME	CI	PI	SI	PV	VOC	EDB	PST	HRB	TC	FC	FS	EC
				INORGANICS				ORGANICS				MICROBIOLOGY			
1	WELL #6	6/6													
2	ENGLE DEEP														
3															
4															
5															
6															
7															

OTHER ANALYSIS ______
OTHER ANALYSIS ______

SPECIAL INSTRUCTIONS: TEST FOR ALKALINITY, BICARBONATE, CARBONATE, CALCIUM MAGNESIUM, POTASSIUM, SODIUM, BROMIDE, CHLORIDE, SULFATE TOTAL PHOSPHATE, HARDNESS, & CONDUCTANCE

ANALYSIS CODE:
INORGANICS: COMPLETE INORGANICS = CI PRIMARY INORGANICS = PI SECONDARY INORGANICS = SI PHASE II & V = PV
ORGANICS: VOLATILE ORGANIC COMPOUNDS = VOC EDB/DBCP = EDB PESTICIDES = PST HERBICIDES = HRB
MICROBIOLOGY: TOTAL COLIFORM = TC FECAL COLIFORM = FC FECAL STREP = FS E COLI = EC

Relinquished by ______ Date/Time ______ Received by [signature] Date/Time 6-7-94 12:
Relinquished by ______ Date/Time ______ Received by ______ Date/Time ______

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 · TELEPHONE (206)922-2310 · FAX (206)922-5047

TRANSMITTAL MEMORANDUM

RECEIVED

JUN 21 1994

TOWN OF COUPEVILLE

DATE: June 16, 1994

TO: Harold Dill
Town of Coupeville

LABORATORY NUMBER: 40812

Two water samples were received for analysis at Sound Analytical Services, Inc., on June 7, 1994, and was assigned Laboratory Work Order Number 40812.

Enclosed is a copy of the completed Washington State Department of Health Drinking Water Report. Copies of this report have been sent to the following parties:

✓ Client

___ State Health Department (Olympia & Regional)

___ County Health Department

___ Other ____________________

If there are any questions regarding this work order, please do not hesitate to call me at (206) 922-2310.

Sincerely,

J. Christopher Shaeffer
Project Manager

JCS:tm

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39815
May 13, 1994

Lab Sample No. 39815-1 Client ID: Well #6

ICP Metals Per EPA Method 6010
Date Analyzed: 5-2-94
Units: mg/L

Parameter	Result	PQL
Calcium	25	1.0
Magnesium	18	1.0
Potassium	9.8	1.0
Sodium	160	1.0

ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39815
May 13, 1994

Lab Sample No. 39815-2 Client ID: Engle Deep

General Chemistry

Parameter	Method	Result	PQL
Bromide, mg/L	EPA 300.0	0.49	0.05
Chloride, mg/L	EPA 300.0	140	5
Sulfate, mg/L	EPA 300.0	28	5
Total Phosphate, mg/L	EPA 365.1	0.44	0.01
Alkalinity (as CaCO3), mg/L	SM 2320B	350	2.5
Carbonate (as CaCO3), mg/L	SM 2320B	0	N/A
Bicarbonate (as CaCO3), mg/L	SM 2320B	350	2.5
Hardness (as CaCO3), mg/L	EPA 130.2	71	2
Specific Conductance, umhos/cm	EPA 120.1	1,100	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-2-94
Units: mg/L

Parameter	Result	PQL
Calcium	8.9	1.0
Magnesium	9.2	1.0
Potassium	8.5	1.0
Sodium	180	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

DRINKING WATER REQUEST FOR ANALYSIS

CONTACT HAROLD DILL
COMPANY TOWN OF COUPEVILLE
ADDRESS 600 NE 9th; POB 725
CITY/ STATE/ COUNTY COUPEVILLE, WA 98230
PHONE 206 / 678-6695

Sound Analytical Services, Inc.
4813 Pacific Hwy. E.
Tacoma, WA 98424
(206) 922-2310

SAMPLE INFORMATION
SAMPLED BY H Dill

SEND REPORT TO STATE HEALTH DEPARTMENT? YES (NO)
SEND REPORT TO COUNTY HEALTH DEPARTMENT? YES (NO)

REQUESTED ANALYSIS

	SYSTEM ID	DATE	TIME	CI	PI	SI	PV	VOC	EDB	PST	HRB	TC	FC	FS	EC
				INORGANICS				ORGANICS				MICROBIOLOGY			
1	WELL #6	4-26-94	0730												
2	ENGLE DEEP	4-26-94	0815												
3															
4															
5															
6															
7															

OTHER ANALYSIS

OTHER ANALYSIS

SPECIAL INSTRUCTIONS: TEST FOR: ALKALINITY, BICARBONATE, CARBONATE, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM, BROMIDE, CHLORIDE, SULFATE, TOTAL PHOSPHATE, HARDNESS & SPECIFIC CONDUCTANCE

ANALYSIS CODE:

INORGANICS: COMPLETE INORGANICS = CI PRIMARY INORGANICS = PI SECONDARY INORGANICS = SI PHASE II & V = PV

ORGANICS: VOLATILE ORGANIC COMPOUNDS = VOC EDB/DBCP = EDB PESTICIDES = PST HERBICIDES = HRB

MICROBIOLOGY: TOTAL COLIFORM = TC FECAL COLIFORM = FC FECAL STREP = FS E COLI = EC

Relinquished by	Date/Time	Received by Siang	Date/Time 4-28-94 1230pm
Relinquished by	Date/Time	Received by	Date/Time

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

TRANSMITTAL MEMORANDUM

DATE: May 13, 1994

TO: Harold Dill
Town of Coupeville

LABORATORY NUMBER: 39815

Two water samples were received for analysis at Sound Analytical Services, Inc., on April 28, 1994, and were assigned Laboratory Work Order Number 39815.

If there are any questions regarding this work order, please do not hesitate to call me at (206) 922-2310.

Sincerely,

J. Christopher Shaeffer
Project Manager

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS
4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville   Date: May 5, 1994

Report On: Analysis of Water   Lab No.: 39662

IDENTIFICATION:
Samples received on 04-21-94   4/19/94

ANALYSIS:

Lab Sample No. 39662-1   Client ID: Well #1

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Bromide	EPA 300.0	0.58	0.05
Total Phosphate	EPA 365.1	0.23	0.01
Alkalinity (as $CaCO_3$)	EPA 310.5	370	2.5
Bicarbonate (as $CaCO_3$)	SM 2320B	370	2.5
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A

ICP Metals Per EPA Method 6010
Date Analyzed: 4-25-94
Units: mg/L

Parameter	Result	PQL
Calcium	36	1.0
Magnesium	43	1.0
Potassium	13	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER 107- 39662-1

DATE RECEIVED 04-21-94

1. Date Collected 4-19-94

2. System Name: WELL #1

3. System ID

4. Circle Group A B

5. County:

6. Source Type: (circle) Surface (Well — circled) Spring Purchase

Sample Taken (circle) (Before Treatment — circled) After Treatment

8. Source No.: Source Name:

10. Collected By: H DILL
Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ____ Water Softener Type ____

12. If taken from distribution, indicate address
Name:

13. Party to pay for testing:
Name: TOWN OF COUPEVILLE
Address: POB 725 COUPEVILLE - 98239
Telephone: (206) 678-6695

14. Remarks
SEE ATACHED

LABORATORY REPORT
(Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		130	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		280	mg/L			MC
Conductivity		700		1,200	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		160	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		3	mg/L		Y	RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

Reference SOP #SAS-0513

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39662
May 5, 1994

Lab Sample No. 39662-2

Client ID: Well #4

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Bromide	EPA 300.0	0.29	0.05
Total Phosphate	EPA 365.1	0.09	0.01
Alkalinity (as $CaCO_3$)	EPA 310.5	420	2.5
Bicarbonate (as $CaCO_3$)	SM 2320B	420	2.5
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A

ICP Metals Per EPA Method 6010
Date Analyzed: 4-25-94
Units: mg/L

Parameter	Result	PQL
Calcium	81	1.0
Magnesium	54	1.0
Potassium	8.7	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS. PLEASE FILL BOXES NUMBERED 1 THRU 13. SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-39662-2

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94

2. System Name: WELL #4

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface (Well) Spring Purchase

7. Sample Taken (circle) (Before Treatment) After Treatment

8. Source No: Source Name:

10. Collected By: H DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ____ Water Softener Type ____

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		52	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		440	mg/L			MC
Conductivity		700		1,100	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		88	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		37	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: [signature] PALMQUIST

Date of Report: 05-05-94

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39662
May 5, 1994

Lab Sample No. 39662-3

Client ID: Well #5

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Bromide	EPA 300.0	0.26	0.05
Total Phosphate	EPA 365.1	0.09	0.01
Alkalinity (as $CaCO_3$)	EPA 310.5	410	2.5
Bicarbonate (as $CaCO_3$)	SM 2320B	410	2.5
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A

ICP Metals Per EPA Method 6010
Date Analyzed: 4-25-94
Units: mg/L

Parameter	Result	PQL
Calcium	64	1.0
Magnesium	48	1.0
Potassium	10	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-39662-3

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94
2. System Name: WELL #5
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface, (Well — circled), Spring, Purchase
7. Sample Taken (circle): (Before Treatment — circled), After Treatment
8. Source No.: Source Name:
10. Collected By: H. DILL
Telephone: (206) 678-6695
11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other ______, Water Softener Type
12. If taken from distribution, indicate address
Name:
13. Party to pay for testing:
Name: TOWN OF COUPEVILLE
Address: POB 725 COUPEVILLE, WA 98239
Telephone: (206) 678-6695
14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		70	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		380	mg/L			MC
Conductivity		700		1,000	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		80	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		29	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39662
May 5, 1994

Lab Sample No. 39662-4 Client ID: Bills Well

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Bromide	EPA 300.0	0.33	0.05
Total Phosphate	EPA 365.1	0.09	0.01
Alkalinity (as $CaCO_3$)	EPA 310.5	390	2.5
Bicarbonate (as $CaCO_3$)	SM 2320B	390	2.5
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A

ICP Metals Per EPA Method 6010
Date Analyzed: 4-25-94
Units: mg/L

Parameter	Result	PQL
Calcium	31	1.0
Magnesium	48	1.0
Potassium	18	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-4

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94
2. System Name: BILLS WELL
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface (Well — circled) Spring Purchase
7. Sample Taken (circle) (Before Treatment — circled) After Treatment
8. Source No.: Source Name:
10. Collected By: H. DILL Telephone: (206) 678-6695
11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ____ Water Softener Type
12. If taken from distribution, indicate address Name:
13. Party to pay for testing: Name: TOWN OF COUPEVILLE Address: POB 725 COUPEVILLE, WA 98239 Telephone: (206) 678-6695
14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		100	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		290	mg/L			MC
Conductivity		700		1,100	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		110	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		23	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: [illegible] FALHOUST

Date of Report: 05-05-94

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39662
May 5, 1994

Lab Sample No. 39662-5

Client ID: Engle Well

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Bromide	EPA 300.0	0.69	0.05
Total Phosphate	EPA 365.1	0.08	0.01
Alkalinity (as $CaCO_3$)	EPA 310.5	350	2.5
Bicarbonate (as $CaCO_3$)	SM 2320B	350	2.5
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A

ICP Metals Per EPA Method 6010
Date Analyzed: 4-25-94
Units: mg/L

Parameter	Result	PQL
Calcium	12	1.0
Magnesium	12	1.0
Potassium	8.8	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

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WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-5

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94
2. System Name: ENGLE DEEP
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface, (Well — circled), Spring, Purchase
7. Sample Taken (circle): (Before Treatment — circled), After Treatment
8. Source No.: Source Name:
10. Collected By: H. DILL — Telephone: (206) 678-6695
11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other ______, Water Softener Type
12. If taken from distribution, indicate address — Name:
13. Party to pay for testing: Name: TOWN OF COUPEVILLE — Address: POB 725 Coupeville, WA 98239 — Telephone: (206) 678-6695
14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		240	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		80	mg/L			MC
Conductivity		700		1,300	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		200	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		40	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: [illegible signature]

Date of Report: 05-05-94

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39662
May 5, 1994

Lab Sample No. 39662-6 Client ID: Well #6

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Bromide	EPA 300.0	1.1	0.05
Total Phosphate	EPA 365.1	0.20	0.01
Alkalinity (as $CaCO_3$)	EPA 310.5	330	2.5
Bicarbonate (as $CaCO_3$)	SM 2320B	330	2.5
arbonate (as $CaCO_3$)	SM 2320B	0	N/A

ICP Metals Per EPA Method 6010
Date Analyzed: 4-25-94
Units: mg/L

Parameter	Result	PQL
Calcium	26	1.0
Magnesium	23	1.0
Potassium	14	1.0

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 - FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-6

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94
2. System Name: WELL #6
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface (Well) Spring Purchase
7. Sample Taken (circle) (Before Treatment) After Treatment
8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-4495

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ____ Water Softener Type

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		250	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		170	mg/L			MC
Conductivity		700		1,600	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		290	mg/L		N	RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		52	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

SOUND ANALYTICAL SERVICES, INC.

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WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-1

DATE RECEIVED: 04-21-94

1. Date Collected: 4-19-94

2. System Name: WELL #1

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface, **Well** (circled), Spring, Purchase

7. Sample Taken (circle): **Before Treatment** (circled), After Treatment

8. Source No.: Source Name:

10. Collected By: H DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other ______, Water Softener Type ______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE - 98239

Telephone: (206) 678-6695

14. Remarks: SEE ATACHED

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		130	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		280	mg/L			MC
Conductivity		700		1,200	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		160	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		3	mg/L		Y	RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

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SOUND ANALYTICAL SERVICES, INC.

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WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-2

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94
2. System Name: WELL #4
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface, **Well** (circled), Spring, Purchase
7. Sample Taken (circle): **Before Treatment** (circled), After Treatment
8. Source No.: Source Name:
10. Collected By: H. DILL — Telephone: (206) 678-6695
11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other ______, Water Softener Type ______
12. If taken from distribution, indicate address — Name:
13. Party to pay for testing: Name: TOWN OF COUPEVILLE — Address: POB 725 COUPEVILLE, WA 98239 — Telephone: (206) 678-6695
14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		52	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		440	mg/L			MC
Conductivity		700		1,100	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		88	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		37	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

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SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER 107- 39662-3

DATE RECEIVED 04-21-94

1. Date Collected 04-19-94

2. System Name: WELL #5

3. System ID

4. Circle Group A B

5. County:

6. Source Type: (circle) Surface (Well) Spring Purchase

7. Sample Taken (circle) (Before Treatment) After Treatment

8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other _______ Water Softener Type _______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		70	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		380	mg/L			MC
Conductivity		700		1,000	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		80	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		29	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

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SOUND ANALYTICAL SERVICES, INC.

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WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-6

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94

2. System Name: WELL #6

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface (Well — circled) Spring Purchase

7. Sample Taken (circle): (Before Treatment — circled) After Treatment

8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		250	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		170	mg/L			MC
Conductivity		700		1,600	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		290	mg/L		N	RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		52	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER 107- 39662-5

DATE RECEIVED 04-21-94

1. Date Collected 04-19-94
2. System Name: ENGLE DEEP
3. System ID
4. Circle Group A B
5. County:
6. Source Type: (circle) Surface **(Well)** Spring Purchase
7. Sample Taken (circle) **(Before Treatment)** After Treatment
8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT
(Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		240	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		80	mg/L			MC
Conductivity		700		1,300	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		200	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		40	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

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SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 39662-4

DATE RECEIVED: 04-21-94

1. Date Collected: 04-19-94

2. System Name: BILLS WELL

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface (Well) Spring Purchase

7. Sample Taken (circle): (Before Treatment) After Treatment

8. Source No.: Source Name:

10. Collected By: H. DILL
Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address
Name:

13. Party to pay for testing:
Name: TOWN OF COUPEVILLE
Address: POB 725 COUPEVILLE, WA 98239
Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT
(Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		100	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		290	mg/L			MC
Conductivity		700		1,100	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		110	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		23	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-05-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville — Date: June 14, 1994

Report On: Analysis of Water — Lab No.: 40486

IDENTIFICATION:
Samples received on 05-25-94 — Sampled on 5/23/94

ANALYSIS:

Lab Sample No. 40486-1 — Client ID: Well #1

ICP Metals Per EPA Method 6010
Date Analyzed: 5-31-94
Units: mg/L

Parameter	Result	PQL
Calcium	32	0.50
Magnesium	40	0.50
Potassium	12	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	370	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	370	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.60	0.05
Total Phosphate, mg/L	EPA 365.1	0.28	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

2

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-40486-1

DATE RECEIVED: 05-25-94

1. Date Collected: 05-23-94
2. System Name:
3. System ID
4. Circle Group: A B
5. County:
6. Source Type: (circle) Surface **(Well)** Spring Purchase
7. Sample Taken (circle) **(Before Treatment)** After Treatment
8. Source No.: Source Name:
10. Collected By: H. Dill
Telephone: (206) 678-6695
11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ________ Water Softener Type ________
12. If taken from distribution, indicate address
Name:
13. Party to pay for testing:
Name: Town of Coupeville
Address: P.O.B. 725 Coupeville, WA 98239
Telephone: (206) 678-6695
14. Remarks: CLIENT ID: WELL #1

LABORATORY REPORT (Do Not Write Inside This Box)

Well 1

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		110	mg/L			
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		280	mg/L			MC
Conductivity		700		1,200	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		170	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		3	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: Stan Palmquist

Date of Report: 06-14-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 40486
June 14, 1994

Lab Sample No. 40486-2 Client ID: Well #4

ICP Metals Per EPA Method 6010
Date Analyzed: 5-31-94
Units: mg/L

Parameter	Result	PQL
Calcium	82	0.50
Magnesium	57	0.50
Potassium	9.6	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	470	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	470	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.40	0.05
Total Phosphate, mg/L	EPA 365.1	0.11	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER 107-40486-2

DATE RECEIVED 05-25-94

1. Date Collected 05-23-94
2. System Name:
3. System ID 4. Circle Group A B
5. County:
6. Source Type: (circle) Surface (Well) Spring Purchase
7. Sample Taken (circle) (Before Treatment) After Treatment
8. Source No.: Source Name:

10. Collected By: H. Dill

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing: Town of Coupeville

Name:

Address: P.O.B. 725 Coupeville, WA 98239

Telephone: (206) 678-6695

14. Remarks Client ID: Well #4

LABORATORY REPORT (Do Not Write Inside This Box) — Well 4

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		56	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		520	mg/L			MC
Conductivity		700		1,200	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		120	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		50	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: Stan Palmquist

Date of Report: 06-14-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 40486
June 14, 1994

Lab Sample No. 40486-3 Client ID: Well #5

ICP Metals Per EPA Method 6010
Date Analyzed: 5-31-94
Units: mg/L

Parameter	Result	PQL
Calcium	41	0.50
Magnesium	58	0.50
Potassium	6.2	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	400	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	400	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.26	0.05
Total Phosphate, mg/L	EPA 365.1	0.09	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-40486-3

DATE RECEIVED: 05-25-94

1. Date Collected: 05-23-94

2. System Name:

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface, **Well** (circled), Spring, Purchase

7. Sample Taken (circle): **Before Treatment** (circled), After Treatment

8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation, Chlorination, Filtration, Other _______, Water Softener Type _______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: Town of Coupeville

Address: P.O. B. 725 Coupeville, WA 98239

Telephone: (206) 678-6695

14. Remarks: CLIENT ID: WELL #5

Well 5

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		46	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		390	mg/L			MC
Conductivity		700		950	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		62	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		43	mg/L	Y		RK
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 06-14-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 40486
June 14, 1994

Lab Sample No. 40486-4 Client ID: Bills Well

ICP Metals Per EPA Method 6010
Date Analyzed: 5-31-94
Units: mg/L

Parameter	Result	PQL
Calcium	27	0.50
Magnesium	44	0.50
Potassium	20	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	380	3
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	380	3
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.35	0.05
Total Phosphate, mg/L	EPA 365.1	0.10	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107-40486-4

DATE RECEIVED: 05-25-94

Bill Engles

LABORATORY REPORT (Do Not Write Inside This Box)

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		89	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		290	mg/L			MC
Conductivity		700		1,100	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		120	mg/L	Y		RK
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		23	mg/L	Y		RK
TDS		500			mg/L			

1. Date Collected: 05-23-94

2. System Name:

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface **Well** (circled) Spring Purchase

7. Sample Taken (circle) **Before Treatment** (circled) After Treatment

8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: P.O.B. 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks: CLIENT ID: BILLS WELL

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 06-14-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

DRINKING WATER R QUEST FOR ANALYSIS

CONTACT HAROLD DILL
COMPANY TOWN OF COUPEVILLE
ADDRESS P.O. B. 725; 600 NE 9th
CITY/ STATE/ COUNTY COUPEVILLE, WA, 98239
PHONE 206 1678-6695

Sound Analytical Services, Inc.
4813 Pacific Hwy. E.
Tacoma, WA 98424
(206) 922-2310

SAMPLE INFORMATION
SAMPLED BY H Dill

SEND REPORT TO STATE HEALTH DEPARTMENT? YES (NO)
SEND REPORT TO COUNTY HEALTH DEPARTMENT? YES (NO)

REQUESTED ANALYSIS

	SYSTEM ID	DATE	TIME	CI	PI	SI	PV	VOC	EDB	PST	HRB	TC	FC	FS	EC
				INORGANICS				ORGANICS				MICROBIOLOGY			
1	WELL #1	5/23/94													
2	WELL #4	"													
3	WELL #5	"													
4	BILLS WELL	"													
5															
6															
7															

OTHER ANALYSIS
OTHER ANALYSIS

SPECIAL INSTRUCTIONS: TEST FOR: ALKALINITY, BICARBONATE, CARBONATE, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM, BROMIDE, CHLORIDE, SULFATE, TOTAL PHOSPHATE, HARDNESS, & CONDUCTANCE

ANALYSIS CODE:
INORGANICS: COMPLETE INORGANICS = CI PRIMARY INORGANICS = PI SECONDARY INORGANICS = SI PHASE II & V = PV
ORGANICS: VOLATILE ORGANIC COMPOUNDS = VOC EDB/DBCP = EDB PESTICIDES = PST HERBICIDES = HRB
MICROBIOLOGY: TOTAL COLIFORM = TC FECAL COLIFORM = FC FECAL STREP = FS E COLI = EC

Relinquished by	Date/Time	Received by	Date/Time
		D. Nguyen	5-25-94

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

RECEIVED

JUN 16 1994

TOWN OF COUPEVILLE

TRANSMITTAL MEMORANDUM

DATE: June 14, 1994

TO: Harold Dill
Town of Coupeville

LABORATORY NUMBER: 40486

Four water samples were received for analysis at Sound Analytical Services, Inc., on May 25, 1994, and was assigned Laboratory Work Order Number 40486.

Enclosed is a copy of the completed Washington State Department of Health Drinking Water Report. Copies of this report have been sent to the following parties:

✓ Client

___ State Health Department (Olympia & Regional)

___ County Health Department

___ Other ____________________

If there are any questions regarding this work order, please do not hesitate to call me at (206) 922-2310.

Sincerely,

J. Christopher Shaeffer
Project Manager

JCS:tm

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville — Date: June 3, 1994

Report On: Analysis of Water — Lab No.: 40357

IDENTIFICATION:
Samples received on 05-19-94 — Sampled on 5/18/94

ANALYSIS:

Lab Sample No. 40357-1 — Client ID: WELL #6

ICP Metals Per EPA Method 6010
Date Analyzed: 5-23-94
Units: mg/L

Parameter	Result	PQL
Calcium	31	0.50
Magnesium	22	0.50
Potassium	11	0.50
Sodium	180	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	340	2.5
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	340	2.5
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.85	0.05
Chloride, mg/L	EPA 300.0	220	10
Sulfate, mg/L	EPA 300.0	36	10
Total Phosphate, mg/L	EPA 365.1	0.23	0.01
Hardness (as $CaCO_3$), mg/L	EPA 130.2	190	2
Conductivity, NTU	EPA 120.1	1,400	10

ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 40357
June 3, 1994

Lab Sample No. 40357-2 Client ID: ENGLE DEEP

ICP Metals Per EPA Method 6010
Date Analyzed: 5-23-94
Units: mg/L

Parameter	Result	PQL
Calcium	11	0.50
Magnesium	10	0.50
Potassium	9.5	0.50
Sodium	180	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	SM 2320B	340	2.5
Bicarbonate (as $CaCO_3$), mg/L	SM 2320B	340	2.5
Carbonate (as $CaCO_3$), mg/L	SM 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.45	0.05
Chloride, mg/L	EPA 300.0	120	5
Sulfate, mg/L	EPA 300.0	26	5
Total Phosphate, mg/L	EPA 365.1	0.42	0.01
Hardness (as $CaCO_3$), mg/L	EPA 130.2	75	2
Conductivity, NTU	EPA 120.1	1,100	10

ND - Not Detected
PQL - Practical Quantitation Limit

DRINKING WATER REQUEST FOR ANALYSIS

CONTACT HAROLD DILL
COMPANY TOWN OF COUPEVILLE
ADDRESS POB 725; 600 NE 9th
CITY/ STATE/ COUNTY COUPEVILLE, WA. 98239
PHONE 206 / 678-6695

Sound Analytical Services, Inc.

4813 Pacific Hwy. E.
Tacoma, WA 98424
(206) 922-2310

SAMPLE INFORMATION
SAMPLED BY H Dill

SEND REPORT TO STATE HEALTH DEPARTMENT? YES (NO)
SEND REPORT TO COUNTY HEALTH DEPARTMENT? YES (NO)

REQUESTED ANALYSIS

				INORGANICS				ORGANICS				MICROBIOLOGY			
	SYSTEM ID	DATE	TIME	CI	PI	SI	PV	VOC	EDB	PST	HRB	TC	FC	FS	EC
1	WELL #6														
2	ENGLE DEEP														
3															
4															
5															
6				OTHER ANALYSIS											
7				OTHER ANALYSIS											

SPECIAL INSTRUCTIONS: TEST FOR ALKALINITY, BICARBONATE, CARBONATE, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM, BROMIDE, CHLORIDE, SULFATE, TOTAL PHOSPHATE, HARDNESS, & CONDUCTANCE

ANALYSIS CODE:

INORGANICS: COMPLETE INORGANICS = CI PRIMARY INORGANICS = PI SECONDARY INORGANICS = SI PHASE II & V = PV

ORGANICS: VOLATILE ORGANIC COMPOUNDS = VOC EDB/DBCP = EDB PESTICIDES = PST HERBICIDES = HRB

MICROBIOLOGY: TOTAL COLIFORM = TC FECAL COLIFORM = FC FECAL STREP = FS E COLI = EC

Relinquished by ________ Date/Time ________ Received by D. Dyger Date/Time 5/19/94
Relinquished by ________ Date/Time ________ Received by ________ Date/Time ________

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

RECEIVED
JUN 9 1994
TOWN OF COUPEVILLE

TRANSMITTAL MEMORANDUM

DATE: June 3, 1994

TO: Harold Dill
Town of Coupeville

LABORATORY NUMBER: 40357

Two water samples were received for analysis at Sound Analytical Services, Inc., on May 19, 1994, and was assigned Laboratory Work Order Number 40357.

Enclosed is a copy of the completed Washington State Department of Health Drinking Water Report. Copies of this report have been sent to the following parties:

✓ Client

___ State Health Department (Olympia & Regional)

___ County Health Department

___ Other ____________________

If there are any questions regarding this work order, please do not hesitate to call me at (206) 922-2310.

Sincerely,

J. Christopher Shaeffer
Project Manager

JCS:tm

MTC JUN 21 1994 ***Analytical/Environmental Services***

Materials Testing & Consulting, Inc TOWN OF COUPEVILLE (206)757-1400 - FAX (206)757-1402

1151 Knudson Rd Burlington, WA 98233

Client: COUPEVILLE, TOWN OF
P O Box 725
COUPEVILLE, WA 98239

Reference: **94-0881**
Project: Town of Coupeville

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

Laboratory Number: **04601979**

Date Received: **5/19/94**

1. Date Collected: **5/18/94**

2. System Name: **COUPEVILLE, TOWN OF**

3. System ID #: **155509**

4. Circle Group: **A B**

5. County: **Island**

6. Source Type: **Groundwater**

7. Sample Taken (Before or After Treatment): **No Treatment**

8. Source Number:

9. Source Name: **WELL #6**

10. Collected By: **Harold Dill**
Telephone: **678-6695**

11. If Taken After Treatment,
Treatment Type:

12. If Taken From Distribution,
Indicate Address:

14. Remarks:

Analyte		*MCL	Result	UNITS	SRL	Complies
Antimony	Sb	0.006	<0.005	mg/L	0.005	Yes
Arsenic	As	0.050	<0.01	mg/L	0.01	Yes
Barium	Ba	2.00	0.1	mg/L	0.1	Yes
Beryllium	Be	0.004	<0.002	mg/L	0.002	Yes
Cadmium	Cd	0.005	<0.002	mg/L	0.002	Yes
Chromium	Cr	0.10	<0.01	mg/L	0.01	Yes
Copper	Cu	1.3*	<0.02	mg/L	0.02	Yes
Iron	Fe	0.30	0.06	mg/L	0.05	Yes
Lead	Pb	0.015*	<0.002	mg/L	0.002	Yes
Manganese	Mn	0.050	0.13	mg/L	0.01	No
Mercury	Hg	0.0020	<0.0005	mg/L	0.0005	Yes
Nickel	Ni	0.10	<0.04	mg/L	0.04	Yes
Selenium	Se	0.050	<0.005	mg/L	0.005	Yes
Silver	Ag	0.050	<0.010	mg/L	0.01	Yes
Sodium	Na		216.0	mg/L	1.0	
Thallium	Tl	0.002	<0.001	mg/L	0.001	Yes
Zinc	Zn	5.00	<0.05	mg/L	0.05	Yes
Hardness			169	mg CaCO3/L	10	
Specific Conductance		700	1409	uS	10	No
Turbidity		1.0	0.5	NTU	0.1	Yes
Color		15	<5	CU	5	Yes
Chloride	Cl	250	205.0	mg/L	20	Yes
Cyanide	CN	0.20	<0.10	mg/L	0.10	Yes
Fluoride	F	2.0	<0.5	mg/L	0.5	Yes
Nitrate-N	NO3-N	10.0	<0.5	mg/L	0.5	Yes
Nitrite-N	NO2-N	1.0	<0.5	mg/L	0.5	Yes
Sulfate	SO4	250	39	mg/L	10	Yes
Total Dissolved Solids		500	750	mg/L	150	No

Laboratory Comments:

P.J. [signature]

Laboratory Supervisor: [signature]

Date of Report: 6/17/94

MCL - Maximum Contamination Level; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper

SRL - Specified Reporting Limit; NA - Not Analyzed; < - "less than"

MTC **Analytical/Environmental Services**

Materials Testing & Consulting, Inc

P.O. Box 309
Mount Vernon, WA 98273
(206)757-1400 - FAX (206)757-1402

Inorganic Chemical Data Report

Client: COUPEVILLE, TOWN OF
P O Box 725
COUPEVILLE, WA 98239

Report Date: 6/17/94
Reference: 94-0881
Project: Town of Coupeville

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

System Name: **COUPEVILLE, TOWN OF**
System ID Number: **155509**
DOH Source Number:
Source Type: **Groundwater**

County: **Island**
Lab Number: **04601979**
Sample Date: **5/18/94**
Date Received: **5/19/94**

Analyte		Method	Result			MRL	UNITS
pH.W		150.1	8.29				pH Units
Silica Molybdate reactive	Si	4500-SI D	<0.5			0.5	mg/L
Silica Molybdate unreactive	Si	4500-SI D	5.04			0.5	mg/L
Alkalinity	Alka	310.1	155.87				mg/L
Tannins(lignins)		SM5550	0.25				mg/L

Patricia B. Jaussi
Inorganics Chemist

QC Review

*MCL - Maximum Contamination Level
MRL - Method Reporting Limit

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT: Materials Testing Labs
1151 Knudson Road
Burlington, WA 98233

ATTN : Don Verrue

Certificate of Analysis

Work Order# : 94-05-794
DATE RECEIVED : 05/20/94
DATE OF REPORT: 05/25/94

Work ID : Town of Coupeville Well #6
Taken By : Client
Transported by: Hand Delivered
Type : Water

SAMPLE IDENTIFICATION:

	Sample Description	Collection Date
01	Well #6	05/18/94

FLAGGING:

The flag "U" indicates the analyte of interest was not detected, to the limit of detection indicated.

ATTACHMENTS:

Following presentation of sample results, the following appendices are attached to this report:

Appendix A: Method Blank Report
Appendix B: Matrix Spike/Duplicate Report
Appendix C: Standard Reference Material Report
Appendix D: Chain-of-Custody

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT : Materials Testing Labs

Certificate of Analysis

Work Order# : 94-05-794

Unless otherwise instructed all samples will be discarded on 07/18/94

Respectfully submitted,
Laucks Testing Laboratories, Inc.

J. M. Owens

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT : Materials Testing Labs

Certificate of Analysis

Work Order # 94-05-794

TESTS PERFORMED AND RESULTS:

Analyte	Units	01
Total Organic Carbon	mg/L	1.0

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

APPENDIX A

Method Blank Report

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

Quality Control Report
Method Blanks for Work Order 9405794

Blank Name	Samples Verified	Test Description	Result	Units	Control Limit
B052494_TOC_W01	1	Total Organic Carbon	1.0 U	mg/L	2.0
B052494_TOC_W02	1	Total Organic Carbon	1.0 U	mg/L	2.0

A method blank can validate more than one analyte on more than one work order. The method blanks in this report may validate analytes not determined on this work order, but nonetheless determined in the associated blank.

Because they validate more than one work order, method blank results are not always reported in the same concentration units or to the same detection limits that are used for sample results.

* = blank exceeds control limit

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

APPENDIX B

Matrix Spike/Duplicate Report

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

Quality Control Report
Matrix Spike/Duplicate Report for Work Order 9405794

MS/Dupe Name	Sample Fractions Verified	Sample	Analyte	RPD	MS Recov	Cont. Limits RPD	Cont. Limits LCL	Cont. Limits UCL
M052494_TOCW01	1	9405707-01	Total Organic Carbon	2.8	98	11	70	119

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
LCL = Lower Control Limit
UCL = Upper Control Limit
L = RPD control limit for this analyte is 5x the detection limit. The value appearing in the RPD column is the absolute difference of the duplicates.
-1 for recovery value indicates that recovery could not be calculated

An MS/Duplicate pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this MS/Duplicate report.

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

APPENDIX C

Standard Reference Material Report

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS
4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville　　　Date: May 24, 1994

Report On: Analysis of Water　　　Lab No.: 40164

IDENTIFICATION:
Samples received on 05-12-94

ANALYSIS:

Lab Sample No. 40164-1　　　Client ID: Well #6

ICP Metals Per EPA Method 6010
Date Analyzed: 5-13-94
Units: mg/L

Parameter	Result	PQL
Calcium	29	0.50
Magnesium	21	0.50
Potassium	14	0.50

General Chemistry　　Sampled on 5/10/94

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	EPA 2320B	350	2.5
Bicarbonate (as $CaCO_3$), mg/L	EPA 2320B	350	2.5
Carbonate (as $CaCO_3$), mg/L	EPA 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.83	0.05
Total Phosphorus, mg/L	EPA 365.1	0.23	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER: 107- 40164-1

DATE RECEIVED: 05-12-94

1. Date Collected: 5-10-94

2. System Name: WELL #6

3. System ID

4. Circle Group: A B

5. County:

6. Source Type: (circle) Surface **Well** Spring Purchase

7. Sample Taken (circle) **Before Treatment** After Treatment

8. Source No.: Source Name:

10. Collected By: [illegible signature]

Telephone: 206 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other _____ Water Softener Type _____

12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks: GET [illegible]

LABORATORY REPORT (Do Not Write Inside This Box) — Well 6

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		180	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		180	mg/L			MC
Conductivity		700		1,300	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		220	mg/L	Y		TB
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		32	mg/L	Y		TB
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-24-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 40164
May 24, 1994

Lab Sample No. 40164-2 Client ID: Engle Deep

ICP Metals Per EPA Method 6010
Date Analyzed: 5-13-94
Units: mg/L

Sampled on 5/10/94

Parameter	Result	PQL
Calcium	10	0.50
Magnesium	10	0.50
Potassium	9.9	0.50

General Chemistry

Parameter	Method	Result	PQL
Alkalinity (as $CaCO_3$), mg/L	EPA 2320B	350	2.5
Bicarbonate (as $CaCO_3$), mg/L	EPA 2320B	350	2.5
Carbonate (as $CaCO_3$), mg/L	EPA 2320B	0	N/A
Bromide, mg/L	EPA 300.0	0.58	0.05
Total Phosphorus, mg/L	EPA 365.1	0.45	0.01

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 • TELEPHONE 206-922-2310 • FAX 206-922-5047

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSIS

DO NOT WRITE IN SHADED AREAS, PLEASE FILL BOXES NUMBERED 1 THRU 13, SEE BACK FOR INSTRUCTIONS

LABORATORY NUMBER 107- 40164-2

DATE RECEIVED 05-12-94

1. Date Collected 05-10-94
2. System Name: ENGLE DEEP
3. System ID 4. Circle Group A B
5. County:
6. Source Type: (circle) Surface (Well) Spring Purchase
7. Sample Taken (circle) (Before) Treatment After Treatment
8. Source No.: Source Name:

10. Collected By: H. DILL

Telephone: (206) 678-6695

11. If taken after treatment, circle: Fluoridation Chlorination Filtration Other ______ Water Softener Type ______
12. If taken from distribution, indicate address

Name:

13. Party to pay for testing:

Name: TOWN OF COUPEVILLE

Address: POB 725 COUPEVILLE, WA 98239

Telephone: (206) 678-6695

14. Remarks

LABORATORY REPORT (Do Not Write Inside This Box) Engles Deep

Tests		MCL	Less Than <	Result	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic	As	0.05			mg/L			
Barium	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium	Cd	0.005			mg/L			
Chromium	Cr	0.1			mg/L			
Copper	Cu	1.3			mg/L			
Iron	Fe	0.3			mg/L			
Lead	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium	Se	0.050			mg/L			
Silver	Ag	0.1			mg/L			
Sodium	Na	None		200	mg/L			PB
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness		None		76	mg/L			MC
Conductivity		700		1,200	umhos		N	MC
Turbidity		1.0			NTU			
Color		15.0			Units			
Chloride	Cl	250		170	mg/L	Y		TB
Cyanide	CN	0.2			mg/L			
Fluoride	F	2.0			mg/L			
Nitrate	as N	10.0			mg/L			
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250		33	mg/L	Y		TB
TDS		500			mg/L			

LABORATORY COMMENTS

Laboratory Supervisor: STAN PALMQUIST

Date of Report: 05-24-94

MCL - Maximum Contaminant Level

Reference SOP #SAS-0513

WHITE COPY - STATE GREEN COPY - CUSTOMER BLUE COPY - LABORATORY GOLDENROD COPY - REGIONAL OFFICE

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

TRANSMITTAL MEMORANDUM

RECEIVED

MAY 25 1994

TOWN OF COUPEVILLE

DATE: May 24, 1994

TO: Harold Dill
Town of Coupeville

LABORATORY NUMBER: 40164

Two water samples were received for analysis at Sound Analytical Services, Inc., on May 12, 1994, and was assigned Laboratory Work Order Number 40164.

Enclosed is a copy of the completed Washington State Department of Health Drinking Water Report. Copies of this report have been sent to the following parties:

✓ Client

___ State Health Department (Olympia & Regional)

___ County Health Department

___ Other ____________________

If there are any questions regarding this work order, please do not hesitate to call me at (206) 922-2310.

Sincerely,

J. Christopher Shaeffer
Project Manager

JCS:tm

DRINKING WATER REQUEST FOR ANALYSIS

CONTACT HAROLD DILL
COMPANY TOWN OF COUPEVILLE
ADDRESS POB 725 ; 600 NE 9th
CITY/ STATE/ COUNTY COUPEVILLE, WA 98239
PHONE 206 / 678-6695

Sound Analytical Services, Inc.
4813 Pacific Hwy. E.
Tacoma, WA 98424
(206) 922-2310

SAMPLE INFORMATION
SAMPLED BY H Dill

SEND REPORT TO STATE HEALTH DEPARTMENT? YES NO (circled)
SEND REPORT TO COUNTY HEALTH DEPARTMENT? YES NO (circled)

REQUESTED ANALYSIS

	SYSTEM ID	DATE	TIME	CI	PI	SI	PV	VOC	EDB	PST	HRB	TC	FC	FS	EC
				INORGANICS				ORGANICS				MICROBIOLOGY			
1	WELL #6	5-10-94													
2	ENGLE DEEP	5-10-94													
3															
4															
5															
6															
7															

OTHER ANALYSIS
OTHER ANALYSIS

SPECIAL INSTRUCTIONS: TEST FOR: ALKALINITY, BICARBONATE, CARBONATE, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM, BROMIDE, CHLORIDE, SULFATE, TOTAL PHOSPHATE, HARDNESS, AND CONDUCTANCE

ANALYSIS CODE:
INORGANICS: COMPLETE INORGANICS = CI PRIMARY INORGANICS = PI SECONDARY INORGANICS = SI PHASE II & V = PV
ORGANICS: VOLATILE ORGANIC COMPOUNDS = VOC EDB/DBCP = EDB PESTICIDES = PST HERBICIDES = HRB
MICROBIOLOGY: TOTAL COLIFORM = TC FECAL COLIFORM = FC FECAL STREP = FS E COLI = EC

Relinquished by	Date/Time	Received by Mary Cutler	Date/Time 5/12/94
Relinquished by	Date/Time	Received by	Date/Time

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville   Date: May 13, 1994

Report On: Analysis of Water   Lab No.: 39957

IDENTIFICATION:
Samples received ~~on 04-21-94~~   Sampled on 5/3/94

ANALYSIS:

Lab Sample No. 39957-1   Client ID: Well #1

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Chloride	EPA 300.0	170	10
Sulfate	EPA 300.0	3	1
Bromide	EPA 300.0	0.59	0.05
Total Phosphate	EPA 365.1	0.24	0.01
Alkalinity (as $CaCO_3$)	SM 2320B	380	4
Bicarbonate (as $CaCO_3$)	SM 2320B	380	4
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A
Hardness	EPA 130.2	280	2

General Chemistry

Parameter	Method	Result	PQL
Conductivity, umhos/cm	120.1	1,200	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-6-94
Units: mg/L

Parameter	Result	PQL
Calcium	33	0.50
Magnesium	39	0.50
Potassium	12	0.50
Sodium	120	0.50

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39957
May 13, 1994

Lab Sample No. 39957-2 Client ID: Well #4

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Chloride	EPA 300.0	120	20
Sulfate	EPA 300.0	47	20
Bromide	EPA 300.0	0.38	0.05
Total Phosphate	EPA 365.1	0.09	0.01
Alkalinity (as $CaCO_3$)	SM 2320B	540	4
Bicarbonate (as $CaCO_3$)	SM 2320B	540	4
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A
Hardness	EPA 130.2	500	4

General Chemistry

Parameter	Method	Result	PQL
Conductivity, umhos/cm	120.1	1,200	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-6-94
Units: mg/L

Parameter	Result	PQL
Calcium	84	0.50
Magnesium	54	0.50
Potassium	9.5	0.50
Sodium	60	0.50

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39957
May 13, 1994

Lab Sample No. 39957-3 Client ID: Well #5

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Chloride	EPA 300.0	63	10
Sulfate	EPA 300.0	41	10
Bromide	EPA 300.0	0.24	0.05
Total Phosphate	EPA 365.1	0.20	0.01
Alkalinity (as $CaCO_3$)	SM 2320B	1,100	4
Bicarbonate (as $CaCO_3$)	SM 2320B	1,100	4
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A
Hardness	EPA 130.2	380	4

General Chemistry

Parameter	Method	Result	PQL
Conductivity, umhos/cm	120.1	960	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-6-94
Units: mg/L

Parameter	Result	PQL
Calcium	48	0.50
Magnesium	52	0.50
Potassium	8.0	0.50
Sodium	51	0.50

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39957
May 13, 1994

Lab Sample No. 39957-4 Client ID: Well #6

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Chloride	EPA 300.0	200	10
Sulfate	EPA 300.0	29	10
Bromide	EPA 300.0	0.71	0.05
Total Phosphate	EPA 365.1	0.08	0.01
Alkalinity (as $CaCO_3$)	SM 2320B	1,000	4
Bicarbonate (as $CaCO_3$)	SM 2320B	1,000	4
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A
Hardness	EPA 130.2	170	4
Total Organic Carbon, mg/L	EPA 415.1	1.3	1

General Chemistry

Parameter	Method	Result	PQL
Conductivity, umhos/cm	120.1	1,300	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-6-94
Units: mg/L

Parameter	Result	PQL
Calcium	28	0.50
Magnesium	20	0.50
Potassium	11	0.50
Sodium	180	0.50

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39957
May 13, 1994

Lab Sample No. 39957-5 Client ID: Bills Well

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Chloride	EPA 300.0	110	20
Sulfate	EPA 300.0	23	1
Bromide	EPA 300.0	0.33	0.05
Total Phosphate	EPA 365.1	0.10	0.01
Alkalinity (as $CaCO_3$)	SM 2320B	1,300	4
Bicarbonate (as $CaCO_3$)	SM 2320B	1,300	4
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A
Hardness	EPA 130.2	280	4

General Chemistry

Parameter	Method	Result	PQL
Conductivity, umhos/cm	120.1	1,100	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-6-94
Units: mg/L

Parameter	Result	PQL
Calcium	28	0.50
Magnesium	43	0.50
Potassium	19	0.50
Sodium	92	0.50

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

Town of Coupeville
Lab No. 39957
May 13, 1994

Lab Sample No. 39957-6 Client ID: Engle Deep

General Chemistry
Units: mg/L

Parameter	Method	Result	PQL
Chloride	EPA 300.0	120	20
Sulfate	EPA 300.0	25	1
Bromide	EPA 300.0	0.45	0.05
Total Phosphate	EPA 365.1	0.44	0.01
Alkalinity (as $CaCO_3$)	SM 2320B	1,300	4
Bicarbonate (as $CaCO_3$)	SM 2320B	1,300	4
Carbonate (as $CaCO_3$)	SM 2320B	0	N/A
Hardness	EPA 130.2	80	4

General Chemistry

Parameter	Method	Result	PQL
Conductivity, umhos/cm	120.1	1,100	100

ICP Metals Per EPA Method 6010
Date Analyzed: 5-6-94
Units: mg/L

Parameter	Result	PQL
Calcium	10	0.50
Magnesium	9.9	0.50
Potassium	8.8	0.50
Sodium	170	0.50

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

DRINKING WATER R[illegible]QUEST FOR ANALYSIS

CONTACT HAROLD DILL
COMPANY TOWN OF COUPEVILLE
ADDRESS POB 725 ; 600 NE 9th
CITY/ STATE/ COUNTY COUPEVILLE, WA 98239
PHONE 206 / 678-6695

Sound Analytical Services, Inc.
4813 Pacific Hwy. E.
Tacoma, WA 98424
(206) 922-2310

SAMPLE INFORMATION
SAMPLED BY H Dill

SEND REPORT TO STATE HEALTH DEPARTMENT? YES (NO)
SEND REPORT TO COUNTY HEALTH DEPARTMENT? YES (NO)

REQUESTED ANALYSIS

	SYSTEM ID	DATE	TIME	CI	PI	SI	PV	VOC	EDB	PST	HRB	TC	FC	FS	EC
				INORGANICS				ORGANICS				MICROBIOLOGY			
1	WELL #1	5-3-94													
2	WELL #4	"													
3	WELL #5	"													
4	WELL #6	"													
5	BILLS WELL	"													
6	ENGLE DEEP	"													
7															

OTHER ANALYSIS
OTHER ANALYSIS

SPECIAL INSTRUCTIONS: TEST FOR ALKALINITY, BICARBONATE, CARBONATE, CALCIUM MAGNESIUM, POTASSIUM, SODIUM, BROMIDE, CHLORIDE, SULFATE, TOTAL PHOSPHATE, HARDNESS, & CONDUCTANCE

ANALYSIS CODE:
INORGANICS: COMPLETE INORGANICS = CI PRIMARY INORGANICS = PI SECONDARY INORGANICS = SI PHASE II & V = PV
ORGANICS: VOLATILE ORGANIC COMPOUNDS = VOC EDB/DBCP = EDB PESTICIDES = PST HERBICIDES = HRB
MICROBIOLOGY: TOTAL COLIFORM = TC FECAL COLIFORM = FC FECAL STREP = FS E COLI = EC

Relinquished by ______ Date/Time ______ Received by [signature] Date/Time 5-4-94
Relinquished by ______ Date/Time ______ Received by ______ Date/Time ______

SOUND ANALYTICAL SERVICES, INC.

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

TRANSMITTAL MEMORANDUM

DATE: May 13, 1994

TO: Harold Dill
Town of Coupeville

LABORATORY NUMBER: 39957

Six water samples were received for analysis at Sound Analytical Services, Inc., on May 4, 1994, and assigned Laboratory Work Order Number 39957.

If there are any questions regarding this work order, please do not hesitate to call me at (206) 922-2310.

Sincerely,

J. Christopher Shaeffer
Project Manager

JCS:tm

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Town of Coupeville Date: May 13, 1994

Report On: Analysis of Water Lab No.: 39815

IDENTIFICATION:

Samples received on 04-28-94 Sampled on 4/26/94

ANALYSIS:

Lab Sample No. 39815-1 Client ID: Well #6

General Chemistry

Parameter	Method	Result	PQL
Bromide, mg/L	EPA 300.0	0.66	0.05
Chloride, mg/L	EPA 300.0	180	5
Sulfate, mg/L	EPA 300.0	26	5
Total Phosphate, mg/L	EPA 365.1	0.21	0.01
Alkalinity (as CaCO3), mg/L	SM 2320B	330	2.5
Carbonate (as CaCO3), mg/L	SM 2320B	0	N/A
Bicarbonate (as CaCO3), mg/L	SM 2320B	330	2.5
Hardness (as CaCO3), mg/L	EPA 130.2	160	2
Specific Conductance, umhos/cm	EPA 120.1	1,300	100
Total Organic Carbon, mg/L	EPA 415.1	1.4	1

N/A - Not Applicable
ND - Not Detected
PQL - Practical Quantitation Limit

Appendix E. Well 6 Drilling Report

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

31/1E/3 WG S. Art # 030140
Application No
Permit No

(1) OWNER Name Town of Coupeville Address High School

(2) LOCATION OF WELL County Island SW ¼ NE ¼ Sec 3 T 31 N R 1E WM

Bearing and distance from section or subdivision corner

(3) PROPOSED USE Domestic ☐ Industrial ☐ Municipal ☑
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK Owner's number of well (if more than one) 4 ??
New well ☑ Method Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS Diameter of well 8 inches
Drilled 520 ft Depth of completed well 520 ft

(6) CONSTRUCTION DETAILS
Casing installed 8" Diam from 0 ft to 485 ft
Threaded ☐ Diam from ft to ft
Welded ☐ Diam from ft to ft

Perforations Yes ☐ No ☑
Type of perforator used
SIZE of perforations in by in
perforations from ft to ft
perforations from ft to ft
perforations from ft to ft

Screens Yes ☑ No ☐
Manufacturer's Name Howard Smith Screen Co.
Type Stainless Model No 304
Diam 8 Slot size 30 from 520 ft to 511 ft
Diam 8 Slot size 35 from 511 ft to 501 ft

Gravel packed Yes ☐ No ☑ Size of gravel
Gravel placed from ft to ft

Surface seal Yes ☑ No ☐ To what depth? 18+ ft
Material used in seal Bentonite / Cement
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type HP

(8) WATER LEVELS Land surface elevation above mean sea level 100+ ft
Static level 85 ft below top of well Date 8/31/91
Artesian pressure lbs per square inch Date
Artesian water is controlled by (Cap valve etc)

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☑ If yes by whom?
Yield gal/min with ft drawdown after hrs

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 100+ gal/min with 3' max ft drawdown after 8 hrs
Artesian flow g.p.m Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG

Formation Describe by color, character, size of material and structure and show thickness of aquifers and the kind and nature of the material in each stratum penetrated with at least one entry for each change of formation

MATERIAL	FROM	TO
Topsoil	0	½
HARD Grey Clay	½	121
SANDY Clay	122	138
(Alternating) HARD Clay + Shale	139	383
Fine Water SAND	384	395
Grey HARD Clay	396	437
(No heave) Water Bearing Clay + Gravel mix	438	474
HARD Clay Shale	475	485
Heaving - Fine Water SAND - Sand gravel	486	—
- Lots wood chips -		520

Slot 20 - 510-501
" - 18 500-490
" 15 489-485
"
7 screens - total

RECEIVED
SEP 24 1991
DEPT OF ECOLOGY

Work started 7/18 1991 Completed 8/30 1991

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

NAME Well Dowe Drillers (Person firm or corporation) (Type or print)
Address 429 N. Valley Dr.
[Signed] Jack F. Harris (Well Driller)
License No 1304 Date 9/1, 1991

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050 1 20

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Well Tagging Form

Unique Well Tag No: AGA 992

RECORD VERIFICATION (check ✓ one)

☐ Well Report available *(please attach this form to the well report and submit it to the Ecology Regional Office near you)*

☐ Verification inconclusive   Source #9

☐ Well Report not available

WELL OWNERSHIP, IF DIFFERENT FROM WELL REPORT

First Name COUPEVILLE, TOWN OF   Last Name ______

Street Address ______

City ______   State ______

LOCATION OF WELL, IF DIFFERENT FROM WELL REPORT

Well Address ______

City ______   County ______

T ______ N   R ______ ______ W M   Sec ______ ______ 1/4 of the ______

FOR AGENCY USE ONLY

Latitude ______ ______ ______ ______

Longitude ______ ______ ______ ______ ______

☐ GPS
☐ Topographic Map
☐ Survey
☐ Computer generated

Elevation at land surface ______ feet/meters *(circle one)*

☐ Digital Altimeter
☐ Topographic Map
☐ Other ______

Additional information, if available.

☐ Location marked on topographic map *(please attach)*

☐ Location marked on air photo *(please attach)*

FOR AGENCY USE ONLY

WELL CHARACTERISTICS

ysical Description of well (size of casing type of well housing etc)

12" CASING WOODEN HOUSE (~10') BLUE/TURQUOISE - SITTING IN THE BACK OF THE HIGHSCHOOL PLAY FIELD WELL HEAD IS ~3' ABOVE GROUND

cation of Well identification Tag

CASING

is supplemental tag needed for ease of identifying well? ☐ Yes ☒ No

is where was tag placed? ______

D	C	B	A
	F	G	H
	L	K	J
	P	Q	R

Scale 1 24 000 (1 =2 000)

Indicate the location of the well within the Section by drawing a dot at that point

SECTION ______

[illegible]

IMENTS

FOR ECOLOGY WATER RESOURCES PROGRAM ONLY

Right # ______ Date Issued ______

One Application Permit Certificate Claim Exempt

Appendix F. 2010 Feasibility Assessment Water Demand Calculations

Town of Coupeville

FINAL RECLAIMED WATER FEASIBILITY ASSESSMENT

May 2010

CONSULTANT TEAM

BHC Consultants LLC
John C Wilson PE
Project Manager

Herrera Environmental Consultants

HWA GeoSciences Inc.

Telegraph Engineering LLC

ACKNOWLEDGEMENTS

Nancy Conard
Mayor

Town Council

Position 1	Ann Dannhauer
Position 2	Bob Clay
Position 3	Molly Hughes
Position 4	Dianne Binder
Position 5	Jim Phay

Malcolm Bishop
Public Works Director

Rex Porter
Program Manager

This document was prepared under the direct supervision of the following professional engineer:

JOHN C. WILSON, JR.
STATE OF WASHINGTON
14681
REGISTERED
PROFESSIONAL ENGINEER

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Seattle, WA 98101
206-505-3400

John C Wilson PE
Project Manager

In Association with:

Herrera Environmental Consultants
HWA GeoSciences Inc
Telegraph Engineering LLC

Element 2-B Estimated Demand for Reclaimed Water

1. Overview

This document is a Feasibility Assessment for the use of reclaimed water as summarized through the alternative uses below:

1. Local farmers have indicated interest in reclaimed water for irrigation of over 1,600 acres, which exceeds the quantity that can realistically be provided.
2. An aquifer recharge system can be developed that would accept all of the reclaimed water produced; but it is not clear that such a use would provide a measurable benefit to the community, though it would remove treated Town wastewater effluent from Penn Cove.
3. Stream augmentation could accept whatever quantity of water is reclaimed from the wastewater treatment plant; the restored stream would enhance the local habitat and aesthetics; however, the augmented discharge may also impair the hydraulic capacity of the pipe system draining groundwater from the farms.
4. No existing commercial or industrial uses have been identified within the Coupeville vicinity that can use an appreciable reclaimed water quantity year-round; and none are expected in the foreseeable future.

Agricultural irrigation is the preferred use by the Coupeville community. Accordingly, this assessment is focused on the capture, treatment, storage, and delivery of reclaimed water to potential agricultural users with a conceptual estimate of the costs. Photo 5 in Appendix A shows some of the agricultural property within the National Historical Reserve that could benefit for irrigation with reclaimed water. The farmers have stated a preference for the best reclaimed water quality reasonably available, which is at least Class B and preferably Class A water.

2. Irrigation Methodologies

Assessment of feasibility necessarily requires some exploration of the likely agricultural and irrigation practices. Evaluation of these practices is beyond the scope of this assessment or the expertise of the consulting team. Yet some measure of the irrigation demand is necessary to assess feasibility. Accordingly, the assessment has relied on advice from Marshall English of Oregon State University, the Whidbey Island Conservation District, and numerous local farmers and interested parties.

Irrigation of crops involves several technical management issues. The general concept of irrigation is shown in Figure B-1. Some issues are more-or-less unmanageable like precipitation, wind, air temperature, or soil composition, ground slope, and off-site variables. Besides the choice of which crops to plant and when, at least three issues are subject to management by individual farmers:

1. Irrigation water can be applied in various ways, such as water guns, spray machines, drip irrigation, as well as various proprietary technologies. Choices as to which irrigation

technology will be used by a given farmer are largely matters of personal choice and economic.

2. The actual management of irrigation application is a decision process for defining when irrigation is to occur, and how much water will be applied. This decision can be simply the choice of an individual farmer based on the irrigation water available, and the price; or the decision can be technology oriented.

3. Water quality needed for irrigation is dependent on the crop chosen for planting; or perhaps the water quality available will determine the crop planted. Alfalfa can be raised with Class D reclaimed water while vegetable crops require Class A water. The decision to invest in treating reclaimed water to a higher standard could be left to individual farmers.

Figure B-2 illustrates the typical irrigation season. The Irrigation Efficiency Model (IEM) was initially designed to model relationships between sprinkler irrigation intensity, water losses, and crop water use. IEM was developed by the Oregon State University and the New Zealand Ministries of Agriculture and Fisheries; then further refined with a USDA National Research Initiative grant. Marshall English of Oregon State University was a key player in the IRM development and has been involved as an advisory for several agricultural operations in the Coupeville vicinity. Accordingly, the IEM concept was used to estimate a baseline of possible irrigation quantities in this Feasibility Assessment. Figure B-3 shows part of a sample IMO report for the Coupeville vicinity.

Irrigation management combines soil moisture as measured in the field together with estimated evapo-transpiration for the specific crop planted to compute irrigation water quantity needed. These results are estimates under even the best of conditions. Soils and moisture content vary across any field undergoing practical farming. Evapo-transpiration is an estimate derived from historic tests that are not likely to be replicated on an actual farm. Still, irrigation management decisions can be seen as an iterative process where the results are observed and the next irrigation decision is modified to achieve a better approach towards the defined farming goal.

Oregon State University and the Natural Resources Conservation Service have been developing Irrigation Management Online (IMO) as a web-based irrigation advisory service. It is now being used successfully in Oregon, Washington, and Idaho. IMO provides a tool for farm managers to implement irrigation strategies specific to their fields and crops that minimizes water use while maximizing economic returns. The concepts developed for IMO are available to farmers in the Coupeville vicinity and provide an appropriate basis for assessing optimum irrigation feasibility.

3. Optimum Irrigation

Precipitation in Coupeville averages only 20.8 inches annually. However there was only 14.09 inches in 2007 and 19.62 recorded for 2008 at the wastewater treatment plant. Groundwater supplies are limited. Whidbey Island is only about one to four miles wide in the Coupeville vicinity with marine waters on both sides. Saltwater intrusion is a concern for the operation of all wells, whether for potable purposes or for irrigation. Optimal management of all water resources is a strong motivator for all agencies, entities, and individuals in the Coupeville community. Such an approach is sometimes called 'total water management'.

Conventional irrigation applies water to maximize crop yields. This 'full irrigation' approach often results in the application of more water than the crop can actually use. A better, more total management approach applies irrigation water at the agronomic rate, meaning only the quantity of water needed to meet the evapo-transpiration demand of the crop.

'Deficit irrigation' goes even further by under-irrigating the crop to better conserve water. This approach recognizes that crop production does not decline lineally with a decline in the water quantity applied. Experimentation has demonstrated that irrigation with significantly less water can achieve nearly the maximum crop production – if the water is applied at the proper times during the crop growth cycle.

Of course this relationship of water-to-yield varies with different crops. Some crops simply require less water. Other crops can be selectively bred or genetically manipulated to require less water. And irrigation systems have different efficiencies in how much of the water actually benefits the crop, such as drip irrigation versus a spray system. Figure B-4 illustrates three levels of irrigation for alfalfa.

Particularly for water-short areas like Coupeville, minimizing the quantity of irrigation water used per land unit potentially maximizes the profit return for each participating farm. Deficit irrigation allows the greatest acreage to benefit from the limited irrigation water available and is the most appropriate strategy for evaluating the feasible use of reclaimed water.

4. Potential Crops

A variety of crops could be raised on various parcels show in Table A-1. Crop variety would be desirable so irrigation applications can be staggered, which would allow more efficient use of the irrigation facilities and capacities. Agricultural benefits accrue where diverse crops are raised too.

A representative selection of potential crops is listed in Table B-1, together with an irrigation strategy using a deficit approach and showing possible dates how deficit irrigation might be applied. These are simply approximate; and are not based on any specific farm preferences. Each irrigation application is intended to provide about 3 inches of irrigation water to the crop. Some inefficiency in irrigation application should be included, so the total inches applied in Table B-1 is larger than 3 inches per application. Irrigation efficiencies would vary with the technology used, and different crops may require different irrigation technologies. If the irrigation efficiency averages 75 percent across all fields and crops, then the actual water use may average about 4 inches per application. Total seasonal irrigation demand was estimated for the example irrigated field acreages as shown in the last column.

Table B-1
Ebey's Prairie Crop Strategy for Deficit Irrigation of 20 Acre Parcels

Crop	Irrigation Strategy	Irrigation Applications	Inches of Water Applied	Total Inches Applied	Acre-feet Applied
Alfalfa	Until second cutting	Three	9	12	20
Apples	Fruit filling	Two	6	8	13
Corn	After tassel	One	3	4	7
Pasture	Until mid-July	Two	6	8	13
Potatoes	Full irrigation	Three	9	12	20

5. Conventional Irrigation Management

The conventional strategy is also known as full irrigation, which provides at least enough water to avoid crop water stress. This strategy will produce maximum crop yields. The specific hypothetical circumstances considered for Coupeville were as follows:

- The cropping pattern comprised a mix of five crops; potatoes, corn, pasture, apples and alfalfa. The area planted in each crop was assumed equal.
- It was postulated that these crops would be irrigated with hand lines or wheel lines; and these systems would normally have an application efficiency of about 65 percent when used for full irrigation.
- The IMO service was used to estimate gross irrigation requirements, expressed as inches of applied water required for full irrigation of these crops. The average gross irrigation requirement for full irrigation was 14.3 inches.
- Crop yields in these full irrigation cases were assumed to be 100 percent of the potential maximum yield.

Based on this analysis, with an estimated average gross irrigation requirement of 14.3 inches, the area that could be fully irrigated with the reclaimed wastewater and storm water runoff would be the total number of acre-inches of water available multiplied by the irrigation efficiency and divided by the average gross irrigation requirement. The summer growing season reportedly averages just over 120 days. About 64 acre-feet of water can be reclaimed during this period without storage, which could conventionally irrigate about 54 acres.

6. Deficit Irrigation Strategy

The deficit irrigation strategy applies about 50 percent of the water required for full irrigation. The rationale for this strategy is that in water limited situations, when all cost factors (production costs, capital costs and opportunity costs) are considered, farm profits are maximized by deliberately under-irrigating crops and using the water thus saved to increase the area under irrigation. The optimum deficit for any particular set of circumstances will depend not only on the crop response to water but on such external economic factors as crop price, costs of such inputs as energy, water and chemicals and the capital costs of the irrigation equipment used.

In one 1996 analysis by Marshall English and Syed Navaid Raja which included estimates of all costs and crop revenues found that farm profits would be maximized by irrigating wheat at 61 percent and corn at 41 percent of the full irrigation requirement. The analysis assumed that the irrigated areas of each crop would be increased with the water saved by the deficit strategy.

The order of magnitude of these optimal deficits is consistent with other analyses for different economic circumstances. The relevant conclusion from such analyses is that the economically optimum level of irrigation is often on the order of 50 percent of the nominal crop water requirement when water supplies are limited.

The deficit irrigation strategy was predicated on the following assumptions:

- The basic strategy was to apply 50 percent of the amount of water needed for full irrigation of all crops. The resulting average gross irrigation water depth is about 7.0 inches per growing season.
- All fields are assumed to be irrigated with hand lines or wheel lines. However, under a deficit irrigation strategy the application efficiency will improve though it will vary with irrigation intensity. It is not possible to estimate the efficiency *a priori*, so IMO was used to estimate losses directly (spray losses, deep percolation and runoff).
- The yields for the partially irrigated fields were estimated using the ‘yield response to water’ model published by the UN(FAO), which is used extensively world-wide. The resulting yield estimates for the five crops came to 78 percent of the potential yield.

Based on these figures, the 50 percent reduction in applied water would double the area that could be irrigated with a particular quantity of reclaimed water, and the resulting crop yields would be, on average, 78 percent of the maximum yield that could be attained with full irrigation. Figure B-5 illustrates how deficit irrigation could be applied to raise alfalfa on a specific parcel in the Coupeville vicinity.

It should be noted that the above analysis was intended as only a preliminary estimate of the amount of land that could be irrigated profitably with the available water. The assumption that the optimum water use would be on the order of 50 percent of full irrigation, though founded on past experience and research, is an arbitrary assumption. The true optimum depths and timing of irrigation applications for each of the five crop examples remain to be determined. A comprehensive analysis tailored to the local ambient conditions and the economics of irrigation on Ebey’s Prairie would be needed.

7. Average Annual Irrigation Demand

The net water requirement for alfalfa and many crops is essentially zero from about September through the winter until about May. These dates are only approximate of course. Weather is a little different each year, and the application dates for irrigation would change accordingly.

Effectively this means that the key growing season begins about mid-May and extends until about mid-September. The typical season therefore totals about 120 to 125 days with the peak growth period for most crops in the June to August time frame. Irrigation for the Coupeville climate area is most critical from about July 1st through about August 20th, or about 50 days.

The irrigation demand would obviously be different for different mixes of crops and acreages. However, Table B-1 does provide a basis for projecting the irrigation water needed to meet the potential demands of the property owners for the farm parcels identified in Table A-1.

Assuming a similar crop mix as shown in Table B-1, the potential irrigation demand could be about 1,170 acre-feet water for the annual growing season.

8. Potential Irrigation Impacts

Irrigation in general is usually accepted as beneficial; and deficit irrigation can be seen as being particularly environmentally responsible. However, several questions or concerns arise with irrigation in general or particularly with deficit irrigation; and others are specific to irrigating with water reclaimed from wastewater, or even storm water:

1. Does irrigation use water that otherwise is irretrievably lost? Clearly treated wastewater being discharged into Penn Cove is lost forever if it is not reclaimed for some use. A similar argument applies to storm water discharged into Penn Cove. The question is less clear with discharge at Ebey's Landing since at least some of this water is return flow from underdrains beneath the fields capturing water that otherwise would recharge the aquifer.

2. Salinity may become a concern with extended irrigation over many years, especially for deficit irrigation. Accumulation of salt may require special attention, and careful selection of crops to be rotated through the field. Irrigation practice in some locales has often been to 'flush' the soil with excess water to leach out the salt. This option may not be available with deficient irrigation, especially in areas with limited precipitation like Coupeville. Careful irrigation practice, crop rotation, and judicious use of soil amendments may manage the issue

3. Risk is inherent in farming since weather and so many factors cannot be reliably predicted in agriculture. Irrigation may reduce some of the risks associated with precipitation; however deficit irrigation in particular requires more management attention than other approaches, and may have less tolerance for error.

4. Water quality concerns span the issues from acid rain, to pesticide/fertilizer runoff from adjacent lands, to road wastes in storm water, to metals and pharmaceuticals in reclaimed water. Modern laboratory methods can detect traces of almost any substance in almost any water sample. Meaning, some quality issues may simply be inherent and unavoidable. However, use of irrigation water obtained from identified sources, treated with proven technologies, sampled and tested according to established protocols, and monitored regularly with retained records do minimize the risks.

In assessing the feasibility of irrigating with reclaimed water, the practice may not be suitable for every property owner, or for each field, or every crop. It may even be that participation in an irrigation organization could change from year to year as some farmers choose to participate for certain years when raising certain crops, and not during other years. Such a practice may complicate management and financing of the irrigation organization but are not necessarily prohibitive of implementing a reclaimed water irrigation program.

9. Current Farm Practices

Owners and operators of several farmed parcels responded during the preliminary phase of the Reclaimed Water Feasibility Assessment to describe their plans for farming based on their current practice. These responses are summarized in Table B-2.

Table B-2
Local Farm Practice Examples

Farm Property	Acres Farmed Now	Planned Acres with Irrigation	Intended Current Crops	Future Crops Planned
Hancock	90	Unknown	Leased out	Unknown
Peterson/Eintevz	146	100	Pasture, hay	Vegetables, hay
Ebey Road Farm	600	Unknown	Open to market	Open to market
Bob Engle	1,600	1,000	Alfalfa, corn, wheat, barley	Vegetables, seed crops
Willowood Farm	5	5+	Raw vegetables	Mixed vegetables
Len Engle	1,400	1,400	Alfalfa, corn	Potatoes, berries, garden

Not all farmers in the Coupeville vicinity responded. Farm practices may change due to market and other conditions even for those farmers that were willing to respond. However, the sample show in Table B-2 provides an indication of the range of farming practice in the Coupeville vicinity that could benefit from more water for increased irrigation.

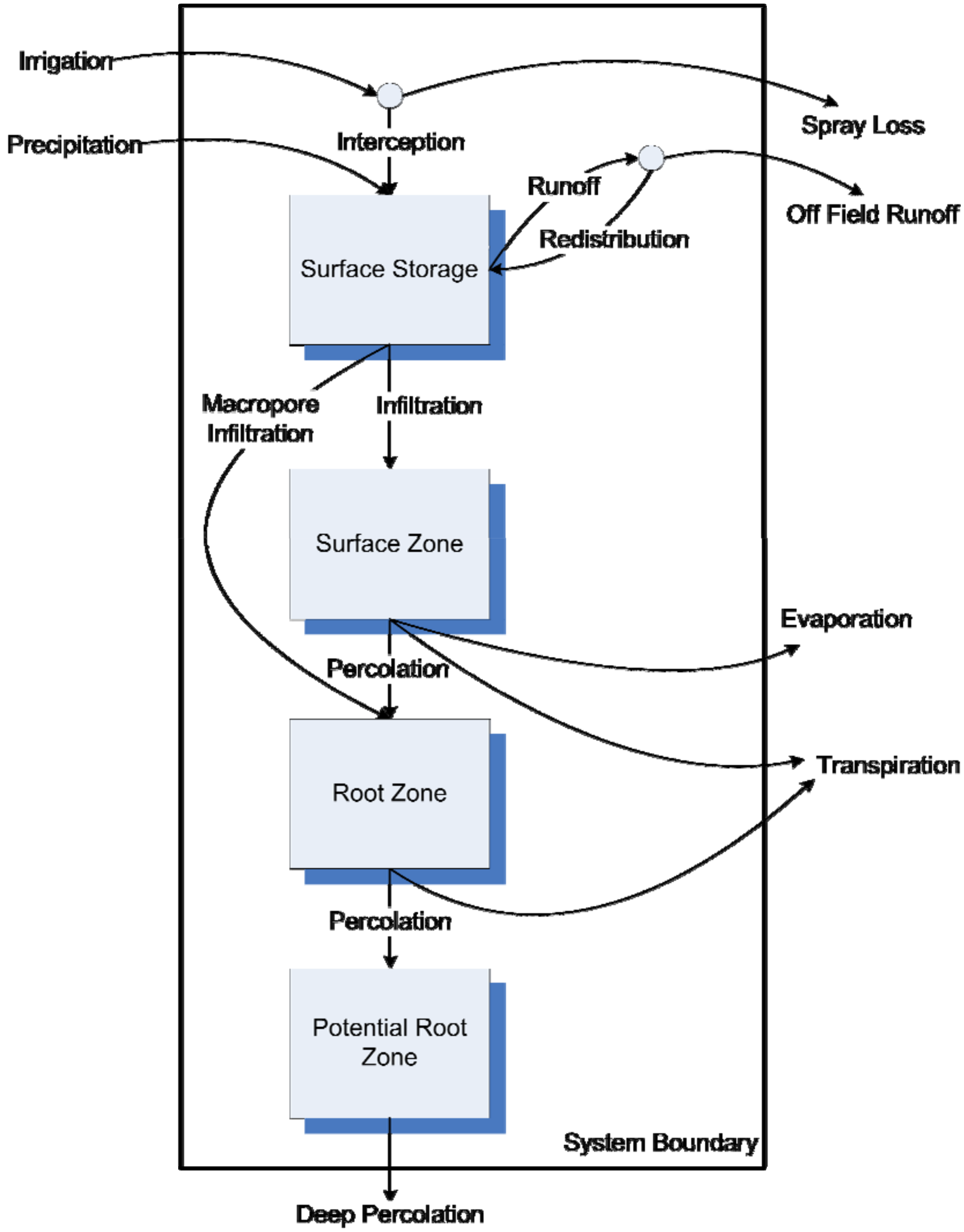


Figure B-1 Irrigation Schematic

A Web-Based Advisory Service For Optimum Irrigation Management
Charles Hillyer, Marshall English, Carole Abourached, Chadi Sayde, Kent Hutchinson and John Busch
Biological and Ecological Engineering Dept., Oregon State Univ., 116 Gilmore Hall, Corvallis OR 97331-3906

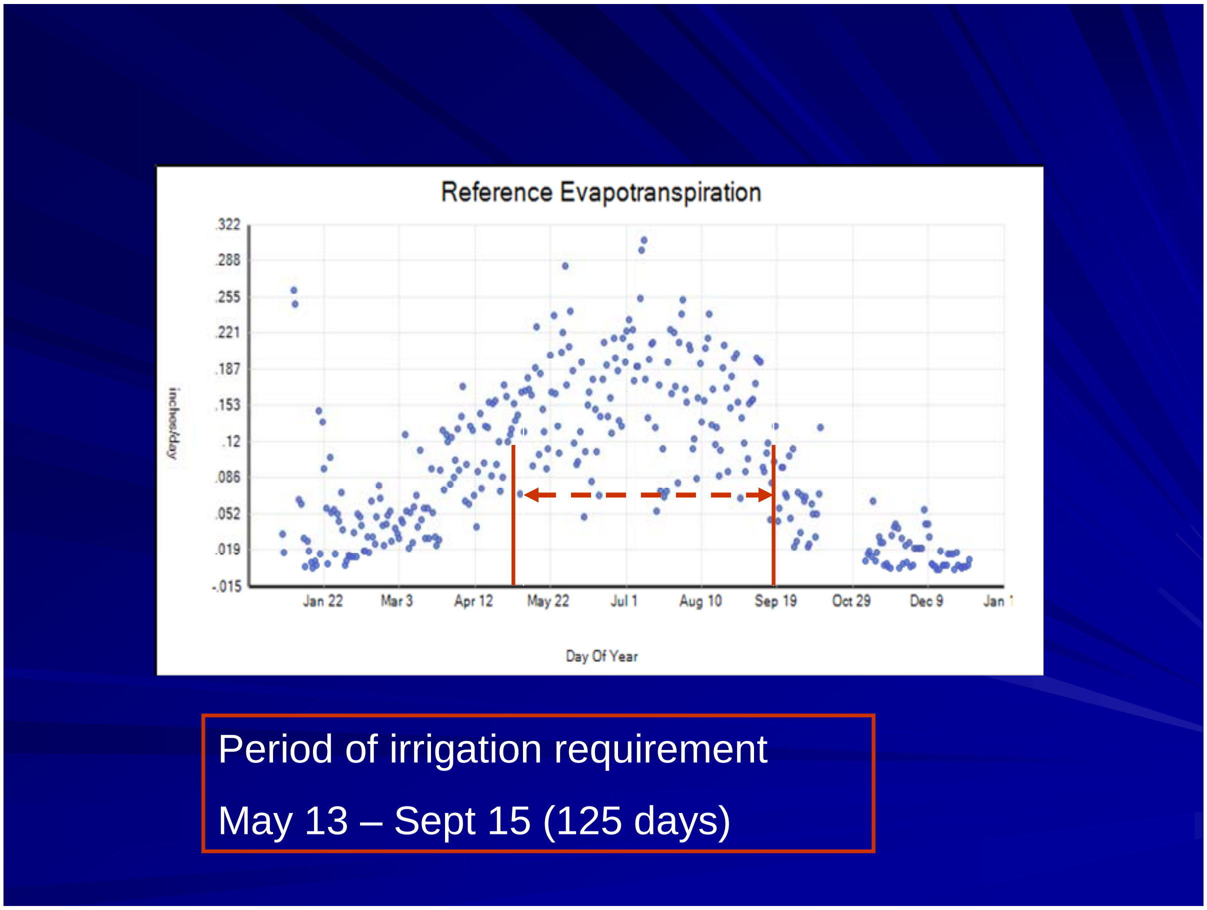
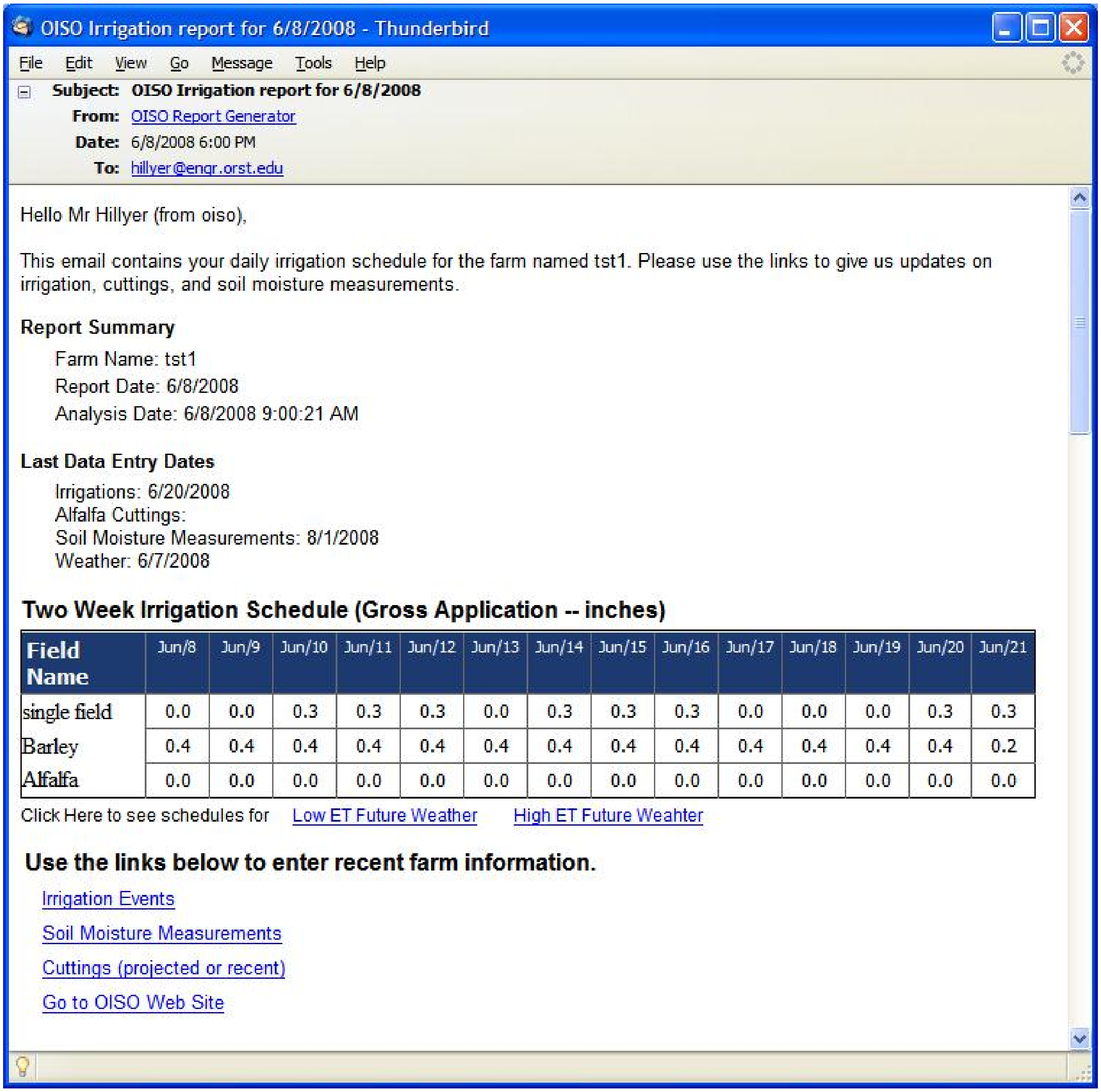


Figure B-2 Typical Irrigation Season

Presentation to Coupeville on Optimum Irrigation Management
Marshall English, Biological and Ecological Engineering Dept., Oregon State Univ., 116 Gilmore Hall, Corvallis OR 97331-3906



OISO Irrigation report for 6/8/2008 - Thunderbird

File Edit View Go Message Tools Help

Subject: OISO Irrigation report for 6/8/2008
From: OISO Report Generator
Date: 6/8/2008 6:00 PM
To: hillyer@engr.orst.edu

Hello Mr Hillyer (from oiso),

This email contains your daily irrigation schedule for the farm named tst1. Please use the links to give us updates on irrigation, cuttings, and soil moisture measurements.

Report Summary

Farm Name: tst1
Report Date: 6/8/2008
Analysis Date: 6/8/2008 9:00:21 AM

Last Data Entry Dates

Irrigations: 6/20/2008
Alfalfa Cuttings:
Soil Moisture Measurements: 8/1/2008
Weather: 6/7/2008

Two Week Irrigation Schedule (Gross Application -- inches)

Field Name	Jun/8	Jun/9	Jun/10	Jun/11	Jun/12	Jun/13	Jun/14	Jun/15	Jun/16	Jun/17	Jun/18	Jun/19	Jun/20	Jun/21
single field	0.0	0.0	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.3
Barley	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
Alfalfa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Click Here to see schedules for Low ET Future Weather High ET Future Weahter

Use the links below to enter recent farm information.

Irrigation Events
Soil Moisture Measurements
Cuttings (projected or recent)
Go to OISO Web Site

Figure B-3 Sample IMO Report (partial)

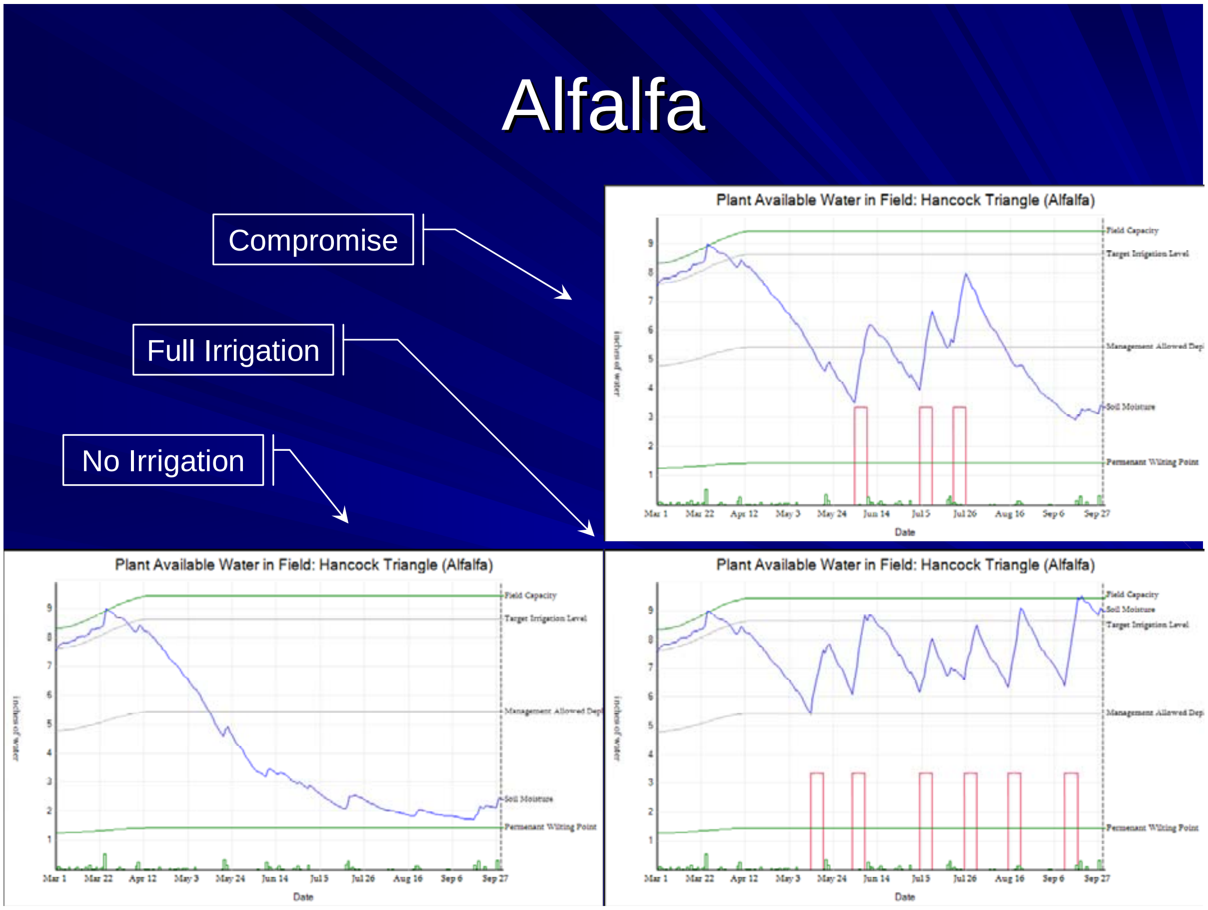


Figure B-4 Alternative Irrigation Strategies for Alfalfa

Presentation to Coupeville on Optimum Irrigation Management
Marshall English, Biological and Ecological Engineering Dept., Oregon State Univ., 116 Gilmore Hall, Corvallis OR 97331-3906

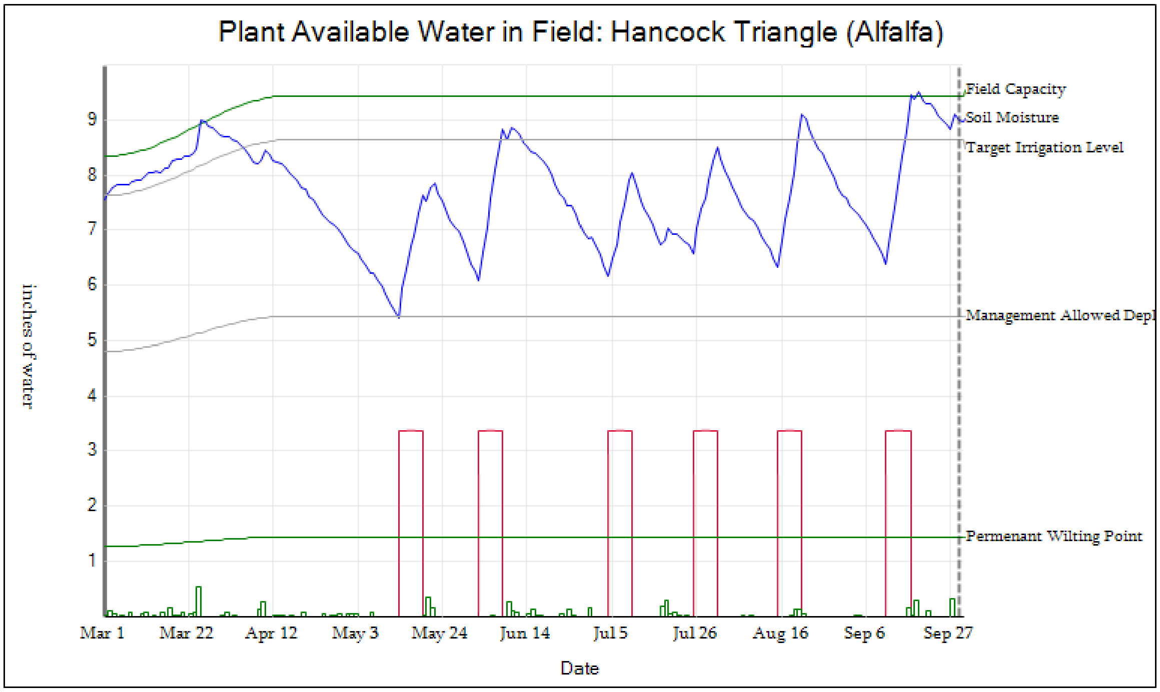


Figure B-5 Deficit Irrigation Example

Presentation to Coupeville on Optimum Irrigation Management
Marshall English, Biological and Ecological Engineering Dept., Oregon State Univ., 116 Gilmore Hall, Corvallis OR 97331-3906

Appendix G. Cost Estimates

Net Present Value (NPV) and Equivalent Annual Cost Calculations

Federal Discount Rate (as of March 2025):	0.045	%
Planning Period:	20	years

Alternative 1: Class B with Direct Reuse

Year	Costs	Present Value
0	$ 240,000	$ 240,000
1	$ 25,000	$ 23,923
2	$ 25,000	$ 22,893
3	$ 25,000	$ 21,907
4	$ 25,000	$ 20,964
5	$ 25,000	$ 20,061
6	$ 25,000	$ 19,197
7	$ 25,000	$ 18,371
8	$ 25,000	$ 17,580
9	$ 25,000	$ 16,823
10	$ 25,000	$ 16,098
11	$ 25,000	$ 15,405
12	$ 25,000	$ 14,742
13	$ 25,000	$ 14,107
14	$ 25,000	$ 13,499
15	$ 25,000	$ 12,918
16	$ 25,000	$ 12,362
17	$ 25,000	$ 11,829
18	$ 25,000	$ 11,320
19	$ 25,000	$ 10,833
20	$ 25,000	$ 10,366

Net Present Value	**$ 565,198**
Annuity Factor	13.008
Equivalent Annual Cost	**$ 43,450**

Alternative 2A: Class B with Direct Reuse with ASR

Year	Costs	Present Value
0	$ 560,000	$ 560,000
1	$ 60,000	$ 57,416
2	$ 60,000	$ 54,944
3	$ 60,000	$ 52,578
4	$ 60,000	$ 50,314
5	$ 60,000	$ 48,147
6	$ 60,000	$ 46,074
7	$ 60,000	$ 44,090
8	$ 60,000	$ 42,191
9	$ 60,000	$ 40,374
10	$ 60,000	$ 38,636
11	$ 60,000	$ 36,972
12	$ 60,000	$ 35,380
13	$ 60,000	$ 33,856
14	$ 60,000	$ 32,398
15	$ 60,000	$ 31,003
16	$ 60,000	$ 29,668
17	$ 60,000	$ 28,391
18	$ 60,000	$ 27,168
19	$ 60,000	$ 25,998
20	$ 60,000	$ 24,879

Net Present Value **$ 1,340,476**

Annuity Factor 13.008
Equivalent Annual Cost **$ 103,051**

Alternative 2B: Class B with Direct Reuse with ASR & pipeline

Year	Costs	Present Value
0	$ 1,240,000	$ 1,240,000
1	$ 100,000	$ 95,694
2	$ 100,000	$ 91,573
3	$ 100,000	$ 87,630
4	$ 100,000	$ 83,856
5	$ 100,000	$ 80,245
6	$ 100,000	$ 76,790
7	$ 100,000	$ 73,483
8	$ 100,000	$ 70,319
9	$ 100,000	$ 67,290
10	$ 100,000	$ 64,393
11	$ 100,000	$ 61,620
12	$ 100,000	$ 58,966
13	$ 100,000	$ 56,427
14	$ 100,000	$ 53,997
15	$ 100,000	$ 51,672
16	$ 100,000	$ 49,447
17	$ 100,000	$ 47,318
18	$ 100,000	$ 45,280
19	$ 100,000	$ 43,330
20	$ 100,000	$ 41,464

Net Present Value **$ 2,540,794**

Annuity Factor 13.008
Equivalent Annual Cost **$ 195,326**

Alternative 3A: Class A Upgrades with Direct Reuse and ASR

Year	Costs	Present Value
0	$ 2,410,000	$ 2,410,000
1	$ 651,500	$ 623,445
2	$ 651,500	$ 596,598
3	$ 651,500	$ 570,907
4	$ 651,500	$ 546,323
5	$ 651,500	$ 522,797
6	$ 651,500	$ 500,284
7	$ 651,500	$ 478,741
8	$ 651,500	$ 458,125
9	$ 651,500	$ 438,397
10	$ 651,500	$ 419,519
11	$ 651,500	$ 401,453
12	$ 651,500	$ 384,166
13	$ 651,500	$ 367,623
14	$ 651,500	$ 351,792
15	$ 651,500	$ 336,643
16	$ 651,500	$ 322,147
17	$ 651,500	$ 308,274
18	$ 651,500	$ 294,999
19	$ 651,500	$ 282,296
20	$ 651,500	$ 270,140

Net Present Value **$ 10,884,671**

Annuity Factor 13.008
Equivalent Annual Cost **$ 836,772**

Alternative 3B: Class A Upgrades with Direct Reuse and ASR & pipelines

Year	Costs	Present Value
0	$ 3,090,000	$ 3,090,000
1	$ 741,500	$ 709,569
2	$ 741,500	$ 679,014
3	$ 741,500	$ 649,774
4	$ 741,500	$ 621,793
5	$ 741,500	$ 595,017
6	$ 741,500	$ 569,395
7	$ 741,500	$ 544,875
8	$ 741,500	$ 521,412
9	$ 741,500	$ 498,959
10	$ 741,500	$ 477,472
11	$ 741,500	$ 456,911
12	$ 741,500	$ 437,236
13	$ 741,500	$ 418,407
14	$ 741,500	$ 400,390
15	$ 741,500	$ 383,148
16	$ 741,500	$ 366,649
17	$ 741,500	$ 350,860
18	$ 741,500	$ 335,751
19	$ 741,500	$ 321,293
20	$ 741,500	$ 307,458

Net Present Value **$ 12,735,385**

Annuity Factor 13.008
Equivalent Annual Cost **$ 979,047**

Table 5-1. Alternative 1: Class B with Direct Reuse

Capital Costs

Description	Cost	
WWTP Outfall Pump Station (Two 15 hp pumps and power supply / controls)	$	60,000
Piping Connections (Old WTP)	$	20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$	10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$	50,000
Engineering and Permitting	$	100,000
Total Capital Cost	**$**	**240,000**
Total Capital Cost -50%	$	120,000
Total Capital Cost +100%	$	480,000

Operation and Maintenance Costs

Description	Cost	
Energy (pumping)	$	10,000
Annual Pump and Pipe Repair	$	5,000
Labor for Increased Monitoring, Reporting, and Repair	$	10,000
Total Annual O&M Cost	**$**	**25,000**
Total Annual O&M Cost -50%	$	12,500
Total Annual O&M Cost +100%	$	50,000
Net Present Value	**$**	**565,198**
Annualized Costs	**$**	**43,450**

Table 5-2. Alternative 2A: Class B with Direct Reuse and ASR

Capital Costs

Description	Cost	
WWTP Outfall Pump Station (Two 30 hp pumps and power supply / controls)	$	120,000
Piping Connections (Old WTP)	$	20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$	10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$	50,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$	150,000
Well 6 Pump Testing	$	10,000
Engineering and Permitting	$	200,000
Total Capital Cost	**$**	**560,000**
Total Capital Cost -50%	$	280,000
Total Capital Cost +100%	$	1,120,000

Operation and Maintenance Costs

Description	Cost	
Energy (pumping)	$	30,000
Annual Pump and Pipe Repair	$	10,000
Labor for Increased Monitoring, Reporting, and Repair	$	20,000
Total Annual O&M Cost	**$**	**60,000**
Total Annual O&M Cost -50%	$	30,000
Total Annual O&M Cost +100%	$	120,000
Net Present Value	**$**	**1,340,476**
Annualized Costs	**$**	**103,051**

Table 5-3. Alternative 2B: Class B with Direct Reuse and ASR & pipeline

Capital Costs

Description	Cost	
WWTP New Pump Station (Three 50 hp pumps and power supply / controls concrete et well and deck, standby generator)	$	200,000
Piping Connections (Old WTP)	$	20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$	10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$	50,000
WTP to Well 6 new 8" PVC Pipe (4,000 ft in street right of way)	$	500,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$	150,000
Well 6 Pump Testing	$	10,000
Engineering and Permitting	$	300,000
Total Capital Cost	**$**	**1,240,000**
Total Capital Cost -50%	$	620,000
Total Capital Cost +100%	$	2,480,000

Operation and Maintenance Costs

Description	Cost	
Energy (pumping)	$	50,000
Annual Pump and Pipe Repair	$	20,000
Labor for Increased Monitoring, Reporting, and Repair	$	30,000
Total Annual O&M Cost	**$**	**100,000**
Total Annual O&M Cost -50%	$	50,000
Total Annual O&M Cost +100%	$	200,000
Net Present Value	**$**	**2,540,794**
Annualized Costs	**$**	**195,326**

Table 5-4. Alternative 3A: Class A Upgrades with Direct Reuse and ASR

Capital Costs

Description	Cost	
WWTP Outfall Pump Station (Two 30 hp pumps and power supply / controls)	$	120,000
Piping Connections (Old WTP)	$	20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$	10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$	50,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$	150,000
Well 6 Pump Testing	$	10,000
Class A WWTP Upgrades and Storage Tank	$	1,650,000
Engineering and Permitting	$	400,000
Total Capital Cost	**$**	**2,410,000**
Total Capital Cost -50%	$	1,205,000
Total Capital Cost +100%	$	4,820,000

Operation and Maintenance Costs

Description	Cost	
Energy (pumping)	$	60,000
Annual Pump and Pipe Repair	$	30,000
Labor for Increased Monitoring, Reporting, and Repair	$	80,000
Class A Chemicals and Advanced Operations Labor	$	481,500
Total Annual O&M Cost	**$**	**651,500**
Total Annual O&M Cost -50%	$	325,750
Total Annual O&M Cost +100%	$	1,303,000
Net Present Value	**$**	**10,884,671**
Annualized Costs	**$**	**836,772**

Table 5-5. Alternative 3B: Class A Upgrades with Direct Reuse and ASR & pipeline

Capital Costs

Description	Cost	
WWTP New Pump Station (Three 50 hp pumps and power supply / controls concrete et well and deck, standby generator)	$	200,000
Piping Connections (Old WTP)	$	20,000
Testing of Existing 8-inch and 4-inch pipes for Reuse Suitability	$	10,000
Well 6 Connection Manifolds with Back Flow Prevention (Farmer Connections)	$	50,000
WTP to Well 6 new 8" PVC Pipe (4,000 ft in street right of way)	$	500,000
4-inch ASR Control Valve, Power, and Controls (for use with existing submersible pump)	$	150,000
Well 6 Pump Testing	$	10,000
Class A WWTP Upgrades and Storage Tank	$	1,650,000
Engineering and Permitting	$	500,000
Total Capital Cost	**$**	**3,090,000**
Total Capital Cost -50%	$	1,545,000
Total Capital Cost +100%	$	6,180,000

Operation and Maintenance Costs

Description	Cost	
Energy (pumping)	$	80,000
Annual Pump and Pipe Repair	$	90,000
Labor for Increased Monitoring, Reporting, and Repair	$	90,000
Class A Chemicals and Advanced Operations Labor	$	481,500
Total Annual O&M Cost	**$**	**741,500**
Total Annual O&M Cost -50%	$	370,750
Total Annual O&M Cost +100%	$	1,483,000
Net Present Value	**$**	**12,735,385**
Annualized Costs	**$**	**979,047**

Appendix H. Public Outreach Materials

Farmer Meetings

Two meetings have been held with farmers in the Ebey's Landing Reserve. A summary of both meetings follows.

Farmer Meeting 1

The first meeting was with Bob and Cheryl Engle at the Public Works shop on December 23, 2024. Joe Grogan and Mark Madison attended. The meeting was a general discussion of the concept of reuse water irrigation and use of Well 6 for ASR. No handouts were made available. The Engles farm the land closest to Well 6 on the east side of Engle Road. The deep well that is in the same aquifer as Well 6 was previously owned by the Engles and is now owned by the U.S. Department of the Interior. The Engles would like to be able to use the deep well as an irrigation water source with or without reuse water. They were most interested in using water from the deep well rather than Well 6 since it is already connected to their irrigation pipeline and the water quality is known to them. If Well 6 is recharged, it could increase the water available in the deep well and cause it to become fresher over time, which would be a benefit. Their farming operation could benefit from irrigation water. They grow primarily livestock feed as pasture, grass and alfalfa hay and feed beef cattle. The farm previously had a dairy and the old dairy barns are now used for beef cattle feeding. Irrigation has previously occurred on their land with manure and deep well water. The old manure lagoons could potentially be available to store reuse irrigation water. They have a buried pipeline with risers for big gun sprinklers that extends to near Well 6. If they were going to take reuse water directly from the Town's pipeline at Well 6 they would prefer for it to be Class A water. They sell some hay to horse owners that want the hay to be organic. A third-party organic certifier would need to approve the hay as organic if it is irrigated with Class B water. The Engles are in favor of a reuse program that could deliver water to them especially if it can be Class A water. They have reservations about organic farming with Class B water. They would be most comfortable withdrawing water from the deep well they used to own with that water replenished by injection into Well 6 with either Class A or Class B reuse water. The travel time in the aquifer from Well 6 to the deep well provides an additional barrier and treatment zone for the reuse water.

Farmer Meeting 2

The second farmer meeting was held at Marshal and Judy English's home on March 4, 2025. They own a small farm and are long-term residents with personal knowledge of local farming operations and irrigation. Marshal was previously a professor at Oregon State University teaching agricultural engineering and irrigation. He wrote the water reuse irrigation section of the 2010 Reuse Feasibility Assessment with BHC consultants.

The meeting attendees were:

- Mark Madison/Jacobs
- Don Sherman/Farmer
- Fran Einterz/Farmer
- Brandon Roos/Farmer
- Marshal and Judy English/Farmers
- Lou Licht/Agricultural engineer with a tree nursery on the English Farm

The draft work-in-progress Water Reuse Feasibility Assessment findings were reviewed with the group as well as information on reuse from other previous studies at Coupeville. No material was handed out. The differences between Class A and Class B reuse water were discussed. The group of farmers were interested in reuse water irrigation and agreed that it would add value to their farming operations. A challenge will be getting the water piped to their farms. Perhaps portable pipe or hose reel pipes could be used as part of the supply piping so it could be moved to different fields on a rotation. There might be USDA or Agricultural Research Service grants or cost share programs for farm irrigation improvements that could help with the cost of piping. The cost difference between producing Class A and Class B water was discussed. Class A provides more options for crops, but Class B is most affordable for the Town to produce. Previous studies of reuse found that Class A water was not economically feasible to provide and is not required by the current discharge permit.

The farmers all grow mostly livestock feed and could use either class of reuse irrigation water. Discussion of cropping options included: Class B water can be used for wheat or fruit trees because wheat is processed before human consumption and fruit trees could be drip irrigate so water doesn't get on the fruit. All livestock feed crops currently grown, and all seed crops could be grown with spray irrigation of Class B water. All landscape nursery plants could be irrigated with reuse water.

Perfluorooctane sulfonate (PFOS) were discussed as a potential concern. The Town water system has new carbon filters to remove PFOS and most other chemical contaminants, so the drinking water is very low in PFOS and used drinking water is what makes up most of the volume of the reuse water. Potential for PFOS in rural wells is more from septic systems than from reuse water. If Well 6 is used for ASR, it is in a deeper aquifer than any other wells except the Engle Deep Well. The deep aquifer is saline and not suitable for potable water production, so it was abandoned. The drinking water aquifers are all much shallower and existing irrigation wells are also shallow. The aquifer cross section drawing from the AGI report was reviewed.

Limited rainfall and the erratic schedule of rainfall are major risks to farm profitability on dryland crops. They currently get about 4 ½ tons/acre of good quality Alfalfa. The first cutting produces the most tons and the third cutting is marginal and sometimes not worth cutting. Irrigation would help all but maybe the first cutting, which has good soil water from winter rain. They also are rotating crops with barley for cattle, other grain crops, and pasture. With irrigation they could plant alfalfa in the fall so the following year gets full yield. Currently they have to wait for winter rain to wet the soil to plant in the spring and lose almost all production in the first year of a 5-year alfalfa crop. Irrigation for fall planting would have a big benefit. They would like to grow silage or feed corn, but it requires irrigation. A pipeline to supply the water to each field is a high cost to farmers and they would like to find a cost share or grant program to assist them.