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SEQUIM-DUNGENESS GROUNDWATER QUALITY STUDY

FINAL REPORT — OCTOBER 30, 1991

(WITH APPENDICES)

by

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SEQUIM-DUNGENESS

GROUNDWATER QUALITY STUDY

Final Report

October 30, 1991

for

Washington State Department of Ecology
Water Quality Financial Assistance Programs
Olympia, WA 98504
Bill Hashim, Project Manager

by

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APPENDICES

Background and History

The Sequim-Dungeness Groundwater Quality Study began in May 1990 funded jointly by Clallam County and the Washington State Department of Ecology (Ecology) Centennial Clean Water grant program. The project was proposed and initiated by Clallam County for the purpose of investigating possible groundwater quality degradation and its possible association with land use changes in the Sequim-Dungeness area. Over the past 50 years the dominant industry in the area, dairy farming, has declined substantially, and residential development has taken place on land that until recently supported cows. This type of change in rural land use is usually accompanied by increased release of non-point source pollution to surface and subsurface waters because of increased runoff and improperly treated septic system effluent. In addition, new and continuing farming operations (mostly, but not exclusively, dairy) produce other types of non-point pollution.

The project was designed to assess the quality of regional groundwater (the uppermost aquifer in particular), and develop tools which could be used by the county to regulate potentially contaminating activities. At the minimum, specific products required by the grant contract include a report on the groundwater quality status with respect to nitrates and priority pollutants, a map designating a "geologically sensitive area" (where groundwater is susceptible to contamination), and an appropriate nitrate loading model. This section summarizes the history of the project's management. The remainder of the Final Report discusses the three primary grant tasks, and there is a section at the end devoted to "other" tasks, which discusses several items added to the original list during the course of the project.

Groundwater Quality Monitoring

The first task of the first project manager, Jim LeGalley, was preparation for sampling area wells. His Quality Assurance Plan (Appendix A), approved by Ecology in September 1990, included a schedule for sampling the well network as well as procedures for collection, transport, and analysis of all samples. Wells were chosen based on the availability of 1980 nitrate data, depth (since the focus of the project was the unconfined aquifer, wells shallower than 100' were preferred), and the accessibility of the owner. Samples from thirty-two wells were collected in both August and September and analyzed for nitrates and bacteria; samples from five additional wells were collected in September and analyzed for total petroleum hydrocarbons. Working with the Departments of Ecology and Health, a complete and continuously updated well log inventory of the entire area is now being maintained in binders at the water quality office.

In January 1991 Ann Soule took over the project where LeGalley left off after his departure in October 1990. One of her first objectives was continuation of the groundwater quality monitoring he had begun, so in early March 1991 samples were collected from the well network LeGalley established. Well depth, location and water quality data were entered into a spreadsheet to facilitate data management. A thorough discussion of the results of all sampling events may be found in the next chapter.

Public Participation

To guarantee public participation in the grant work, LeGalley wrote a Public Involvement Plan (Appendix B) which was accepted by Ecology in June 1990. The plan outlined the process for creating a citizen advisory committee representing several professional and public interests. LeGalley intended to identify the group in late June - early July, after a community meeting at which this project and the Dungeness Watershed project was introduced. At the meeting it was proposed that public participation committees for the two projects be merged. Because of the time schedule for the Watershed project, the board-member education process was expected to begin in late December. In fact, the Water Quality staff (brought together in November) decided to form four "working" committees to handle specific issues for the watershed, one being groundwater. These committees were designated in April 1991; Appendix C includes a list of Groundwater Committee members and their affiliations.

The postponed establishment of the Groundwater Committee resulted in accelerated public input, but also provided some additional benefits. The committee became a cohesive unit which has a clear idea of their purpose, goals, and methods for achieving those goals. Members contributed enormously in a short period of time to the completion of specific tasks for this project, and to the quality of the overall content of this report. (There were extensive review comments from the committee on the first proposed geologically sensitive area and on the drafts leading to this Final Report and Recommendations. These comments are available upon request.) The indirect benefit to the groundwater resource resulting from the committee members' involvement in this study is invaluable. The committee's postponed start resulted in hurried conditions for the initial tasks before it. In the rush to accomplish grant requirements, their goals, ground rules, and general project objectives were incompletely addressed for several meetings, causing some confusion and uncertainty among members as to their overall long-term purpose. At the June 12, 1991 meeting, however, the committee reaffirmed its goals, discussed the sensitive area designation, and prepared to continue into further phases of the groundwater issues of the area. Appendix D contains the minutes from all Groundwater Committee meetings held during the project period. In addition, a significant groundwater library has been established in the water quality office, for the use of the committee and public as well as the staff. This library will be kept current as staff time and budgets allow.

Consultants' Involvement

There are several elements of this study which were given to consultants to address. Progress was monitored on the contracted projects and the data, documents, maps, etc. were coordinated to fulfill each task. The River Basin Team supplied some information specifically pertaining to development of the nitrate loading model and the predictive tool. An intern and county Environmental Health staff researched files to assist the summarization of septic system age and density for sections in the study area; the consultant utilized this information in the predictive tool for groundwater contamination potential from on-site systems. Well logs were compiled from which the consultant created geologic cross sections.

Consultants were generally quite helpful responding to questions directly or indirectly related to their contracted tasks. Consultants produced several products for the study which will prove advantageous to the county in its decision-making. Several of these products are contained in the chapter on "Other Tasks." Future groundwater work in the county will include further review and application of the information and ideas presented in them. It was unfortunate that the limitations of this project did not accommodate our interest in considering these at this time.

Task 1 Report: Groundwater Quality Determination

The purpose of this task was to assess the current groundwater quality for the Sequim-Dungeness area, concentrating on the water table aquifer, and focusing on nitrates, EPA's priority pollutants, and total coliform bacteria. The results of these analyses are summarized in Table 1. (Note that the wells and associated data are listed in order of decreasing nitrate concentration (1990-91 data). Also, "depth" refers to well depth from the ground surface.) Following is a discussion on each parameter of the data, source identification (where possible), potential health risks from elevated levels, and recommendations for further actions.

Nitrates

In 1980, nitrate information collected by Brian Drost of the USGS indicated that nitrate concentrations in certain areas were elevated above natural levels. This nitrate data is the focus of discussion in the DSHS Carlsborg Groundwater Study of 1982. County staff designed the sampling plan for this project and selected wells which had relatively elevated nitrate levels in 1980 (at that time the maximum was 2.5 mg/L), and a handful from outlying areas which, in 1980, had nitrate levels less than 0.5 mg/L. Thirty-six wells were sampled in August and September of 1990, and in March of 1991, following the Quality Assurance/Quality Control (QA/QC) sampling plan approved by Ecology in 1990. Information was collected from all well owners on historical land use, noticable changes in water quality or quantity, septic problems, fertilizer use, location and use of irrigation ditches, and previous ownership. Letters of appreciation containing current nitrate and bacteriological data were mailed to all participants. Discussions regarding the local hydrogeology, water quality, and health implications of nitrates were held with participants whose wells exhibited concentrations at or near the maximum contaminant level (MCL) of 10 mg/L.

Figure 1 shows the location of each well in our network, its depth, the average 1990-91 nitrate level, and the 1980 nitrate level (where available). An initial analysis of the data reveals very little interpretable patterns or overall trends. For example, while the nitrate level in most wells increased over the past decade, it actually decreased in 31% of the 29 wells sampled in both 1980 and 1990-91. In 22 of 29 wells (76%) the nitrate level changed (up or down) less than 1.5 mg/L in the past decade; in nine of these the level changed less than 0.3 mg/L. In five of 29 wells the nitrate level increased between 1.5 and 3.2 mg/L. Finally, in 2 of 29 wells the nitrate level increased greatly: 5.9 and 8.1 mg/L increase in the past decade.

The bottom of Table 1 shows that the average of all wells sampled in both 1980 and 1990-91 (n=29) is about 2.4 mg/L, compared to the historical average for those wells of about 1.3 mg/L. Note that when the two wells with the highest increase are omitted from calculating the average (n=27), the current average drops to 1.9 mg/L, only 0.6 mg/L greater than a decade ago. This analysis suggests that the two wells with greatest increases are anomalous. In other words, the change in their concentration differs substantially from the rest of the group.

TABLE 1. 1990/91 GROUNDWATER DATA SUMMARY

		NITRATES (mg/L)			TPH (mg/L)	Total Coliform			Fec.Col.	
WELL NO.	DEPTH	Av. 90/91	(n)	1980	'9/90	'8/90	'9/90	'3/91	'3/91	Treatment?
30-4-4L"4"	?	10.80	3				0			
30-4-5J2	111	10.28	3	2.2		0	0			
30-3-17M?	?	7.483	3			TNTC	TNTC	0	0	Yes; 10/90
30-4-4L2	56	6.977	3	1.1		0	0			
30-3-20B1	23	4.44	3	1.9	<1.0	124	TNTC	0	0	Yes; Fall '90
30-4-21B1	38	3.887	3	0.72		0	0			
30-3-20C2	36	3.66	3	1.5	<1.0	0	0			
30-3-17F1	32	3.597	3	1.6		0	0			
30-4-5J1	117	3.553	3	0.87		0	0			
30-4-21G3	54	3.543	3	2.5		0	0			
30-3-18F3	38	3.227	3	1.9	<1.0	TNTC	TNTC	26	0	No
30-3-18M?	?	2.817	3			0	0			
30-3-20E1	71	2.697	3	1.2	1.45	0	1			
30-4-15G3	55	2.36	3	1.3		2	0	0	0	No
30-3-18R3	85	2.23	2		<1.0		0			
30-4-23F3	35.5	2.177	3	0.88	<1.0	0	11	0	0	No
30-3-5H2	31	1.817	3	0.98		0	0			
30-3-7M1	42.5	1.817	3	2.3		0	0			
30-4-10Q2	82	1.703	3	1.0		0	1	0	0	No
30-4-17P1	66	1.637	3	0.96		21	0	0	0	Leak fixed 9/90
30-3-19D1	49	1.605	2	1.5	<1.0	0	TNTC			Yes
30-4-8J1	56	1.52	3	2.5		0	88	0	0	No
30-4-14M3	?	1.357	3	1.2		0	0			
30-3-7A1	32	1.181	3	1.6		0	0			
30-4-23E2	37	1.18	3		<1.0	0	3	0	0	No
30-4-25G1	72	1.13	3	1.2		0	0			
30-4-25D3	79.5	1.033	3	0.98		0	0			
30-4-10H1	38	1.006	3	1.3		0	0			
30-4-25D4	86	0.999	2			0				
30-4-24G2	79	0.987	3	1.5		0	0			
30-3-18E6	35-40	0.915	3	1.0		0	0			
30-4-17B1	91	0.782	3	0.45		0	0			
30-4-13J4	45	0.177	3	1.1		0	0			
30-4-16C?	72	0.12	1							
30-4-16C2	47	0.06	2	0.01			0			
30-3-31A1	48	0.055	2		<1.0		0			
30-4-9C1	70	0.055	2				1	0	0	No
30-4-9K1	22 or 90	0.055	2	0.06			TNTC	0	0	No
AVERAGE, for wells										
sampled in '80 & '90:		2.385	29	1.287						
Omitting highest two:		1.923	27	1.26						

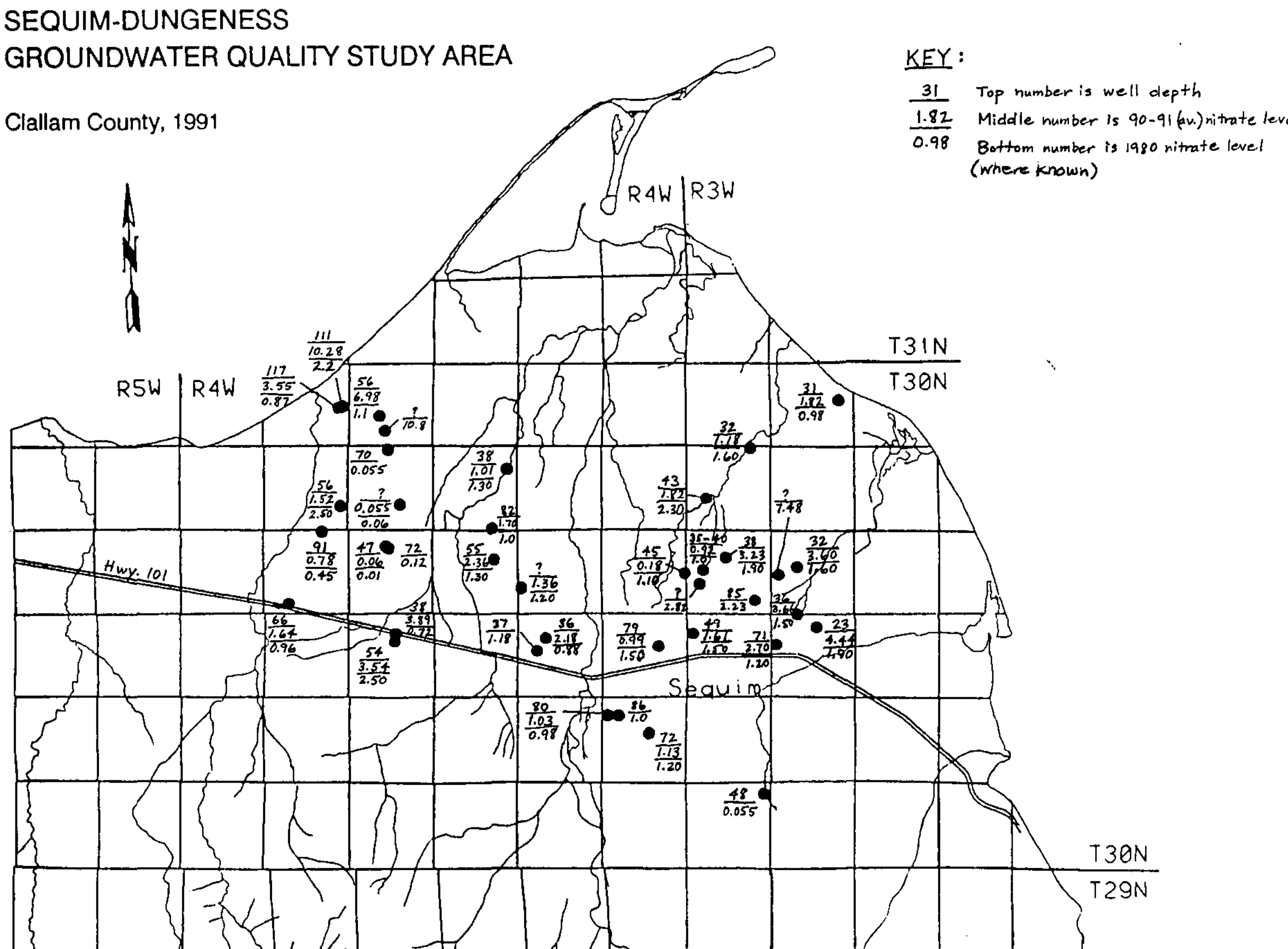


FIGURE 1. Well network and data.

Figure 2 shows the current data against lines of equal concentration (nitrate contours) drawn for the 1982 DSHS study (the contours were based on nitrate data collected by USGS in 1980). Brian Drost, the hydrogeologist who collected this data, emphasizes that contours drawn from such limited data should be viewed with skepticism (personal contact 1/91); the contours in Figure 2 were included only for reference - they indicate areas of relatively high nitrate levels from 1980. The wells which currently have the highest levels are in or near areas of relatively high nitrate concentration from a decade ago. However, there are also wells which currently exhibit relatively low levels that are located in areas which had relatively high levels in the past. Note that the few wells recently sampled outside the historically high areas currently have very low or undetectable levels of nitrates. This *may* indicate that historically low areas remain low, however, the current data is *not* sufficient to make this conclusion.

Wells in two distinct areas exhibit anomalously high nitrate levels and, as shown in Figure 2, are underlain by coarse soils. In fact, 13 of the 16 wells with nitrate levels greater than 2.0 mg/L are located in areas with "excessively drained" soils. These soils might be a factor leading to elevated nitrate levels since they typically afford the least resistance to the downward migration of contaminants. However, Figure 2 shows that the presence of well-drained soils do not always indicate higher levels, and higher levels do not always correlate to a particular soil type. Soil conditions, apparently, are not the only factor affecting the fate of nitrates in groundwater.

As stated in the consultant's "Ground Water Characterization Study" (Appendix E), "insufficient information is available regarding the elevated groundwater nitrate levels to support formal conclusions concerning the source(s)." The consultants drew preliminary conclusions based on geologic and land use conditions in the area, the chemical properties of nitrate, and the circumstances regarding similar contamination incidents in other parts of the state and country:

1. The elevated nitrogen levels identified through the groundwater monitoring program could be the result of :

a) poorly constructed wells located in close proximity to a nitrogen source such as a barn or a cesspool. Poorly constructed wells include those that are improperly or poorly protected by a cover, lack adequate casings, lack adequate sanitary seals, or are improperly located.

b) regionalized nitrate contamination associated with multiple non-point sources. It is likely that on-site sewage systems, livestock, waste, and fertilizer practices (residential, commercial, and agricultural) all contribute to the contamination. However, the dominant source may vary from area to area depending on the nature of local land use.

c) a combination of the above.

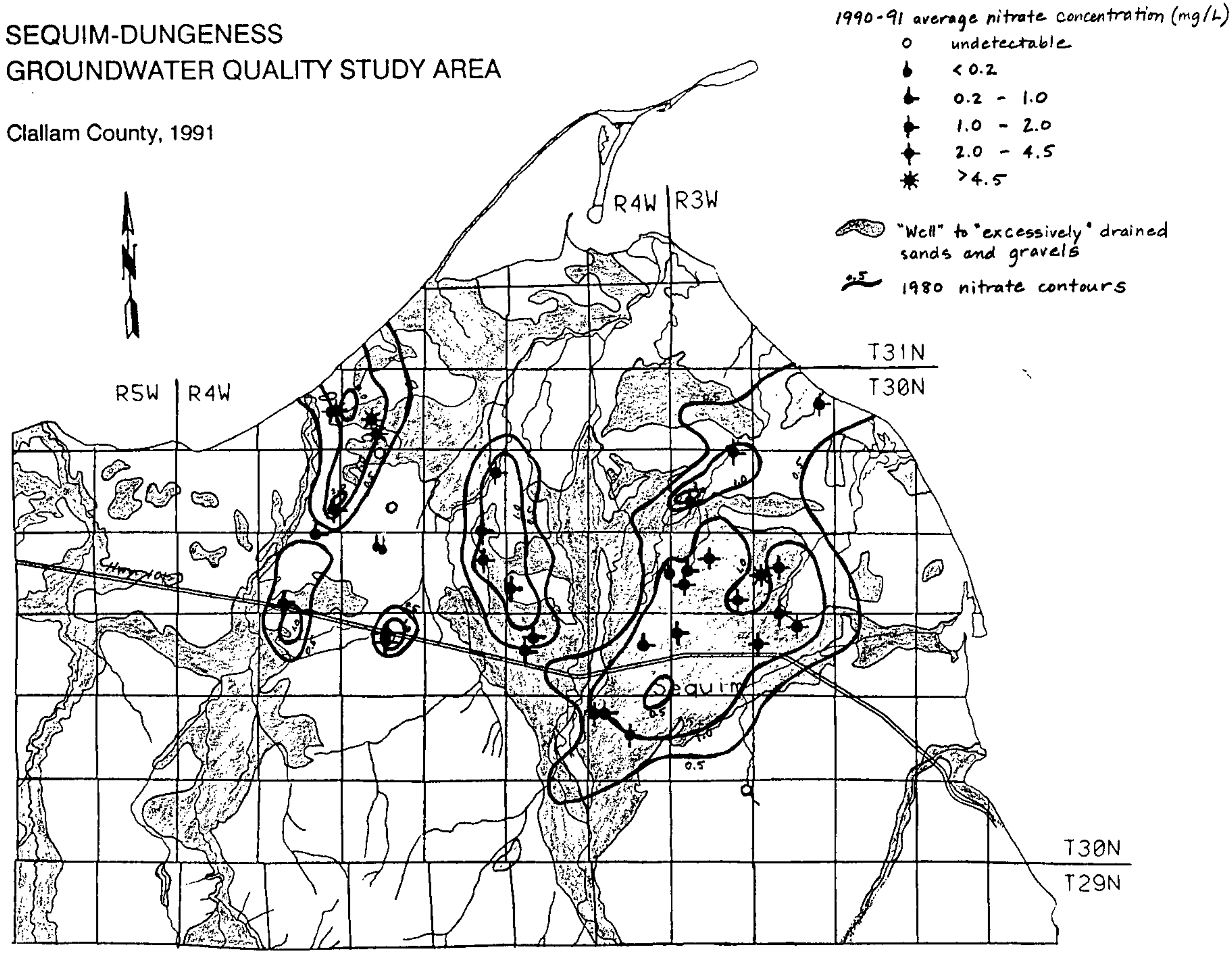


FIGURE 2. Nitrate information and soils.

2. The presence of nitrate indicates a possiblity that other mobile contaminants (pesticides, chlorides, viruses, and some volatile organics) could be present in well water in areas with agricultural, commercial, institutional, and industrial land uses.

It is important to note that certain surficial conditions, such as soil conditions, render some areas particularly susceptible to contamination from land activities. Contamination entering the groundwater system from these areas may travel downward, but it may also travel laterally, and be detected downgradient in an area where surficial conditions are relatively impermeable. Data from this study indicate that neither surficial conditions nor well depth adequately explain relatively high nitrate concentrations in some areas. Apparently, complex subsurface hydraulic pathways are responsible for transporting contamination from either surface or subsurface sources. Identification of these pathways by investigating the hydrostratigraphy of certain areas should be included in any future evaluations of potential sources of nitrates.

Nitrates cause health problems for infants under 6 months who consume water with nitrate concentrations in excess of 10 mg/L. Their digestive systems are not capable of processing certain nitrogen compounds which, in turn, results in an oxygen deficiency in the infant's blood and a condition called methemoglobinemia. The condition is reversible, however, it can be fatal if not treated soon enough. As mentioned before, owners of wells with a nitrate level at or near 10 mg/L were notified of their situation and possible health implications.

The possible presence of other mobile contaminants is an additional and potentially more serious health concern for areas with elevated nitrate levels. For this reason, water from wells in these areas should be analyzed for additional parameters associated with drainfield effluent and synthetic and manure fertilizers. A focused investigation into the areas with elevated nitrate concentrations would involve adding wells in these areas to the current network; measuring water levels and sampling for a more comprehensive list of contaminants in those wells; examining the vicinity for land uses, septic age and density, irrigation ditches, and proper well construction; and evaluating area well logs to get a good picture of the subsurface geology and water table.

There are many portions of the study area not covered by the well network designed for this project. Wells from these areas should be added to the network and sampled for at least one year. If nitrates are undetected, then sampling of outlying wells may be discontinued. Appendix F, "Recommendations for Groundwater Data Collection," proposes a method for selecting additional wells for the network and a sampling plan specifying which parameters should be sampled and the schedule for each.

Total Petroleum Hydrocarbons

County staff intended to estimate the impact to groundwater of non-point pollution from stormwater runoff. While the Ecology grant specifies that priority pollutants were to be measured, the Quality Assurance plan approved by Ecology (Appendix A) specifies that a less expensive analysis for Total Petroleum Hydrocarbons (TPH) would be substituted. Samples were collected on dry days in September 1990 from shallow wells downgradient from WSDOT drywells and catchbasins along Highway 101 and Kitchen-Dick Lane, as well as from control sites distant from any roads. If elevated levels of hydrocarbons were found, selected priority pollutant scans would be conducted to identify the nature and scope of organic chemical contamination.

Results of the TPH analysis were mostly undetectable, though one sample had 1.45 mg/L TPH. The method of TPH analysis used (EPA Method 418.1) does not distinguish between individual hydrocarbons, so the well water ought to be reanalyzed to more closely specify the organic compounds present in the water. The consultant recommends EPA Method 8015M for TPHs and BTEX for benzene, toluene, ethylbenzene, and xylene, which would indicate whether these concentrations exceed cleanup levels (of 1.0 mg/L) in this well. (See Appendix E: Section 3.2 of the "Ground Water Characterization Study")

A future effort might focus on wells located in permeable soils and geology which are near different types of drywells and underground storage tanks. Sampling for organic compounds should be conducted in both wet and dry seasons, as the mobility of these compounds may be influenced by the quantity of recharge and depth of the water table.

Coliform Bacteria

Elevated nitrate levels often indicate that contamination from animal (including human) waste is occuring. Tests for total coliform bacteria were conducted at the same time as the nitrate tests, intending that bacteriological data would assist the identification of sources of nitrate contamination. Instead, there was very little correlation between high nitrates and high coliforms, indicating that the two contaminants may have different sources. In addition, the owners who performed bleach treatments on wells with coliforms succeeded in eliminating the bacteria. This suggests that the problem was restricted to the individual system, and was not a condition of the aquifer itself.

An interesting aspect of the bacteria data is the near-disappearance of all coliforms by March 1991 (see Table 1). In March, bacteria samples were collected only for those wells with counts the previous summer. Many of the well owners had treated their systems, in which case the "disappearance" of bacteria is more or less expected. However, several systems had not been treated, yet the result was the same: either the coliform count was zero or it was substantially lower. Belle Fuchs of the Washington Dept. of Health reviewed the bacteria data and mentioned that dry to wet transitional weather often incurs changes, as bacteria counts are expected to rise with rainfall. She recommends collecting rainfall data and comparing it to bacteria data, collecting turbidity measurements in the future along with bacteria counts, testing a subset of wells on a monthly basis to assess seasonal variation, and carefully documenting conditions at the well site. It was also noted that the surprising change may be related to the different samplers.

After each sampling, all well owners with coliform in their water were informed of the results, health implications, and methods of treatment. In many cases the owner treated their system right away, but several never treated for various reasons. After seeing the results of the March analyses most owners that had not yet treated probably will not bother, though it was explained that they should periodically test their water for bacteria, since it may reoccur.

Task 2 Report: Geologically Sensitive Area Designation

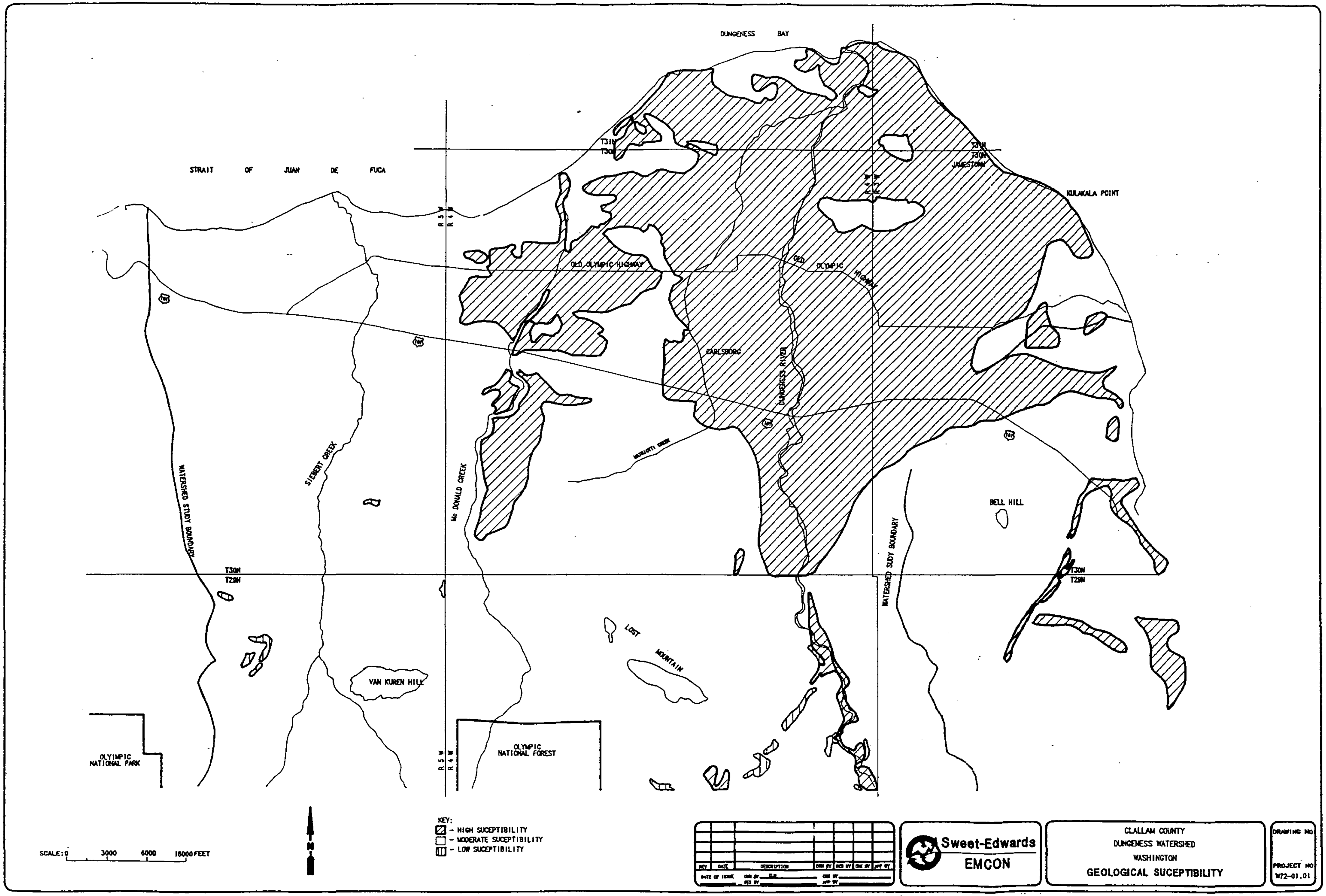
The Groundwater Committee

The grant requires that designation of a geologically sensitive area include full public participation. In fact, this task was the first order of business for the "citizen advisory board" (known as the Groundwater Committee; see Background and History chapter). Because of the limited amount of time in which the group had to fulfill this grant requirement, a tight schedule was observed and, at the committee's first meeting, as much baseline information as possible was provided. The consultant summarized some existing information in the Ground Water Characterization Study (Appendix E), and described the hydrostratigraphy of the study area using three geologic cross sections included in the report. Information about local soil units and the relationship between soil texture and treatment of on-site septic system effluent was presented. A map which the River Basin Team provided was extremely useful for this because soil units are coded by hydrologic soil group. Finally, the committee was presented with an overlay for the soils map showing current nitrate levels (similar to Figure 2). The committee discussed the limitations of the current nitrate data for interpretation to the broader region as well as the health implications of excessive nitrates in drinking water. The committee reviewed the immediate and urgent project goals, as well as the longer term function of the committee in the context of watershed planning and potential future groundwater studies.

First Proposed Designation

The grant requires that an area be delineated where the unconfined aquifer is sensitive to contamination because of geologic and other conditions. The consultant proposed a two-tiered approach for designating a "geologically sensitive area" for the unconfined aquifer (see Appendix G, Hydrogeologic Sensitive Area Designation Proposed Criteria and Rationale). The first level involved assessing the recharge potential for the entire study area (i.e., defining "susceptible" areas), and the next level involved overlaying land use criteria to relatively susceptible areas and defining areas which would then be viewed as "vulnerable" because of human activities. The first level, therefore, would identify physical sensitivity and the second would identify risk areas. The Groundwater Committee felt strongly that physical criteria alone should be used to identify "geologically sensitive" areas, and that a separate list of potential threats from human activities should be generated for when management issues are addressed.

During the month of May the committee reviewed the proposed physical criteria (see Appendix H, Recharge Potential Mapping Criteria and Rationale) and the consultant developed the individual criteria maps and the composite map. They presented the maps at a committee meeting and the committee set numerical ranges for high, moderate, and low sensitivity. The consultant proceeded to create a final map showing the three ranges (see Figure 3).



DUNGENESS BAY
STRAIT OF JUAN DE FUCA
T31N
T30N
R 5 W
R 4 W
JAMESTOWN
KULAKALA POINT
OLD OLYMPIC HIGHWAY
OLD OLYMPIC HIGHWAY
CARLSBORG
DUNGENESS RIVER
SIEBERT CREEK
Mc DONALD CREEK
WATERSHED STUDY BOUNDARY
WATERSHED SUDY BOUNDARY
BELL HILL
T30N
T29N
LOST MOUNTAIN
VAN KUREN HILL
OLYIMPIC NATIONAL PARK
OLYMPIC NATIONAL FOREST
SCALE: 0 3000 6000 18000 FEET
N
KEY:
- HIGH SUCEPTIBILITY
- MODERATE SUCEPTIBILITY
- LOW SUCEPTIBILITY
REV DATE DESCRIPTION
DATE OF ISSUE
Sweet-Edwards
EMCON
CLALLAM COUNTY
DUNGENESS WATERSHED
WASHINGTON
GEOLOGICAL SUCEPTIBILITY
DRAWING NO
PROJECT NO
W72-01.01

On June 12th the Groundwater Committee met to discuss members' comments on the proposed Geologic Sensitivity designation as written in a June 5, 1991 draft of this Final Report. A subcommittee charged with synthesizing the review comments reported that the concerns of many members were serious enough that the proposed designation could not be supported. (See Appendix I, Geologically Sensitive Areas - Proposal I, for all documentation surrounding this decision. The Appendix contains the review draft of the proposal and all comments submitted by the committee.) The explanations offered by the committee at the meeting include:

1. The presently identified criteria, expressed in the map showing sensitivity ranges, show insufficient correlation with current nitrate data and known distribution of nitrate contamination in the groundwater. This raised the question whether the map, or the criteria used to create it, adequately or accurately delineates sensitive areas.

2. There is insufficient data to support the criteria. In particular, subsurface geologic formations are not considered in the criteria, resulting in little explanation for the interrelation of confined and unconfined aquifers. This is a particular concern because the focus of designating geologically sensitive areas was to protect the unconfined, "water table" aquifer, but its depth and location have not been adequately determined.

Actual Designation

The committee recognizes the non-renewable character of groundwater quality. Once contaminated, it is very difficult and costly to remedy groundwater problems. Because of this, it is important to prevent contamination if at all possible. The Groundwater Committee now recommends designating, with interim status, the entire study area as "geologically sensitive." This designation is intended to "flag" the general susceptibility of the entire study area to groundwater contamination. The needed note of caution may be incorporated into codes without definition of specific management and policy implications of the term. A sub-committee will be formed at the next Groundwater Committee meeting for the purpose of examining the county on-site sewage code and the possible application of this designation to it. This sub-committee will develop proposed amendments to the code for approval by the Clallam County Board of Health.

Groundwater Management

As mentioned above, a sub-committee will address the immediate management applications of the geologically sensitive area designation in the county on-site sewage code. As a whole, the Groundwater Committee recognizes that a more comprehensive management strategy is desirable for long-term protection of the resource. In fact, the goal statement of the Committee reads: "To protect groundwater quality and quantity for present and future inhabitants." One of the methods intended to achieve this goal reads:

"Develop a combined groundwater quality and quantity management strategy which may include some or all of the following:

- ordinances and/or regulations
- tax districts
- grant funding
- interaction and coordination with some or all of the following:
    - Dungeness Watershed Management Committee
    - Clallam Co. Divisions of Water Quality, Environmental Health, and Planning
    - Clallam Co. Public Utility District
    - State Departments of Ecology and Health
    - Federal Environmental Protection Agency
    - Others"

The first effort toward achievement of the committee's goal will be the formation of a second sub-committee to investigate groundwater quality and/or quantity management alternatives. The committee has read a document written for Clallam County by consultants, called "Management Programs Relating to Ground Water Quality and/or Quantity" (Appendix J). There were no strong opinions for or against any programs listed in the document, however, a need was expressed for further information; it is anticipated that those interested in further investigating management options will participate on the sub-committee.

The grant requires an assessment of "the usability of Chapter 36.36 RCW, Aquifer Protection Areas, for the creation and protection of Sequim-Dungeness aquifer as a county geologically sensitive area." The committee had no particular attraction to this program, and was encouraged to thoroughly consider this code (including recent amendments) and specificly compare it with Chapter 173-100 WAC (Ground Water Management Areas and Programs) and Section 197-11-908 WAC (re: Environmentally Sensitive Areas).

Creation of an Aquifer Protection Area has the advantage that, because it is tax-supported, funding is certain for activities such as monitoring groundwater and on-site septic systems, and public education. Unfortunately, there are no guidelines for delineation of the boundary of such an area, and there is some risk in investing time into a ballot proposition. Sequim-Dungeness residents are certainly aware of the need for protecting the quality of their drinking water, but a tax proposal would determine the level to which they are ready to pay for that protection.

There seems to be close similarity between the designation and provisions for an "Environmentally Sensitive Area" and the intent and potential application of the geologically sensitive area which we have designated. On p. 7 of the report "Management Programs..." (Appendix J) the consultant states "an Environmentally Sensitive Area designation may provide several important benefits for an area of ground water vulnerability. It would assist in raising the level of awareness of both the public and governmental agencies regarding the sensitivity of the aquifer system to contamination from overlying land-use activities. Additionally, the Clallam County Commissioners could adopt a ground water policy framework concerning land and water-use activities that potentially affect the viability of an aquifer that has been declared to be environmentally sensitive."

Task 3 Report: Nitrate Loading Model Development

Refer to Appendix K, Nitrate Loading Model Documentation, for all materials pertaining to this task.

Other Tasks

a) Review and Recommendations for Parkwood Monitoring Program (Appendix K)

This document discusses an existng groundwater monitoring program designed to detect groundwater impacts of community on-site systems used at Parkwood Adult Community. The consultant recommends numerous improvements to the current program which should increase the likelihood of detection of contamination.

b) Evaluation of the Environmental Health Division On-Site System Standards (Appendix L)

This document includes a summary and comparison of state and county sewage regulations, a review of the 1988 on-site program audit by DOH, a review of the impacts of Chapter 173-200 WAC (groundwater quality standards) on on-site system use, and conclusions and recommendations for improvement of the program. One of the consultant's recommendations is to develop specific regulations for on-site system use in geologically sensitive areas.

c) Predictive Tool for Groundwater Contamination Potential Associated with On-Site Systems (Appendix M)

This document contains the conceptual design and narrative for a predictive tool to be used to identify areas where the risk of nitrate contamination of groundwater associated with on-system use would be greatest. It is also intended to assess the potential for other contaminants associated with on-site systems to reach groundwater, and identify other land use activities that should be factored into a predictive tool.

d) Evaluation of a Groundwater Data Management System for Clallam County (Appendix N)

This document recommends a data management system which will be an efficient data management tool, facilitate data analysis, and meet data reporting requirements of the Dept. of Ecology. The system is available from the Seattle-King County Health Department at little or no cost. The system accepts the following data: site ID, owner ID, township-range-section ID, latitude-longitude ID, water levels, pumpage, well log information, constructon data, site file information, water quality data, and more. This document is quite long because it includes the Dept. of Ecology Data Reporting Manual for Groundwater Management Programs and sample menus and file structures from the Seattle-King County Health Dept. database system.

e) Stormwater Infiltration System Recommendations (Appendix O)

This document outlines interim measures to lessen the potential for groundwater contamination from both acute and chronic events releasing contaminants into stormwater infiltration systems. It is expected that formal stormwater contaminant management strategies will be developed in the future.

Synthesis and Recommendations

Products of the Study

The products of this study are of three varieties. First, new information has been obtained, such as:

The average increase in nitrate levels for all but two area wells sampled was 0.6 mg/L over the past decade. The nitrate levels in a few wells increased substantially, while in several wells the levels actually decreased.

The character of the subsurface is more variable than previously believed. Geologic cross sections through the study area indicate interfingering glacial deposits of varying permeability.

A consistent method for estimating potential loadings of nitrates from a proposed development is now available.

Second, the additional information acquired as well as the efforts of county personnel and the public have raised new questions. Some of these include:

What is the depth and areal extent of unconfined and confined aquifers?

What are probable contaminant pathways ? Do higher nitrate levels indicate the presence of other contaminants? Are shallow wells always more vulnerable than deeper wells?

Should some land uses be regulated to prevent further contamination? If so, what types of regulations are needed?

How and where are groundwater levels changing?

Third, a concerned and motivated public has been identified and mobilized. The Groundwater Committee is a resource the county will benefit from if taken advantage of. For example:

Members represent a variety of public and professional interests.

Some members are willing to perform research and assist in technical as well as public review.

Both public and targeted education are facilitated by a citizens committee.

Recommendations

Good groundwater quality is a vital part of the high quality of life for humans and other inhabitants of the Sequim-Dungeness area - it is vital for a healthy economic, social, and natural environment. Residents and visitors value this region for its clean appearance and undepleted and undegraded natural resources, compared to other parts of the country. Protection of the groundwater resource before it is severely contaminated will ensure safe drinking water for years to come. Recommendations for actions which will assist this goal include:

Investigate the potential applications of various consultants' reports which are products of this study.

Monitor groundwater quantity and quality for a variety of parameters across an area at least as extensive as the irrigation ditch system. Monitor chloride concentrations along shorelines.

Establish a coordinated data management system for groundwater, surface water, soil, and well log data. Utilize Geographical Information System (GIS) facilities available, and consider purchasing software for 3-D contouring of the subsurface.

Consider proposed improvements to the Environmental Health Division on-site sewage program (see Appendix M).

Support public education efforts toward groundwater quality protection, including further education of the groundwater committee and professionals whose businesses affect surface or groundwater quality.

Utilize the Groundwater Committee for continued research assistance and review of proposed aquifer protection policy and management.

The Groundwater Committee's "Unfinished Agenda"

In their work related to grant requirements, the Groundwater Committee identified several specific issues which they plan to address as time allows. These "unfinished agenda" items will probably comprise the working agenda in the very near future. As this report is finalized, the committee's unfinished agenda includes the following:

I. Educational sessions/workshops

1. Geology, hydrogeology, and glaciology, featuring local geology experts (e.g., Penin. College Prof. Crawford, well drillers), including a field trip to Bell Hill overlook, beach cliffs at Port Williams, etc.

2. Well drilling and construction, including a site visit. Discuss zones of "good" and "bad" water, aquifer depths, changes over time. Attempt to standardize terms used by drillers on well logs.
3. Septic system theory and reality, including site visits. Discuss local soil conditions, failures, and areas of high risk of contamination.

II. Sub-studies/mini-research projects (incl. a presentation to entire committee afterward)

1. Groundwater quality standards and their applicability to our goals.
2. Groundwater management options, including what other areas have done.
3. Further investigations into well reports:
   a) identify specific areas where "protective" layers exist
   b) create more geologic cross sections showing water table
4. Further investigations into well construction and adequacy of surface seals.
5. Compile nitrate data collected for all building permits issued between 7/90 and 4/91 (from Environmental Health files)
6. Help county devise a way to coordinate all hydrogeologic and water quality data generated in the process of permitting and monitoring.

Appendix A

Quality Assurance Plan

ORGINAL

RECEIVED
AUG 27 1990
DEPARTMENT OF ECOLOGY
QUALITY ASSURANCE SECTION

SEQUIM-DUNGENESS
GROUNDWATER QUALITY STUDY
QA/QC PROJECT PLAN
JULY 17, 1990

for and funding provided by

WASHINGTON STATE DEPARTMENT OF ECOLOGY
WATER QUALITY FINANCIAL ASSISTANCE PROGRAMS
OLYMPIA, WASHINGTON 98504

by

JIM E. LE GALLEY
CLALLAM COUNTY
DIVISION OF ENVIRONMENTAL HEALTH
223 EAST FOURTH STREET
PORT ANGELES, WASHINGTON 98362

In witness thereof, the parties approval of the QA/QC project plan:

Bill White 9-12-90
Bill White Date
Director, Clallam Co.
Dept. of Community
Development

William A. Hashim 9-10-90
Bill Hashim Date
WDOE Project Manager

Jim E. Le Galley 9-24-90
Jim E. Le Galley Date
Environmental Health Specialist

Cliff J. Kirchmer 9/3/90
Dr. Cliff J. Kirchmer Date
WDOE QA Officer

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ILLUSTRATIONS

1. INTRODUCTION

The Sequim-Dungeness Groundwater Quality Study is the result of joint funding provided by Clallam County and the Washington State Department of Ecology (WDOE). As a contract requirement of WDOE, a project QA/QC plan has been developed to address all aspects of this project. Upon WDOE acceptance of this plan, Clallam County will initiate field investigations and systematically work to complete all project tasks with the assistance of an engineering consultant and an analytical laboratory.

2. PROJECT DESCRIPTION

2.1 Historical Information

The eastern portion of Clallam County has an area that has been the subject of much concern and study over the last twelve years. This area, better known as the Sequim-Dungeness Valley, generally exhibits highly permeable, well drained soils over a shallow aquifer. Previous studies have thoroughly documented the vulnerability of the shallow aquifer in this area. The potential for detrimental public health impacts is growing with increased development pressure. The aquifer is very sensitive to land uses and is a primary source of drinking water for many private and public water supplies.

Although the county has been able to implement several of the recommendations generated in earlier studies, trend analysis has not been accomplished. Absence of updated water quality monitoring data prevent further assessment of public health risk. In addition, increasing development pressure over the aquifer has indicated a need for a valid predictive model of pollutant loading. Finally, the practice of storm water discharge by way of deep dry-wells in the urbanized areas and by Washington State Department of Transportation (WDOT) has created a new concern for groundwater quality and nonpoint source control.

Since 1982, the Sequim-Dungeness area has been one of the most rapidly developing areas of the county. The growth includes single family dwellings, commercial activities, and mobile home parks. All of these developments have relied on on-site sewage disposal systems. In addition, agricultural activities have remained high.

Much energy, time, and money has been invested in the Sequim-Dungeness area by US Geologic Survey, Ecology, Department of Social and Health Services, and Clallam County. These studies, conducted at a combined cost of over $500,000, clearly indicate the intimate relationship between land uses, agricultural practices, irrigation, and the aquifer's condition. While these studies did not find the aquifer contaminated to a point where regulatory limits were exceeded, the risk of such contamination was clear and evident.

The most recent and relevant study was completed by DSHS and Clallam County in 1982 addressing nitrate concentrations. Although the study concluded that these levels were within allowable limits, increased agricultural and urban activities threaten groundwater quality. (Figure 1)

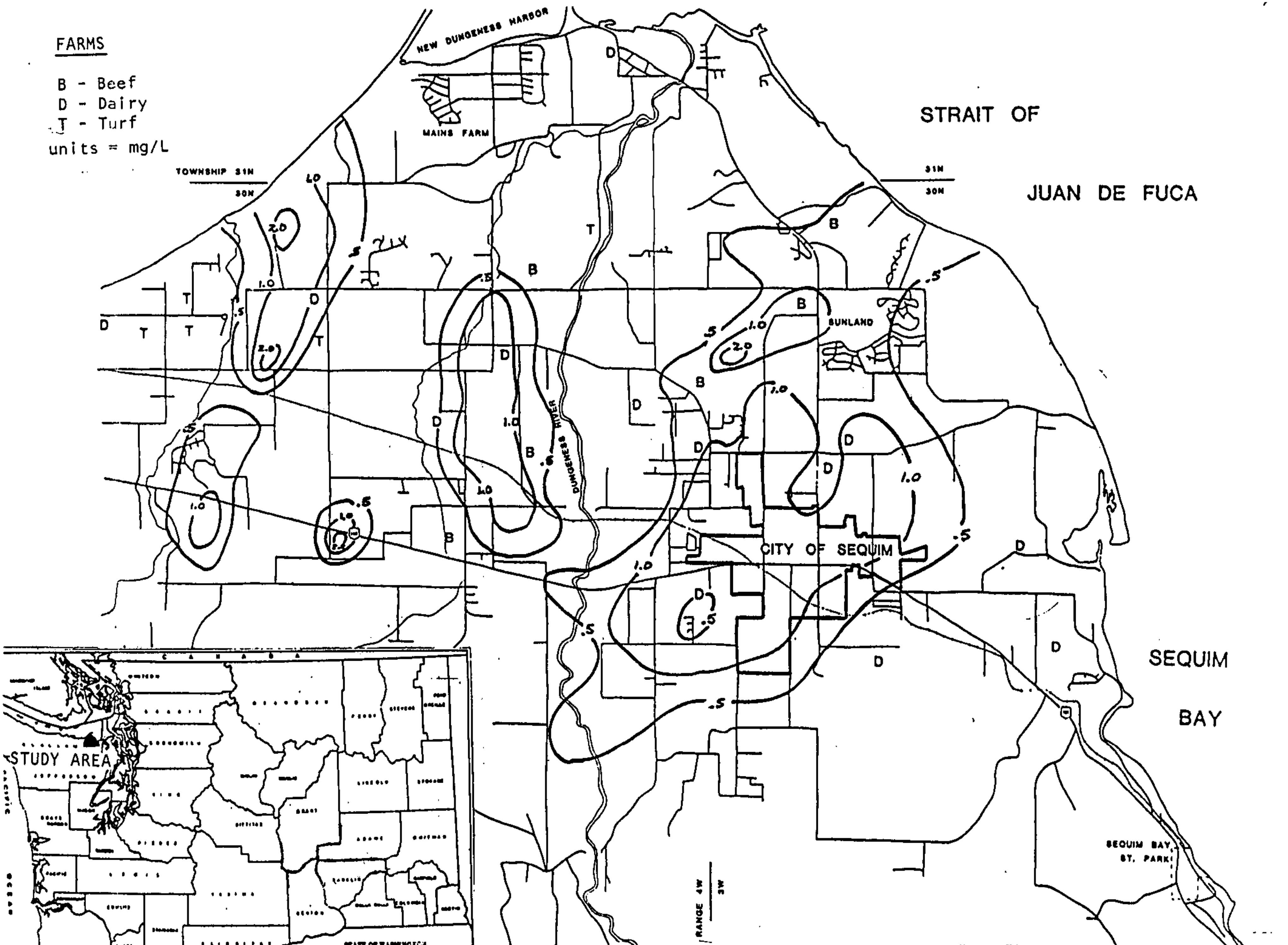


FIGURE 1. NITRATE CONCENTRATIONS AND DISTRIBUTION OVER URBANIZED AREAS

2.2 Project Objectives

Objectives of this study are fourfold:

1. To update nitrate data from an unpublished Washington State Department of Social and Health Services (DSHS) groundwater study, where elevated nitrate levels were observed from a 1978 USGS groundwater quality monitoring program. Monitoring for pH, specific conductance, and total coliform will also be performed.

   Nitrate data will be compared to earlier data, other nitrate/total coliform studies and to the drinking water regulatory criteria.

2. To generate baseline Total Petroleum Hydrocarbon (TPH) contaminant data from wells which are located down gradient from urban and roadside drywell disposal systems. A comparison will be made with background levels and other TPH drywell studies and to the drinking water regulatory criteria. If elevated levels exist, selected priority pollutant sampling may begin to identify the nature and scope of organic chemical contamination.

3. To develop and implement a predictive nitrate loading model which will assess future impacts to the regional groundwater quality. The generated model will be compared to other nitrate models for reliability and performance.

4. To determine sensitive area boundaries of the Sequim-Dungeness aquifer using an assessment strategy. The evaluation will be based on area geology, geography, soils, land use, hydrology, water quality and opinions of land owners/users expressed through a Citizens Advisory Board. Usability of Chapter 36.36 RCW, Aquifer Protection Areas, for the creation of the Sequim-Dungeness aquifer as a "geologically sensitive area" will be assessed.

2.3 Study Site

Located on the Sequim-Dungeness Peninsula in eastern Clallam County, the study site covers approximately sixty square miles. The terrain is mainly flat to rolling on the valley floor with strongly sloping uplands to the south. Specifically, the study site is bordered by the Strait of Juan de Fuca to the north, Sequim Bay to the east, the Olympic foothills in the south and west to a line extending from Township 30, Range 4 West, Section 6 south to Township 29, Range 4 West, Section 7 (Figure 2).

The climate of the study area is Marine West Coast. Average summer high/low temperatures are 70/55, while the average winter high/low temperatures are 45/35. Being in the rain shadow of the Olympic Mountains, rainfall is fifteen inches per year.

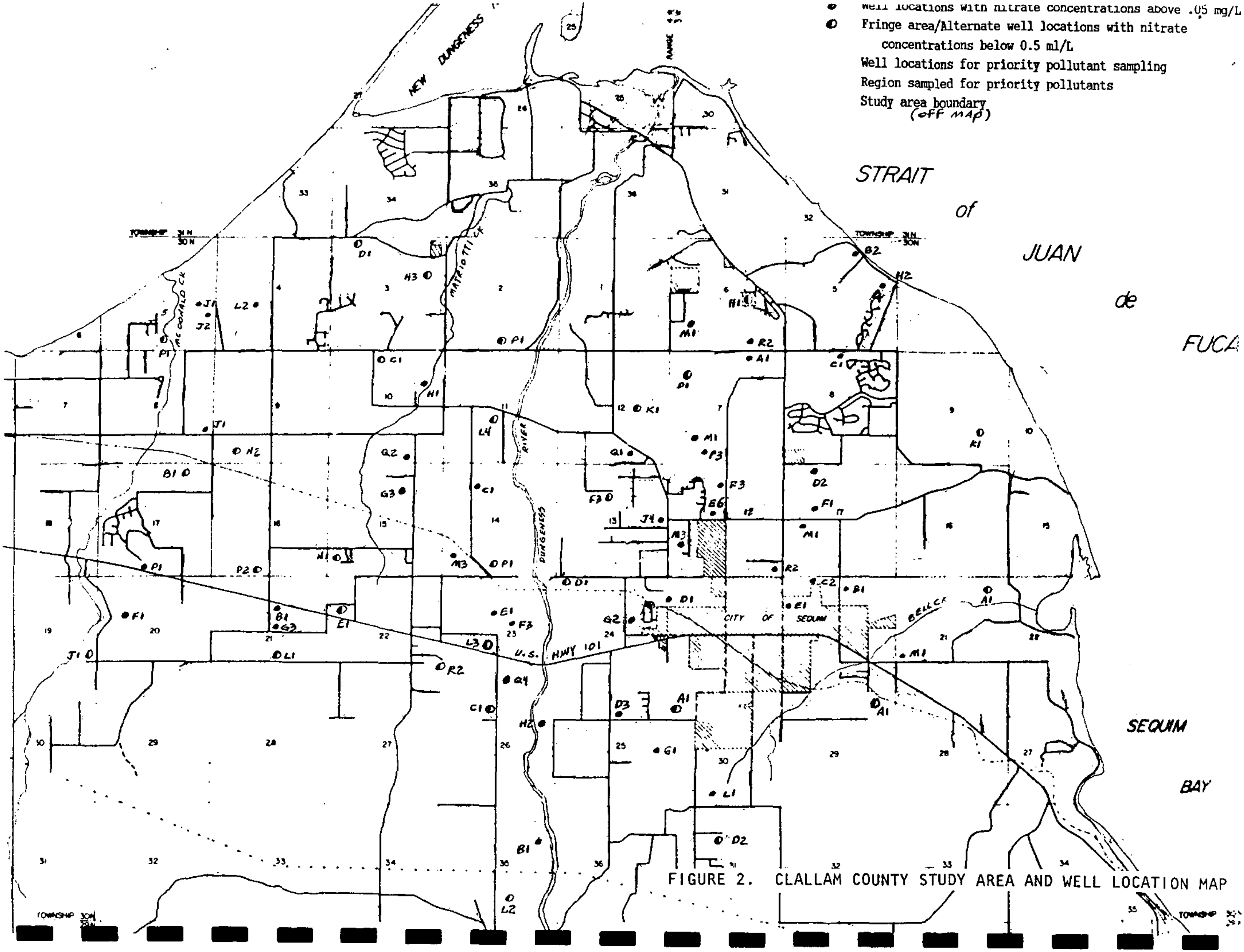


FIGURE 2. CLALLAM COUNTY STUDY AREA AND WELL LOCATION MAP

Seventeen soil classifications are found in the study area. Three of these, the Hoypus, the Carlsborg, and the Sequim, are soils having more than 35% coarse material and textures of sandy loam or greater. Soil permeability ranges from rapid to very rapid. It is generally in these areas where elevated nitrate concentrations are found and where rapid residential and commercial development is occurring. Groundwater quality monitoring, therefore, will be focused over these soil types having low protection.

Hydrogeological investigations revealed three aquifers and two confining beds (Drost, 1983). The confining beds are composed of clay, silt, and till with inclusions of sand. The water table aquifer is composed mainly of glacial, alluvial, and glaciomarine deposits. No artesian aquifers are found in the study area.

Since the mid 1890s, water has been diverted from the Dungeness River into over 200 miles of canals for use mainly as irrigation in agriculture. The canals act as a source of recharge for regional groundwater. With a decrease in future irrigation, well failures, salt water intrusion, and degradation of water quality may occur (Drost, 1983).

Land use is varied for a study area population of 13,000: In 1980, forested land was 46%, agriculture 39%, urban space 12.5%, and miscellaneous 2.5%. Current changes in land use indicate a conversion of agricultural land to residential and commercial use at an accelerated rate during the late 1980s.

2.4 Schedule

A project schedule illustrating dates of sampling, lab sample arrival, delivery of analytical results, and report deliverables relative to sampling and final report activities is observed in Table 1. Depending on QA/QC plan approval, sampling events for the nitrate study and TPH survey are to be performed on three separate occasions. Phase 1 Nitrate sampling will occur during the high irrigation/low rainfall season of July and August. Phase 2 Nitrate sampling and TPH monitoring will begin on September 17, during the transition of the high irrigation/low rainfall season. Selected Priority Pollutant sampling may begin at a later date if TPH levels are elevated. Monthly sampling for nitrates at 10 percent to establish trend analysis has been discussed. WDOE will be informed of any changes by a QA/QC update.

Following the completion of all sampling events, samples will be shipped to AM Test Laboratory for chemical analysis. The first batch of nitrate samples are scheduled for shipment August 8. Shipment of Phase 2 Nitrate and TPH samples will occur on October 3. Total coliform analysis will be performed at Clallam County's state approved water testing laboratory.

TABLE 1. PROJECT SCHEDULE

Parameter	Sampling	Arrival	Results	Deliverables
Phase 1 Nitrate Sampling	July 25 to August 7	August 8	September 5	
Phase 2 Nitrate Sampling	Sept 17 to Sept 28	October 3	November 5	
TPH Sampling	Sept 17 to Sept 28	October 3	November 5	
Selected Priority Pollutants Sampling	TBA*	TBA	TBA	
Final Project Report				March 31, 1991

* To be announced.

A laboratory turnaround time of three to four weeks is anticipated. Based on this, delivery dates of the following sampling events are assured:

1) Phase 1 Nitrates, September 5
2) Phase 2 Nitrates and TPH, November 5
3) Selected Priority Pollutants, to be announced

Total coliform data turnaround time is two to three days. With the exception of total coliform analysis, laboratory turnaround times are tentative, subject to delay.

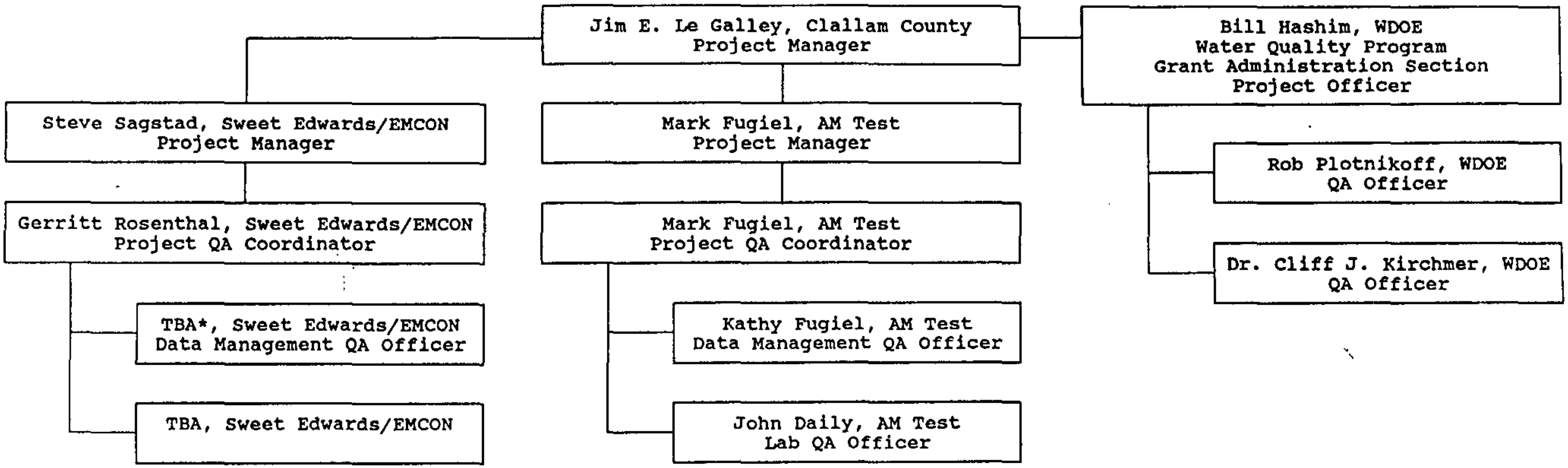
This project must be completed on or before March 31, 1991, with a final project report submitted at this time. The grant contract will expire June 31, 1991.

3. PROJECT ORGANIZATION

A breakdown of project organization and authority is illustrated in Figure 3. Jim E. Le Galley, of Clallam County, is the overall project manager. All field activities, including sample collection, transportation, and storage and shipment to analytical laboratories, will be performed by Mr. Le Galley. Other duties include in-field water quality determinations and laboratory Total Coliform analyses.

AM Test Laboratory of Redmond, Washington will perform nitrate and organics analyses. Mark Fugiel will facilitate project management. John Daily will be the laboratory QA officer. Data management is performed by Kathy Fugiel.

Sweet Edwards/EMCON, an engineering consultant, has been contracted to prepare a nitrate loading model, and to provide technical support in areas outside the scope of Clallam County's capabilities. Steve Sagstad is the firm's project manager. Gerrett Rosenthal will be project QA coordinator. Since contract negotiations are in progress, additional duties and key personnel have yet to be identified. When contract negotiations are complete, WDOE will be informed of any changes by a QA/QC update.



* To be announced

FIGURE 3. QA PROJECT ORGANIZATION

4. DATA QUALITY OBJECTIVES

Project data quality objectives are found in Table 2. It is imperative that the stated detection limits for nitrate-nitrite analyses be achieved and that results be reported in the stated units so that comparisons to earlier data can be made. The laboratory will strive to achieve precision of less than ten percent relative standard deviation based on replicate analyses of samples and check standards. It is expected that results near the detection limit may exhibit poorer precision. The bias, based on the mean of percent recovery results for check standards, should be less than plus/minus ten percent.

Satisfactory results are expected for all samples collected. The stated completeness of ninety percent anticipates that some of the primary well sites may not be accessible. The objectives of this project will be met if satisfactory results are obtained for ninety percent of the primary well sites.

TABLE 2. DATA QUALITY OBJECTIVES

VARIABLE	MATRIX	UNITS	LOWER LIMIT OF DETECTION	BIAS	PRECISION	COMPLETENESS
Inorganics and Conventionals						
NO_3 - NO_2	water	mg/L	0.01	±10%	±10%	90%
pH	water	std pH units	N/A*	±0.1 pH units	±0.1 pH units	90%
Specific Conductance	water	umhos/cm	1.0	±10%	±10%	90%
Temperature	water	degrees °C.	4°C.	1.0°C.	0.5°C.	90%
Total Coliform	water	colonies/100 ml	1 colony/100 ml	N/A	±10%	90%
Total Petroleum Hydrocarbon	water	mg/L	1.0	±10%	±10%	90%

* Not applicable

5. SAMPLING PROCEDURES

5.1 Site Selection

Well monitoring sites which were sampled by the USGS in 1978 are to be resampled for nitrates and total coliform. Forty four wells, located in five areas where nitrate levels varied from a median concentration of 0.35 mg/L to a maximum concentration of 2.5 mg/L are scheduled for sampling. Thirty fringe area/alternate well locations have been designated as backups in the event that well access is denied. These wells have nitrate levels generally less than 0.5 mg/L. If sampling reveals widespread elevated nitrate levels, fringe area/alternate well locations are to be extensively resampled to determine the extent of regional contamination.

These well monitoring sites are located, in general, down gradient from urban areas over soils that have low protection to chemical degradation. Rapid residential and commercial development has occurred over the last twelve years with sewage treatment limited to on-site disposal. This nitrate/total coliform update will serve as a preliminary screening tool to assess changes in regional groundwater quality that may be impacted by development.

Since 1985, the City of Sequim has diverted storm sewer runoff from sewage treatment to disposal by deep drywells. These drywells are located in soil types that have high permeability and low protection values in areas where the water table is generally less than fifty feet. The potential exists to contaminate groundwater with synthetic organic compounds from nonpoint source urban runoff. To study this issue, consultation with an engineering firm for site selection is necessary before TPH sampling can begin. The general area of sampling, however, is north of U.S. Highway 101 from the eastern boundary of the City of Sequim to the Village of Carlsborg. When well monitoring locations have been determined, WDOE will be informed by a QA/QC update.

5.2 Sampling Schedule

A list of the number and type of samples to be collected is illustrated in Table 3. A total of fifty samples are to be collected for nitrate and total coliform analyses from forty four well locations. Four of these samples are duplicates at 10% while two samples are trip blanks at 20%.

As mentioned earlier, TPH locations have not been identified. It is anticipated that ten well locations may be used for preliminary screening using necessary QA/QC methods, including duplicates, trip blanks, and transfer blanks. When this information is determined, WDOE will receive a QA/QC update.

TABLE 3. SAMPLING SCHEDULE

No.	Sample I.D.	Duplicate	Trip Blank	Transfer Blank	Nitrate	Total Coliform	TPH	Priority Pollutants /Analyte
1	30-3-5-B2				X	X		
2	30-3-5-H2				X	X		
3	30-3-6-M1				X	X		
4	30-3-6-R2				X	X		
5	30-3-7-A1				X	X		
6	30-3-7-M1				X	X		
7	30-3-7-P3				X	X		
8	30-3-8-C1				X	X		
9	30-3-17-D2				X	X		
10	30-3-17-F1				X	X		
11	30-3-17-F1/R	X			X	X		
12	30-3-17-M1				X	X		
13	30-3-18-E6				X	X		
14	30-3-18-F3				X	X		
15	30-3-18-M3				X	X		
16	30-3-18-R2				X	X		

Table 3
Page 2

No.	Sample I.D.	Duplicate	Trip Blank	Transfer Blank	Nitrate	Total Coliform	TPH	Priority Pollutants /Analyte
17	30-3-19-D1				X	X		
18	30-3-20-B1				X	X		
19	30-3-20-C2				X	X		
20	30-3-20-E1				X	X		
21	30-3-30-L1				X	X		
22	30-3-D0-L1/R	X			X	X		
23	TB-1		X		X	X		
24	30-4-4-L2				X	X		
25	30-4-5-J1				X	X		
26	30-4-5-J2				X	X		
27	30-4-8-J1				X	X		
28	30-4-10-H1				X	X		
29	30-4-10-Q2				X	X		
30	30-4-12-Q1				X	X		
31	30-4-13-J4				X	X		
32	30-4-14-C1				X	X		
33	30-4-14-M3				X	X		
34	30-4-14-M3/R	X			X	X		

No.	Sample I.D.	Duplicate	Trip Blank	Transfer Blank	Nitrate	Total Coliform	TPH	Priority Pollutants /Analyte
35	30-4-15-G3				X	X		
36	30-4-17-P1				X	X		
37	30-4-20-E1				X	X		
38	30-4-21-B1				X	X		
39	30-4-21-G3				X	X		
40	30-4-23-E1				X	X		
41	30-4-23-F3				X	X		
42	30-4-23-R4				X	X		
43	TB-2		X		X	X		
44	30-4-24-G2				X	X		
45	30-4-25-A1&2				X	X		
46	30-4-25-A1&2/R	X			X	X		
47	30-4-25-D3				X	X		
48	30-4-25-G1				X	X		
49	30-4-25-H2				X	X		
50	30-4-35-B1				X	X		
1-A*	30-3-6-H1				X	X		
2-A	30-3-7-D1				X	X		

No.	Sample I.D.	Duplicate	Trip Blank	Transfer Blank	Nitrate	Total Coliform	TPH	Priority Pollutants /Analyte
3-A	30-3-9-K1				X	X		
4-A	30-3-21-A1				X	X		
5-A	30-3-21-M1				X	X		
6-A	30-3-29-A1				X	X		
7-A	30-4-31-D2				X	X		
8-A	30-4-2-P1				X	X		
9-A	30-4-3-D1				X	X		
10-A	30-4-3-H3				X	X		
11-A	30-4-5-P1				X	X		
12-A	30-4-9-N2				X	X		
13-A	30-4-10-C1				X	X		
14-A	30-4-10-P1				X	X		
15-A	30-4-11-L4				X	X		
16-A	30-4-12-K1				X	X		
17-A	30-4-13-F3				X	X		
18-A	30-4-14-P1				X	X		
19-A	30-4-15-N1				X	X		
20-A	30-4-16-P2				X	X		

No.	Sample I.D.	Duplicate	Trip Blank	Transfer Blank	Nitrate	Total Coliform	TPH	Priority Pollutants /Analyte
21-A	30-4-17-B1				X	X		
22-A	30-4-19-H1				X	X		
23-A	30-4-20-B1				X	X		
24-A	30-4-21-L1				X	X		
25-A	30-4-22-E1				X	X		
26-A	30-4-22-R2				X	X		
27-A	30-4-23-L3				X	X		
28-A	30-4-24-D1				X	X		
29-A	30-4-26-C1				X	X		
30-A	30-4-35-L2				X	X		

*"A" designation = fringe area/alternate well locations

5.3 Standard Operating Procedures

To ensure that valid data has been collected, Standard Operating Procedures (SOPs) have been developed and will be strictly followed. In the following discussion, both field equipment and field sampling SOPs are highlighted.

Field Equipment

At every well sampling location, measurements for pH, conductivity and temperature will be obtained. Procedures for instrument calibration are as follows:

1. pH Meter

   A portable Beckman pH meter will be calibrated and operated according to the manufacturer's recommendations as referenced in Appendix 1. A two step calibration process using pH buffer solutions of 4 and 7 will be followed at every sampling site. Measurements are to be made to the nearest 0.1 pH units.

2. Conductivity Meter

   A portable YSI conductivity meter will be calibrated and operated according to the manufacturer's recommendations as referenced in Appendix 2. Prepared standards of 250 and 125 micromhos/cm^2 shall be used for calibration prior to sample measurement.

3. Thermometer

   All temperature measurements will be made with the portable YSI conductivity meter to 1.0^{o}C. No pre-field calibration procedure exists. Aside from damage and suspicious measurements, all temperature data will be accepted without correction.

Field Sampling

Outlined procedures are listed below which will be utilized at every sampling site. Any deviations from the described protocol will be noted in the groundwater sampling record (Appendix 4).

1. All well sampling locations will be field checked prior to sampling activity according to well logs and field notes from previous investigations.

2. A groundwater sampling record will be used to record well and sampling data.

3. Well users will be interviewed on-site to investigate possible changes in well location, well depth, well usage, changes in water quality and if treatment systems are employed.

4. No static water table elevations will be made during the first round of sampling due to sampling logistics. However, contracted technical support may request these data at a later date.

5. Wells with casings four inches or less will be pumped for a period of fifteen minutes. At five minutes intervals, pH, conductivity and temperature measurements shall be obtained. Sample collection will occur when measurements have stabilized.

6. Samples will be obtained as close to the well head as possible before entering a pressurized tank or receiving chemical treatment.

7. All field equipment will be rinsed with distilled deionized water after analysis at each site, then blotted dry with paper towels.

8. Only appropriate sample containers will be used for a specified analyte. Sample container labels shall be completely filled out on-site.

9. In transport, samples will be cooled with ice to 4°C and stored upright with custody seals.

5.4 Field Notebook

A weatherproof-bound notebook will be used to record field data at all well sampling locations. This notebook will contain the groundwater sampling record in addition to field observations, comments and a detailed site sketch. The following information shall be documented:

1. Date and time of collection

2. Name, address, and phone number of well user

3. Well location sketch map

4. Drawings of helpful or unusual conditions

5. Changes of well condition (i.e. new screening, new pumps, new piping, changes in water quality, drilling depth and time of last pumping)

6. Well evacuation procedure

7. Sample withdraw method

8. Parameters tested

9. Field analysis results (i.e. temperature, pH and conductivity)

10. Sample identification number

11. Name of investigator

12. Field observations (i.e. weather, air temperature, or unusual conditions)

5.5 Sample Identification

Unless otherwise noted, all nitrate and total coliform well sampling locations are obtained from a compiled list of Clallam County wells from USGS Report 83-4227. Wells excavated after 1981 will not be included. However, sampling sites for TPH analyses may include post 1981 well locations.

To simplify sample identification and reduce mistakes in transcription, standard township, range, and section numbers, along with well location codes, will suffice for sample identification numbers. Duplicate samples will be labeled with a suffix "R". For example, a duplicate sample obtained from a well at 30N/03W-06 G03 would have a sample identification number of 30-3-6-G3/R.

Trip blanks and transfer blanks are labeled using only a designator code and number. Codes TB and TR represent trip blank and transfer blank respectively. For example, trip blank number 1 is labeled TB-1. Successive samples will change only in their number suffix.

In addition, each well sample site will have sample bottle labels to record:

1. Sample I.D. number

2. Type of preservative

3. Date and time

4. Signature of Collector

5. Analysis required

5.6 Field QC Samples

Three types of field QC samples will be collected:

1) 10% duplicates
2) 20% trip blanks
3) 20% transfer blanks

As listed in Table 4, six QC samples each for Nitrate and total coliform analysis are scheduled for collection. When TPH QC sampling sites are identified, a QA/QC update will be sent to WDOE.

Generated QC data will assist in determining whether potential contamination or sampling problems exist by comparing values to anticipated precision and accuracy criteria. Trip blanks, for example, should have both high levels of accuracy and precision. If levels are high, contamination or sampling problems may exist. Transfer blanks may illustrate atmospheric contamination problems during sample collection if accuracy levels are high. Ten percent duplicate sampling will assess precision. If variability exists, errors in sampling or laboratory analysis may exist.

All field QC samples will be treated as ordinary samples and their results reported and assessed in terms of the project objectives along with other sample results.

5.7 Containers, Preservation, and Holding Times

Container types, preservation methods and specific holding times for each analyte are listed in Table 5. No deviations from these criteria will be accepted.

Sample bottles are preserved at the laboratory prior to sample collection. An ample supply of preserved sample bottles exists if lab data suggests an expanded sampling schedule at a later date.

Custody seals will be affixed to all sample containers. In addition, TPH sample containers are to be enclosed in resealable plastic bags to reduce leakage and cross contamination.

5.8 Sample Custody

Since project data will not be used in legal affairs, no formal chain of custody procedures will be used. Shipping receipts, however, will serve as a means of tracking samples while in transit. A private courier service, such as Greyhound or U.P.S., will ship samples from Clallam County to AM Test Laboratory. AM Test will inform Clallam County by phone of receipt of samples.

Sample transport will occur in strapped insulated coolers iced at $4^{o}C$. A laboratory sample analysis request form will be included with the samples during delivery to AM Test Laboratory.

TABLE 4. FIELD QC SAMPLES

No.	Sample I.D.	Duplicate Samples	Trip Blanks	Transfer Blanks	--------Parameters------- Nitrate	Total Coliform	TPH
1	30-3-17-E1/R	X			X	X	
2	30-3-30-L1/R	X			X	X	
3	TB-1		X		X	X	
4	30-4-14-M3/R	X			X	X	
5	TB-2		X		X	X	
6	30-4-25-A1&2/R	X			X	X	

TABLE 5. CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Type/Quantity	Preservation	Holding Time	Container Volume /Sample Volume (Ml)
NO_3-NO_2	Poly/125	Cool, 4°C H_2SO4 to pH<2	28 days	250/225
Total Coliform	Poly/30*	Cool, 4°C 0.008% Na_2 S_2O_3	6 hours	125/100
+ TPH	glass/15	Cool, 4°C	28 days	1000/1000

* Sample containers will be washed and sterilized from previous sampling events.

+ Sample bottles will be filled slowly so no air bubbles or headspace develops above the sample.

6. ANALYTICAL PROCEDURES

Analytical methods for sample parameters are listed in Table 6. AM Test Laboratory will analyze for Nitrate - Nitrite, and TPH, while the remaining analyses will be conducted by Clallam County. No exceptions to these methods will be accepted.

Previous sampling in 1978 revealed a Nitrate median concentration of 0.35 mg/L. The highest nitrate concentration is 2.5 mg/L. No historic data exists for TPH.

Calibration and standardization procedures which are applicable to specific methods are acceptable and expected to be used in analysis. Any non-standard procedures are not acceptable.

TABLE 6. ANALYTICAL PROCEDURES

Parameter	Method	Reference EPA	Reference Std Methods	Reference SW	Lower Reporting Limit
Nitrate-Nitrate	Rapid Flow Analysis	353.2			0.010 mg/L
pH	Electrometric	150.1			+ 0.1 units
Conductivity	Wheatstone Bridge	120.1			1 umho/cm
Total Coliform	Membrane Filter		909A		1 colony/100 ml
TPH	IR	413.2			1.0 mg/L

7. QUALITY CONTROL

The results of the analysis of quality control samples will provide an estimate of the precision and bias associated with the sampling and analytical procedures.

7.1 Field QC Procedures

Field QC samples are listed in Table 4. Descriptive information regarding field samples are found in Section 5.6.

In general, field QC samples include 10% duplicate sampling, trip blanks and field blanks. Duplicates will be collected at every tenth sampling site for nitrates, total coliform and TPH. Trip blanks will be employed for nitrate and total coliform analysis at the rate of one per twenty samples. Transfer blanks will be collected at a rate of one per twenty samples for TPH. This QC procedure will remain in effect for the duration of the project despite adjustment in sampling locations.

QC sampling and assessment procedures which are specific to QC analytes are described below:

Duplicate sampling requires the collection of an additional sample at the same time of sample collection. Laboratory results for duplicate samples will only provide an estimate of the total random error of the sampling and analytical procedures. Errors due to improper preservatives, excessive holding times or unrepresentative samples are, in general, systematic and would not contribute to variability in the duplicate results.

Trip blanks are prepared by filling a sample container with distilled water, sealing it, and subjecting it to the same transportation and storage conditions as the other samples. The results of the analysis of trip blanks will indicate the presence of contamination in the sample containers or acquired as a result of transportation and storage of the samples.

Transfer blanks are prepared by transferring organic-free distilled water to a sample container by hand pouring during sample collection. Laboratory data for transfer blanks will provide information regarding atmospheric induced contamination during sample collection. Sample concentrations may be adjusted with this value to obtain a representative sample concentration.

The results for field blanks and duplicates will be reported along with those of the sample in the project reports. Duplicate results will be used to estimate the precision of the sample results. Blank results will be used to assess the presence and magnitude of any contamination problems.

7.2 Laboratory QC Procedures

Specific laboratory QC samples are listed in Table 7. The QC delegation schedule is flexible to accommodate normal laboratory operating procedures. However, all four laboratory QC parameters, such as check standards, duplicates, spikes and blanks, must be evaluated for without compromise.

In the event of poor laboratory QC performance, laboratory QC parameters, along with prior analyzed samples, will be reanalyzed. If sample volumes are too low for reanalysis, data will be accepted and discussed at length in separate task reports. AM Test will provide a validation report in which they provide their judgement of the impact of any QC results which fail to meet the criteria on the data (Appendix 4).

TABLE 7. LABORATORY QC SAMPLE DELEGATION

Parameter	Check Standards	Duplicates	Spikes	Blanks
Nitrate-Nitrate	1 hi, 1 low /batch	1/batch	1/batch	2/batch
TPH	1 hi, 1 low /batch	1/batch	1/batch	2/batch
pH	2/site	1/site	N/A*	N/A
Conductivity	2/site	1/site	N/A	N/A
Temperature	N/A	1/site	N/A	N/A

* Not Applicable

8. DATA ASSESSMENT PROCEDURES

All laboratory results will be subjected to statistical evaluation. Mathematical procedures to assess precision, bias and completeness shall be used. Standard statistical methods are to be employed when evaluating all nitrate, total coliform and TPH data. Complex evaluations are not necessary, given the nature and small size of this project.

Listed below are four equations that will be used in data assessments:

1. Standard Deviation From a Single Pair of Results

$$s = D/\sqrt{2}$$

2. Standard Deviation Estimated from Combining M Pairs of Duplicate Results

$$s = \sqrt{(\Sigma D_i^2 / 2m)}$$

3. Confidence Limits on an Estimate of the Mean

$$\bar{x} \pm_{(1-\gamma)} s/\sqrt{n}$$

4. T-Test/Comparison of Means

$$t = \frac{|(\bar{x} - \bar{y})|}{s_m}$$

QA assessment of project data will include three topics:

1. Validation of the laboratory results.
2. Overall precision of the results based on the results of field duplicate samples, as well as analytical precision based on the results of lab duplicates and check standards.
3. Impact of the field blank results.

If the laboratory's validation report qualifies any of the sample results on the basis of their QC procedures, Clallam County will use judgement whether to make full use, limited use, or no use of those results.

The total random variability of the results for nitrate-nitrite, and TPH will be calculated using the equation for the standard deviation of duplicate results. If the results of two or more pairs of duplicate samples are positive and of the same magnitude, the standard deviations of the pairs can be pooled to obtain a better estimate of the precision.

If the field blank results exhibit positive levels of any analyte, then some criterion for the acceptance of the sample results, based on the variability of the blank results, will be developed.

Baseline data currently exists for nitrates and total coliform at selected sites. This data will be reviewed and utilized in statistical evaluations. Statistical assessment will be limited for TPH as no historical data exist.

9. WATER QUALITY DATABASE

All project water quality data will be stored on an IBM-PC, using the Lotus 1-2-3 spreadsheet software, immediately upon review by Sweet Edwards/EMCON. Historic and generated data will be entered and tabulated in row and column format using sample I.D. number and analyte/concentrations. All data is to be stored on hard drive, having two floppy disks as backup.

Other data that will comprise the standard format include:

1. Units
   * mg/L Nitrate
   * colonies/100 ml Total Coliform
   * mg/L TPH

2. All values are to be reported to three significant figures.

3. Concentrations of all field and laboratory QA/QC Data
   * Trip Blanks
   * Transfer Blanks
   * Field Duplicates
   * Lab Duplicates
   * Spikes
   * Standards
   * Reference Standards

4. Results of statistical analyses

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10. State of Washington, Department of Ecology, May 1990. Guidelines and Specifications for Preparing Quality Assurance Project Plans. Olympia, Washington.

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12. White, Bill, March 1988. Sequim-Dungeness Groundwater Quality Grant Proposal. Clallam County Division of Environmental Health. Port Angeles, Washington.

APPENDIX 1

pH METER SOPs

BECKMAN

Φ™10 pH Meter
Φ™11 pH Meter
Φ™12 pH/ISE Meter

Beckman Instruments, Inc. • Scientific Instruments Division • Fullerton, CA 92634-3100

MEASURING pH (Φ10, Φ11, Φ12)

MEASURING mV AND RELATIVE mV (Φ11, Φ12)

MEASURING CONCENTRATION (Φ12)

INSTRUMENT FUNCTIONS AND FEATURES

ELECTRODES, BUFFERS, AND ACCESSORIES

BATTERY REPLACEMENT, SERVICE
AND TROUBLESHOOTING

SPECIFICATIONS

pH MEASUREMENT: DETAILED INSTRUCTIONS

METHODS: The pHI 10, 11, and 12 can measure pH from 0 to 15.99. They will perform one- or two-point standardization automatically, using any buffer listed below, at any temperature between -5°C and 100°C.

STANDARD pH BUFFERS RECOGNIZED BY THE pHI 10, 11, AND 12:

1.68, 4.00, 7.00, 10.01, 12.45.

TWO-POINT STANDARDIZATION METHOD:

Two-point standardization, the preferred and more accurate method of pH measurement, should be used when pH accuracy of beyond ±0.1 pH is required. Use buffers as close to the sample pH as possible; one above, and one below. (For example, if sample pH is about 8.5, use 7.00 and 10.01 pH buffers).

ONE-POINT STANDARDIZATION METHOD:

One-point standardization, a somewhat faster procedure, is recommended only if (a), accuracy of ±0.1 pH unit is acceptable, and (b), sample pH is within 1.5 pH of that of the buffer used for standardization.

pH MEASUREMENT PROCEDURE:

1. Connect electrode(s) to appropriate input(s):
   a. If a *combination electrode* is used, connect it to the input marked "pH".
   b. If an *electrode pair* is used, connect the indicating electrode to the input marked "pH" and the reference electrode to the input marked "REF".
   c. For better accuracy, or when measuring and/or standardizing at a temperature of other than 25°C, connect a Beckman 598115 Automatic Temperature Compensator probe to input marked "ATC".

2. Press [①] to turn on instrument, then press [C] to clear. Display will show [Clr, AUTO].

3. Rinse electrode(s) (and ATC if used) with deionized water. Blot excess.

4. Immerse electrode(s) (and ATC if used) in first standard. Stir briefly with electrodes to remove bubbles from electrode surfaces. Press [pH]. Displayed pH value will have a resolution of 0.01. If 0.1 resolution is desired, press [.1/.01].

5. Press [STD]. When [◁▷] stops flashing, display will show [pH value locked, ◁▷, ▶ STD 1].

6. Rinse electrode(s) (and ATC probe if used) with deionized water. Blot excess. Proceed to appropriate step, according to desired type of standardization:
   a. If ONE-POINT standardization is to be used, instrument is ready for sample measurement; proceed to Step 9.
   b. If TWO-POINT standardization is desired, proceed to Step 7.

7. Immerse electrode(s) (and ATC if used) in second standard. Stir briefly with electrodes to remove bubbles from electrode surfaces. Press [STD]. When [◁▷] stops flashing, display will show [pH value locked, ◁▷, ▶ STD 1, ▶ STD 2].

8. Rinse electrode(s), (and ATC probe if used) with deionized water. Blot excess.

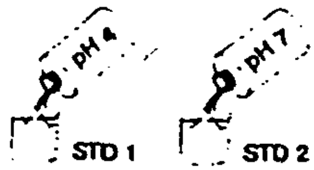
9. Immerse electrode(s) (and ATC if used) in sample. Stir briefly with electrodes. Press [pH]. When [◁▷] stops flashing, display will show [pH value locked, ◁▷]. Measurement is now complete. Repeat Steps 8 and 9, above, for additional samples.

10. If continuous pH monitoring is desired, press [AUTO] to turn off Auto Read function.

pH MEASUREMENT

(Two-standard method: Condensed Instructions)

I. SETUP

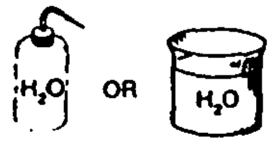
① 

Prepare buffers (eg., pH 4 and 7).

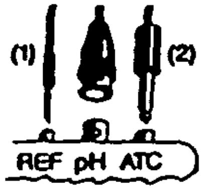
② 

SAMPLE

Prepare sample.

③ 

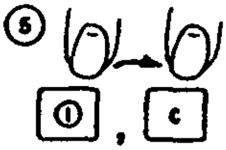
Prepare deionized or distilled water for electrode rinse.

④ 

(1) Omit reference if combination electrode is used.

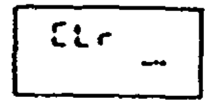
(2) ATC optional.

Connect electrodes to instrument.

⑤ 

Turn on and clear instrument.

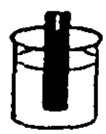
⑥ Display will read:



II. STANDARDIZE

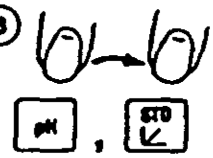
① 

Rinse electrode(s). Blot excess.

② 

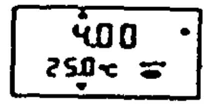
STD 1

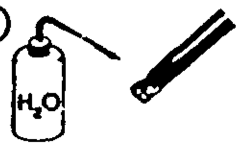
Immerse electrode(s) in STD.1. Stir briefly.

③ 

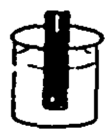
Press [pH], then [STD].

④ After [◁▷] stops flashing, display will read pH of STD.1



⑤ 

Rinse electrode(s). Blot excess.

⑥ 

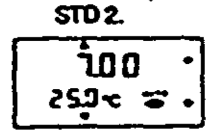
STD 2

Immerse electrode(s) in STD 2. Stir briefly.

⑦ 

Press [STD].

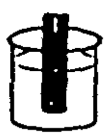
⑧ After [◁▷] stops flashing, display will read pH of STD 2.



III. MEASURE pH

① 

Rinse electrode(s). Blot excess.

② 

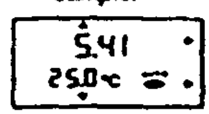
SAMPLE

Immerse electrode(s) in sample. Stir briefly.

③ 

Press [pH].

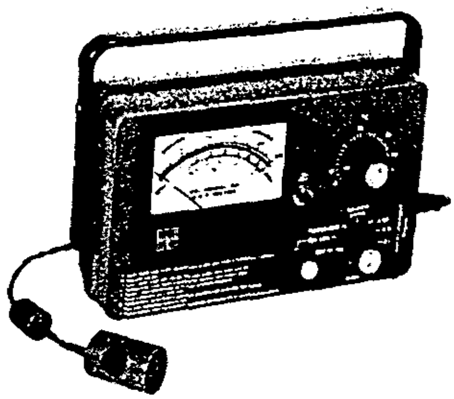
④ After [◁▷] stops flashing, display will read pH of sample.



APPENDIX 2

CONDUCTIVITY METER SOPs

YSI MODEL 33 S-C-T METER INSTRUCTIONS



GENERAL DESCRIPTION

The YSI Model 333 S-C-T Meter is a battery powered, transistorized instrument designed to accurately measure salinity, conductivity and temperature. It uses a probe consisting of a rugged, plastic conductivity cell and a precision YSI thermistor temperature sensor combined in a single unit.

Conductivity is expressed in micromhos/centimeter. This is a measurement of the electrical conductance the sample would show if measured between opposite faces of a 1 cm cube. Salinity is expressed in the number of grams of salt/kilogram of sample (ppt = parts per thousand). The "metric," or Systeme International unit is milliSiemens/meter. (Conversion information: 1 micromho/cm = 0.1 mS/m. "Metric" values are shown in parenthesis in these instructions.) This measurement assumes the sample contains a "standard" sea water salt mixture. The sample temperature is measured in degrees Celsius.

Salinity measurements are manually temperature compensated by direct dial. Conductivity measurements are not temperature compensated; however, a temperature function is provided on the instrument to aid with calculation of corrections. When temperature and conductivity are known, it is possible to calculate salinity; and when only temperature and salinity are known, it is possible to calculate conductivity. This is discussed in the section on Recalibration.

SPECIFICATIONS

Model 33 Conductivity

Ranges: 0 to 500 (x1), 0 to 5,000 (x10), and 0 to 50,000 micromhos/cm (x100) with YSI 3300 Series Probes. (Note: The "micromho" designations on the meter are a shorthand form for "micromho/cm".)

Accuracy: (See Error Section)
±2.5% max. error at 500, 5,000 and 50,000 plus probe.
±3.0% max. error at 250, 2,500 and 25,000 plus probe.

Readability:
2.5 micromhos/cm on 500 micromho/cm range.
25 micromhos/cm on 5,000 micromho/cm range.
250 micromhos/cm on 50,000 micromho/cm range.

Temperature Compensation: None.

Salinity

Range: 0-40 ppt in temperature range of -2 to +45°C, within specified conductivity range of 0 to 50,000 micromho/cm (0 to 5.000 mS/m). See chart in section on Recalibration.

Accuracy (See Error Section)
Above 4°C: ±0.9 ppt at 40 ppt and ±0.7 ppt at 20 ppt plus conductivity probe.

Below 4°C: ±1.1 ppt at 40 ppt and ±0.9 ppt at 20 ppt plus conductivity probe.

Readability: 0.2 ppt on 0-40 ppt range.

Temperature Compensation: Manual by direct dial from -2 to +45°C.

Temperature Range: -2 to +50°C.

Accuracy: ±0.1°C at -2°C, ±0.6°C at 45°C plus probe (See Error Section)

Readability: ±0.15°C at -2°C to ±0.37°C at 45°C.

Power Supply: Two D-size alkaline batteries, Eveready E95 or equivalent, provide approximately 200 hours of operation.

Instrument Ambient Range: -5 to +45°C. A maximum error of ±0.1% of the reading per °C change in instrument temperature can occur. This error is negligible if the instrument is readjusted to redline for each reading.

YSI Incorporated
Yellow Springs Instrument Co., Inc., Yellow Springs, Ohio 45387 USA
Phone 513 767-7241 • 800 343-HELP • Fax 513 767-9353 • Telex 205437

YSI 3300 Series Conductivity/Temperature Probe

Nominal Probe Constant: K = 5/cm (K = 500/m)

Accuracy: ±2% of reading for conductivity and salinity.

Error of ±0.1°C at 0°C and ±0.3°C at 40°C.

OPERATION

Setup

1. Adjust meter zero (if necessary) by turning the bakelite screw on the meter face so that the meter needle coincides with the zero on the conductivity scale.

2. Calibrate the meter by turning the MODE control to REDLINE and adjusting the REDLINE control so the meter needle lines up with the redline on the meter face. If this cannot be accomplished, replace the batteries.

3. Plug the probe into the probe jack on the side of the instrument.

4. Put the probe in the solution to be measured. (See Probe Use.)

Temperature

Set the MODE control to TEMPERATURE. Allow time for the probe temperature to come to equilibrium with that of the water before reading. Read the temperature on the bottom scale of the meter in degrees Celsius.

Conductivity

1. Switch to X100. If the reading is below 50 on the 0-500 range (5.0 on the 0-50 mS/m range), switch to X10. If the reading is still below 50 (5.0 mS/m), switch to the X1 scale. Read the meter scale and multiply the reading appropriately. The answer is expressed in micromhos/cm (mS/m). Measurements are not temperature compensated.

Example
Meter Reading: 247 (24.7 mS/m)
Scale: X10
Answer: 2470 micromhos/cm (247.0 mS/m)

2. When measuring on the X100 and X10 scales, depress the CELL TEST button. The meter reading should fall less than 2%; if greater, the probe is fouled and the measurement is in error. Clean the probe and re-measure.

NOTE: The CELL TEST does not function on the X1 scale.

Salinity

1. Determine the sample temperature and adjust the temperature dial to that value.

2. Switch to x100. If the reading is above 500 micromho/cm (50 mS/m), the salinity value is beyond the measurement range.

3. If the reading is in range, switch to SALINITY and read salinity on the red 0-40 ppt meter scale.

4. Depress the CELL TEST button. The fall in meter reading should be less than 2%; if it is greater, the probe is fouled and the measurement is in error. Clean the probe and re-measure.

Error

The maximum error in a reading can be calculated by using the graphs in the following sections.

Temperature Error

The temperature scale is designed to give the minimum salinity error when temperature readings are used to compensate salinity measurements.

Figure 1 shows total error for probe and instrument versus °C meter reading.

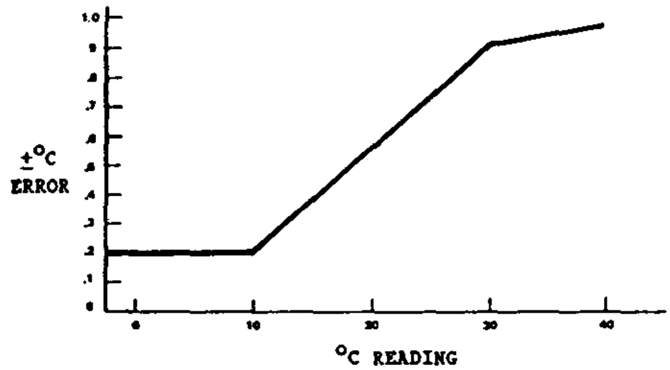


FIGURE 1

Example:
Meter Reading: 15°C
Total Error: 0.4°C
Accuracy: 15°C ±0.4°C for probe and instrument combined.

Conductivity Error

Figure 2 shows the worst-case conductivity error as a function of the conductivity reading for the probe and instrument combined.

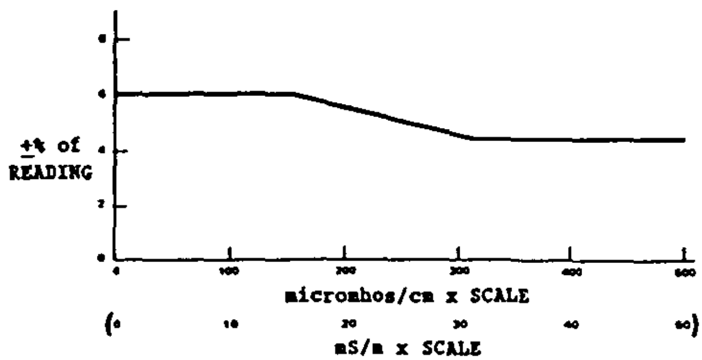


FIGURE 2

Example
Meter Reading: 360 micromhos/cm (36 mS/m)
Scale: X10
% Reading Error: ±4.5%
Accuracy: 3600 ±162 micromhos/cm (360 ±16.2 mS/m) for probe and instrument

Salinity Error

The salinity readings are a function of temperature and conductivity, therefore the accuracy is a function of both.

The temperature scale and temperature control have been designed to minimize the temperature error contribution to the salinity error. The error shown in Figure 3 is the total of the temperature and conductivity probe, the temperature scale and the salinity scale error.

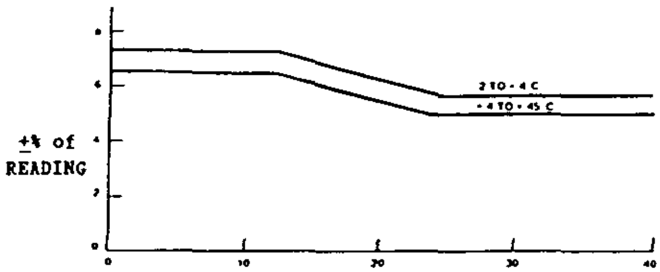


FIGURE 3

Example
Meter Reading: 10 ppt, @ 10°C
% of Reading Error: 6.5%
Accuracy: 10 ppt ±0.65 ppt for all errors, combined worst case.

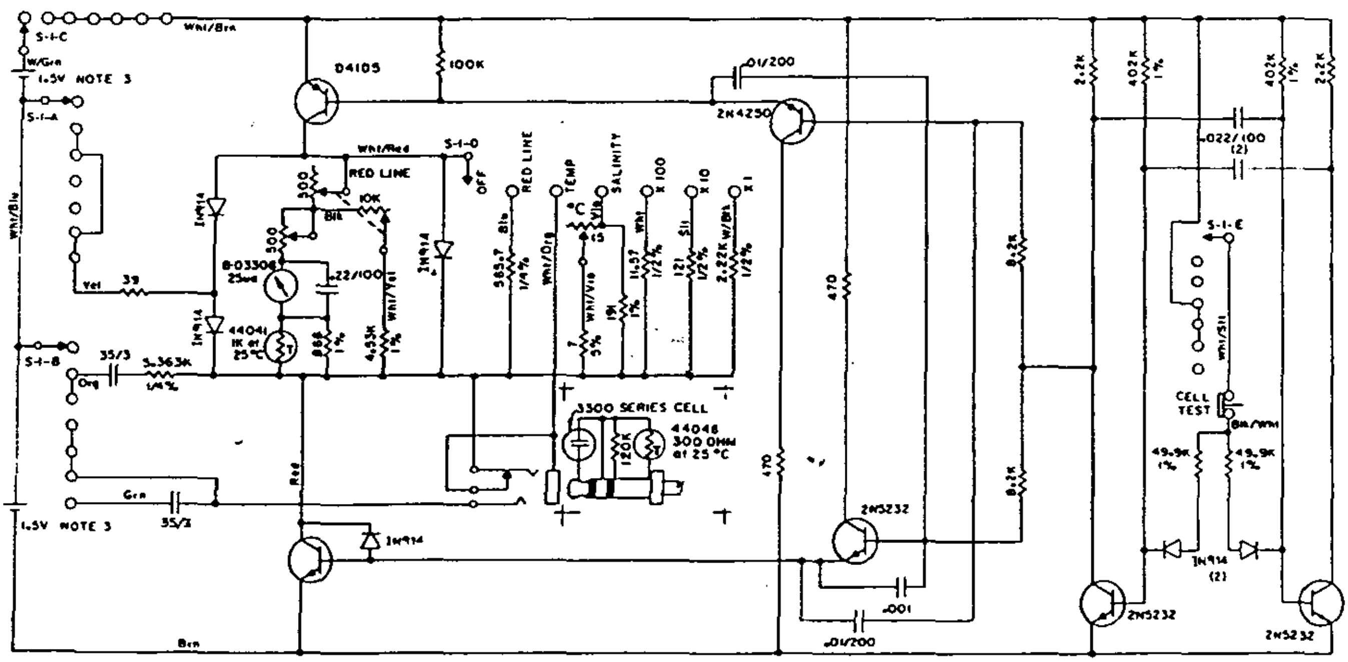
CIRCUIT DESCRIPTION

The circuit is composed of two parts; a multivibrator and switching transistors. The multivibrator produces a square waveform voltage. The square wave is applied to two switching transistors. They alternately apply two batteries of opposite polarity to the probe thus providing AC power which minimizes polarization effects. The meter is in series with one battery and measures the current from it. The current from the battery is proportional to the conductance of the cell. Salinity is measured in a special range conductivity circuit which includes a user-adjusted temperature compensator. In the temperature, redline and X1 positions, the multivibrator operates at 100Hz. In the salinity, X100 and X10 positions the multivibrator operates at 600Hz; in these ranges, pushing the CELL TEST button drops the frequency to 100Hz, allowing the operator to test for probe polarization.

INSTRUMENT MAINTENANCE

The only maintenance required is battery replacement. Two "D" size alkaline flashlight cells, such as Eveready E95 or equivalent, will provide 200 hrs. of operation. Accuracy will not be maintained if zinc-carbon "D" cells are used. Battery replacement is indicated when the redline adjustment cannot be accomplished.

Replace batteries every six months to reduce the danger of corrosion due to leaky batteries. To replace batteries, remove the screws from the rear cover. The battery holders are color coded. The positive end must go on red.



NOTES:
Resistance values in ohms. K = 1,000. Resistors are 1/2 W, 10%, unless otherwise specified.

Battery is D size, alkaline only. Eveready E-95 or equivalent.

This schematic is representative and may be slightly different from the circuit in your instrument.

YSI MODEL 33 AND 33M SCHEMATIC

RECALIBRATION

Recalibration should be done at the factory. If emergency recalibration is necessary, however, one of the procedures described below may be attempted.

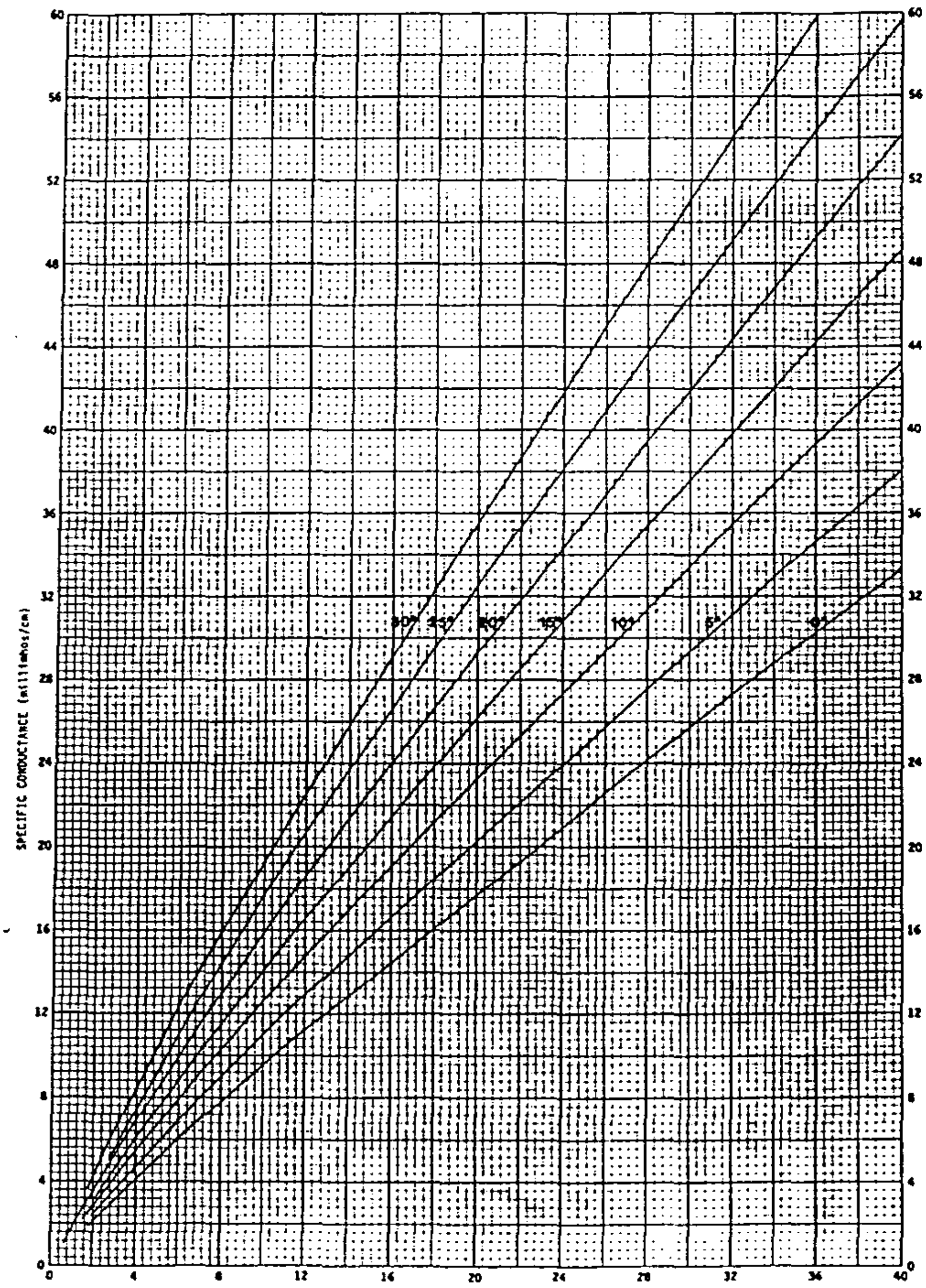
1. Use this method if the temperature knob has become loose or slipped from its normal position.

a. Read the temperature and conductivity of a sample. Determine the salinity of the solution by running a line vertically on the Calibration Graph from this conductance value until it intersects the appropriate °C line (interpolate as required for temperature between the given °C lines). From this intersection extend a line horizontally to the edge of the graph to read the salinity for this sample.

Example: 25,000 micromhos/cm (2,500 mS/m) and 20°C gives a salinity of 17 ppt.

b. Remove the temperature knob, switch to SALINITY, and turn the conrol shaft until the meter needle indicates the salinity value determined in Step a. In the example given, the value is 17.

c. Switch to TEMPERATURE and note the reading. This reading must be the same as Step in a; if it is not, begin again. Replace the knob (without turning the control shaft) with the pointer at the same temperature as the meter reading and tighten both set screws securely.

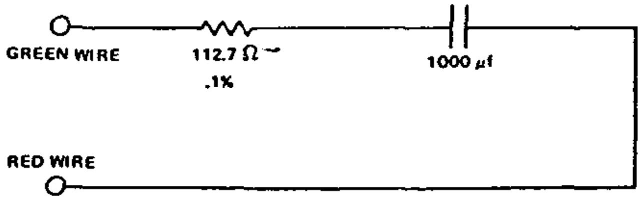


2. You may use the resistor and capacitor hookup shown in the sketch to substitute for the probe in the following recalibration procedure.

a. Set the instrument for a salinity measurement as normal.

b. Substitute a 1000 microfarad capacitor and 112.7 ohm 0.1% tolerance resistor for the probe.

Connect the resistor and capacitor between the green wire and red wire on the jack connections inside the instrument.



c. Turn the temperature dial until the meter reads redline.

d. Reinstall the temperature knob with the arrow at 25°C.

This is a temporary calibration only. Return the instrument to the factory for proper recalibration.

YSI 3300 SERIES CONDUCTIVITY/TEMPERATURE PROBES

Description

These probes are designed and constructed for rugged, accurate service in field use. The conductivity cell constant is 5.0/cm (500.0/m) ±2%. Each probe contains a precision YSI thermistor temperature sensor of ±0.1°C accuracy at 0°C and ±0.3°C at 40°C. The low capacitance cable assembly terminates in a three terminal 0.25" dia. phone plug.

The 3310 has a 10 foot cable and the 3311 a 50 foot cable. Other lengths are available on special order.

The probe has a rigid P.V.C. body, platinized pure nickel electrodes, and a rugged cable.

Cleaning and Storage

Cleaning

When the cell test indicates low readings the probable cause is dirty electrodes. Hard water deposits, oils and organic matter are the most likely contaminants.

For convenient normal cleaning soak the electrodes for 5 minutes with a locally available bathroom tile cleaning preparation such as Dow Chemical "Bathroom and Chrome Cleaner," Johnson Wax "Envy, Instant Cleaner," or Lysol Brand "Basin, Tub, Tile Cleaner."

For stronger cleaning a 5 minute soak in a solution made of 10 parts distilled water, 10 parts isopropyl alchol and 1 part HCl can be used.

Always rinse the probe thoroughly in tap water, then in distilled or deionized water after cleaning and before storage.

CAUTION: Do not touch the electrodes inside the probe. Platinum black is soft and can be scraped off.

If cleaning does not restore the probe performance, replatinizing is required.

Storage

It is best to store conductivity cells in deionized water. Cells stored in water require less frequent platinization. Any cell that has been stored dry should be soaked in deionized water for 24 hours before use.

Replatinization

1. Clean the probe.

2. Place the cell in a 50 ml (approximate) jar or beaker and add enough YSI 3140 Platinizing Solution to cover the electrodes. Do not cover the top of the probe.

3. Plug the probe into the Model 33 or 33M, switch to the X100 scale to platinize the electrodes. Move the probe slightly to obtain the highest meter reading and continue platinizing for the approximate time shown below:

Meter Reading micromhos/cm	Meter Reading mS/m	Time in minutes
30,000	3,000	5
25,000	2,500	6
20,000	2,000	8
15,000	1,500	11
10,000	1,000	16

4. After the elapsed time, remove the probe and rinse in tap water, then in distilled or deionized water.

5. Return the solution to its container. 2 oz. of solution should be sufficient for 50 treatments.

Probe Use and Precautions

1. Obstructions near the probe can disturb readings. At least two inches of clearance must be allowed from non-metallic underwater objects. Metallic objects such as piers or weights should be kept at least 6 inches from the probe.

2. Weights are attached to the cable of the YSI 3310 and 3311 Probes. The YSI 3327 Weights are supplied in pairs with a total weight of 4 ounces per pair. Should it become necessary to add more weight to overcome water currents, we suggest limiting the total weight to two pounds (8 pairs). For weights in excess of two pounds use an independent suspension cable. In either case, weights must be kept at least 6 inches away from the probe.

3. Gentle agitation by raising and lowering the probe several times during a measurement insures flow of specimen solution through the probe and improves the time response of the temperature sensor.

Conductivity and Salinity Corrections for Long Cables

The additional length of wire in long cables adds capacitance and resistance which will effect readings. The recommended way to correct for these influences is by use of YSI Conductivity Calibrator Solutions (see below), which will permit an estimate of correction factors. If these solutions are not available, the following tables can be used for the correction of errors caused by cable resistance and capacitance on special length versions of the 3310, 3311, S-17933 and S-16120 probes.

TABLE I: CONDUCTIVITY CORRECTIONS (IN % OF READING)

Indicated Conductivity Range	umho/cm	Cable Length in Feet 10	50	100	200	300	500	1000
x1	100	-1.0	-5.0	NR	NR	NR	NR	NR
x1	500	-0.2	-1.0	-2.0	-4.0	-6.0	NR	NR
x10*	500	-1.2	-6.0	NR	NR	NR	NR	NR
x10	1000	-0.6	-3.0	-6.0	NR	NR	NR	NR
x10	5000	-0.1	-0.5	-1.0	-2.0	-3.0	-5.0	NR
x100	10000	-0.06	-0.3	-0.6	-1.2	-1.8	-3.0	-6.0
x100	50000	-0.01	-0.05	-0.1	-0.2	-0.3	-0.5	-1.0

* This row indicates the effect of the change from 100 Hz to 600 Hz when the instrument is switched to the x10 range.

NR represents conductivity levels which we do not recommend for probes with the indicated cable lengths.

TABLE II: TEMPERATURE CORRECTIONS IN °C

Indicated Temperature °C	Cable Length in Feet 10	50	100	200	300	500	1000
0	NONE	NONE	NONE	NONE	+0.1	+0.2	+0.4
10	NONE	NONE	NONE	+0.1	+0.2	+0.3	+0.6
20	NONE	NONE	+0.1	+0.2	+0.3	+0.5	+1.0
30	NONE	NONE	+0.1	+0.3	+0.4	+0.7	+1.4
40	NONE	+0.1	+0.2	+0.4	+0.7	+1.1	+2.2
50	NONE	+0.2	+0.3	+0.6	+1.0	+1.5	+3.1

NONE indicates that the corrections are less than 0.1°C.

TABLE III: SALINITY CORRECTIONS IN PARTS PER THOUSAND

Temperature Setting °C	% Conductivity Corrections from Table I -1	-5	-10
0	-0.1	-0.5	-1.0
10	NONE	-0.4	-0.8
20	NONE	-0.3	-0.6
30	NONE	-0.25	-0.5
40	NONE	-0.2	-0.4
50	NONE	-0.12	-0.25

NOTES:

1. Conductivity corrections should be made from Table I, or by interpolation of the table.

2. Salinity corrections require determination of conductivity, hence conductivity correction, and the setting of corrected temperature readings prior to salinity measurements.

3. Use of these corrections should increase the error band for measurements by less than 10%.

4. If your measurement conditions are such that a 2% or greater conductivity correction is required, the cell test feature will not properly indicate a defective probe.

Cell Calibration and Standard Solutions

The cell constant of a conductivity cell may vary slightly with the conductivity of the solution being measured. Cell Calibration may also be affected by electrode fouling, replatinization, or by mechanical shock. A cell and meter can be calibrated together, as a system, with YSI Conductivity Calibrator Solutions.

YSI Conductivity Calibrator Solutions are supplied with a full technical discussion and detailed instructions for use.

Part Number	Size	Conductivity at 25.00 degrees C
YSI 3161	Quart	1000 micromho/cm ±0.50%
YSI 3163	Quart	10,000 micromho/cm ±0.25%
YSI 3165	Quart	100,000 micromho/cm ±0.25%
YSI 3167	8 Pints	1000 micromho/cm ±1%
YSI 3168	8 Pints	10,000 micromho/cm ±1%
YSI 3169	8 Pints	50,000 micromho/cm ±1%

Directions for calibration at temperatures other than 25°C are included with the Conductivity Calibrator Solutions.

In calculating the cell constant in absolute terms, the uncertainty of the meter calibration must be added to the tolerance of the conductivity Calibrator Solution.

YSI Model 33 Used with YSI 51A, 54, 57 and 58 Oxygen Meters

If the salinity measurement is to be used for salinity correction on the 51A, the reading should be converted to Chlorosity. The formula is:

$$\text{PPM Chlorosity} = [(\text{Salinity ppt} - 0.03) / (1.8)] \times 10^3$$

For these instruments the 0.03 can be neglected so the equation simplifies to:

$$\text{PPM/Cl} = (\text{salinity in ppt} \times 10^3) / 1.8$$

For salinity correction when using the Model 57 or 58, use the Model 33 salinity reading directly. No conversion is necessary.

Model 33 salinity readings taken in conjunction with Model 54 dissolved oxygen readings can be used to correct the Model 54 for salinity and to make post-measurement salinity corrections to dissolved oxygen data. Correction tables are available from the factory.

WARRANTY

All YSI products carry a one-year warranty on workmanship and parts, exclusive of batteries. Damage through accident, misuse, or tampering will be repaired at a nominal charge.

If you are experiencing difficulty with any YSI product, it may be returned to an authorized YSI dealer for repair, even if the warranty has expired. If you need factory assistance for any reason, contact:

Product Service Department
YSI Incorporated
1725 Brannum Lane
P.O. Box 279
Yellow Springs, Ohio 45387, U.S.A.
Phone: (513) 767-7241, (800) 343-HELP

APPENDIX 3

GROUNDWATER SAMPLING RECORD

GROUND-WATER SAMPLING RECORD

Ground-Water Management Area ______________________ Date ____________

Facility or Owner Name & Address ______________________ PHONE # ________

Sample Location ______ 1/4 ______ 1/4 Section ______ T ______ R Well Use ____________ Lab Sample No. ______

Well Number ______________ Well Depth ______ (ft) ______ (in) Well Casing Diameter ________ inches

Type of Pump ______________________ Date Last Pumped ______________

Sampling Device ______________ Tubing Material ______________

Name of Sampler(s) ______________________

Volume of Casing Water before Purging (gallons)* ______________

- -

Time	Water Level (ft. below top of casing)	Water Level (ft. above mean sea level)	Pump on (Time)	Pump off (Time)	Volume pumped (gallons)	Pumping Rate (gallons/ minute)	Sample Start /End (Time)	Temp (C)	Eh	pH	Cond. (umhos)

Samples Delivered To ______________________ By ______________________

*$V = 3.14\ r^2 \times h$, where V = volume of water in casing (cubic feet), r = radius of the casing (feet), and h = length of casing filled with water (feet) (1 cubic foot = 7.48 gallons).

APPENDIX 4

LABORATORY QC CRITERIA/PROCEDURES

AMTEST

V. Procedures for Determining and Reporting Out of Control Events

Criteria for interpreting control charts and establishing that a procedure is out of control:

Control charts provide a useful tool in assessing QC efforts through graphic displays of a parameter and its variability over time. The warning limits for a parameter is set at x +/- (1.5)STD of percent recovery for an SRM and spike and x +/- (1.5)STD of RPD for duplicates.If one or two points fall in the warning area, more frequent observation of the analysis is required. If three consecutive points fall out side the warning limits, analysis is terminated and the problem is corrected.(Form V is filed)

Action limits are set at x +/- (2.0)STD of percent recovery for SRM and spikes. The action limits for duplicates are x +/- (2.0)STD of RPD. No data will be accepted when an SRM calibration check point or RPD for duplicates or a spike recovery in (clean) water falls outside the action limits. In a non-water matrix, if the spike recovery falls outside the action limits, the data is flagged, but acceptable.

Besides defining warning and action limits, control charts also reveal shifts, trends, and biases in the analytical system.

Conditions necessary to re-establish control:

Once an out of control event is identified, analysis stops. The problem is identified and corrected. To re-establish control, three consecutive points must be generated inside the warning limits on the SRM, duplicate or spike control chart (whichever event was out of control).(Form V is filed) At this time all of the samples included in the sample set of which there was an out of control event are reanalyzed.

The procedure and format for documenting the out of control event and corrective action:

When an out of control event occurs, the Department Director, Technical Director, and Quality Control Officer is notified. A permanent record of the event is kept. This record includes no less than the date of the event, the out of control values, & parameter corrective action taken, and verification of control values.(See Form V)

Appendix B

Public Participation Plan

SEQUIM-DUNGENESS VALLEY
GROUNDWATER QUALITY STUDY

PUBLIC PARTICIPATION PLAN

JUNE 8, 1990

FOR

BILL HASHIM
WASHINGTON STATE DEPARTMENT OF ECOLOGY
WATER QUALITY FINANCIAL ASSISTANCE PROGRAMS
OLYMPIA, WASHINGTON 98504

BY

JIM E. LE GALLEY
CLALLAM COUNTY
DIVISION OF ENVIRONMENTAL HEALTH
223 EAST FOURTH STREET
PORT ANGELES, WASHINGTON 98362

I. INTRODUCTION

The Sequim-Dungeness Groundwater Quality Study is the result of joint funding from Clallam County, Washington and the Washington State Department of Ecology (WDOE). A requirement of the contract is community participation at all stages of the study. To satisfy this requirement, Clallam County developed a Groundwater Advisory Board to include individuals and organizations living in the study area.

TABLE OF CONTENTS

1. Citizen Advisory Board

As this study is limited, both in duration and funding, the most effective mode for full public involvement is through a Groundwater Advisory Board. Community organizations and individuals such as tribal groups, environmental organizations, irrigation districts and companies, farmers, elected officials, builders, medical authorities and the general public will be offered an opportunity to participate in the shaping of this project.

A. Purpose and Authority

The purpose of a Groundwater Advisory Board will be to assist in the scoping, reviewing and evolution of project needs. The board's input will keep the study from becoming self-serving; it will also serve as a sounding board to reflect and represent the community's interests if political decisions involving land use are made.

Additionally, several board members will sit on the Dungeness Watershed Management Committee (DWMC). The DWMC is a local public involvement group of the WDOE funded Dungeness Surface Water Quality Study. This two group interaction will facilitate an on-going information/education exchange on local water quality problems. The final result will be an integrated understanding of regional water resource issues that will aid in future planning and policy decisions.

The Groundwater Advisory Board will have authority to review, comment, advise and produce recommendations. Board input will be considered in policy formation and in areas of a general nature. Final project decisions, however, will be made by Clallam County and WDOE.

B. Represented Community Interests

The study area will include eastern Clallam County, including Carlsborg east to Sequim Bay. A list of organizations and individuals residing in the study area which may be selected to participate on the Groundwater Advisory Board are listed below.

1. Citizen Advisory Board

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Environmental Organizations
Bay Watchers
Sierra Club
Sequim Native Plant Society
Friends of the Elwha
Olympic Ancient Forest Alliance
Peninsula Trails Coalition
Olympic Conservation Council
Olympic Outdoor Sportsmen
Save Our Streams
Olympic Peninsula Audubon Society
Protect the Peninsula's Future

Well Drillers
Bekkevar Well Drilling
Louie's Well Drilling
Stoican Drilling Co.
Mel Williams Well Drilling

Government
City of Sequim
Clallam County

Tribes
Jamestown Klallam

Fisheries
Washington Aquaculture Council
Washington State Department of Fisheries

Health Officials
Dr. Harold Royaltey, M.D. — 108 James St 98382

General Public
It is expected that two to three people from the general public will participate. These members will either be self-nominating or selected from a list compiled by the Clallam County Board of Commissioners.

Irrigators
Dungeness River Agricultural Water Users Association

Realtors
Sequim/Dungeness Board of Realtors

Home Builders
North Olympic Home Builders Association

Farmers
Dungeness Organic Produce
Clallam County Conservation District

C. <u>Board Solicitation Process</u>

A variety of methods will be employed to request volunteers in the creation of the Groundwater Advisory Board. Formal letters of solicitation will be used for organization and key individuals. If no response is received, phone calls will follow. To attract the general public, newspaper and radio advertising will be used. Ads will be placed with the <u>Peninsula Daily News</u> and the <u>Sequim Gazette</u> on Monday, July 2, until an adequate response is generated. In addition, local radio station KAPY will advertise for community participation. It is anticipated that the creation of this advisory board will pose few problems, due to the community's high level of environmental awareness.

D. <u>Format - Education/Issue Development</u>

To assist the board in becoming familiar with aspects of the study, short lectures will be given by either Clallam County or an engineering consultant. Topics discussed will be environmentally oriented to key aspects of the study, including but not limited to the proposed State of Washington groundwater quality standards or the EPA's listing of Priority Pollutants. These lectures will be on a general level so that anyone who attends learns. In addition, a short presentation will be provided by the project manager at every meeting to inform the board of progress or problems. Discussions will follow, allowing for all parties present to raise questions, make comments or suggestions.

E. <u>Meeting Schedule</u>

For the duration of the study, or until March 1991, the Groundwater Advisory Board will tentatively meet bimonthly on Tuesdays of the third week at 7:00 p.m. in the downstairs Conference Room at the Clallam County Courthouse, beginning in June. However, an initial meeting will be held on Wednesday, July 11 in the afternoon and evening to discuss an agreeable meeting schedule. In addition, designated board members who chair on DWMC will be required to attend meetings as dictated by the DWMC's meeting schedule. Selected board members are required to attend meetings during the entire course of the study ending in March 1991.

Meetings are anticipated to last for one hour, but will be flexible to accommodate the needs of the occasion and the group. Either the engineering consultant or the study project manager will be leading the group through a series of planned activities.

An open door policy will be instituted at every meeting. Each session will be on record. Copies of the Advisory Board's minutes will be distributed to interested parties both inside and outside the board after every session.

2. Community Education

A. News Releases

Private media sources will be utilized to inform the public of ongoing sampling activities. The Peninsula Daily News, Sequim Gazette and local radio station KAPY will be contacted on Monday, July 2 to post general board meetings and inform the public when sampling activities will occur. Perhaps a feature article could be written by the Peninsula Daily News or Sequim Gazette to describe in-depth the specifics of the groundwater water quality study.

B. Pamphlet Distribution

Pamphlets have been purchased, which discuss in a general manner, information regarding nitrates and health. These brochures will be distributed to people at every sampling site in late July. In addition, information on priority pollutants will be dispersed to occupants at every site sampled for priority pollutants. This information will also be made available at the Groundwater Advisory Board meetings, Clallam County Division of Environmental Health and at the request of individuals beginning on Monday, July 2. It is reasoned that this literature will educate and subdue fears that may arise during sampling events.

PUBLIC PARTICIPATION AND
STRUCTURAL PLAN
for the

DUNGENESS WATERSHED MANAGEMENT COMMITTEE
and the
DUNGENESS GROUNDWATER ADVISORY COMMITTEE

Submitted to:
Bill Hashim, Project Manager
Department of Ecology

23 October 1990

Submitted by:
Jeff Bohman, Manager
Clallam County Division of Water Quality

Submitted in partial fulfillment of:

Task 2: Establishment and Facilitation of a local Watershed Management Committee
Dungeness Watershed Action Plan
(TAX 90179)

Introduction

As specified in 400-12-410 WAC, the Dungeness Watershed Management Committee shall be composed of representatives of all affected parties, agencies, governmental entities, interest groups, special districts and general residents. The size and diversity of the Dungeness study area in both natural and socio-economic terms makes it infeasible to have a single committee be all-inclusive of these parties. As provided in Task 2 of the Dungeness Watershed Action Plan grant (TAX90179), the overall structure will include additional support committees which will ensure the opportunity for complete representation.

This committee structure plan was developed after review of past experience in Clallam County and elsewhere on the size, effectiveness, cohesiveness and community influence of other watershed management committees and similar entities. After considering this perspective, this committee structure was developed by seeking to identify all potentially interested or affected parties and allowing the structure to grow from what was found. This draft structure was then reviewed by 8-10 key residents who had been involved in the previous local watershed planning process in Sequim Bay. Final adjustments were made based on their recommendations and the proposal is now ready for review/approval by the Department of Ecology,

Development of the Committee Structure

As an early action watershed, the Sequim Bay Watershed Committee was not explicitly called upon to have any particular composition. The county's approach was to emphasize non-staff, community citizens in the Watershed Committee and to have agency and other technical perspective and experience in a technical committee. In addition, an education committee was established. The Sequim committee numbered about 25 with a technical committee of about 20 and an education committee of about 30. Interviews with Katherine Baril (who developed the Sequim Bay Watershed Committee), several members of that committee, and representatives of the Puget Sound Water Quality Authority and other watershed projects led to the conclusion that the Sequim committee was unwieldy in size and that its technical and education committees were underutilized. These considerations led to a decision to reduce the management committee membership to 15-18 individuals, while expanding the membership and the roles/activities of the support committees. This reduction in the watershed committee size, coupled with the expansion and added emphasis on the support committees is the principal modification being made in this proposed Dungeness committee structure.

The other parameter that applied, as noted above, is the application of the requirements of 400-12-410 WAC. In order to ensure inclusiveness, a preliminary list of identifiable entities and interest groups was developed. This list was examined by the reviewers mentioned above. During the course of these reviews only a few groups were identified as missing and they were added.

These parties were also separated into three categories: governmental and quasi-governmental entities; federal state and local agencies; and citizen-based groups and organizations. After all identifiable additions, these categories and their constituent parties now include:

<u>Governmental entities</u>

Clallam County
City of Sequim
Jamestown Klallam Tribe
Clallam County Public Utility District
Port of Port Angeles — Total = 5

<u>State/federal/local agencies</u>

US National Park Service
US Forest Service
US Soil Conservation Service
US Fish & Wildlife Service
US National Marine Fisheries Service
WA Dept. of Ecology
WA Dept. of Fisheries
WA Dept. of Wildlife
WA Dept. of Natural Resources
WA Dept. of Transportation
Cooperative Extension Service/Sea Grant program
Arthur Fiero Marine Science Center (Peninsula CC) — Total = 12

<u>Interest groups/constituencies</u>

Private foresters
Landowners: Dungeness Property Owners' Association
Dungeness Flood Advisory Board
Dungeness River Management Team
Septic installers
Well drillers
Realtors/developers
Sequim Chamber of Commerce
Irrigators: Sequim-Dungeness Water Users' Association
Dairy farmers
General agriculture: Clallam County Conservation District
Educators: Sequim School District
Sportsmen: Olympic Outdoor Sportsmen
Olympic Rivers Council
Wild Olympic Salmon
North Olympic Salmon Coalition
North Olympic Peninsula Aquaculture Association
Audubon
Protect Peninsula's Future
Washington Environmental Council — Total = 20

Note: Although not a part of the identified parties above, it is recognized that there are various special case entities that we will want to have involved wherever appropriate. This includes entities such as golf courses, nurseries, concrete/gravel companies, and the Olympic Game Farm.

The next consideration was how to compose a management committee from all these interests that would be most responsive, effective and successful. Two different basic scenarios were considered. The first was one which sought to mimic the Sequim approach by having the watershed committee be citizen-based--composed of "at-large" citizens who didn't necessarily represent any of the identified groups while relying on the agency/government involvement to be through the support committee structure. This approach was reluctantly but firmly rejected for several reasons: 1) It is questionable that we could find 15 to 18 committed, capable people who would want to devote the time to the process. 2) If we did, it would likely be that they do have a particular personal interest that would preclude them from being completely objective and representative of the community as a whole. 3) The learning curve to achieve basic capability on the diverse issues would be the longest of any approach. 4) There would be a loss of community investment and credibility because identifiable constituencies would not be directly involved. 5) There would be great difficulty in determining the criteria by which any particular such "at-large" person would be chosen over others and in deciding who should be doing the choosing.

These drawbacks, in conjunction with the ways in which a more representative, constituency-based composition resolved these drawbacks, led to the recommendation made here that the Dungeness Watershed Management Committee be made up of individuals representing the most significant parties from the lists above.

The Committee Structure

Coordinating Committee

The Watershed Management Committee will actually consist of a central Coordinating Committee and four specialized support committees: Technical, Education, Policy and Groundwater. The size of the Coordinating Committee will be limited while the membership in one or more of the support committees will be based on both the parties' interests and our overall program goals and objectives (ie. we may seek to "draft" people or parties to particular committees). There will be a close integration between the Coordinating Committee and the support committees because at least three members of the Coordinating Committee will be on each of the support committees and because each support committee will have the staff support of one of the Water Quality Division staff people who will be responsible for maintaining communication between the Coordinating Committee and their specific support committee.

The target size for the Coordinating Committee will be 15 persons, with a retained flexibility to add up to three additional persons. These additions, being reflective of the composition of the Coordinating Committee, will emphasize citizen rather than agency/governmental representation. With a target size of 15, and keeping in mind the relative numbers of parties in each of the three categories above, we are recommending that there be persons representing three of the governmental parties, four of the agency parties and eight of the citizen parties, as follows:

Governmental entities

Clallam County
City of Sequim
Jamestown Klallam Tribe

Federal/State/Local Agencies

US Forest Service
WA Dept. of Fisheries
WA Dept. of Natural Resources
WA Dept. of Ecology

Interest groups/constituencies

Agriculture: Clallam County Conservation District
Irrigation: Sequim-Dungeness Water Users' Association
Private Forestry
Realtors/Developers
Landowners
Sportsmen
Educators
Environmental

This composition provides for truly meaningful cross-sectional representation of the diverse parties affected by our watershed planning effort. In conjunction with its support committees it will provide comprehensive coverage that should successfully be able to address all the issues we'll encounter. It is purposely composed with a majority of non-professional citizens to ensure that any staff/professional tendency to make assumptions or take shortcuts won't occur. And, of course, more than anything it maintains our local commitment to having the product of the work be truly reflective of the citizens who are directly affected. The additional seats that may be used will allow flexibility to incorporate all geographic areas and constituencies that may not otherwise be adequately included at this level.

Support committees

The support committees will operate to provide specific information to, and respond to specific inquiries from, the Coordinating Committee. Each of the four support committees will have open membership to representatives of any interested governmental/agency/organization/individual party. Each committee will have a designated chairperson who will not be someone from the Coordinating Committee (there will be a preference applied to have each support committee chair be an informed lay person interested in that committee's field of responsibility). Each committee will be supported by a staff person from the Water Quality Division as detailed below. And each support committee will have the specific membership of at least three representatives from the Coordinating Committee as is also shown below.

The full membership of each of these committees may hardly ever meet as a group. Rather, we see the process working so that each particular issue or question to be dealt with by any one committee will be addressed only by those who express an interest in that particular question. In this way we can assure maximum inclusion, while allowing for focussed attention on each issue with a minimum wasted effort of trying to carry along disinterested parties. These issue groups within each support committee will be supported by the respective staff person and will also be the most effective mechanism to get questions addressed and the responses back to the Coordinating Committee.

Any given party may choose to be involved in any or all of the support committees. However, we do see some likely orientation among the groups identified, so, for illustrative purposes, here is a how this approach might actually look (parties shown above the line are members of the Coordinating Committee):

<u>Technical Committee</u> staffed by Habitat Specialist

US Forest Service
WA Dept. of Fisheries
WA Dept. of Natural Resources
WA Dept. of Ecology

US Fish & Wildlife Service
US National Marine Fisheries Service
US National Park Service
US Soil Conservation Service
WA Dept. of Wildlife
WA Dept. of Transportation
Arthur Fiero Marine Lab (Peninsula CC)
Clallam County Department of Public Works
Clallam County Public Utilities District
(any interest groups/constituencies/individuals from above or at-large)

<u>Education Committee</u> staffed by Education Specialist

Education
Environmental
Landowners
Sportsmen
Jamestown Klallam Tribe
(any other parties from the Coordinating Committee)

Sequim Chamber of Commerce
Port of Port Angeles
Clallam County Public Utility District
(any of the other identified parties from above or at-large)

Policy Committee staffed by Planner

Clallam County
City of Sequim
Jamestown Klallam Tribe
(any other parties from the Coordinating Committee)

Clallam County Public Utility District
Port of Port Angeles
Sequim Chamber of Commerce
(any of the other identified parties from above or at-large)

Groundwater Committee staffed by Groundwater Specialist

Clallam County
City of Sequim
Irrigators
Landowners
Realtors/Developers
Clallam County Conservation District
(any other parties from the Coordinating Committee)

Clallam County Public Utility District
Clallam County Dept. of Public Works
(any other parties from above or at-large)

Roles of the Committees

It is intended that any conceivable matter that might come up in the course of this planning process will be able to be addressed by one or more of these committees within the overall Watershed Management Committee. Although there will certainly be some marginal areas where the relevance to one committee or another may be unclear, we will readily be able to decide any possible assignment or designation and respond satisfactorily. In general terms, however, we see the committee roles in this way:

Coordinating Committee

Will function in much the way as other watershed committees function. It will assemble all available information on a given issue, assess the information and develop response recommendations if possible. It will be responsible also for referring any incompletely understood matters to the appropriate support committee(s) for their detailed examination and response. There will be a presumption in favor of referring matters or at least seeking input from the support committees on all issues being examined. Ultimately it will be this committee that will be charged with refining recommendations and developing the draft action plan and subsequent versions.

Technical Committee

Will be responsible for providing best available information on all natural resource, land use and other quantifiable information. Will also be expected to provide response options to the Coordinating Committee whenever possible. This committee may well be one of the busiest, especially in the early stages.

Education Committee

Will be responsible for actively exploring all educational and informational opportunities to further the community's knowledge of water quality issues and considerations, its intrinsic valuation of the water resources of the area, and its commitment to the highest and best stewardship of these water resources and the myriad activities that affect them or are affected by them. More than the other support committees, this committee will have freedom to explore its own ideas and provide spontaneous suggestion to the Coordinating Committee.

Policy Committee

Will be responsible for examining current and/or potential policy (ie statute, code, regulation, etc.) as it affects or might affect any particular aspects of water quality and the activities that have impact on water quality. Will provide the Coordinating Committee with analysis of how existing policy works or doesn't work and with how policy might be developed and applied in specific circumstances identified by the Coordinating Committee.

Committee Process

Although much of the finer points of committee process will be determined by the committees themselves after formation, we do expect them to develop a consensus approach. Each will determine its own schedule, with an understanding of the time frames required under the contract. As mentioned above, specific staff people will assist the committees and the issue groups composed within the committees. And there are already qualified people tentatively identified to serve as the committee chairs mentioned above.

We expect to solicit interest and participation beginning in early November with a goal of a first meeting on November 20. Thereafter, meetings will be scheduled by the committees.

The Coordinating Committee will be facilitated by the Water Quality Division manager. It will meet on a regular basis, while the other committees may meet more irregularly.

Committee Selection

All identifiable groups, organizations, agencies and entities will be written a letter of invitation explaining the watershed process. (Of course, most all parties are already fully aware of what is intended.) The letter will also explain the expectations that will be held of people chosen for the Coordinating Committee and the support committees. Each letter will request the name of a designated nominee and an alternate nominee. This will allow more flexibility in developing a broadly representative Coordinating Committee and support committees as well as providing a way to avoid interpersonal conflicts that may become apparent as the formation is refined. In addition, prominent advertising will seek the involvement of unaffiliated individuals who might not have been included within the mailing.

Prospective members will be interviewed moderately to verify commitment and qualifications. After receiving all nominees, the Water Quality Division will review them and make a roster of recommendations to the County. The County will then officially appoint them. Then the fun really begins!

Appendix C

Groundwater Committee Members and Affiliations

GROUNDWATER COMMITTEE
(Rev. 5/21/91)

Name and address	*Tel. No.*	*Notes*
Nancy McHenry, Chair 2287 Freshwater Bay Rd. Port Angeles, WA 98362	H 928-3982 W 452-8491	Septic design (NTI); at large
Dave Cameron 505 Hooker Rd. Sequim, WA 98382	H 683-5483 W 452-7831, ext. 233	Clallam County Commissioner; DWMC Coordinating Committee, Policy Committee
Romeo Conca 730 Lost Mountain Rd. Sequim, WA 98382	H 683-5229	Clallam Conservation Dist.; DWMC Coordinating Committee
Ken Clark P. O. Box 713 Sequim, WA 98382	H 683-8325 W 683-6880	Realtor; DWMC Coordinating Committee
Dr. Jack Fletcher 250 Three Crabs Rd. Sequim, WA 98382	H 683-1958	Audubon; at large
Dr. M. Pat Wennekens 399 Norman St. Sequim, WA 98382	H 683-4007	Protect the Peninsula's Future; at large
Mike Kitz PUD No.1 P. O. Box 1090 Port Angeles, WA 98362	W 452-9771	PUD; (liaison)
Richard Parker City of Sequim P. O. Box 2108 Sequim, WA 98382	W 683-4139	Director, Sequim Public Works Dept.
Rich Fox CC Dept. of Public Works 223 E. Fourth St. Port Angeles, WA 98362	W 452-7831	County Dept. of Public Works; DWMC Policy Committee
Tom Santos 243 Dungeness Meadows Sequim, WA 98382	H 683-7112	Landowners; Grange member; sportsman; DWMC Coordinating Committee

Roger Schmidt Sunny Farms P. O. Box 125 Carlsborg, WA 98324	W 683-8003	Irrigators
Nick Stoican Larry Stoican Stoican Drilling Co., Inc. P. O. Box 161 Sequim, WA 98382	W 683-5580	Well drillers
Welden Clark 260 Sporseen Rd. Sequim, WA 98382	H 683-1087	Audubon; at large; DWMC Coordinating Committee, Policy Committee
Ed Sprouse 197 Mill Road Sequim, WA 98382	H 683-6920	Sequim Yacht Club; at large
Joe Donisi NTI Engineering 717 S. Peabody Port Angeles, WA 98362	H 452-1305 W 452-8491	Drainage design (NTI); at large
Mike Wallingford CC Dept. of Community Dev. 223 E. Fourth St. Port Angeles, WA 98362	W 452-7831, ext. 335	Div. of Environmental Health (liaison); DWMC Policy Committee
Dr. Harold Royaltey 108 James Place Sequim, WA 98382	H 683-1525	Medical doctor; Public Health Advisory Board
Dale Brown P. O. Box 1365 Port Angeles, WA 98362	W 457-8481	Septic tank pumping (Arrow)
Bob Tillia Louie Rychlik Louie's Well Drilling 1652 Barr Road Extension Port Angeles, WA 98362	W 457-8388	Well drillers

Appendix D

Groundwater Committee Meeting Minutes

GVWMC Gmm file

SUMMARY OF THE SEVENTH GROUNDWATER COMMITTEE MEETING

June 26, 1991 - 5:30 to 7:30 p.m.

MEMBERS PRESENT:
Romeo Conca, Rich Fox, Welden Clark, Mike Wallingford, Nancy McHenry, Joe Donisi, Pat Wennekens, Tom Santos

MEMBERS ABSENT:
Richard Parker, Ed Sprouse, Ann Soule, Dave Cameron, Jack Fletcher, Nick Stoican, Ken Clark, Harold Royaltey, Dale Brown, Mike Kitz, Louie Rychlik, Bob Tillia, Paul Stoican, Roger Schmidt

OTHERS PRESENT:
Jeff Bohman, Bill Hashim

HANDOUTS

Unfinished Agenda - Updated 6-14-91

Final Report of "Sequim-Dungeness Groundwater Quality Study" without appendices

ANNOUNCEMENT

Bill Hashim from DOE was present and committee members were introduced.

Committee members are to submit their comments on the final groundwater report to the Water Quality Office by July 10th.

FOCUS OF MEETING

The turnout for the meeting was quite small. 'Where do we go from here?' was the focus of the meeting. The following list was developed.

1. Provide input to Board of Health for recommendations on implication of Geologically Sensitive Areas to the On-Site Septic System Regulations.
2. Review Management Options for groundwater protection.
3. Review criteria for setting up the next Groundwater Quality Study Grant. Develop research and monitoring details for the groundwater project.
4. Review Subsurface Geology.

Sub-committees will be formed to review items 1, 2, and 4.

An activity list was developed on how we should go about to understand information and determine GSA's.

A. Review publications and items on Bibliography
B. Identify subsurface transport formations
C. Look at extent of aquifer protective strata
D. Look at susceptibility of groundwater contamination in the upland section of Dungeness Valley
E. Update model done by Drost

OVER →

F. Describe the affect of vegetation . soils and recharge potential
G. Look at surface drainage and relation to recharge
H. Test accuracy of soils map
I. Review well logs

In reference to subsurface geology, the question was raised: "how much do we need to know before we make recommendations"? It is understood that we will not be able to master the complete groundwater picture. It is also understood there will be a limit to the accuracy and detail on information we produce. A comment was made to the longer the committee takes in developing GSA's and recommendations, the more of a chance there is for possible groundwater contamination.

To get a start on tackling the activity list, Pat W. is willing to synthesize the available publications to get a better picture of how the groundwater systems operate. In addition, Pat W. is willing to take on items A, B, C, & F. Welden C. volunteered to look at how glaciation affects the groundwater (item A). Joe D. volunteered to look at a sampling of well logs to get a better picture of the unconfined and confined aquifers (item I). Nancy volunteered to review a sampling of soils logs on septic permits to test the validity of the soils maps (item H).

Concern was expressed by Steve Gray (Critical Areas Committee) that the groundwater committee has not developed GSA's. Therefore, Pat and Welden will be drafting a letter to Steve and the Critical Areas Committee to relay to them where we are and the complexities we have found. The draft letter will be ready for review at the next meeting.

Nancy is presently looking at the survey forms to develop the optimum meeting time for the committee.

NEXT MEETING:

Monday, July 8, 5:30p.m. at Welden Clark's House - 260 Sporseen Road

Proposed focus of meeting is to:

* Have a presentation on wells and well logs
* An update on the progress of tackling the activity list
* Review draft letter to the Critical Areas Committee

All committee members are encouraged to attend.

fc: H2ONOTE5.NLM
Dir: NLM/Ltr

GROUNDWATER COMMITTEE

UNFINISHED AGENDA, REV. 2 (6/14/91)

I. Educational sessions/workshops

1. Geology, hydrogeology, and glaciology, featuring local geology experts (e.g., Penin. College Prof. Crawford, well drillers), including a field trip to Bell Hill overlook, beach cliffs at Port Williams, etc.
2. Well drilling and construction, including a site visit. Discuss zones of "good" and "bad" water, aquifer depths, changes over time. Attempt to standardize terms used by drillers on well logs.
3. Septic system theory and reality, including site visits. Discuss local soil conditions, failures, and areas of high risk of contamination.

II. Sub-studies/mini-research projects (incl. a presentation to entire committee afterward)

1. Groundwater quality standards and their applicability to our goals.
2. Groundwater management options, including what other areas have done.
3. Further investigations into well reports:
   a) identify specific areas where "protective" layers exist
   b) create more geologic cross sections showing water table
4. Further investigations into well construction and adequacy of surface seals.
5. Compile nitrate data collected for all building permits issued between 7/90 and 4/91 (from Environmental Health files)
6. Help county devise a way to coordinate all hydrogeologic and water quality data generated in the process of permitting and monitoring.

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6/14/91 AS

SUMMAKı OF THE SIXTH GROUNDWATER COMMITTıᴇE MEETING

June 12, 1991 - 5:30 to 7:30 p.m.

MEMBERS PRESENT:

Romeo Conca, Ken Clark, Rich Fox, Roger Schmidt, Welden Clark, Mike Wallingford, Nancy McHenry, Ann Soule, Dave Cameron, Jack Fletcher, Nick Stoican, Joe Donisi, Paul Stoican

MEMBERS ABSENT:

Richard Parker, Ed Sprouse, Harold Royaltey, Dale Brown, Pat Wennekens, Mike Kitz, Louie Rychlik, Bob Tillia, Tom Santos

OTHERS PRESENT:

Jeff Bohman

HANDOUTS

RCW Chapter 36.36, Aquifer Protection Areas with attachment
House Bill 1019

ANNOUNCEMENT

Bill Hashim from DOE was expected to attend the meeting, however, he did not arrive.

FOCUS OF MEETING

The ground rules and goal statement were discussed. Both items were adopted with minor changes. Please find the attached adopted copies for your use and future reference.

A sub-committee was formed to review the comments by members to Ann's draft report. The sub-committee consisted of Ken Clark, Mike Wallingford, Nancy McHenry, and Roger Schmitt. Roger reported to the committee a summary of the common concerns and comments. The main points were:

* The identified GSA criteria showed insufficient correlation with current nitrate data and known distribution of nitrate contamination.

* There is insufficient data to support the criteria. In particular, subsurface geologic formations are not considered in the criteria, resulting in little explanation for the interrelation of confined and unconfined aquifers. Important because the intent was to designate a GSA to protect the unconfined aquifer, but depth and location have not been determined.

* The rating system for GSA's has not field tested to determine accuracy.

* The factors have not been identified with enough accuracy to be used as a planning tool.

* We, as a committee, may be setting a precedent of inaccurate products by releasing the GSA map with boundaries showing high, moderate, and low.

* Placing onus on the property owners to "prove" the physical conditions on the property, when this designation has not been tested.

The committee realizes the non-renewable character of groundwater quality. Once it's contaminated, it would be very difficult to correct. Therefore, the consensus of the committee was to recommend an interim status of the whole study area as "geologically sensitive". Until we have a better understanding, we could not make a full judgment on mapping GSA's.

Some recommendations to obtain additional information (which will be addressed fully at the next meeting) include drilling test wells, matching the septic system soil holes to soils book, education of the public, and uniformity in well drillers logs.

The next agenda item was management programs. Ann handed out RCW Chapter 36.36, Aquifer Protection Areas with attachment House Bill 1019 and asked for comments on the Management Programs. Although the committee felt we would advocate something, we need more information to designate the GSA's before recommending a program.

NEXT MEETING:

Wednesday, June 26, 5:30p.m. at the Sequim Community Center

Proposed focus of meeting is to:

* Determine where to go from here
* Update unfinished agenda
* Develop sub-committees to review GSA and adapt to on-site sewage code; review other groundwater management plans; review subsurface geology

Enclosed with the minutes is a survey that all committee members need to return at the next meeting (or mail in earlier) regarding meeting day and times.

---

cc: B. Hashim
B. White
Planning
Long Range Planning
A. Soule

file: Groundwater committee
C/R
Q:D-2

fc: H2ONOTE4.NLM
Dir: NLM/Ltr

GROUNDWATER COMMITTEE
GROUND RULES

Adopted June 12, 1991

1. A commitment is made to reach consensus for decisions and to work together to achieve success.

2. Meetings are open to public participation throughout, though all people present will abide by these ground rules.

3. Each person present at a meeting is committed to participate in the discussions; each member, present or not, is responsible for giving input, written or otherwise.

4. The chair and staff will prepare the agenda and announce it at the start of each meeting. Members may suggest agenda items prior to the meeting date.

5. The staff and chair are primarily responsible for ensuring the agenda items are addressed. Each member has the opportunity to speak, and is responsible for discussions stay on track.

6. A member must be addressed by the chair prior to speaking.

7. The discussion of each member will be limited to two to three minutes and will be relevant to the specific agenda item. The staff or chair will defer a member(s) if discussions are led astray. However, members may also assist in this function.

8. The chair will call a 5 minute break at an appropriate time.

9. Each member will exercise patience both with people and the process.

10. All issues identified by any party will be addressed by everyone.

11. If a member represents a group, they will communicate with their group prior to and following substantial decisions.

12. If a member is habitually absent from meetings, the group may decide whether a replacement should be appointed. Staff and chair will appoint any replacements.

13. All communications with news media concerning these discussions will be by agreement of the group. Everyone will be mindful of the impacts their public and private statements will have on the climate for this effort.

14. All comments to the news media or non-participants shall go through the chair.

15. Members are encouraged to seek the best advice from knowledgeable people not present, in an effort to use the most knowledge for the best solutions and recommendations.

16. The staff or county commits to full disclosure to the committee of contractual agreements, budgets, work tasks, schedules and work products.

GROUNDWATER COMMITTEE
GOAL STATEMENTS

GOAL: To protect groundwater quality and quantity for present and future inhabitants.

METHODS:

1. Endorse utilization of best technical knowledge and best known practices of reasonable means to prevent further deterioration and, where necessary, improve the quality of water in the aquifers.

2. Advance the state of our understanding of the physical groundwater systems and hydrogeology of the area, including confined and unconfined aquifers and the unsaturated zone, through use of the best available information and, where feasible, obtain additional information.

3. Investigate the relationship of groundwater contamination and land uses and human activities.

4. Develop a combined groundwater quality and quantity management strategy which may include some or all of the following:
   - ordinances and/or regulations
   - tax districts
   - grant funding
   - interaction and coordination with some or all of the following:
     - Dungeness Watershed Management Committee
     - Clallam Co. Divs. of Water Quality, Environmental Health, and Planning
     - Clallam Co. Public Utility District
     - State Departments of Ecology and Health
     - Federal Environmental Protection Agency
     - Others

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6/14/91 AS

SUMMARY OF THE FIFTH GROUNDWATER COMMITTEE MEETIN
May 29, 1991 - 5:30 to 7:30 p.m.

MEMBERS PRESENT:
Romeo Conca, Ken Clark, Pat Wennekens, Rich Fox, Roger Schmidt, Elden Clark, Mike Wallingford, Nancy McHenry, Ann Soule, Jack Fletcher, Tom Santos, Nick Stoican, Joe Donisi

MEMBERS ABSENT:
Dave Cameron, Mike Kitz, Louie Rychlik, Bob Tillia, Richard Parker, Ed Sprouse, Harold Royaltey, Dale Brown

OTHERS PRESENT:
Jeff Bohman, Jim Bailey

LIST OF HANDOUTS

Groundwater Committee, Unfinished Agenda, Rev. 1 (5/28/91)

Bibliography of Groundwater Literature at the Division of Water Quality

Management Programs Relating to Ground Water Quality and/or Quantity

ANNOUNCEMENTS

Ann Soule passed out the above mentioned handouts. The purpose of the bibliography is for members to become acquainted with the available data on groundwater, in general, and within the Dungeness area. If a member would like to read a particular item, then call Ann and she will make them available. Additionally, a member can stop by the Water Quality office and review the items.

The unfinished agenda will be addressed at each meeting. At the end of a meeting, the committee will review items that should be put on the list.

FOCUS OF MEETING

The intent of the meeting was to delineate between high Geologically Sensitive Areas and low Geologically Sensitive Areas. Jim Bailey addressed the committee as to how a preliminary map was prepared with overlays*of each criteria previously discussed.

* Maps were distributed at the meeting, and mailed to absent members

The consensus of the committee was to break down the Geologically Sensitive Areas into three categories and ranges: High (20-16), Moderate (15-10), and Low (9-4). At future meetings, the committee can break down the categories further, but with our known data, it was decided to have the three categories. Additionally, the map should be titled as "preliminary".

Concerns brought up during the discussions were:

The amount of precipitation, runoff, irrigation ditches, etc. contribute more water to the system, therefore theoretically having more chance of contamination of the groundwater.

All categories, except for soils, used for the mapping are very conservative and may not give true picture.

MEMORANDUM

JUNE 4, 1991

TO: GROUNDWATER COMMITTEE NLM
FROM: NANCY McHENRY, CHAIR

RE: MEETING OF JUNE 12, 1991

Reminder that the next meeting will be June 12, 5:30 to 7:30 p.m. at the Sequim High School Cafeteria.

Prior to the next meeting, please review the handout given at last meeting - "Management Programs relating to Ground Water Quality and/or Quantity".

Additionally, review the attached Ground Rules and Goals and bring comments or revisions. I would like to have the committee adopt them at the next meeting.

The relevant portions of Ann's report will be mailed out this week to all members. Please review this document prior to the next meeting for we will be discussing it.

Since we have a lot to review, I better let you get to it. See you at the next meeting.

Note from Ann:
I included FYI a copy of the new Ground Water Quality Standards, WAC 173-200, in this mailing. Please keep it in your files for reference. Thanks.

DWMC file
mailed 6/24

SUMMARY OF THE FOURTH GROUNDWATER COMMITTEE MEETING
May 22, 1991 - 5:30 to 7:30 p.m.

MEMBERS PRESENT:
Romeo Conca, Ken Clark, Pat Wennekens, Rich Fox, Roger Schmidt, Welden Clark, Ray Franklin for Mike Wallingford, Nancy McHenry, Ann Soule, Dave Cameron, Mike Kitz, Louie Rychlik, Bob Tillia

MEMBERS ABSENT:
Richard Parker, Ed Sprouse, Harold Royaltey, Dale Brown, Jack Fletcher, Tom Santos, Nick Stoican, Joe Donisi

OTHERS PRESENT:
Jeff Bohman

ANNOUNCEMENT

Ann Soule read a memo sent to her from Bill White, Director of Clallam County Department of Community Development. The memo explained the background, the scope of the project, and how it relates to on-site systems. The memo stated that the original focus of the project was aimed at addressing contamination from on-site systems. Also, he stressed the importance of establishing a premise of work so the report is more easily adoptable to the Board of Health. Additionally, we would need to define what level of protection we, as a committee, feel is necessary to protect groundwater. Contact Ann if you would like a copy of this memo.

The discussion was then focused on the Clallam County On-Site Sewage Code definition for Geologically Sensitive Areas (GSA's). A request was made to recommend to the Board of Health that the definition be changed. The definition described "definite boundaries" of geological conditions and "surface water contamination". The focus of our last meeting was not to use definite boundaries in defining GSA's, therefore the request for modification.

FOCUS OF MEETING

The planned agenda had been revised by staff so that we could discuss Bill White's memo, spend time on outlining goals and ground rules, and Jim Bailey would need to be present to discuss vulnerability factors.

Attached is a very rough draft of a goal statement and ground rules. All members are strongly encouraged to bring a list of other goals and rules to the next meeting so that another set of goals and ground rules can be circulated.

OTHER ITEMS ADDRESSED

Discussions lead to the suggestion that two sub-committees be formed. The first is that members be aware of state and federal groundwater rules and WAC regulations. This sub-committee could gather this information and distribute pertinent data to the groundwater committee. It would be important for all members to become familiar with these rules, so that we will not be "reinventing the wheel" for standards and codes already in place.

The second sub-committee would review other groundwater management plans developed in other regions. This could provide valuable information and we could learn from others successes and mistakes.

A sign-up sheet will be passed around at the next meeting. Members will be free to sign-up for either sub-committee.

Due to the limited focus of the project, that is already under way and will be finished by June, the committee can not look at all the issues that we would like to prior to then. It was suggested that we prepare an unfinished agenda at the end of the study. This way members can review these items at future meetings and not be brushed aside.

distribute

fc: H2ONOTE2.NLM
Dir: NLM/Ltr

mailed 5/20

MAY 17 1991

SUMMARY OF THE THIRD GROUNDWATER COMMITTEE MEETING — MAY 15, 1991 5:00-7:

MEMBERS PRESENT:
Romeo Conca, Ken Clark, Jack Fletcher, Pat Wennekens, Rich Fox, Tom Santos, Roger Schmidt, Nick Stoican, Welden Clark, Joe Donisi, Mike Wallingford, Nancy McHenry, Ann Soule

MEMBERS ABSENT:
Dave Cameron, Mike Kitz, Richard Parker, Ed Sprouse, Harold Royaltey, Dale Brown

OTHERS PRESENT:
Jeff Bohman, Jim Bailey

ANNOUNCEMENT

Enclosed is a copy of a handout given to the Dungeness Area Watershed Coordinating Committee by Frank Gaffney on May 13, 1991. Please review the document prior to the next meeting so that we can spend a little bit of time to discuss and prepare draft ground rules. Although this may seem a little late to prepare, we will have several more meetings and it would be helpful in conducting future meetings.

Additionally, before we wrap up the meetings for the study and report, we will need to discuss our future goals and prepare a goal statement for subsequent meetings.

ITEMS DISCUSSED

It was decided by the Water Quality Staff to separate physical characteristics from land use criteria in developing hydrogeologic sensitive area designations. A handout, "Recharge Potential Mapping Criteria and Rationale" (enclosed in members absent package) was passed out, reviewed, and discussed.

The consensus of members present was to incorporate the handout into the groundwater study with the following comments/deletions/additions:

Table 1, Soil Unit Classifications

Highlight the soils within the study area or delete the soils not in the study area.

Add a footnote on how to rate soils which have a L/H, H/M, L/M, etc. recharge potential classification.

Table 2, Rating Criterion

Use qualifiers or definitions in discussing the factors within the Rating Criterion Categories. Pat Wennekens volunteered to write the qualifiers.

Additional comments were made and discussed:

A point should be made within the final report that we are mapping the critical areas within the study area on the shallow aquifer only. The map developed will address the recharge potential on a particular piece of land within the study area only. This task does not address the quantity of water from precipitation, runoff, etc. Our committee could address the amount of water impacting the recharge area when we discuss land use factors, if desired.

Another point should be made within the report is that the maps developed are based on available existing information. Since no additional field work was performed, the exact boundaries may not be accurate. The map should not be used for land use planning decisions, only as a planning tool.

Finally, when the maps are developed and reviewed, a few points were brought up to discuss. Perhaps buffer area around high potential recharge areas should be used instead of definite boundary lines. Also, the maps should be updated and we could recommend a time frame when that should be done.

Enclosure

fc: H2ONOTE1.NLM
Dir: NLM/Ltr

INTER-OFFICE STAFF MEETING

SAMPLE GROUND RULES

1. We will all attempt to make "I" statements.

2. We will avoid personal attacks.

3. We will take turns and listen to each other's concerns.

4. No punitive actions will result from these discussions.

5. The particulars of these discussions will remain in the room unless the group decides otherwise.

Northwest
Renewable
Resources
Center

1133 Dexter Horton Building
710 Second Avenue
Seattle, Washington 98104
(206) 623-7361

Boise National Forest Process Negotiations
Ground Rules

1. Take turns.

2. Listen carefully: Ask questions to understand and make statements to explain or educate.

3. Needs, problems and opportunities--not positions--will be stated. Positive candor is a little used but effective tool.

4. Separate the people from the issues.

5. Do not assume the answers are known.

6. All parties to this meeting bring with them the legitimate purposes and goals of their organizations. All parties agree to respect the goals of others and assume that their own goals will be respected.

November 1988

Northwest Renewable Resources Center
1133 Dexter Horton Building • 710 Second Avenue • Seattle, Washington 98104 • (206) 623-7361

Ground Rules for T/F/W
A Better Future in Our Woods and Streams

Each of the participants in these discussions agrees to the following ground rules:

1. We will attempt to develop a system which provides:

   a. minimum guarantees for everyone,

   b. incentives which maintain and enhance timber, fisheries and wildlife resources, and

   c. future flexibility, accountability, better management, compliance with regulations and resource goals.

2. All participants in the negotiation bring with them the legitimate purposes and goals of their organizations. All parties recognize the legitimacy of the goals of others and assume that their own goals will also be respected. These negotiations will try as much as possible to maximize attainment of all the goals of all the parties.

3. This effort will receive priority attention, staffing and time commitments.

4. The same priority will be given to solving the problems of others as you would give to solving your own.

5. A commitment is made to search for opportunities: Without creativity, there will be no plan or agreement.

6. A commitment is made to listen carefully: Ask questions to understand and make statements to explain or educate.

7. All issues identified by any party must be addressed by the whole group.

8. Needs, problems and opportunities, not positions will be stated--positive candor is a little used but effective tool.

9. A commitment is made to attempt to reach consensus on a plan.

10. A commitment is made to be an advocate for an agreed upon plan.

11. Participants will defend each other and the process with their constituencies and the general public.

(over)

12. Weapons of war are to be left at home (or at least checked at the door).

13. Anyone may leave the process and disavow the above ground rules, but only after telling the entire group why and seeing if the problem(s) can be addressed by the group.

14. All communications with news media concerning these discussions will be by agreement of the group. Everyone will be mindful of the impacts their public and private statements will have on the climate for this effort.

15. No participant will attribute suggestions, comments or ideas of another participant to the news media or non-participants.

16. In the event this effort is unsuccessful, participants are free to pursue their interests without prejudice in other dispute resolution forums.

17. Participants are free to, and, in fact, are encouraged to, seek the best advice from people who are not in the room.

18. All of the individuals who are participants accept the responsibility to keep their friends and associates informed of the progress of the discussions.

19. Participants agree to check rumors with facilitation team before taking action.

July 1986

Northwest Renewable Resources Center
1133 Dexter Horton Building • 710 Second Avenue • Seattle, Washington 98104 • (206) 623-7361

Proposed
Ground Rules for Water Resources Retreat

Each of the participants in these discussions agrees to the following ground rules:

1. The Retreat participants are representative of the full range of water uses and interests in our state, and each has concerns about future use of water. All parties recognize the legitimacy of the interests of others and expect that their interests will also be respected.

2. Individual delegates to this retreat will be selected by their own organization/ constituent group.

3. Participants commit to listen carefully to each other, ask questions to understand and make statements to explain or educate. Participants should not assume that any one person knows the answer.

4. Participants commit to search for opportunities: The creativity of the group can often find the best solution.

5. Participants will state needs, problems and opportunities, not positions -- positive candor is a little used but effective tool.

6. Weapons of war are to be left at home (or at least checked at the door).

7. This retreat is in no way meant to detract from or interfere with ongoing or current efforts regarding water throughout the state.

8. Participants agree that to get maximum benefit from the retreat a climate that encourages candid and open discussion should be created. In order to create and sustain this climate, participants agree not to attribute suggestions, comments or ideas of another participant to the news media or non-participants.

May 1990

DWMC file

SUMMARY OF THE SECOND GROUNDWATER COMMITTEE MEETING
May 1, 1991, 7:00 - 9:30 pm, Sequim Prairie Grange (MacLeay Hall), Carlsborg

MEMBERS PRESENT:
Dave Cameron, Ken Clark, Welden Clark, Joe Donisi, Jack Fletcher, Rich Fox, Ray Franklin (for Mike Wallingford), Mike Kitz, Tom Santos, Ann Soule, Ed Sprouse, Nick Stoican, Pat Wennekens

MEMBERS ABSENT:
Dale Brown, Romeo Conca, Nancy McHenry, Richard Parker, Hal Royaltey, Roger Schmidt

OTHERS PRESENT:
Jeff Bohman, Steve Gray

AGENDA

I. ANNOUNCEMENTS
Several reports pertaining to groundwater in the study area were displayed in the back of the room. These will be available to members at any time in the Water Quality office and will be brought to meetings regularly. Members are reminded to bring their contributions.

II. HYDROGEOLOGIC SENSITIVE AREA CRITERIA
Discussion focused on the consultant's report "Hydrogeologic Sensitive Area Designation - Proposed Rationale and Criteria." Ann first explained that the consultants identified "critical aquifer recharge areas" prior to developing the criteria listed in this report. These recharge areas were identified using information on soils, geology, and depth to groundwater. Jeff and Ann then explained that the purpose of designating sensitive areas using criteria was to enable a first pass to be made at selecting areas which may need special protection in the form of restrictions on land activities. The proposal does not detail how the rating system will be used and applied. A better explanation will be provided at the next meeting.

General comments pertaining to the structure and approach of the proposal centered on the appropriateness of the rating scheme. This discussion was deferred until a later meeting so that we could focus first on the criteria.

Comments on specific criteria:

1. Aquifer separation. Potentially an extremely important factor, especially for the quality of the lower aquifers.

2. Depth to groundwater. The importance of such a measurement varies depending on the permeability of the material between the ground surface and the water table. For example, the

water table could be 50 feet down but the subsurface might be comprised of coarse sand and gravel and no "protective" layers of clay. It was suggested that the two factors "depth to groundwater" and "aquifer material" be considered together.

3. Aquifer material. Since this refers to the composition of subsurface layers in the unsaturated zone, the factor might more appropriately be called "subsurface composition." Also, it probably should focus on porous qualities instead of grain size. Is bedrock considered to have high recharge potential, and if not, why is it listed here? Ann will check with the consultants on both these items.

4. Beneficial use. The question was raised whether this is relevant in light of the fact that communities in our study area depend on groundwater now and expect to even more so in the future. I.e., is it appropriate to consider society's relative dependence on an aquifer when designating sensitive areas? Also, the language "sole source aquifer" should probably be changed to differentiate from the federally designated discrete geographic zones. Possibly "sole water supply?" How are primary, secondary, minor defined? Ann will investigate.

5. Waste disposal site present. The question was raised whether "waste disposal sites," official or unofficial, are identifiable.

6. Hazardous waste disposal site present. Confirmed sites have been identified by Dept. of Ecology. "Potential" sites may include any business or operation which uses hazardous substances - how will these be identified? Possibly the factor should include hazardous materials in general, and not be limited to hazardous waste.

7. Septic system density. The discussion included the point that modern systems are designed to protect groundwater by treating effluent before it reaches the water table, hence, high densities of modern systems may be less significant than low densities of old systems. However, the argument was made that each system (regardless of age) is a potential point source of contamination, and thus the density of such points should be considered. The age of systems could be incorporated into a similar analysis applied on a site specific basis. Also, the proposed criteria utilizes zoning patterns to determine septic density; the accuracy of this method should be investigated. Ann will confirm whether zoning patterns are the unit of measure for this factor.

8. Transportation corridors. Important because of the potential for spills along highways and arterials which could threaten groundwater quality. Another, more continuous, threat is that of stormwater runoff from roadways, which should be considered under this factor along with potential spills.

9. Land use. Many potentially contaminating activities are incorporated into this factor, which is based solely on zoning (commercial/industrial, urban residential, rural residential, forested). Some of these include density of drywells for impervious surface drainage, [others?]. This factor assumes that the impact from agriculture, dairy operations, and hobby farms is distributed roughly evenly across all areas, since these activities are allowed in all zones.

10. Irrigation ditches. Of obvious importance because of the potential of the ditches to recharge the aquifer with contaminated water. This is also true of streams and drainage ditches; possibly they should be included in this factor.

Additional factors not covered in the proposed criteria:

11. Underground storage tanks (USTs). They may or may not be covered by hazardous materials sites. Ann will check on whether these are identified somewhere.

12. Gravel pits. May or may not be covered by soils/geology criteria.

13. Ground surface drainage. Sources of water to areas of moderate to high recharge potential should be considered. Locations of springs, wetlands, and steep slopes would be included in this factor. Jeff, Steve, and Weldon will elaborate on this topic.

III. NEXT MEETING
Wednesday, May 15th, **5:00 pm**, Sequim Prairie Grange

5/8/91 AS

cc: B. White
Planning
Long Range Planning
file: DW/MC –
C/R
0-D-2

SUMMARY OF THE FIRST GROUNDWATER COMMITTEE MEETING
April 15, 1991, 7:00 - 9:00 pm, Pioneer Park Clubhouse, Sequim

MEMBERS PRESENT:
Ken Clark, Welden Clark, Roméo Conca, Joe Donisi, Jack Fletcher, Rich Fox, Hal Royaltey, Tom Santos, Roger Schmidt, Ann Soule, Nick Stoican, Pat Wennekens

MEMBERS ABSENT:
Dale Brown, Dave Cameron, Mike Kitz, Nancy McHenry, Richard Parker, Ed Sprouse, Mike Wallingford

OTHERS PRESENT:
Jim Bailey (consultant), Bill White

AGENDA

I. INTRODUCTIONS
All present briefly described their affiliation to the Committee.

II. GOALS
Immediate goals of the groundwater quality project which Ann Soule is coordinating were presented. Specific products related to this study which the Committee will be involved with in the next two months include Geologically Sensitive Area designation, and recommendations for management of groundwater in the area. Enclosed with the minutes is the Project Outline for Ann's study, which is funded in part by the Department of Ecology.

III. HYDROGEOLOGY
Jim Bailey, the author of the consultant's report, gave a brief presentation and described in further detail the geologic cross sections found in the report. He assured us that the missing geologic map and bibliography would be included in the next (final) version. Other remarks from those present regarded:

- Water level information. There is clearly a need for static water level information for wells in the study area. Ann will compile the information we know of (collected by Ecology and USGS), and make sure the consultants are aware of it, too.

- Further characterization of the unconfined aquifer. Jim noted that the unconfined aquifer may be composed of up to seven different types of deposits. The suggestion was made that areas should be identified where fine-grained "protective" layers were not present in the vertical profile. This would involve another, closer look at well logs for the entire study area to see if, and when, such layers were encountered during drilling.

- Standardization of soil/rock descriptions on well logs (driller's logs). This would facilitate an understanding of the deposits each well passes through and draws water from, and make regional characterization easier and more accurate.

- Additional logs from oil company test drilling. Pat will investigate the existence of additional geologic information from oil companies, who drilled several wells in the study area in the 1950's.

IV. SOILS

A soils map for the study area was presented showing the extent of four "hydrologic soil groups." A brief summary was passed out which describes the four groups, which range from A (coarsest soil) to D (finest soil).

Another map was presented showing the surface water (streams, irrigation ditches, wetlands, etc.) in the study area. This map is on display at the Water Quality office.

V. NITRATES

An overlay for the soils map was presented showing the difference between nitrate levels from 1980 and those obtained in 1990/91. The point was made that most elevated levels occur where surface soils are coarsest, though occurence of coarse soils did not always correspond to elevated nitrate levels. Ann discussed the status of her project and the limitations of the project's contract with regard to source identification and remediation. Comments included:

- Improper well or surface seal construction may be a cause of well water contamination. Nick suggested that electricity grounded through the well casing may cause deterioration of the casing. Also, the point was made that irrigation wells were exempt for the first ten years of surface seal requirements. Roger will investigate the number of irrigation wells which exist, and operate as such, in the study area.
- Water quality testing required for new wells includes nitrate testing; the fate of these results will be investigated by Bill.

VI. STUDY AREA REFERENCES

The Water Quality Division office in Sequim has on file most reports which exist regarding groundwater in the study area. Ann encouraged everyone to visit the office and borrow materials at any time, and to make additions to the list of references. Ann will bring to the next meeting as many pieces of literature as possible, as well as extra copies of the USGS report "Impact of Changes in Land Use on the Ground-Water System in the Sequim-Dungeness Peninsula."

VII. NEXT MEETING

Wednesday, May 1st, 7:00 pm, Sequim Prairie Grange

4/17/91 AS

Appendix E

Ground Water Characterization Report

Sequim - Dungeness

Ground Water Characterization Study

Prepared for
Clallam County
October 25, 1991

Prepared by

Sweet-Edwards/EMCON, Inc.
18912 North Creek Parkway, Suite 210
Bothell, Washington 98011

Project W72-01.01

CONTENTS

TABLES AND FIGURES

Tables

Figures

Plates

1 BACKGROUND

This report summarizes the existing information on the geology and hydrogeology of the Sequim-Dungeness area. It provides information on the nature and distribution of geologic units, ground water occurrence, and historical water quality conditions. The information presented relies solely on evaluation of previous studies and existing data.

1.1 Study Area Description

1.1.1 Topography and Surface Features

The Sequim-Dungeness study area covers approximately 100 square miles on the north central coast of the Olympic Peninsula in Washington State. The study area is bordered on the north by the Strait of Juan de Fuca, the Olympic Mountain foothills on the south, McDonald Creek on the west, and the 400 foot elevation contour east of the city of Sequim but including Happy Valley (see Plate 1 at the end of this report). Elevations range from sea level in the north to over 2,500 feet in the southeast.

The area is transected by four major streams (McDonald, Matriotti, Cassalery, and Gierin) and one river (Dungeness), all of which discharge into the Strait of Juan de Fuca. With the exception of the Dungeness River, all the major streams headwaters originate within the study area boundaries.

The Dungeness River, with a 49-year average discharge rate of 390 cubic feet per second (cfs) and average monthly diversions of 67 (cfs) (USGS, 1986), is a significant source of irrigation water. The irrigation water is diverted from the river through a system of ditches that crisscross the study area.

1.2 Climate

The study area's position on the lee slope of the Olympic Mountains gives it one of the driest climates in western Washington (Figure 1). Data from the Sequim weather reporting station indicate the average annual precipitation for Sequim is 16.8 inches. Due to the variation in topographic relief, local precipitation amounts vary. Highest precipitation is likely to occur in the hilly areas in the southern portions of the study area. Precipitation amounts decrease in the lowlands approaching the Strait of Juan de Fuca.

Most precipitation occurs as rainfall in the winter months. December is the wettest month with an average of 2.66 inches of rainfall. July is the driest month with an average of 0.47 inches. Winter precipitation is occasionally snow. The seasonal average snowfall for Sequim is 4.5 inches.

Ambient air temperatures are relatively mild. The annual average temperature at Sequim is 49°F. The average high temperature is 58°F, and the average low is 40°F.

1.3 Geology

1.3.1 Previous Studies

Many geologic, hydrogeologic, and water quality studies have been completed in the study area. A list of these studies is provided in the References Section immediately following Section 3.

1.3.2 General Description and Relationship of Units

The study area contains three basic rock types: Tertiary or older sedimentary and crystalline bedrock, semi- to unconsolidated fluvial, glacial, and marine Pleistocene sediments, and recent alluvium.

Depth to bedrock in the study area ranges from less than 1 foot in the south to a maximum depth of 2,900 feet northwest of Jamestown. Near surface bedrock occurs as topographic "highs" in the southern study area, is exposed as outcrop, or is covered with thin layers of Pleistocene sediments in other areas. Buried bedrock exists below thick layers of Pleistocene sediments along the northern study area boundary and is noted only in deep (greater than 1000 feet) borings.

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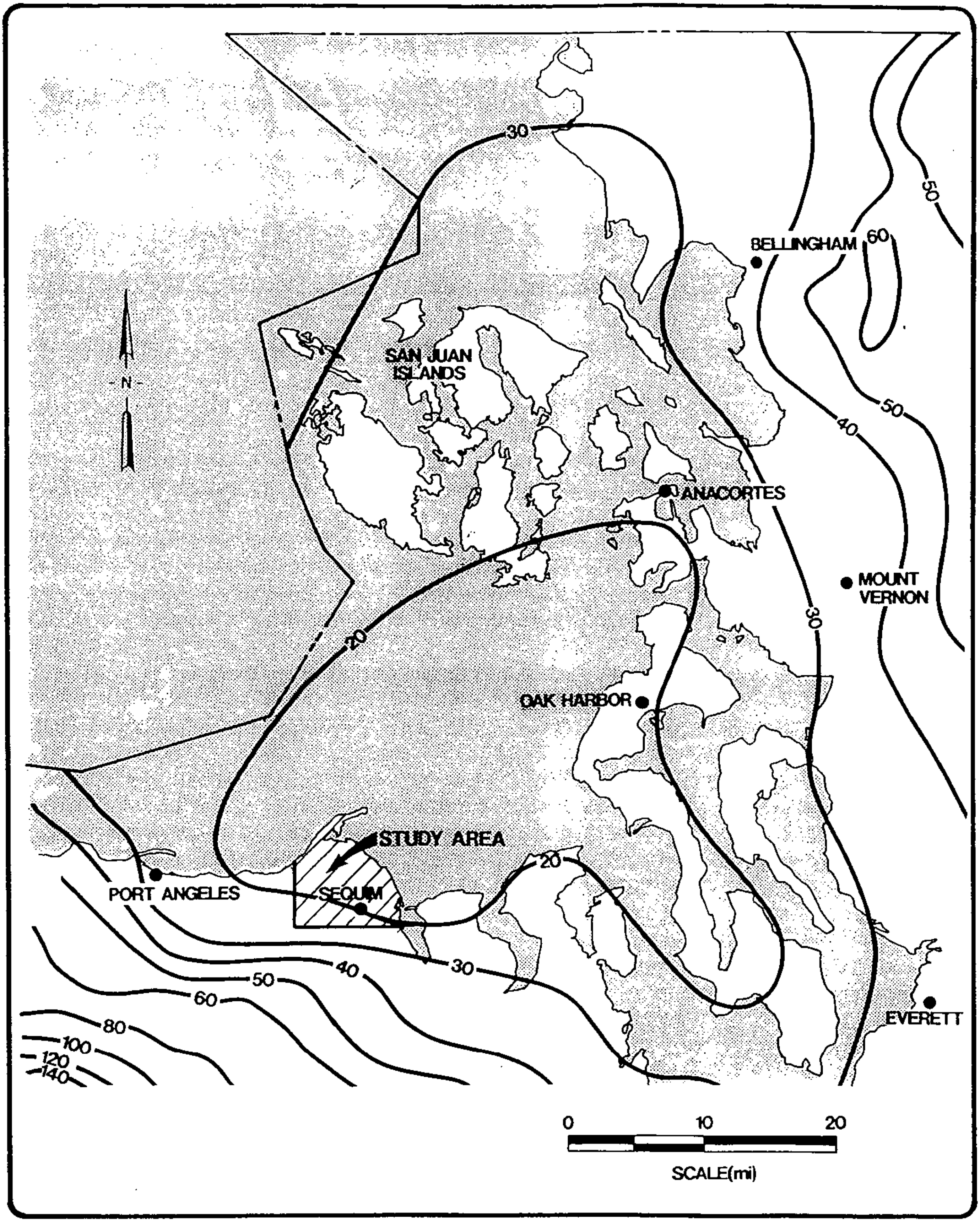

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Figure 1

MEAN ANNUAL PRECIPITATION, 1930-1957

Pleistocene sediments cover the Puget Sound Basin in layers ranging from inches to several hundred feet in thickness. Pleistocene sediments occur throughout the study area. These sediments may be absent at topographic highs or where erosion in the Dungeness River valley has removed the deposits.

Recent alluvial sediments occur within river or stream systems as thin to thick flat-lying sediments. Thicknesses range from less than 1 foot up to 100 feet. Older alluvium may form benches or terraces above the Dungeness River valley. Alluvium may be deposited directly onto bedrock where Pleistocene sediments are absent or have been eroded.

1.3.3 Geologic History

The Puget Sound Basin has existed since Tertiary times when sedimentary and volcanic basement rocks were folded downward between the Olympic and Cascade ranges. The resulting basin provided an avenue for several episodes of piedmont or ice sheet-type glacial flow from southwestern Canada, with concurrent sedimentary deposition during the Pleistocene. Recent post-glacial topographic modifications by erosion and deposition have been minor, occurring primarily along river floodplains.

A minimum of two and perhaps four glacial episodes occurred during the Pleistocene. Glacial, river, lake, and marine sediments (a maximum of 1,000 feet) were deposited in the study area during the first glacial episodes and interglacial periods. The final episode of glaciation, termed the Vashon stade, was the most significant geologic influence on the development of ground water in the study area. Approximately 20,000 years ago, the ice sheet was in the vicinity of Vancouver, British Columbia; 18,000 years ago, the ice sheet had reached the Port Townsend area and effectively isolated the Puget Sound Basin from the Strait of Juan de Fuca.

A large lake developed before the ice front and thick sequences of fine-grained sediments were deposited in the basin. As the ice advanced and reached the maximum southern limits 14,000 years ago, lateral streams from the Olympic and Cascade ranges were blocked by ice, diverting flow through temporary channels. Thick sequences of coarse sands and gravels flowed from the ice front, spreading over the basin and mixing with river sediments. The ice front overrode the coarse sediments and deposited a veneer of till (a mixture of clay, silt, and fine gravel). The ice reached a maximum thickness of 3,000 feet and an elevation of approximately 5,000 feet above mean sea level (AMSL) in Clallam County. The weight of the ice compressed the till and depressed the basin. Soon after the glacial maximum, the ice front began to recede as the rate of accumulation of snow and ice dropped below the rate of melting. By 12,500 years ago, the ice had retreated from the study area. Isolated lenses of sand and gravel were deposited from the ice margins as the glacier retreated. After the ice had retreated past the lateral streams and into the strait, rivers returned to former channels and marine deposition continued (Thorsen, 1983).

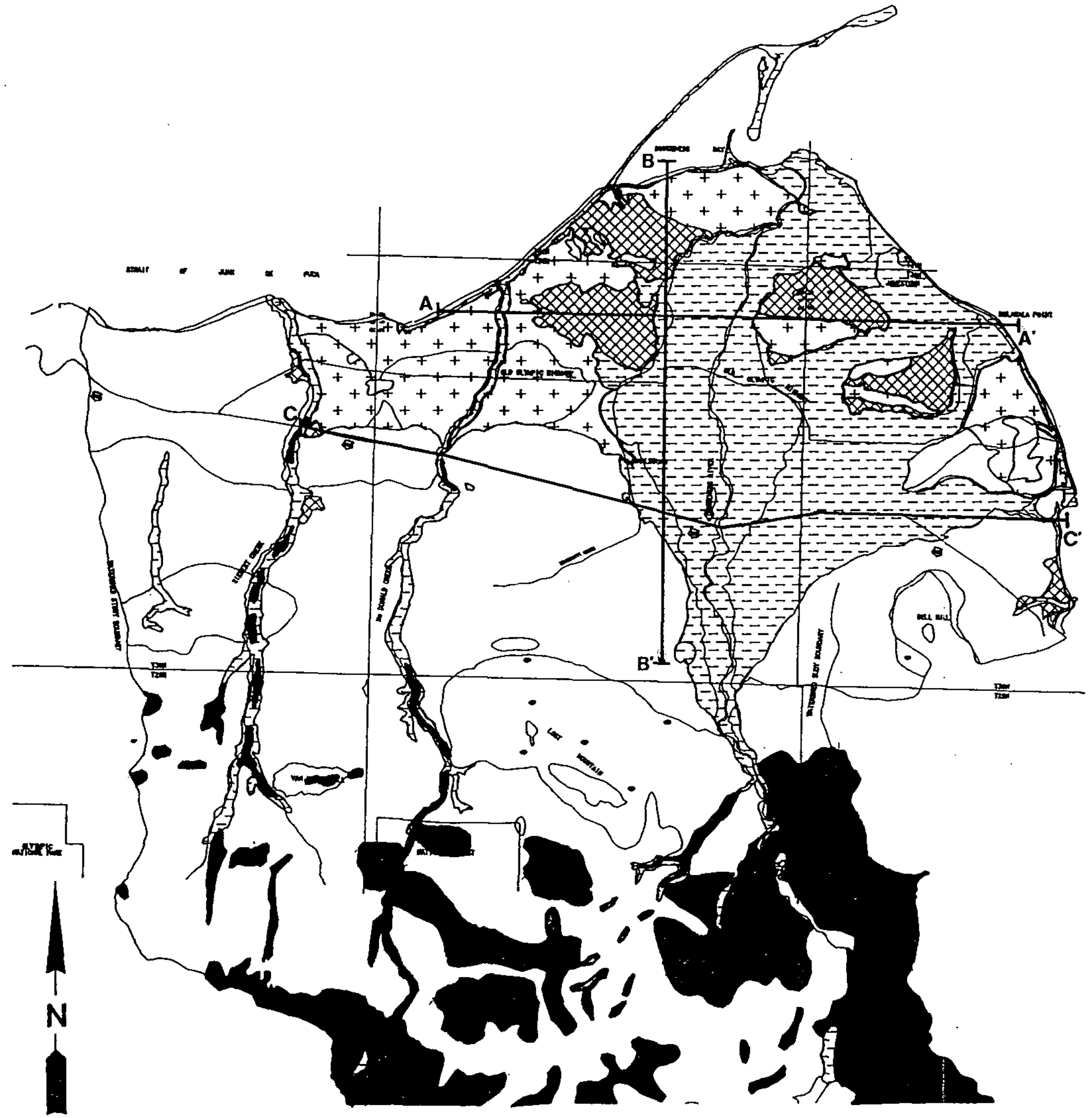
The surficial and subsurface geologic deposits form distinct layers exposed at the surface and are reported in logs of deep borings in the study area. The surficial distribution of geologic materials is shown on Figure 2. The vertical relationships of these deposits are illustrated in three geologic cross-sections shown on Figures 3 and 4 and in a generalized stratigraphic column, Figure 5, which shows the relative formational age of each unit. Well logs used to prepare these cross-sections are presented in Appendix A.

1.3.4 Bedrock

Tertiary sedimentary and volcanic rocks are exposed in the southern portions of the study area. These rocks are estimated to be approximately 24 to 58 million years in age and underlie all the unconsolidated deposits in the area. The sedimentary rocks consist of marine sandstone, siltstone, and mudstone of the undifferentiated Twin River Group, the Aldwell Formation, and the Blue Mountain Unit of Tabor and Cady (1978). A volcanic unit, the Crescent Formation, is composed of submarine basalt flows and breccias, as well as some sedimentary, argillaceous and/or volcaniclastic rocks. These rocks are usually overlain by Pleistocene unconsolidated sediments and contain a less significant quantity of ground water in the study area.

1.3.5 Pleistocene Unconsolidated Sediments

Three episodes of glaciation are believed to have occurred in the study area. The latest and predominant (Vashon Age) glacial episode is the near surface glacial unit in the study area. Current data are insufficient to correlate earlier, pre-Vashon glacial deposits with previous glacial episodes and so they will be discussed as pre-Vashon deposits in this report. The glacial sediments and all sediments deposited before and between the glacial episodes are deposited in thicknesses up to 1,600 feet in the study area. The sediments associated with the pre-Vashon glacial deposits are found at elevations between -1,500 and 100 feet AMSL. Surface exposures of these sediments are restricted to coastal cliff faces. The most recent Vashon drift and associated sediments are found extensively from ground surface to elevations up to 2,000 feet AMSL.



EXPLANATION

- ALLUVIUM, LANDSLIDE AND PEAT DEPOSITS
- VASHON RECESSIONAL OUTWASH
- GLACIOMARINE DRIFT
- VASHON TILL
- BEDROCK
- A — A' APPROXIMATE LOCATION OF GEOLOGIC CROSS-SECTION

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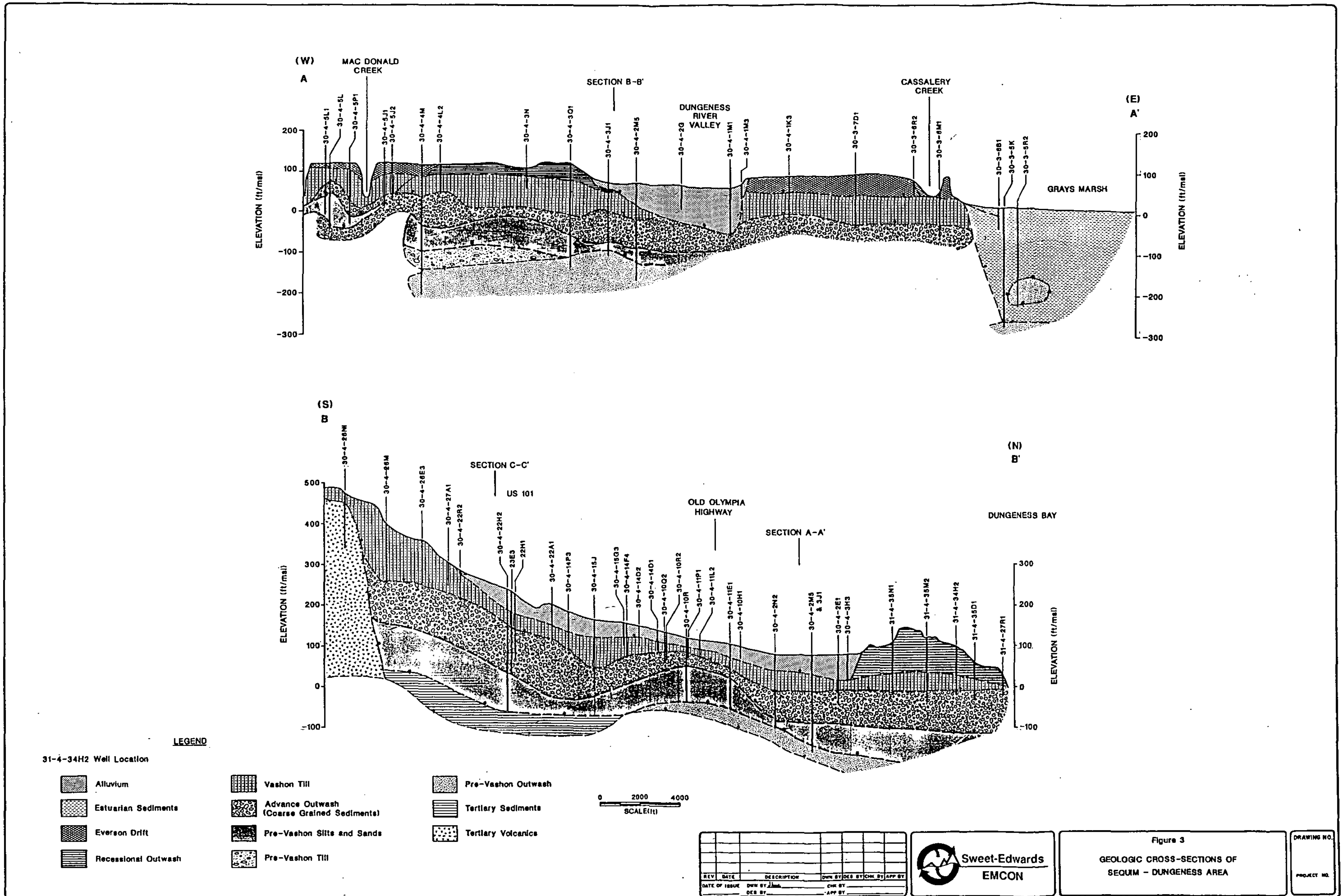
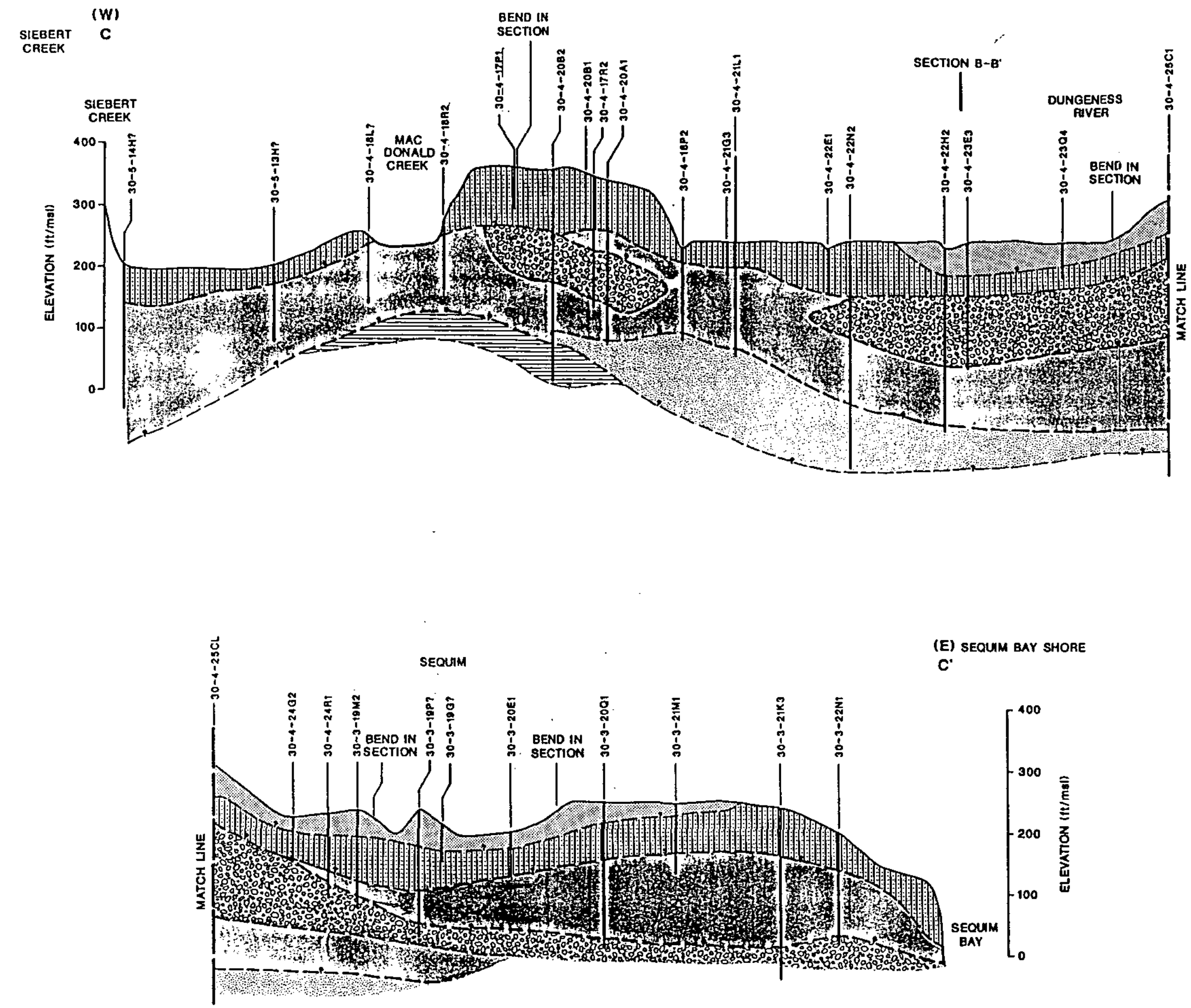
Figure 2
CLALLAM COUNTY
WASHINGTON
SEQUIM DUNGENESS STUDY AREA
GENERALIZED GEOLOGICAL MAP



(W)
A
MAC DONALD CREEK
SECTION B-B'
DUNGENESS RIVER VALLEY
CASSALERY CREEK
(E)
A'
GRAYS MARSH
ELEVATION (ft/msl)
(S)
B
SECTION C-C'
US 101
OLD OLYMPIA HIGHWAY
SECTION A-A'
(N)
B'
DUNGENESS BAY
LEGEND
31-4-34H2 Well Location
Alluvium
Estuarian Sediments
Everson Drift
Recessional Outwash
Vashon Till
Advance Outwash (Coarse Grained Sediments)
Pre-Vashon Silts and Sands
Pre-Vashon Till
Pre-Vashon Outwash
Tertiary Sediments
Tertiary Volcanics
0 2000 4000
SCALE(ft)
Sweet-Edwards
EMCON
Figure 3
GEOLOGIC CROSS-SECTIONS OF SEQUIM - DUNGENESS AREA



LEGEND

Alluvium	Vashon Till	Pre-Vashon Outwash
Estuarian Sediments	Advance Outwash (Coarse Grained Sediments)	Tertiary Sediments
Everson Drift	Pre-Vashon Silts and Sands	Tertiary Volcanics
Recessional Outwash	Pre-Vashon Till	30-3-22N1 Well Location

0 2000 4000
SCALE(ft)

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DATE OF ISSUE DWN BY MP DES BY CHK BY APP BY

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Figure 4

GEOLOGIC CROSS-SECTION OF SEQUIM - DUNGENESS AREA

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STRATIGRAPHIC SEQUENCE OF GEOLOGIC UNITS

RECENT	Recent 12,000 – 0 years ago		Alluvium Stratified clay, silt, sand and gravel
PLEISTOCENE			Recesssional Outwash Stratified clay, silt, sand and gravel
	Vashon Stade Fraser glaciation		Vashon Till Compacted unsorted clayey, silty sand and gravel
	20,000 – 12,000 years ago		Advance Outwash Stratified clean sand and gravel with few silty beds
			Transitional Beds Thin bedded to massive clay silt and fine sand
	Olympia Interglaciation 40,000 – 20,000 years ago		Olympia Gravel Stratified sandy gravel and sand
	Possession Glaciation 60,000 – 40,000 years ago		Possession Drift Compacted non-sorted clayey, silty sand and gravel
	Pre-Possession Interglaciation 130,000 – 60,000 years ago		Whidbey Formation Stratified clay, silt and sand
	Double Bluff Glaciation >130,000 years ago		Double Bluff Drift Compacted non-sorted till with interbedded stratified sand and gravel
	Pre-Double Bluff 2 million to 1 million years ago		Pre-Double Bluff Sediments Fluvial and lacustrine silts sands and gravels
TERTIARY	Sedimentary and Volcanic Rock 24 million to 65 million years ago		Sedimentary and Volcanic Rocks Shale, Sandstone, Conglomerate and Basalt
MESOZOIC & PALEOZOIC	Crystalline Bedrock >65 million years ago		Crystalline Rocks Igneous and metamorphic basement

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Figure 5
CLALLAM COUNTY GROUND WATER CHARACTERIZATION STUDY

GENERALIZED STRATIGRAPHIC COLUMN

Pre-Vashon Sediments. Up to 1,400 feet of unconsolidated sediments occur below the Vashon deposits. These deposits consist mostly of alternating beds of sand, silt, and clay, although peat layers, wood fragments, and gravel are reported at several locations throughout the section. These deposits generally lie entirely below sea level and are primarily found beneath the northern three-quarters of the study area.

Vashon Advance Outwash Deposits. The Vashon Advance outwash deposits underlie a large portion of the study area. The unit is absent where pre-Vashon topography was too high for deposition or where subsequent erosion by the advancing ice or post-glacial rivers removed the sediments. These sediments may be up to 150 feet thick in the study area.

The unit consists predominantly of gray layered sand overlain by sandy gravel with occasional cobbles. The unit is locally silty and oxidized, particularly where derived from weathered Tertiary sedimentary rocks. The unit typically coarsens upward, from thick fine sand beds through medium to coarse sands in the center, to sand and gravel at the top. The outwash was likely deposited on moderately flat surfaces of pre-Vashon deposits by meltwater flowing into ponded areas and as braided streams in front of the advancing ice sheet.

Vashon Till. Vashon till is found throughout the study area. The till has a thickness of less than 1 foot to 100 feet. Vashon till consists of a non-sorted, compact mixture of clay, silt, sand, cobbles, and boulders. Layers of silty and sandy sediments occur locally within lower portions of the unit. The Vashon till is a significant barrier to ground water flow between the underlying outwash and the surficial deposits above.

Vashon Recessional Outwash and Glaciomarine Drift. The recessional outwash and glaciomarine drift are generally discontinuous and occur as isolated deposits lying atop Vashon till primarily in the northern portion of the study area (see Figure 2). The outwash and drift may also lie directly atop and in hydraulic connection with the advance outwash. The outwash and drift range in thickness from a few feet to approximately 100 feet in the study area.

Recessional outwash deposits are layered glacial and marine sediments consisting of partly oxidized sand and gravel, and locally contain beds of silt and clay. The recessional outwash is much more permeable than the Vashon till and generally does not form a hydraulic barrier. The Glaciomarine drift deposits are a poorly sorted deposit of silt and clay. At scattered localities, the drift interfingers with the recessional outwash deposits. The drift is generally less permeable than the outwash deposits and often acts as a barrier to downward movement of water.

1.3.6 Recent Alluvium

Post-glacial depositional and erosional processes modified the glacial landforms and former stream and river valleys. Alluvial sediments are found primarily in stream channels and the Dungeness River valley (Figure 2). Older alluvium forms terraces composed of sand and gravel above existing floodplains. Younger alluvium has been deposited by existing river and stream systems with sand, silt, and clay in the upper layers of the alluvium. The alluvial deposits blanket much of the surface topography in the study area. Thickness ranges from 10 feet in the southern portions to approximately 125 feet in the Dungeness River valley.

2 GROUND WATER

This section describes the known occurrence, movement, and recharge of ground water within the major geologic units in the study area. Although ground water occurs in all the geologic units discussed in Section 1.3, physical conditions such as soil permeability and layering determine the role of each unit in the overall ground water regime.

2.1 Occurrence of Ground Water

Geologic materials that are able to store and conduct ground water are considered to be aquifers. In the Sequim-Dungeness area, the major aquifer systems have been divided into shallow, intermediate, and deep ground water systems. Previous studies have defined the shallow ground water system as comprising at least seven geologic units including alluvium and all the Vashon age deposits. The intermediate and deep flow systems are poorly defined due to the scarcity of data, but are generally believed to be composed of pre-Vashon age unconsolidated materials.

2.2 Ground Water Flow Directions

Reliable data are not sufficient to draw accurate ground water flow maps for each aquifer; however, generalizations can be made. In the shallow ground water system, ground water is expected to flow downslope and generally perpendicular to topographic contours. Limited water level data collected by the USGS (1983) appear to support this conclusion. In the deep aquifer systems, ground water in the pre-Vashon deposits will flow under regional gradients generally in a northerly direction from the Olympic Range to the Strait of Juan de Fuca.

2.3 Major Hydrostratigraphic Units

When evaluating the hydrologic characteristics of geologic units, it is often more appropriate to talk in terms of hydrostratigraphic units. In this context the geologic units can be described in terms of their role in the overall ground water regime. The major hydrostratigraphic units of the Sequim-

Dungeness area occur within the Pleistocene glacial and pre-glacial sediments. The units may either form barriers to ground water flow or readily store and transmit ground water. Table 1 lists the hydrostratigraphic units in the study area.

Table 1
Major Hydrostratigraphic Units

Ground Water System	Hydrostratigraphic Unit	Estimated Thickness (feet)	Ground Water Characteristic
Shallow	Alluvium/Vashon Recessional Outwash	<1-100	Aquifer
	Vashon Till	<1-100	Aquitard
	Vashon Advance Outwash	<1-350	Aquifer
Intermediate	Upper Confining Bed (pre-Vashon silts, sands)	25-200+	Aquitard
	Upper Artesian Unit (pre-Vashon sands and gravels)	<50-100+	Aquifer
Deep	Lower Confining Bed (older pre-Vashon silts and sands)	<50-200+	Aquitard
	Lower Artesian Unit (older pre-Vashon sands and gravels)	?	Aquifer

The USGS (1983) divided the unconsolidated sediments beneath the study area into five hydrostratigraphic units: three aquifers and two confining units. The uppermost unit is the water-table aquifer followed by the upper confining bed, the upper artesian aquifer, the lower confining bed, and finally the lower artesian aquifer.

2.4 Shallow Ground Water Systems

The water table aquifer is currently the most important for domestic water supplies. The aquifer includes at least six geologic units identified by Othberg and Palmer (1980, a,b,c): alluvium, older alluvium, Vashon glaciomarine drift, Vashon recessional outwash, Vashon advance outwash deposits, and Vashon till. The shallow water table aquifer can be further divided into three distinct ground water systems which reflect the water-bearing capacity of the Vashon sediments.

Alluvium and Recessional Outwash Units. The shallow aquifer contained within these geologic formations is often discontinuous and thin. The aquifers are typically perched upon the upper surface of the underlying till. Ground water generally ranges from 5 to 80 feet below ground surface (bgs). The aquifer is usually under water table (unconfined) conditions. In places where the underlying glacial till is absent, the aquifer may be hydraulically connected with lower aquifers. Domestic wells completed in this aquifer often yield 10 to 50 gpm.

Recharge to these units is primarily through direct precipitation in the upland areas and induced recharge from surface water bodies such as the Dungeness River and irrigation ditches. Direct recharge potential to these aquifers is generally moderate to high, except where silty and clayey sediments prevent infiltration of rain water.

Vashon Till. The Vashon till typically forms a low permeability barrier to downward water percolation. Shallow ground water may occur on the base of the upper 8 feet of weathered till, perching upon the upper surface of the unweathered till. Ground water is also sometimes found within the unweathered portion of the Vashon till, typically restricted to thin, discontinuous lenses of sand and gravel. Ground water may be under water table or semiconfined conditions and water levels are generally 10 to 100 feet bgs. Sources of water in the till are occasionally used by older private wells which may yield up to 25 gpm, but are subject to seasonal fluctuation and may completely dry up during the summer months.

Recharge of rain water to the unweathered Vashon till is slow because of low infiltration capacities, and most water is lost through surface runoff. Increased infiltration occurs in the locally higher permeable zones that have the ability to transmit and store ground water. Topographic depressions in the upper surface of the unweathered till trap ground water that slowly infiltrates into underlying geologic units and aquifers.

Vashon Advance Outwash Deposits. The outwash deposits constitute the thickest (up to 150 feet) and most significant aquifer zone in the study area. The aquifer occurs beneath most of the study area, except for limited areas of non-deposition or erosion such as beneath portions of the Dungeness River valley. The unit generally decreases in thickness to the south.

The Vashon outwash readily transmits water, particularly in the upper layers of highly permeable gravel and sand. Ground water percolates downward through these layers to be stored in thick lenses of medium to coarse sand.

The majority of water supply wells in the study area are completed in this aquifer zone, which typically yields 10 to 500+ gpm, sufficient quantities of water for private, public, or industrial supply. The aquifer can be under water table or confined conditions and water levels range from above ground surface (flowing artesian) to 150 feet bgs.

The vashon outwash aquifer is recharged from three sources: (1) direct infiltration from precipitation and surface runoff; (2) ground water leakage from aquifers contained in and above the till; and (3) ground water recharge from underlying aquifer(s) in hydrogeologic connection with the vashon outwash aquifer.

2.5 Deep Aquifer Systems

The deeper hydrostratigraphic units include all the pre-Vashon deposits. The extent of the deeper aquifer systems beneath the study area is largely unknown because of the scarcity of wells completed in these units. Correlations of geologic formations beneath the Vashon deposits have been extrapolated between sporadic data points (Figures 3 and 4).

The shallow water table aquifer zone overlies the upper confining layer. The confining layer and the deeper confined aquifers are not exposed at the surface in the study area. The confining beds are composed of silt and clay, with minor discontinuous thin beds of sand. The thickness of the upper confining bed varies from approximately 25 feet to over 200 feet. The thinnest part is in the southern upland area. Some thickening occurs to the north towards the Strait of Juan de Fuca. The upper confining unit is not a significant source of water supply.

The upper artesian aquifer underlies the upper confining layer and is composed of sand and gravel with some silt and clay (USGS, 1983). The thickness of the upper aquifer ranges from less than 50 feet to over 100 feet. Wells completed in this unit generally yield 10 to 50 gpm. Ground water is under confined conditions and water level depths range from 100 to 250 feet bgs.

The lower confining layer is located between the upper and the lower artesian aquifers. Very few wells penetrate the unit. The estimates of thickness range from less than 50 feet in the southern uplands to over 200 feet towards the northeast. As with the upper confining unit, there is not a significant potential for water supply.

Little is known about the lower artesian aquifer and deeper unconsolidated material due to the low number of wells penetrating these deposits. Water-bearing material may occur at depth in some portions of the study area, but data concerning its characteristics do not exist.

Recharge to these deep aquifers is probably via deeper ground water flow paths that originate south of the study in the Olympic Mountains. Some recharge may occur through leakage from overlying deposits. However, the thick, dense, low-permeability aquitards in the section reduce vertical ground water movement. Ground water discharge is believed to be to the Strait of Juan de Fuca.

2.6 Ground Water Recharge

The USGS (1983) attributed ground water recharge to two primary sources: precipitation and irrigation ditches. An average annual ground water recharge rate from precipitation was calculated using potential evapotranspiration and precipitation figures. Drost concluded the average recharge rate from precipitation to be about 11,000 acre-feet per year. As expected, most of the recharge occurs near the mountains. Calculated average annual recharge ranged from 1.3 inches in the northeast part of the study area to 11.2 inches in the southern hilly area and 2.3 inches at the Sequim weather station located at the sewage treatment plant near the mouth of Bell Creek.

The influence of the irrigation ditches on ground water recharge was also evaluated by USGS (1983). Hydrographs of an irrigation ditch and a nearby shallow (49 feet) well showed a good correlation between water levels in the well and flow in the ditch 100 feet away. As flow increased or decreased in the ditch water level generally rose or dropped in the well within a relatively short period.

The USGS estimated the ground water recharge to the water table aquifer from the irrigation ditches using data from the Dungeness River, McDonald Creek, and evapotranspiration. Recharge from irrigation ditches was calculated to be approximately 50,000 acre-feet per year. Results of recharge calculations from precipitation and from irrigation ditches indicate that irrigation ditches contribute up to 4.5 times the annual recharge of precipitation.

Changes in land use and irrigation practices since 1983 may have modified the recharge estimates in localized areas. In particular, the contribution of irrigation water to ground water recharge has probably decreased.

3 GROUND WATER QUALITY

Overall ground water quality for the study area is good. Ground water quality can be impacted by both natural and human generated constituents (e.g. iron, nitrate, chloride etc.). The level of natural constituents can be impacted by both surface and subsurface conditions. Factors that play an important role in determining the concentration of natural constituents in ground water include:

- Aquifer permeability
- Amount of precipitation
- Concentration of leachable natural constituents in the soil or rock medium
- Age of ground water

Natural constituents are widespread, but they severely impact the water quality only in selected areas. The natural constituent levels are not expected to change significantly over time or with changing land use.

The human generated constituents are generally restricted to areas of urban, industrial, agricultural, and transportation corridor land uses. Constituent levels and water quality may change with changing land use practices. Natural and human generated constituents in ground water can affect both the aesthetic and health-related aspects of ground water (Primary and Secondary Drinking Water Standards, Washington State Water Quality Criteria, 1990). Secondary water quality standards regulate the allowable concentration of constituents which can affect the aesthetic quality of water. For instance, iron is a secondary standard because it can affect the taste of water and also stain porcelain fixtures. Manganese tends to precipitate in pipes, reducing their ability to transmit water; this is also a non-health related property, but is still undesirable. Primary drinking water standards refer to constituents that can impact human health. The most significant naturally occurring contaminant which can potentially impact human health in the Sequim-Dungeness area is coliform bacteria. Nitrate from agricultural activities and disposal of sewage (septic tanks) is a widespread chemical in the study area and can impact human health. A complete list of the primary and secondary water quality standards for ground water in Washington State is included in Appendix B.

The Vashon outwash and pre-Vashon deposits more commonly have naturally elevated concentrations of iron and manganese because of lower pH and dissolved oxygen levels. In the study area, the location of naturally occurring constituents in ground water can be localized or widespread. For instance, organic material from existing or buried swamps or bogs will contain abundant peat, or organics. This may result in high levels of sulfur, iron, and manganese in ground water. These compounds are introduced into the ground water by weak organic acids from decaying organic matter which dissolve minerals in soils and rock. Chlorides in ground water occur in two forms in the study area. One is from salt water intrusion. Salt water intrusion has not been a major problem in the area, but may increase as additional ground water withdrawals occur from new development near the Strait. The other principal source of chlorides is naturally occurring, derived from the elements present in the soil and rock that contain the ground water. This condition does not appear to be a problem in the study area.

Nitrates, sulfur, coliform bacteria, and human generated chemicals can be expected to be found in shallow ground water such as in the recessional outwash, Vashon till, and alluvial sediments. The potential vulnerability of the study area's ground water resources to land use activities can be illustrated with a brief discussion of nitrate, coliform, and TPH contamination in the study area.

3.1 Nitrate

Nitrate is an oxidized form of the element nitrogen. Nitrogen makes up about four-fifths or eighty percent of the gases in the earth's atmosphere and is a nutrient which is essential for the growth of all plants. Atmospheric nitrogen generally cannot be assimilated by plants, and thus conversion to other forms must occur to support plant growth. In an environment where oxygen is abundant, conversion of nitrogen to nitrate is carried out by a variety of microorganisms that inhabit soil and water.

Nitrate is also formed by the complete oxidation of ammonium ions by soil or water microorganisms. Ammonia is abundant in most fertilizers, septic tank effluent, animal (e.g., livestock) wastes, and decomposing plant and soil organic matter.

Nitrate is highly soluble in water and can be carried into the soil by rainwater, irrigation water, surface runoff, and septic tank effluent. Up to a limit, growing plants can assimilate nitrate that enters the soil. However, if the rate of nitrate application exceeds the uptake rate of plants, or if nitrate is introduced to the soil below the plant root zone, excess nitrate will be present. The ability of a soil to remove or somehow absorb excess nitrate is generally quite limited. Because of its non-reactive nature, excess nitrate can be carried to ground water with water percolating through the soil column. Because of its high solubility, its resistance to removal in the soil, and almost universal presence, nitrate is a common contaminant of ground water. A survey conducted by the U.S. Environmental Protection Agency in 1987 indicated that nearly 500 public water systems nationwide exceeded federal drinking water standards for nitrate (AWWA, 1987).

Nitrate is a natural component of many vegetables such as spinach, rhubarb, beets, cauliflower, and cabbage. Nitrate is also widely used as an additive in sausages, ham, bacon, hot dogs, and other cured or corned meats. While nitrates are often consumed by adults and children in food and food products, the presence of nitrate in drinking water can create a unique problem.

The maximum contaminant level for nitrate in drinking water is 10 mg/l. The maximum contaminant level was established to prevent any significant risk of a disorder known as methemoglobinemia (infant cyanosis). Methemoglobinemia can occur in infants under 5 months of age who have been given water or fed formula prepared with water having high concentrations of nitrates. Telltale symptoms include intestinal discomfort and cyanosis, a bluish or lavender tint to the skin caused by discolored blood.

Because an infant's gastric juices are less acidic than those of older children and adults, nitrate can be transformed to a closely related compound, nitrite, in the gastrointestinal tract. If nitrite is absorbed in an infant's bloodstream, it, like oxygen, reacts directly with hemoglobin. Because nitrite competes with oxygen for hemoglobin sites, it impairs the blood's ability to transport oxygen. However, while this can be a life-threatening disorder, methemoglobinemia is generally associated with drinking water nitrate levels far in excess of 10 mg/l.

An evaluation of long-term trends in nitrate concentrations in ground water of the Sequim-Dungeness area shows a statistically significant increase in mean nitrate levels between 1980 and 1990. Average concentrations have almost doubled from 1.4 mg/l in June 1980 to 2.6 in August 1990. The increases do not appear to be confined to any particular portion of the

Sequim-Dungeness area and they do not appear to be associated with a specific source. Both shallow (less than 50 feet) and deep (greater than 100 feet) wells have shown elevated levels of nitrate. Twenty-five out of 36 wells sampled by Clallam County in September 1990 had reported nitrate concentrations in excess of 1 mg/l. Of those 25 wells:

- Sixty percent (15) are in areas mapped as having excessively drained soils, particularly Carlsborg gravelly sandy loam and Sequim very gravelly sandy loam.

- Twenty percent (5) are located immediately adjacent to areas mapped as having excessively drained soils.

- Eight percent (2) are in areas mapped as having well-drained soils that are not underlain at a shallow depth by hardpan or clay layers.

- Twelve percent (3) are in areas of well-drained to slowly-drained soils that are underlain at a shallow depth by hardpan or clay layers.

All of the sampled wells with reported nitrate concentrations exceeding 5 mg/l (fifty percent of the water quality standard) and 12 of the 15 wells with the highest nitrate levels (2.1 to 11.4 mg/l) are located in areas with excessively drained soils. These types of soils typically afford the least resistance to the vertical migration of contaminants and, therefore, provide little protection for ground water from surface or near-surface nitrate sources.

Insufficient information is available regarding the elevated ground water nitrate levels to support formal conclusions concerning the source(s). However, based on knowledge of geologic and land use conditions in the area, the chemical properties of nitrate, and the circumstances regarding similar contamination incidents in other parts of the state and country, it is possible to draw some preliminary conclusions:

- The elevated nitrogen levels identified through the ground water monitoring program could be the result of:

    - Poorly constructed wells located in close proximity to a nitrogen source such as a barn or a cesspool. Poorly constructed wells include wells that are improperly or poorly protected by a cover, lack adequate casings, lack adequate sanitary seals, or are improperly located.

- Regionalized nitrate contamination associated with multiple non-point sources. It is likely that on-site sewage systems, livestock waste, and fertilizer practices (residential, commercial, and agricultural) all contribute to the contamination. However, the dominant source may vary from area to area depending on the nature of local land use.

- Nitrate transport and loading by the irrigation canals and ditches which traverse the area. Nitrogen inputs to the irrigation ditches could result from surface runoff directed to the ditches and irrigation return flow. The sources of nitrogen are the same as described above; however, because of contaminant transport in the canals, they could be located a considerable distance from where the ground water contamination is actually manifest. Once present in an irrigation canal, nitrogen is free to migrate to underlying ground water with irrigation water seeping from the unlined canal bottom.

- A combination of all of the above.

• The presence of nitrate indicates a possibility that other mobile contaminants (pesticides, chlorides, viruses, and some volatile organics) could be present in well water in areas with agricultural, commercial, institutional, and industrial land uses.

3.2 Total Petroleum Hydrocarbons

Selected water samples collected from wells in the Sequim-Dungeness study area were analyzed for total petroleum hydrocarbons (TPHs) using EPA Method 418.1. Analyses were performed by Amtest Inc., of Seattle, Washington. The method detection limit for these analyses is 1.0 mg/l, which is the same as the Model Toxics Control Act compliance cleanup level. TPHs were detected in one sampled well at a concentration of 1.9 mg/l (sample 30-3-20-E1). TPHs were also detected in the transfer blank (distilled water) at a concentration of 1.6 mg/l.

As its name implies, a TPH analysis measures the concentration of total petroleum hydrocarbons recoverable from a soil or water sample. EPA Method 418.1 reports the combined concentration of petroleum hydrocarbons plus non-polar non-petroleum hydrocarbons (e.g., wood resins and turpins). This method is also known to have a low recovery for gasoline, and to be susceptible to a significant positive or negative bias depending on the sample matrix. An alternative analytic method (EPA Method 8015M) provides analyte-specific tests using gas chromatography techniques, which give more reliable quantitative results for petroleum hydrocarbons. These methods are described below.

EPA Method 418.1

EPA Method 418.1 measures the total number of carbon-to-hydrogen (C-H) bonds in a sample. It does not identify or measure specific petroleum hydrocarbon compounds. This method cannot be used to quantitate petroleum hydrocarbon fractions that can volatilize (boil) at temperatures below 70°C (e.g., solvents or gasoline). Semivolatile petroleum hydrocarbon fractions (which volatilize at temperatures above 70°C) are first extracted from the sample using a solvent (freon 113, a chlorofluorocarbon), then analyzed using an infrared (IR) spectrometer.

In theory, the shortest quantifiable hydrocarbon chain is C-6 (a hydrocarbon chain containing six carbon atoms) however, for practical purposes C-10 may be a more reliable lower quantitation limit. Quantitation of the semivolatile petroleum hydrocarbon fractions can be limited by their solubility in freon 113, which has less solvating strength than the solvent methylene chloride which is used for EPA Method 8015M. Heavier (longer-chain) petroleum hydrocarbons may contain significant fractions which are not extractable with freon 113, and therefore not detected using EPA Method 418.1. The low solubility of longer-chained hydrocarbons in freon 113 may result in a practical upper quantitation limit of C-30.

Polar hydrocarbons (e.g., waxes and fats) are selectively removed in the EPA Method 418.1 analytical procedure using a silica gel cleanup. However, the silica gel cleanup procedure will also remove complex aromatic compounds and other chlorine-, sulfur-, and nitrogen-containing hydrocarbons, which can result in a low bias (underestimation of the TPH concentration).

Non-polar nonpetroleum hydrocarbons will be present in samples that have high background concentrations of organic compounds (such as woodwaste, peat, or organic soil). This may result in a high bias (overestimation of the TPH concentration in the samples) because the C-H bonds of the non-polar background hydrocarbons will be included with those of the petroleum hydrocarbons in determining the samples' TPH concentration.

EPA Method 418.1 requires calibration with a reference oil consisting of 25 percent aromatic total petroleum hydrocarbons. This can lead to significant high or low bias, because the actual proportion of aromatic compounds to the total can range from 0 to 100 percent.

EPA Method 8015M

Petroleum hydrocarbons can also be analyzed using EPA Method 8015M. This method is not subject to the bias or extraction problems of EPA Method 418.1. Method 8015M carries the designation "M" (Modified) because EPA Method 8015 was adapted to specifically measure petroleum hydrocarbons. EPA Method 8015M measures volatile (C-4 to C-12) and/or semivolatile (C-10 to C-40) petroleum hydrocarbons using a gas chromatograph (GC) instrument. In select cases, petroleum hydrocarbons up to C-60 can be measured. The GC method generates a unique "fingerprint" (chromatogram) representing the suite of compounds associated with the type of petroleum present in the sample. The gas chromatogram can be used for identifying, as well as quantitating, those compounds.

Volatile hydrocarbons, such as gasoline and solvents, are analyzed using methods which minimize volatile loss by eliminating the extraction procedure. This is accomplished by introducing the analytes to the GC using either a purge-and-trap method (EPA Method 5030), or the headspace method (EPA Method 3810).

The EPA Method 8015M analysis of semivolatile hydrocarbons employs a liquid-liquid extraction for water samples (EPA Method 3510 or 3520). Methylene chloride is used as the solvent. The extracted sample is analyzed using a GC equipped with a flame ionization detector (FID). The FID is considered a universal detector since it measures the total number of C-H bonds in a sample, without discriminating between polar and non-polar hydrocarbons. The GC then separates specific hydrocarbon types by their chemical properties and boiling point ranges. The analyst can select the region (i.e., the carbon number or range of numbers) of the gas chromatogram on which to base the final quantitation of total petroleum hydrocarbons present.

EPA Method 8015M does not allow the (silica gel) cleanup of non-polar nonpetroleum hydrocarbon interferences. However, since the analyst can base quantitation on the selected range of hydrocarbons considered most representative of the sample, results from this method are often considered more representative of the true concentration of the petroleum hydrocarbons in the sample than results from EPA Method 418.1.

Since EPA Method 418.1 was used to analyze the water samples selected in the study area wells, and because this method is known to have potential biases, the TPH concentration in well 30-3-20E1 should be confirmed using EPA Method 8015M, and using benzene, toluene, ethylbenzene, and xylene (BTEX) analysis. For each sample, if a gasoline component is identified using the EPA Method 8015M volatile TPH analysis, then the associated BTEX sample should be analyzed using EPA Method 8020. These analyses will indicate whether petroleum hydrocarbon concentrations, and in particular benzene concentrations, exceed the MTCA Method A cleanup levels in this well. Future TPH sampling should also use the EPA Method 8015M analysis to avoid the bias and problems mentioned in this section.

3.3 Coliform Bacteria

The coliform group comprises all aerobic and facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35°C (Standard Methods, 1980). Total coliform bacteria include bacteria of fecal origin and aerobic bacteria that live in the soil. Fecal coliform bacteria originate in the intestinal tract of warm-blooded animals and their presence is indicative of fecal contamination. Coliform bacteria can be transported to ground water via stormwater runoff into dry wells, through the casing annulus around poorly sealed wells, and from septic tank drainfields. Thus, the presence of coliform bacteria often serves as an indicator of land use impacts. Although the health risks from coliform bacteria rarely include more than intestinal discomfort, their occurrence may mean other more high risk contaminants are also present.

Total and fecal coliform densities were measured during the nitrate sampling (Section 3.1) of wells in the fall of 1990 in the Sequim-Dungeness watershed. Total coliform densities ranged from 0 to a density that was too numerous to count (TNTC). No fecal coliform densities were detected in wells sampled in March of 1991 that previously had detectable levels of total coliform bacteria when sampled in the fall of 1990. The state water quality standard for total coliform bacteria is 1 organism per 100 ml of sample. Since fecal coliform bacteria represent a subset of total coliform bacteria, the same standards would apply.

A review of the coliform data does not indicate any pattern or trend in the observed coliform concentrations. High levels (TNTC) of coliform bacteria were detected in wells with elevated nitrate levels and low nitrate levels. In fact, the wells with the highest nitrate levels (9-10 mg/l) did not have any detectable levels of coliform bacteria.

Existing bacteriological data are insufficient to identify any specific sources or the magnitude of this problem throughout the Sequim-Dungeness study area. As with nitrate contamination, the observed bacteriological levels are a result of a number of non-point sources including poorly constructed well seals, impacts from septic systems, agricultural impacts and surface water impacts. The dominant source may vary from area to area depending on the local land use activities.

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Appendix A

Well Logs

30-4-5L1

Well Number

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD | Physiographic Province: | Section:

Drainage Basin: | Subbasin:

Topo of well site: local depression (D), flat surface (F), hilltop (H), hillside (S), terrace (T), valley flat (V),

MAJOR AQUIFER: system, series | aquifer, formation, group

Lithology: | Origin: | Aquifer Thickness: ft

Length of well open to: ft | Depth to top of: ft

MINOR AQUIFER: system, series | aquifer, formation, group

Lithology: | Origin: | Aquifer Thickness: ft

Length of well open to: ft | Depth to top of: ft

Intervals Screened:

Depth to consolidated rock: ft | Source of data:

Depth to basement: ft | Source of data:

Surficial material: | Infiltration characteristics:

Coefficient Trans: gpd/ft | Coefficient Storage:

Coefficient Perm: gpd/ft^2; Spec cap: gpm/ft; Number of geologic cards:

Log

0-4' Clay

4-80 Sand clay

80-124 gray gravel clay

124-126 gravel with water

GPO 844-225

480722123132801

WRD Exp. (GW)
Aug. 1964

30/4W-5L1

U. S. DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

Water Resources Division Well Schedule Form

MASTER CARD

Record by: D. R. Cline — Source of data: Mrs Brambach — Date: July 26 1968 — Map: Carlsborg 7½'

State: Wash 56 — County (or town): Clallam 05

Latitude: 480722N — Longitude: 1231328 — Sequential number: 1

Lat-long accuracy: — T 30 N, R 4 W, Sec 5, NE ¼ SW ¼

Local well number: 30N04W05L01 — Other number:

Local use: — Owner or name: A. H. Brambach

Owner name: A N BRAMBACH — Address: Rt 2, Box 870, Port Angeles

Ownership: County, Fed Gov't, City, Corp or Co, Private, State Agency, Water Dist — P

Use of water: Air cond, Comm, Dewatering, Fire, Dom, Irr, Ind, P S, Stock, Instit, Unused — H

Use of well: Anode, Drain, Seismic, Obs, Oil-gas, Recharge, Spring, Test, Unused, Withdraw, Waste, Destroyed — W

DATA AVAILABLE: Well data 9 — Freq. W/L meas.: Ø — Field aquifer char.:

Hyd. lab. data:

Qual. water data; type:

Freq. sampling: Ø — Pumpage inventory: yes no period:

Aperture cards: yes

Log data: drillers

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD — Depth well: 126 ft 126 — Meas. Rept. accuracy 6

Depth cased (first perf.): 126 ft 126 — Casing type: Steel — Diam. 6 in 6

Finish: porous concrete, gravel w. (perf.), gravel w. (screen), horiz. gallery, open end, perf., screen, sd. pt., shored, open hole, other — Ø

Method Drilled: air rot., bored, cable, dug, hyd rot., jetted, air percussion, reverse rotary, trenching, driven, drive wash, other

Date Drilled: Sept 1964 — 964 — Pump intake setting: ft

Driller: Earl Van Rudle — address: Port Angeles

Lift (type): air, bucket, cent, jet, multiple (cent.), multiple (turb.), none, piston, rot, submerg, turb, other — J — Deep Shallow

Power (type): diesel, elec, nat gas, gasoline, hand, LPG gas, wind; H.P. 1 — 5 — Trans. or meter no.

Descrip. MP: ft above below lsd, Alt. MP

Alt. LSD: 110 — 110 — Accuracy (source): 5

Water level: 116 ft above below MP; Ft above below lsd — 116 — Accuracy: 5

Date meas.: Sept 1964 — 964 — Yield: 5 gpm — Method determined

Drawdown: ft — Accuracy: — Pumping period hrs

QUALITY OF WATER DATA: Iron ppm — Sulfate ppm — Chloride 18 ppm — Hard. ppm

Sp. Conduct 484 k x 10^6 — Temp. °F — Date sampled July 26, 1968 — 768

Taste, color, etc.

Copy — Owner's Copy Canceling
Copy — Driller's Copy

30/4W-5P1

STATE OF WASHINGTON

Permit No. ....

(1) OWNER: Name .... Address ....

(2) LOCATION OF WELL: County .... ¼ ¼ Sec. ..... T. .... N., R. .... W.M.

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) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well .... inches.
Drilled .... ft. Depth of completed well .... ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 161 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 ....
Type .... Model No. ....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Fresh, Dom. Depth of strata 3'
Method of sealing strata off Bailed & Cleaned

(7) PUMP: Manufacturer's Name ....
Type .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level 200 ft.
Static level 196 ft. below top of well Date April 14, 73
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 25 gal./min. with 20 ft. drawdown after 1 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
	0	3
Top soil		
[illegible]	3	10
Brown clay & sand	10	120
Sand & gravel	120	130
Blue clay	130	150
[illegible]	[illegible]	[illegible]
Coarse sand & gravel	158	161

4807131251322301

RECEIVED
OCT 29 1974
DEPARTMENT OF ECOLOGY
SOUTHWEST REGION OFFICE

Work started .... 19.. Completed .... 19..

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 Earl R. Van Ausdle
(Person, firm, or corporation) (Type or print)

Address Rt 2, Bx 1654 - Port Angeles

[Signed] Earl R Van Ausdle
(Well Driller)

License No. 223-62-8534 Date .... 19..

OK Winn 10-28-74 (USE ADDITIONAL SHEETS IF NECESSARY)

21565

S. F. No. 7356—OS—(Rev. 4-71).

-dgar A. Olson
22606 2 Pl. E.
Bothell, Wash. 98011

WATER WELL REPORT 4432

STATE OF WASHINGTON

Application No ...

Permit No. ...

(1) OWNER: Name Edgar A. Olson Address RR 4 Box 328 Sequim Wash

(2) LOCATION OF WELL: County Clallam ... ¼ SE ¼ Sec 5 T. 30 N., R. 4 W.M.

Bearing and distance from section or subdivision corner 127' W + 152' S of Rem NE corner of ... 30-4-5J1

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 117 ft. Depth of completed well 117 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 110 ~~102~~ 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 ...
Type Hydro Phyllic Model No. ...
Diam. ... Slot size ... from ... ft. to ... ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes ☐ No ☐ Size of gravel: ...
Gravel placed from ... ft. to ... ft.

Surface seal: Yes ☐ No ☐ To what depth? ... ft.
Material used in seal ...
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ... Depth of strata ...
Method of sealing strata off ...

(7) PUMP: Manufacturer's Name Myers
Type: Submersion H.P. 3/4

(8) WATER LEVELS: Land-surface elevation above mean sea level 100 ft.
Static level 75 ft. below top of well Date 5-25-73
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? Stevens Co
Yield: 30 gal./min. with 6 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 ... gal./min. with ... ft. drawdown after ... 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~~ Thickness	~~TO~~ Depth
Surface Soil	0	1
Sandy Clay	28	29
Packed Sand	53	82
Gray + Black Packed Sand (W.B.)	17	99
Gray Clay	5	104
Sand Gravel + Rocks (W.B.)	2	106
Sand (water Bearing)	11	117

Work started 5-23 , 1973. Completed 5-29-73 , 1973

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME ... (Person, firm, or corporation) (Type or print)

Address ...

[Signed] ... (Well Driller)

License No. ... Date ..., 19...

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

4907311731269l   39/4N-5B2   CC'90 A... 1

First Copy with Ecology
Owner's Copy
Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No.

Permit No. by

OWNER: Name Phillip Hall - 21911 Address SE May Valley Rd Issaquah Wn

LOCATION OF WELL: County Pratt? Lot 35 SE ¼ NE ¼ Sec. 4 T. 30 N., R. 4 W.M.

Bearing and distance from section or subdivision corner — Snohomish

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 110 ft. Depth of completed well 111 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 106' ft.
Threaded ☐ 5" Diam. from 104 ft. to 106 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
Type Stainless Steel Model No.
Diam. 5¼ Slot size 20 from 106 ft. to 111 ft.
Diam. Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level... APROX 75 ft.
Static level 63 ft. below top of well Date 12-18-76
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 12-18-76
Bailer test 30 gal./min. with ? ft. drawdown after 1½ hrs.
Artesian flow g.p.m. Date
Temperature of water 49 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
Brown Surface Soil	0'	3
Brown Sandy Clay	3	19
Brown Sand	19	24
Brown Sandy Clay	24	76
Brown fine Muddy Sand	76	101
Brown Medium to Coarse Sand	101	111

Work started 12-17 1976 Completed 12-18-76 19

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 Stoican Drilling Co INC
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim Wash 98382

[Signed] Valus Stoican (President)
(Well Driller)

Voc 6 Pike

License No. 0391 Date 12-28- 1976

Markd Miller

(USE ADDITIONAL SHEETS IF NECESSARY)

30N/4E

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

30-4-4M?

START CARD # Application No. 005623

Permit No. ....

(1) OWNER: Name Andrew Nisbet 645-D Address Kitchen Rd Sequim, WN 98382

(2) LOCATION OF WELL: County Challam- E½ NE¼ - NW ¼ SW ¼ Sec 4 T 30 N., R 4 W.M.

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) 2
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ AIR Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 320 ft. Depth of completed well 318 ft.

(6) CONSTRUCTION DETAILS: Plus 2' Above GRADE 645"
Casing installed: 6 " Diam. from 0 ft. to 212 ft.
Threaded ☐ 5" " Diam. from 0 ft. to 307 ft.
Welded ☐ 4" " Diam. from 304 ft. to 308 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 Johnson-V. Wire
Type 304 Stainless Steel Model No. K-Packer
Diam. 4½ Slot size 0.20 from 308 ft. to 318 ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ...... ft. to ...... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement + Bentonite
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: ...... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level... 125 ft.
Static level 61 ft. below top of well Date 12-8-87
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 50 gal./min. with 60 ft. drawdown after 1½ hrs.
Artesian flow ...... g.p.m. Date
Temperature of water 46 Was a chemical analysis made? Yes ☐ No ☒

IRON 0.8
MANG. 0.00
HARDNESS - 13 G.P.G.

(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
Brown Surface Soil	0	2
Brown Cemented Sand + Cobbles	2	15
Brown Sand + Gravel Clay Binder	15	37
Brown Loose Sand + Gravel	37	46
Brown Sandy Clay	46	78
Brown + Gray Sandy Gravel W/B	78	125
Gray Hard Clay	125	132
Gray W/B Course Sand	132	140
Gray fine W/B Sand	140	148
Gray Silty Clay	148	170
Gray Gravelly Clay	170	185
Gray Sticky Clay	185	195
Gray muddy Sand W/B	195	197
Gray Gravelly Clay Hard Boulders	197	210
"Note" Colasp Drive Shoe 6"		
Gray Cemented Till "Hard"	210	212
Gray Cemented Till + Boulders	212	215
Gray Cemented Till	215	225
Gray Gravelly Clay	225	253
Gray Sand W/B	253	274
Gray Gravelly Clay	274	276
Gray Gravelly Clay Sandy	276	283
Brown Sandy Clay	283	304
Brown Gravelly Clay	304	306
Brown Gravel + Sand tight	306	309
Brown Silty Clay	309	311
Brown Sand + Gravel W/B	311	315
Brown Gravel + Clay W/B	315	317
Brown Sand + Gravel W/B	317	320

Work started 10-9 , 19 87 . Completed 12-8 , 19 87

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 Stoican Drilling Co INC
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, WN 98382

[Signed] Valier Stoican Secretary 047
(Well Driller)
Paul Stoican

License No. 1073 Date 12-21 , 19 87

(USE ADDITIONAL SHEETS IF NECESSARY)

30/4W-4L2

Driller's Copy

STATE OF WASHINGTON

Permit No. CG 90 [illegible]

(1) OWNER: Name Hakr Scandskov Address Rt 2 Box 148 Poulsbo [illegible]

(2) LOCATION OF WELL: County Kitsap — NE SW Sec. 4 T. 30 N., R. 4W W.M.

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)

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 72 ft. Depth of completed well 56 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 54 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 Johnson
Type 304 stainless Model No.
Diam. 6 Slot size 18 from 54 ft. to 56 ft.
Diam. Slot size from ft. to 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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 58 ft. below top of well Date
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 10 gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date April 1974
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
Clay Brown Sand	0	16
Clay Brown Sand gravel	16	30
Clay Tan gravel	30	40
Clay Brown Sand	40	5[illegible]
Clay Brown Sand gravel	5[illegible]	57
Clay Brown Sand	57	67
Sand Blue	67	72
10-23-78 RT 3 Bx 461	RC3	
OK to measure monthly. If No Ho[illegible]		
also OK. Just Hop fence & [illegible] Note		
Hold 60		
-1.43		
wl 58.6 blw	mp	
mp 0.3 blw	LSD	
58.9		
[illegible] ET con 20 C		
Wl 58.9 blw LSD		
mp access [illegible]		
[illegible] Asphalt [illegible]		
House		

Work started Apr 8 1974. Completed April [illegible] 1974

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 Van Hasselt [illegible] Drilling (Person, firm, or corporation) (Type or print)

Address Rt 2 Box 165 [illegible]

[Signed] [illegible] (Well Driller)

License No. 0334 Date April [illegible] 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

Form No. 1834—OS—(Rev. 4-71)

riginal and First Copy with
tment of Ecology
d Copy — Owner's Copy
Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. 30-4-3N?

OWNER: Name Rose Edgintown Address 403A Woodcock Rd. Sequim

LOCATION OF WELL: County .... N1/2 - SW SW 1/4 Sec 3 T 30 N., R 4 W.M.

distance from section or subdivision corner

PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

TYPE OF WORK: Owner's number of well (if more than one)....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

DIMENSIONS: Diameter of well .... inches.
Drilled........ft. Depth of completed well........ft.

CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 50 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........
Type........ Model No........
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☑ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☑ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water?........ Depth of strata........
Method of sealing strata off........

PUMP: Manufacturer's Name........
Type: .... H.P........

WATER LEVELS: Land-surface elevation above mean sea level.... 150 ft.
tic level 32 1/2 ft. below top of well Date........
esian pressure .... lbs. per square inch Date........
Artesian water is controlled by........ (Cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
s a pump test made? Yes ☐ No ☐ If yes, by whom?........
ld: .... gal./min. with .... ft. drawdown after .... hrs.
" " "
" " "

covery 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

... of test
iler test 12+ gal./min. with 6 ft. drawdown after 2 hrs.
tesian flow........ g.p.m. Date........
mperature 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
Brn sandy Clay	0	30
Brn sandy Clay & gravel	30	33
Coarse gravel	33	38
W.B. Coarse gravel	38	45
Coarse rock	45	50

'85 APR 26 P1 :24
...OGY OFFICE

Work started 4-16 , 1985. Completed 4-16 , 1985

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 Richard Bekkevar (Person, firm, or corporation) (Type or print)

Address 2722 Hwy 101 E SEQUIM WA.

[Signed] Richard Bekkevar (Well Driller)

License No. 779 Date 4-22- , 1985

(USE ADDITIONAL SHEETS IF NECESSARY)

F. No. 7356—OS—(Rev. 4-71).

Original and First Copy with
Department of Ecology
2nd Copy — Owner's Copy
3rd Copy — Driller's Copy

WATER WELL REPORT

Country Club STATE OF WASHINGTON

Application No. ____________

Permit No. 10274

~~Mt Vista Water Co~~ Inc.

OWNER: Name William M. Hoff ~~Agency~~ Address Rt 3 Box 551, Sequim, Wa. 98382

LOCATION OF WELL: County Clallam Lot 29 x ¼ ___ ¼ Sec. 3 T. 30 N., R. 4W W.M.

and distance from section or subdivision corner 30-4-3Q1

PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

TYPE OF WORK: Owner's number of well (if more than one) ....

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

DIMENSIONS: Diameter of well 8 inches.
Drilled 265 ft. Depth of completed well 249 ft.

CONSTRUCTION DETAILS:

Casing installed: 8 " Diam. from ______ ft. to ______ 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 Johnson Type Screen
Type ______ Model No. ______
Diam. 7 3/8 Slot size 40 from 234 ft. to 249 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☐ No ☐ Size of gravel: ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☐ No ☒ To what depth? ______ ft.
Material used in seal ______
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: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 120 ft.
Static level 5 ft. below top of well Date 5/17+18-73
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? Driller
Yield: 40 gal./min. with 20 ft. drawdown after ______ hrs.
" Refer To Pumping Log: "
" " " "

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 ______ gal./min. with ______ ft. drawdown after ______ 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
Surface Soil 0' To	2	2
Brown Gravely Clay	10	12
Brown Sandy Clay	14	26
Brown Sand (Water B)	10	36
Gray Gravely Clay	6	42
Gray Packed Gravel (Water)	16	58
Gray Gravely Clay	15	73
Gray Silty Clay (W.B.)	111	184
Gray Clay (No water)	14	198
Gray Silty Clay (W.B)	32	230
Brownish Gravel (W.B.)	6	236
Layer of Gravely Clay	1	237
Brown Sand & Gravel (W.B)	10	247
Brown Muddy Sand	11	258
Brown & Gray Clay	7	265

RECEIVED
AUG 29 1977
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started ______, 19___. Completed ______, 19___.

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 Strican Drilling Co. Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim WN. 98382

[Signed] Valier Strican (President) Lic. 047
(Well Driller)
Joe Pike

License No. 0391 Date 6/25, 1976

Refer To Pumping Log

(USE ADDITIONAL SHEETS IF NECESSARY)

E. F. No. 7356-OS—(Rev. 4-71).

MA 11/13/77

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

Application No. ....
Permit No. 30-4-3J

(1) OWNER: Name LaVerne Hartman Address Route 3 Sequim Wa

(2) LOCATION OF WELL: County Clallam Tax# 4317 — NE¼ S E¼ Sec. 3 T. 30 N., R. 4 W.M.

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) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 178 ft. Depth of completed well 178 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 173 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 Johnson
Type Stainless Model No. .....
Diam. 6 Slot size 8 from 173 ft. to 178 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
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: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 100 ft.
Static level 2 ft. below top of well Date 5-20-78
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 5-20-78
Bailer test 6 gal./min. with ..... ft. drawdown after 4 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	8
Brn mud & sand	8	18
gray sand & gravel W.B.	18	45
gray Clay	45	75
sandy Clay W.B.	75	95
Brn muddy sand	95	98
gray sandy Clay	98	130
fine sand & Clay	130	145
Blue clay	145	173
Clay sand & gravel	173	178

RECEIVED 5/24/78
DEPARTMENT OF ECOLOGY SOUTHWEST REGIONAL OFFICE

Work started 5-10, 1978 Completed 5-20, 197..

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Richard Bekkevar Jr (Person, firm, or corporation) (Type or print)

Address Route 2 Sequim W.

[Signed] Richard Bekkevar (Well Driller)

License No. 779 Date 5-22, 197..

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. 30-4-2M5
Permit No.

(1) OWNER: Name RAYMOND MAHAN Address Rt 3 Box 187 SEQUIM WA 983

(2) LOCATION OF WELL: County CLALLAM - THAT PORTION of THE NW¼ SW¼ Sec 2 T 30 N., R 4W W.M.
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)
New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☒ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 239 ft. Depth of completed well 239 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 232'3" 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 ☐ OVERALL Length 9'7"
Manufacturer's Name SMITH
Type STAINLESS STEEL Model No.
Diam 5"OD Slot size 18 from 231 ft. to 239 ft.
Diam. Slot size from ft. to 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 & puddle Clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level. Approx 75 ft.
Static level ft. below top of well Date 9/17/75
Artesian pressure 6.5 lbs. per square inch Date 9/17/75
Artesian water is controlled by Valve (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 ~~20 GPM~~
Bailer test 20 gal./min. with 150 ft. drawdown after hrs.
Artesian flow g.p.m. Date 9/17/75
Temperature of water Was a chemical analysis made? Yes ☐ No ☒
Open Flow. 3½ GPM

(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
SURFACE SOIL & FILL DIRT	0	8
BROWN CLAY, SOME ROCKS	8	15
BROWNISH-GRAY GRAVEL	15	32
W.B. GRAY GRAVEL	32	45
GRAYISH-BLUE CLAY	45	92
BROWN CLAY & GRAVEL	92	13[illegible]
W.B. GRAY CLAY & GRAVEL & FINE SAND-SILT	130	15[illegible]
CONSOLIDATED GRAVEL & ROCK	158	16[illegible]
GRAY CLAY & FINE SAND & GRAVEL	168	1[illegible]
" SAND & GRAVEL	185	1[illegible]
CEMENTED SAND, GRAVEL & CLAY	188	19[illegible]
W.B. SAND	198	20[illegible]
BROWN CEMENTED SAND & GRAVEL	200	20[illegible]
W.B. SANDY CLAY STRATIFIED	208	23[illegible]

Work started 8/13 1975 Completed 9/17 19

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 STOICAN DRILLING CO INC (Person, firm, or corporation) (Type or print)
Address P.O. BOX 161 SEQUIM, WA.
DRILLER: CLINT RUSHTON - LIC # 06[illegible]
[Signed] Valer Stoican (Well Driller)
License No. 0473 Date Sept 17, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71)

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

Start Card No. 026216

30-4-2G?

Water Right Permit No. ______

(1) OWNER: Name Jim Schramm 816 South Address Hawthorne - Tacoma, Wn 984

(2) LOCATION OF WELL: County Clallam SW ¼ NE ¼ Sec 2 T 30 N., R 4 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 160 Mantle Rd Sequim, Wn

(3) PROPOSED USE: ☒ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ ~~Test Well~~ ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ______

Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 55'6 feet. Depth of completed well 55'6" ft.

(6) CONSTRUCTION DETAILS: Plus - 1 ft Above Grade

Casing installed: 6 " Diam. from 0 ft. to 45 ft.
Welded ☒ 5" Diam. from 44 ft. to 45 ft.
Liner installed ☐
Threaded ☐ 5" Diam. from 50 ft. to 55 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 Johnson V. Wire F-K
Type Packer - 304 Stainless Model No. ______
Diam. 5½ Slot size 0.12 from 45 ft. to 50 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement & Bentonite
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: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level APROX 120 ft.
Static level 17 ft. below top of well Date 8-8-89
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 20 gal./min. with 15 ft. drawdown after 2 hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water 46.5 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
Brown top soil	0	2
Brown Gravel - with Large Rocks	2	12
Brown Cemented Gravel	12	19
Brow Gravely Clay	19	22
Brown Sand & Gravel	22	31
Brown Cemented Gravel	31	41
Gray Clay & Gravel	41	47
Gray Sand & Gravel W/B	47	50
Gray Clay & Gravel	50	56

Work started 7-24, 19__ Completed 8-8, 1989

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Stoican Drilling Co Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address P.O. Box 161 Sequim Wn 9838

(Signed) Leland A Cox (WELL DRILLER) License No. ______

Contractor's Registration No. StoicDC-137AR Date 8-8-89, 19__

(USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Well # 1

WATER WELL REPORT

30-4-1M1

STATE OF WASHINGTON

Application No. G2-2404

Permit No. P

(1) OWNER: Name WA ST Dept of Fisheries Address 115 G. A. Bldg. Olympia WA 98504

(2) LOCATION OF WELL: County Clallam — SW ¼ SW ¼ Sec. 1 T. 30 N., R. 4W W.M.

Bearing and distance from section or subdivision corner 1230' N & 2350' W of S⁴ Corner Sec 1

(3) PROPOSED USE: Domestic ☐ Industrial ☒ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 1

New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Bored ☐ Cable ☒ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16-14 inches.
Drilled 130 ft. Depth of completed well 118 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0 ft. to 31 ft.
Threaded ☐ 14" Diam. from 31 ft. to 118 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
Type Model No.
Diam. Slot size 125 from 38 / 49 ft. to 42 / 99 ft.
Diam. Slot size 40 from 103 ft. to 113 ft.

Gravel packed: Yes ☒ No ☐ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? ft.
Material used in seal
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: Vert Turbine H.P. 20

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 67 ft.
Static level 8 ft. below top of well Date
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? Richardson
Yield: 1016 gal./min. with 25'10" ft. drawdown after 2 hrs.
" 1212 " 33'1" " 6 "
" " " "

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 gal./min. with ft. drawdown after 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
Rock & gravel, brown clay	0	6
Boulder & gravel, water	6	8
Sand, gravel, brown clay, water	8	14
Cemented sand, gravel	14	29
Water, brown sand, gravel	29	31
Water, sand, gravel	31	42
Cemented sand, gravel, some rock	42	47
Water, sand, gravel	47	61
Water, fine-course sand, gravel	61	63
Water, course gravel, course-fine sand	63	72
Water, fine-course sand, gravel	72	80
Water, sand, gravel, brown silt	80	100
Fine-course sand, gravel, water	100	113
Water, F-C sand, some gravel	113	116
Water, F-C sand, gravel, brown silt	116	127
Gray clay sand (No water)	127½	130

Work started June 20, 1975. Completed Aug 22, 197

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Richardson Well Drilling (Person, firm, or corporation) (Type or print)

Address Tacoma WA

[Signed] Data taken from Drillers Daily Log (Well Driller)

License No. Date , 19

(USE ADDITIONAL SHEETS IF NECESSARY)

STOICAN DRILLING COMPANY

WATER WELL DRILLING

Route 3, Box 175 — Port Orchard, Wash.

P.O. Box 161 — Sequim, Wash.

№ 449

(30/4W-1M3)

WELL LOG

No. ..../.........

Date Dec 69, 19

Record by

Source DRILLED WELL

Location: State of WASHINGTON

County

Area

Map

.....¼ .....¼ sec. ..... T. ..... N., R. ..... E. W.

Diagram of Section

Drilling Co. STOICAN DRILLING CO. INC.

Address P.O. BOX 161 SEQUIM, WN

Method of Drilling CABLE Date ....., 19

Owner MC DONALD

Address

Land surface, datum ..... ft. above / below

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	SURFACE SOIL 0' TO	1	1
	BROWN CLAY	13	14
	BROWN SANDY CLAY	3	17
	GRAVEL (W.B.)	3	20
	BROWN SANDY CLAY	10	30
	CASING 33' 5½" PERFORATED	17' TO	20'
	STATIC WATER LEVEL 12'		
	BAIL TEST 30 G.P.M.		
	2½' DRAW DOWN		

MC DONALD

Turn up

Sheet ..... of ..... sheets

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

30-4-1K3

Application No.

STATE OF WASHINGTON

Permit No.

(1) OWNER: Name Kirk Aldrich Address Rt 5 Box 846 Sequim

(2) LOCATION OF WELL: County Clallam — SW ¼ SE ¼ Sec 1 T. 30 N., R. 4 W.M.

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)

New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 93 ft. Depth of completed well 93 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 93 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 71 ft. below top of well Date July 11
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 approx.
Bailer test 25 gal./min. with 10 ft. drawdown after hrs.
Artesian flow g.p.m. Date July 11
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
Clay Brown	0	38
Clay Brown sand gravel	38	65
Clay Brown Sand	65	75
Clay Brown	75	80
Sand gravel	80	82
Clay Brown Cemented grav	82	90
gravel	90	93

Work started June 23 1977 Completed June 24 1977

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

VAN Auslie Well Drilling INC

NAME Mel Williams Drilling Co.
(Person, firm, or corporation) (Type or print)

Address Rt. 5 Box 1118 Sequim

[Signed] Melvin Williams
(Well Driller)

License No. 524 Date July 11, 1977

(USE ADDITIONAL SHEETS IF NECESSARY)

P.O. Box I6I Sequim, Wash.

/ Oct 20/I958

BOB Gaskel

Box.I22 Sequim, Wash.

39/3W-7D1

Altitude 90 feet. Drilled by Stoican ,1958

Materials	Thickness (feet)	Depth (feet)
Brown Clay	33	33
Silty Blue Clay	I9	52
Cemented Blue Clay With Gravel.	I3	65
Hard Pan	I6	8I
Sandy Clay &Gravel	I8	99
Blue Sticky Clay	25	I24
Hard Pan	2	I26
Course Gravel & Sand	4	I30
Total Depth Of Well		I30 Ft
6"standard well caseing. Well Shoe.		
Electric Welded		
Aprox. Static Leavel, 75 Ft		
" " Pumping Level 85 Ft.	At 20 G.P.M.	
Bail Test.		
Water Clear.		
Keep This Record In Safe Place,		

l and First Copy with
t of Ecology
Copy — Owner's Copy
Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

30/3 - 6R2
Application No.
Permit No.

(1) OWNER: Name [illegible] Address [illegible]

(2) LOCATION OF WELL: County [illegible] — [illegible] ¼ [illegible] ¼ Sec 6 T [illegible] N., R [illegible] W.M.

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) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 45 ft. Depth of completed well 45 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 45 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 25 ft. below top of well Date July 6
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 Approx.
Bailer test 20 gal./min. with 5 ft. drawdown after hrs.
Artesian flow g.p.m. Date July 6
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
clay Brown	0'	8'
clay Brown Sand	8	22
clay Brown Sand gravel	22	40
gravel	40	45

Work started July 5, 1979 Completed July 6, 1979

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 Mel Williams Well Drilling Co. (Person, firm, or corporation) (Type or print)

Address Rt 5 Box 1118 Sequim Wn.

[Signed] Melvin Williams (Well Driller)

License No. 524 Date July 9, 1979

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30/3W-6M1

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

Application No. ....
Permit No. ....

(1) **OWNER:** Name .... Address ....

(2) **LOCATION OF WELL:** County .... ¼ ¼ Sec ... T. 30 N., R. 3W W.M.

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) 2
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6 inches.
Drilled 105 ft. Depth of completed well 105 ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: 6" Diam. from 0 ft. to 105 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 ....
Type .... Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... 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 & clay
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: .... H.P. ......

(8) **WATER LEVELS:** Land-surface elevation above mean sea level.... approx. ft.
Static level 83 ft. below top of well Date 3/7/78
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 20 gal./min. with 0 ft. drawdown after 3 hrs.
Artesian flow ...... g.p.m. Date ......
Temperature of water 52 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
Brown sandy clay	0	9
Hard sandy clay	9	13
Sandy gravel & clay	13	84
Clean coarse sand W/B	84	87
Fine clean sand W/B	87	98
[illegible]	98	101
[illegible] W/B	101	105
10-2-79 [illegible]		
[illegible]		
[illegible]		
88.84		
-5.1		
83.7		
-.8 MP (top casing)		
82.9		
	remove	
	cover	
	(6 bolts)	
	pitless	
	adapter	
permission to use as an observation well — Mrs. Parkinson		

Work started 3/2, 1978 Completed 3/7, 1978

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 Stoltz Drilling Co., Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 151 Sequim, Wash. 98382

[Signed] Valerie Stoltz President 0473
Carl Rushton
(Well Driller)

License No. 0473 Date 3/8, 1978

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

30-3-8B1

STATE OF WASHINGTON

Application No. 11711

Permit No. G2-00802P

(1) OWNER: Name SUNLAND ASSOCIATES Address Rt 5, BOX 514D SEQUIM WA

(2) LOCATION OF WELL: County CLALLAM the N½ of the W½ SW¼ - NW ¼ SE ¼ Sec. 8 T. 30 N., R. 3 W.M.

Bearing and distance from section or subdivision corner: 400 ft South + 450 ft East of North ¼ Corner of Sec 8

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☒ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Over All Depth - 51'6" Diameter of well 10 inches.
Drilled 58 ft. Depth of completed well 50½ ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10" Diam. from 0 ft. to 42'6" 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 Johnson
Type Stainless Model No. ____
Diam. 9½ Slot size 40 from 42 ft. to 51-6" ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☐ Size of gravel: ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 25 ft.
Material used in seal Bentonite & puddle clay
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: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 6'2" ft. below top of well Date ____
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? DRILLER
Yield: gal./min. with ft. drawdown after hrs.
" REFER TO PUMPING LOG ATTACHED "
" " " "

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 ____ gal./min. with ____ ft. drawdown after ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water 49° 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
BROWN SILTY Sand & Clay	0	8
W.B. GRAVEL & Sand	8	10
BROWN Washed gRAVEL & Sand	10	16
" SILTY Sand Clay gRAVEL	16	19
BLUE Clay & gRAVEL W.B	19	21
GRAY Clay & gRAVEL	21	25
BROWN GRAVELY Clay, Sand	25	32
" GRAVELY Sand	32	34
" W.B. GRAVEL & Sand	34	48
" Sandy gRAVEL	48	53
Sand	53	58

RECEIVED
APR 10 1975
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 1/15, 1975. Completed 1/27, 1975

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 STOICAN DRILLING Co INC (Person, firm, or corporation) (Type or print)

Address P.O. BOX 161 SEQUIM, WA 98382

[Signed] Valir Stoican (Well Driller)

License No. 0473 Date 2/1, 1975

OK/WHM 4-14-75

(USE ADDITIONAL SHEETS IF NECESSARY)

F. No. 7356—OS—(Rev. 4-71).

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

Start Card No. ~~013630~~ 013635
30-3-5K?
Water Right Permit No. G2-?3?7

(1) OWNER: Name CARL FENNEMA   Address 294 JAMESTOWN RD. SEQUIM, WA. 98

(2) LOCATION OF WELL: County Clallam   NW ¼ SE ¼ Sec. 5 T. 30 N., R. 3 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address)

(3) PROPOSED USE: ☑ Domestic ☐ Irrigation ☐ DeWater ☐ Industrial ☐ Test Well ☐ Municipal ☐ Other

(4) TYPE OF WORK: Owner's number of well (if more than one) #3
Abandoned ☐ New well ☑ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☑ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 290 feet. Depth of completed well 290 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: ___" Diam. from ___ ft. to ___ ft.
Welded ☑ 6" Diam. from 01 ft. to 290 ft.
Liner installed ☐
Threaded ☐ ___" 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
Type ___ Model No.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.
Diam. ___ Slot size ___ from ___ ft. to ___ 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 Benite 600 LB
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: ___ H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ___
Static level 0 ft. below top of well Date 7/18/88
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 30 gal./min. with 90 ft. drawdown after 3 hrs.
Airtest ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date
Temperature of water ___ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
top Soil	0	3
Brown clay	3	12
Sand & clay Brown	12	14
clay Blue	14	36
Sand & clay Blue	36	94
clay Blue	94	160
Sand & clay Blue	160	189
clay Blue	189	203
Sand & gravel gray	203	205
clay Blue	205	285
gravel w.B.	285	290

RECEIVED
JUL 20 '88 AM 10:45
DEPARTMENT OF ECOLOGY SW REGIONAL OFFICE

Work started 7/11, 1988. Completed 7/19, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME LOUIE'S well Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 1662 BARR RD. RD. PORT ANGELES WA
(Signed) [signature] (WELL DRILLER) License No. 0848
Contractor's Registration No. LOUIEWD137RD Date 7-18, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

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

30-3-5R2

Application No.

Permit No. G2-22153

(1) OWNER: Name SOREN Pedersen et al Address Rt 3 Box ... Sequim WA 98...

(2) LOCATION OF WELL: County Clallam SE ¼ SE ¼ Sec 5 T. 30 N., R. 3 W.

Bearing and distance from section or subdivision corner 800' W & 1100' N of SE corner of Sec 5

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6" inches.
Drilled 238 ft. Depth of completed well 238 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 238 " Diam. from 6" ft. to 6" 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☐ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal mud
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level ft. below top of well Date
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.
"air lift" at app 40 gal per min"

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 gal./min. with ft. drawdown after 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
Brown Mud	0'	15'
Mud & Gravel	15' ~~33'~~	33' ~~50~~
~~Sand & Clay~~	~~160'~~	
Gray Clay	33'	160'
Sand Clay	160'	173'
Gravel clay / some H_2O	173'	211'
Sandy Water (H_2O)	211'	226'
Clay gravel	226'	23[illegible]
Water in coarse sand		
w/ gravel at		238'

Work started 6-4 , 1976 Completed 10-4-7 , 19

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 (Person, firm, or corporation) (Type or print)

Address

[Signed] Earl R. Van ... (Well Driller)

License No. Date , 19

OK
GM 1-6-78

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS (Rev. 4-71)
ECY-070-28

Appl. 11016
Per. 9991
Cert. 7156

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

30-4-26N1

WELL LOG

Record by: Driller

Source: Driller's record

Location: State of WASHINGTON

County: Clallam

Area:

Map:

SE¼SW ¼ SW ¼ sec 26 T 30 N., R. 4 W.

Diagram of Section: 26

File number: 30/4W-26N1

Drilling Co. Hood Canal Drilling Co.

Address: Route 2, Box 690, Quilcene, WA

Method of Drilling: cable   Date: Aug. 11 1967

Owner: L. M. Ward

Address: Route 1, Box 757, Sequim, WA

Land surface, datum ft. above / below

SWL: 32   Date: Aug. 11, 1967   Dims.: 6" x 135'

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	From (feet)	To (feet)
	Domestic supply		
	top soil	1	6
	hardpan	6	20
	clay hardpan	20	26
	basalt rock	26	135
	water viens at 127'		
	Casing: 6" from 1' to 27'		
	Bailer test: 5 gpm with 50' DD after 2 hrs.		
	Pump: Sta=Rite, subm 1/3 hp		

Turn up   Sheet ___ of ___ sheets

Second Copy — Owner's Copy
Third Copy — Driller's Copy

STATE OF WASHINGTON

Permit No. 30-4-26M?

(1) OWNER: Name Dave Oswald Address Rt. 3 Box 802 Sequim, Wash. 98382

(2) LOCATION OF WELL: County Clallam — NW¼ SW¼ Sec. 26 T. 30 N., R. 4 W.M.

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) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 145 ft. Depth of completed well 145 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ...." Diam. from .... ft. to .... ft.
Threaded ☐ ...." Diam. from .... ft. to .... ft.
Welded ☑ 6" Diam. from 01 ft. to 145 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
Type .... Model No.
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... 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 Benite
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: .... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 115 ft. below top of well Date 8-20-79
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 6 gal./min. with 15 ft. drawdown after 1½ 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
Big Rock & gravel	0	15
Hard pan	15	40
Clay Blue	40	45
Brown clay	45	80
hard Pan	80	125
clay Brown	125	130
Hard pan	130	140
gravel w.B.	140	145

RECEIVED
OCT 17 1979
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started Aug. 17, 1979. Completed Aug. 20, 1979.

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 Louie's Well Drilling (Person, firm, or corporation) (Type or print)

Address 1652 Barr Ext. Rd. Port Angeles, Wash.

[Signed] .... (Well Driller)

License No. 0848 Date Sept. 28, 1979.

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

Application No. 30-4-26E3
Permit No. 9961

(1) OWNER: Name GEROLD S. GUGEL SR Address P.O. BOX 12 KODIAK, ALASKA

(2) LOCATION OF WELL: County CLALLAM SW ¼ NW ¼ Sec 26 T 30 N., R 4W W
Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic [X] Industrial [ ] Municipal [ ] Irrigation [ ] Test Well [ ] Other [ ]

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well [X] Method: Dug [ ] Bored [ ]
Deepened [ ] Cable [X] Driven [ ]
Reconditioned [ ] Rotary [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 130 ft. Depth of completed well 130 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 124'7" ft.
Threaded [ ] ....." Diam. from ..... ft. to ..... ft.
Welded [X] ....." Diam. from ..... ft. to ..... ft.

Perforations: Yes [ ] No [X]
Type of perforator used X
SIZE of perforations ..... in. by ..... in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

OVERALL LENGTH - 7'10"
Screens: Yes [X] No [ ]
Manufacturer's Name SMITH
Type STAINLESS STEEL Model No. .....
Diam 5 3/16 Slot size 18 from 125 ft. to 130 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes [ ] No [X] Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal Bentonite & puddle Clay
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

(7) PUMP: Manufacturer's Name .....
Type: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level APPX 300 ft.
Static level 104 ft. below top of well Date 12/9/75
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 [X] 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 15 gal./min. with 0 ft. drawdown after 2 hrs.
Artesian flow ..... g.p.m. Date 12/9/75
Temperature of water 49° Was a chemical analysis made? Yes [ ] No [X]

(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
TOP SOIL	0	2
BROWN SANDY CLAY	2	32
BLUE CLAY	32	56
BRN CEMENTED SAND & GRAVEL	56	68
BROWN SANDY CLAY	68	86
DRY SAND W/CLAY LAYERS	86	106
FINE SAND, W.B. BROWN, MUDDY	106	117
BRN. COARSE SAND & GRAVEL W.B.	117	120
CEMENTED GRAVEL	120	123
BRN W.B. SAND, COARSE	123	130

Work started 12/3 1975 Completed 12/9 1975

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 STOICAN DRILLING CO. INC. (Person, firm, or corporation) (Type or print)

Address P.O. BOX 161 SEQUIM WA 98382
DRILLER: MYRL HANCOCK - LIC # 0204

[Signed] Vallis Hassel (Well Driller)

License No. 0473 Date Dec 10, 1975

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71)

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. 30 / 4W - 27A1

Date 8-16 1960

Record by J. B. Noble

Source V. Staican

Location: State of WASHINGTON

County Clallam

Area

Map Carlsberg

NE ¼ NE ¼ sec. 27 T. 30 N., R. 4 W.

27

Diagram of Section

Drilling Co. Staican

Address

Method of Drilling ____ Date April, 1952

Owner K. A. Beatz

Address Rt 1, Sequim

Land surface, datum 320 ft. above/below

Correlation	Material	Thickness (feet)	Depth (feet)

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	Soil	3	3
	gravel w/small boulders	15	18
	Cemented gravel	7	25
	Fine gravel (some water)	2	27
	Hardpan	12	39
	sand & gravel	30	69
	Coarse gravel	5	74

Turn up

Sheet ____ of ____ sheets

40412012510080

30/4W-22R2

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

Application No.

Permit No.

(1) OWNER: Name Mike Schultz Address Rt 6 Box 647 Sequim Wash 98382

(2) LOCATION OF WELL: County Clallam SE ¼ SE ¼ Sec 22 T 30 N., R 4W
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)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled ft. Depth of completed well 60 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 56 ft.
Threaded ☐ 5" Diam. from 53 ft. to 55 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
Type Stainless Steel Model No
Diam 5¼ Slot size 30 from 55 ft. to 60 ft.
Diam. Slot size from ft. to 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 & Clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level APPX 250 ft.
Static level 20 ft. below top of well Date 6-1-77
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 6-1-77
Bailer test 30 gal./min. with 10 ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 49 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
Brown Surface Soil	0	1
Brown Sandy Clay	1	29
Brown Sand & Gravel	29	43
Brown Semicemented Sand & Clay	43	45
Brown Sand & Gravel	45	59
Grey Clay & Sand Gravel	59	60

11-27-78 BWD
P 189.61 E (15.00) 189.44 (15.01)
165 E-tape 165.00
24.6 24.4
14 MP 1.4
23.2 23.0
(no cap) recovering from pumping

Work started 5-25 1977 Completed 6-1 1977

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 Stoican Drilling Co Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim WA 98382

[Signed] Valen Stoican President
(Well Driller)

Chad Runyon

License No. 0218 Date 6-1 1977

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30-4-33H1

WELL LOG.—Continued No........./.........-.........

Correlation	Material	From (feet)	To (feet)
	Depth forward	———	
	Sand, brown, muddy	146	148
	Sand, brown, & gravel, water bearing	148	154
	Sand, brown, coarse, & fine gravel, water bearing	154	163
	Casing: 6" from 0-158'		
	Screen installed from 158-163'		
	Surface sealed with drilling mud from 0-25'		
	Unusable water cased off (81-144')		
	Yield: 30 gpm with 25'6" DD after 4½ hrs.		
	50 " " 46'6" DD " 3½ hrs.		
	Recovery data:		
	Time Water Level		
	5:30 p.m.		
	5:32 " 102'		
	5:34 " 99'		
	5:36 " 98'		
	5:40 " 97'		
	5:50 " 96'		
	8:30 " 95'		
	Test made 2-2-65		
	Temp: 49°		
	Pump: 3 h.p. submersible F. E. Myers		

S. F. No. 7449—OS—12-65.

DIVISION OF WATER RESOURCES

Appli. #7919

WELL LOG

Record by Driller

Source Driller's Record

Location: State of WASHINGTON

County Clallam

Area

Map

SE ¼ NE ¼ sec. 22 T. 30 N., R. 4 W.

Diagram of Section: 22

Drilling Co. Stoican Drilling Co.

Address P. O. Box 161, Sequim, Washington

Method of Drilling Date Feb. 2, 1965

Owner Arvie Smith

Address Sequim, Washington

Land surface, datum ft. above/below

SWL: 94' Date February 2, 1965 Dims.: 6" x 163'

File number 30/4W-22H

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	From (feet)	To (feet)
	Domestic supply		
	Boulders	0	25
	Sand, muddy, brown, & gravel	25	43
	Sand, brown, & gravel, water bearing	43	46
	Hardpan, brown	46	60
	Clay, gray, & gravel	60	64
	Sand, brown, muddy, & gravel	64	71
	Sand, cemented, & gravel, water bearing	71	80
	Clay, brown, gravelly	80	100
	Clay, gray, gravelly	100	109
	Sand, brown, muddy	109	139
	Sand, brown, clean, water bearing	139	144
	Sand, brown, cemented	144	146

Turn up (Over) Sheet.......of.......sheets

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

Application No. 30-4-23E3
Permit No

(1) OWNER: Name Bill Bacon Address ~~Rt. 4, Box 1133~~ Sequim, Wa.

(2) LOCATION OF WELL: County Clallam — SW¼ NW¼ Sec. 23 T. 30 N., R. 4 W

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) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 201'8" ft. Depth of completed well 201'8" ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 201'8" 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
Type ..... Model No.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... 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 & Puddle clay
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: ..... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... Approx. 240 ft.
Static level 123 ft. below top of well Date 11/17/77
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

Air Date of test
Bailer test 20 gal./min. with ? ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date
Temperature of water 49 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, show thickness of aquifers and the kind and nature of the material in e[ach] stratum penetrated, with at least one entry for each change of forma[tion].*

MATERIAL	FROM	T[O]
Brown gravel & Boulders	0	8
Brown loose gravel	8	35
Sandy gravel W/B	35	3[illegible]
Muddy sand & gravel W/B	39	4[illegible]
Brown cemented soil	42	4[illegible]
Loose sand, gravel & clay	46	[illegible]
Brown cemented soil	52	6[illegible]
Gray sandy clay & gravel	64	6[illegible]
Gray sandy clay	68	7[illegible]
Brown sandy clay & gravel	71	[illegible]
Brown sandy clay	123	1[illegible]
Gray sandy clay	138	1[illegible]
Brown hard clay	164	1[illegible]
Brown clay & gravel	171	1[illegible]
Brown muddy sand, gravel & clay W/B	176	1[illegible]
Brown sandy clay	188	[illegible]
Brown gravel W/B	194	2[illegible]

...LOGY
...FFICE

Work started 11/17, 19 77 Completed 11/21, ...

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this rep[ort is] true to the best of my knowledge and belief.

NAME Stoican Drilling Co., Inc. (Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wa. 98...

[Signed] Valier Stoican President (Well Driller)

Harold Miller 0343
Bob Tillia Helper
License No. ..... Date 11/22, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

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

30-4-22H2
Application No.
Permit No. G2-22899P

(1) OWNER: Name Arnie Smith Address Sequim, Wn

(2) LOCATION OF WELL: County Clallam SE ¼ NE ¼ Sec 22 T 30 N., R 4W W.M.

Bearing and distance from section or subdivision corner 2130 ft So of NE Cr. S 22 T 30 R 4W & 450 Ft W

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☑ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 2
New well ☑ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☑ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 298 ft. Depth of completed well 298 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 298 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
Welded ☑ ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes ☑ No ☐
Type of perforator used Milled
SIZE of perforations 1/4 in. by 1 1/2 in.
...... perforations from 275 ft. to 277 ft.
...... perforations from 160 ft. to 170 ft.
...... perforations from ...... ft. to ...... ft.

Screens: Yes ☐ No ☑
Manufacturer's Name ......
Type ...... Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☐ No ☑ Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.

Surface seal: Yes ☑ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
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: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level 150 ft.
Static level 102 ft. below top of well Date 2-24-78
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? Excel Pump & Drill...
Yield: 76 gal./min. with 20 ½ ft. drawdown after 5 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

RECEIVED
1978
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Date of test 3-7-78
Bailer test 30 gal./min. with 10 ft. drawdown after 2 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
rock & sand	0	12
Sandy hardpan	12	25
Clay sand & gravel	25	29
Clean sand & gravel W.B.	29	41
coarse gravel & Clay	41	48
Coarse sand & gravel W.B.	48	53
Gray Clay	53	55
Clay & gravel	55	62
Clay & gravel	62	73
Gravel shale & sand	73	78
cemented sand	78	85
Clay & sand	85	90
Coarse gravel	90	95
Yellow Clay	95	105
gray Clay	105	120
Blue Sandy Clay	120	130
Shale	130	140
Muddy Brn sand & Clay W.B.	140	150
Coarse sand W.B.	150	170
Coarse sand	170	172
Brn Clay	172	193
gray Clay	193	212
Brn Sandy Clay W.B.	212	230
Brn Clay	230	242
Brn Sandy Clay	242	250
gray Clay Coarse sand	250	265
Blue Clay	265	270
Brn Sandy Clay	270	275
Coarse sand W.B.	275	277
fine sand	277	283
hardpan	283	286
Bedrock	286	298

Work started 1-10, 1978 Completed 2-24, 197[illegible]

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 Richard Bekkevar (Person, firm, or corporation) (Type or print)

Address Route 2 Sequim Wa

[Signed] Richard Bekkevar (Well Driller)

License No. 779 Date 2-25, 197[illegible]

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

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

Application No. ....
Permit No. 30-4-22A1

(1) OWNER: Name ~~Mr. Arvie Smith~~ Robert KAMPRUD Address ~~P.O. Box 759~~ Rt Box 1170 Sequim, Wash. 98382

(2) LOCATION OF WELL: County Clallan NE ¼ NE ¼ Sec. 22 T. 30 N., R. 4 W.M.

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)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 95 ft. Depth of completed well 90' 6" ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 90'6" ft.
Threaded ☐ ...." Diam. from .... ft. to .... ft.
Welded ☒ ...." Diam. from .... ft. to .... ft.

Perforations: Yes ☒ No ☐
Type of perforator used Mills Knife
SIZE of perforations 1/4 in. by 2 in.
48 perforations from 81 ft. to 91 ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ....
Type .... Model No. ....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... 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: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level.... Approx. 180 ft.
Static level 28 ft. below top of well Date 6/21/77
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 30 gal./min. with 52 ft. drawdown after 2 hrs.
Artesian flow .... g.p.m. Date 6/21/77
Temperature of water 49 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
Surface Soil	0	2
Brown tight gravel	2	21
Brown loose gravel W/B	21	28
Sand & gravel	28	47
Brown tight sand, gravel & clay	47	57
Brown muddy gravel W/B	57	60
Loose gravel W/B	60	62
Tight muddy gravel	62	80
Brown tight gravel W/B	80	95

RECEIVED
JUN 30 1977
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started June 17, 19 77. Completed June 21, 19 7

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Stoican Drilling Co., Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wash. 98382

[Signed] Valier Stoican President
(Well Driller)
Harold Miller

License No. 0343 Date June 23, 19 7

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. ....
Permit No. 30-4-14P3

(1) OWNER: Name Ray Thompson Address 2500 Samish - Box 1 - Bellingh

(2) LOCATION OF WELL: County CLALLAM SE ¼ SW ¼ Sec 14 T. 30 N., R. 4 W.M.

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) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☑
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 98 ft. Depth of completed well 98 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 98 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 ....
Type .... Model No. ....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... 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
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: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 17'6" ft. below top of well Date 6-16
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

Approx.
Date of test ....
Bailer test 40 gal./min. with 30 ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date 6-16-76
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	1
Clay Brown - cobbles	1	15
Clay Brown - sand - gravel	15	43
CLAY Brown	43	45
fine Sand	45	48
tan clay - sandy	48	55
Clay blue - cemented gravel	55	72
Clay tan - sand - gravel	72	81
Clay blue - cemented gravel	81	91
Sand	91	94
Course sand - gravel	94	98

Work started June 11, 1976 Completed 6-16, 1976

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 Van Ausdle Well Drilling I (Person, firm, or corporation) (Type or print)
Address Rt 5 Box 1118 - Sequim
[Signed] Melvin Williams (Well Driller)
License No. 0524 Date 6-21, 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Start Card No. 064547 J

Water Right Permit No. 30-4-15R

(1) OWNER: Name PUD #1 CLALLAM COUNTY Address PORT ANGELES WA

(2) LOCATION OF WELL: County CLALLAM NE ¼ SE ¼ Sec. 15 T. 30 N., R. 4 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) 800' DUE EAST of CARLSBORG STORE / SOUTHERLY WELL

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ____
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 177 feet. Depth of completed well 177 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 8 " Diam. from 0 ft. to 159 ft.
Welded ☒ ____ " Diam. from ____ ft. to ____ ft.
Liner installed ☐
Threaded ☐ ____ " 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 JOHNSON
Type STAINLESS WIRE WOUND Model No. ____
Diam. 8" TEL Slot size 25/35 from 159 ft. to 167 ft.
Diam. 8" TEL Slot size 60/60 from 167 ft. to 177 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 40 ft.
Material used in seal BAROID BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name N/A
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level 185 ft.
Static level 38 ft. below top of well Date 12 JUNE 90
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? CANAL PUMPS
Yield: ____ gal./min. with ____ ft. drawdown after " hrs.
" NOT AVAILABLE " "
" " "

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 ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest 120+ gal./min. with stem set at 80 ft. for 2 hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
Surface soil and fill sand	0	4½
Cobbles and gravel in silt matrix	4½	33
boulder	33	36
silt and gravel	36	40
silty sands and gravel - wet	40	54
W/B gravels and sand	54	56
various gravels all W/B	56	70
hardpan	70	72
gravelly sands W/B	72	98
sand W/B	98	104
gravel and minor sand W/B	104	112
gray compact silt - clay	112	124
	124	
silty gravels no water	~~124~~	127
W/B sand and gravel some clay	127	140
gravel in clay matrix	140	142
W/B gravels and sand w clay	142	147
fine to medium sand	147	155
various W/B gravel and sand loose and much H_2O	155	176
Clayey hardpan	176	177

Work started 10 JUNE, 1990 Completed 12 JUNE, 1990

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME LOUIE'S WELL DRILLING (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 1652 Barr rd ext PA

(Signed) Bob Tilles (WELL DRILLER) License No. 0868

Contractor's Registration No. LOUIEWD137 PN Date 6/12/, 1990

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. CC 90 Area 4
Permit No.

(1) OWNER: Name George Leadon Address Rt 5 Box 756 - Sequim

(2) LOCATION OF WELL: County CLALLAM SW ¼ NE ¼ Sec 15 T 30 N., R 4 W.M.

Bearing and distance from section or subdivision corner 30-4-15G3

(3) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled ____ ft. Depth of completed well ____ ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 55 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 ____
Type ____ Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ 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
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: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 24 ft. below top of well Date Mar 26
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 Approx.
Bailer test 25 gal./min. with 16 ft. drawdown after ____ hrs.
Artesian flow ____ g.p.m. Date Mar. 26
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
clay Brown	0'	6'
clay Brown gravel	6	27
fine sand clay Brown	27	43
clay tan cemented gravel	43	50
gravel	50	55

RECEIVED
MAY 18 1977
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started Mar 25, 1977 Completed Mar 26, 1977

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 Van Ausdle Drilling - Mel Willi (owner)
(Person, firm, or corporation) (Type or print)

Address Rt. 5 Box 1118 Sequim W

[Signed] Melvin Williams
(Well Driller)

License No. 0524 Date Mar 30, 197

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

(30-4-14F4

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

Application No.

Permit No. Pg 1 of

(1) OWNER: Name ELMER ADAMS Address Rt 1 BOX 619 SEQUIM WA 983

(2) LOCATION OF WELL: County CLALLAM N½ S½ of SE¼ NW¼ Sec 14 T 30 N., R 4W

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)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 116 ft. Depth of completed well 81 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 71 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used MILLS TYPE
SIZE of perforations 3/8 in. by 2 in.
46 perforations from 66 ft. to 73 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No.
Diam. 7½ OD Slot size 25 from 76 ft. to 81 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☒ To what depth? ft.
Material used in seal
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level
Static level 24 ft. below top of well Date 4/8/66
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 30 gal./min. with 30 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date 4/8/66
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
OPEN WELL	0	25
BOULDERS & TIGHT GRAVEL W.B	25	31
SILTY CLAY	31	36
CLAY GRAVEL & CLAY	36	42
SILTY CLAY	42	46
GRAY GRAVELY CLAY	46	65
BROWN CEMENTED GRAVEL SOME WATER SEEPAGE	65	66
W.B GRAVEL	66	74
W.B BROWN SAND	74	82
BROWN MUDDY SAND CLAY	82	89
GRAY CONSOLIDATED MATERIAL	89	116

Work started 3/31 1966 Completed 4/8 1966

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 STOICAN DRILLING CO INC
(Person, firm, or corporation) (Type or print)
Address P.O. BOX 161 SEQUIM WA 98
[Signed] Valeriu Stoican
(Well Driller)
License No. 0473 Date Aug 19 19

[redacted] WATER WELL DRILLING [redacted] LOG (Continued) [redacted]

Route 3, Box 175
Port Orchard, Wash.

P.O. Box 161
Sequim, Wash.

№ 139

30/4W-14F4

WELL LOG

No. 1

Date MARCH 31 1966

Record by Joe Pike

Source Drilled Well

Location: State of WASHINGTON

County Clallam

Area S2 N2 SE NW & N2

Map S SE NW

¼ ¼ sec. 14 T. 30 N., R. W E/W M

Diagram of Section

Drilling Co. Stoican Drilling Co

Address P.O. Box 161 Sequim Washington

Method of Drilling Churn Date APRIL 8 1966

Owner Elmer Adams

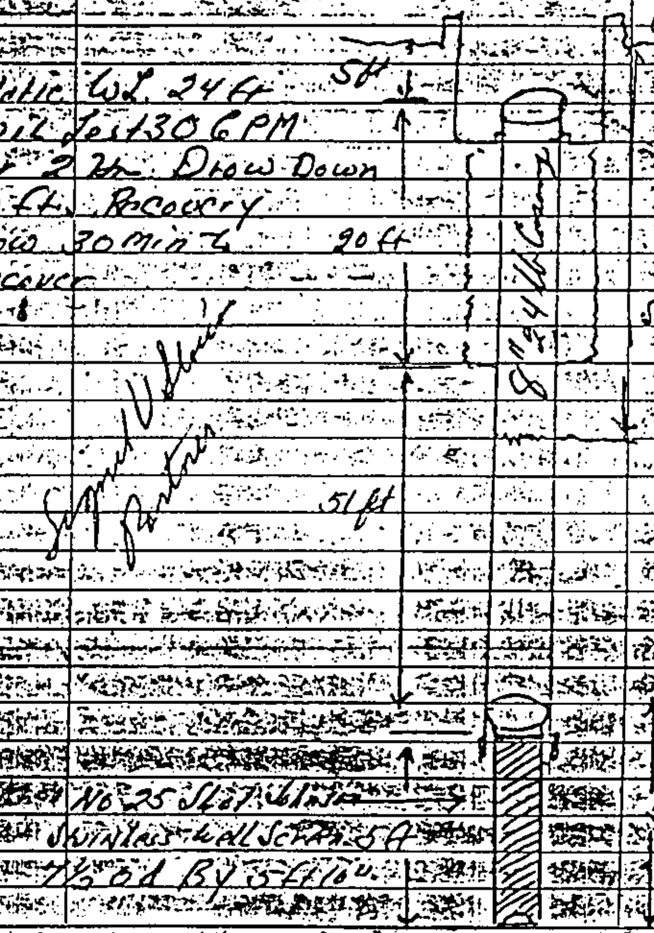
Address Rt 1 Box 619 Sequim, Wash

Land surface, datum ft. above / below

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Open Well	0 to 25 ft	25
	Boulders & Tight Gravel (W.B.)	6	31
	Silty Clay	4	36
	Gray Gravel Clay	6	42
	Silty Clay	4	46
	Gray Gravelly Clay	19	65
	Brown Cemented Gravel	1	66
	Some Water Seepage		
	W.B. Gravel	8	74
	W.B. Brown Sand	8	82
	Brown Muddy Sand Clay	7	89
	Gray Hard Pan	27	116
	Over Back		

Turn up Sheet of sheets

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward		
	Pulled Casing Back to 82 ft. Installed		
	No 25 Slot Johnson Well Screen	7½" od	x 5 ft 10
	Length 81 ft to 76 SCREEN Swedge to		8" Casing
	SCREEN Stainless type		
	Perforated 8" Well 73 to 66 ft		4 Holes
	⅜" x 8" Per Ring Total Holes 40		
			Ground head
	Static WL 24 ft 5 ft		
	Bail Test 30 GPM		
	For 2 Hr Draw Down		
	30 ft Recovery		
	Slow 30 min to 20 ft		
	Recover		
			Static WL 34 ft
	51 ft		
	No 25 Slot Johnson	5 ft 10"	
	Stainless Well Screen 5 ft		
	7½ OD BY 5 ft 10"		



OLYMPIC PRINTERS

Table 4. -- Well Logs. -- Continued

Materials	Thickness (feet)	Depth (feet)
Well 30/4W-12Q1		
Lester Robins. Altitude about 119 feet. Drilled by Stolcan.		
Soil	$1\frac{1}{2}$	$1\frac{1}{2}$
Brown, sticky clay with some boulders	$10\frac{1}{2}$	12
Packed, brown sand and gravel	7	19
Sand and gravel, brown	4	23
Packed sand and gravel	2	25
DD 4 inches after 1 hr pumping 65 gpm: final 5 ft perforated; SWL 5.33 ft. Adjacent well irrigates 22 acres.		
Shot-hole 30/4W-14D1		
Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 135 feet.		
Gravel	50	50
Shot-hole 30/4W-14D2		
Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 147 feet.		
Gravel	50	50
Shot-hole 30/4W-14E1		
Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 153 feet.		
Gravel and boulders	46	46
Shot-hole 30/4W-14E2		
Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 158 feet.		
Gravel and boulders	50	50

30-4-14D1

Elmer E. Adams. Alt

Clay loam
Soil and gravel
Clean gravel

DD 1 ft after 10 hrs p

Drilled for Standard Oi
about 175 feet.

Clay (soil)
Gravel and boulders

Drilled for Standard Oi
about 170 feet.

Gravel
Sand

Drilled for Standard Oi
about 183 feet.

Gravel and boulders
Gravel
Clay

Drilled for Standard O
about 145 feet.

Sand and clay
Gravel and sand
Clay

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

Application No

Permit No

(1) OWNER: Name Lloyd Smith Address Rt4 Box218- Sequim Wash-

(2) LOCATION OF WELL: County Clallam SE ¼ SW ¼ SE ¼ Sec. 10 T. 30 N., R. 4 W.
Except EAST 20 FT.

Bearing and distance from section or subdivision corner 30-4-10Q2

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 82 ft. Depth of completed well 82 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 76'9" ft.
Threaded ☐ 5" Diam. from 74 ft. to 76' 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
Type 5+5/8 Stainless Model No.
Diam. " Slot size 18 from 76 ft. to 81 ft.
Diam. Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level. APPROX 210 ft.
Static level 11 ft. below top of well Date 5/5/1976
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

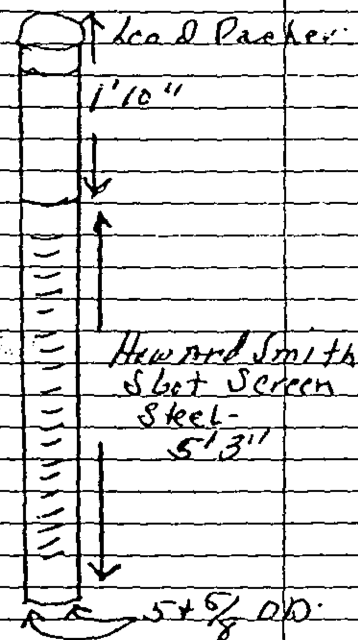
Date of test 5/5/176
Bailer test 65 gal./min. with 12 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water 51 Was a chemical analysis made? Yes ☐ No ☒

(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
Brown Surface Soil + Stones	0	1
Brown Gravel + Rocks	1	15
Brown Simecemented Gravel to Gray	15	37
Brown tight Gravel + Sand	37	40
" Very fine Brown SAND	40	45
" Course Sand W.B.	45	50
" MED to Course Sand	50	81
Black Crumbly Clay + Sand	81	82

Screen Dem:



Work started 5/1, 1976 Completed 5/5

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 Stoican Drilling Co INC
(Person, firm, or corporation) (Type or print)

Address PO Box 661 Sequim Wn-983

[Signed] Valier Stoican 0475
William Weber (Well Driller)

License No. 0535 Date 5/19
Charles Sherk- 0458

(USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

SE SE

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. 30-4-10R2

(1) OWNER: Name MELVIN STREGE Address 877 So. 88th TACOMA, WA. 98444

(2) LOCATION OF WELL: County CLALLAM S½, W½, W½, S½ SE ¼ SE ¼ Sec. 10 T. 30 N., R. 4 W W.M.

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) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 67 ft. Depth of completed well 67 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 60 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
Type STAINLESS Model No. ....
Diam. 5 5/8 OD Slot size 15 from 59'2" ft. to 67 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite & puddle Clay
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: .... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level 125 ft.
Static level 11 ft. below top of well Date 5/2/74
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 40 gal./min. with 23 ft. drawdown after 1 hrs.
Artesian flow ..... g.p.m. Date 5/2/74
Temperature of water 47° 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
BROWN SURFACE Soil	0	1
" Soil & Clay	1	4
" Soil, Clay, gravel & Boulders	4	6
" Gravel & Boulders	6	9
" Cemented gravel & Boulders	9	19
" Cemented Sand & Clay, pea gravel	19	23
W.B. Sand & gravel	23	24
Clay packed sand & gravel	24	27
Grayish-Brown Cemented gravel, Boulders	27	28
Cemented gravel	28	34
packed rock & gravel	34	39
W.B. Brown Sandy Clay	39	41
FINE BROWN Sand & pea gravel	41	54
W.B. SAND	54	67

Work started 4/30, 1974. Completed 5/2, 1974

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 STOICAN DRILLING Co. INC.
(Person, firm, or corporation) (Type or print)

Address P.O. BOX 161 SEQUIM, WA.

[Signed] Carl C Rushton
(Well Driller)

License No. 0427 Date May 8, 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

30-4-10R3

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

Application No. ......
Permit No. ......

(1) OWNER: Name GLENN BORN Address 1366-B OLD OLYMPIC Hwy SEQUIM

(2) LOCATION OF WELL: County Clallam NW1/4 SE 1/4 SE 1/4 Sec. 10 T. 30 N., R. 4 W.M.

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) ......
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 162 ft. Depth of completed well 162 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ...... " Diam. from ...... ft. to ...... ft.
Threaded ☐ ...... " Diam. from ...... ft. to ...... ft.
Welded ☑ 6 " Diam. from 01 ft. to 162 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 ......
Type ...... Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☐ No ☑ Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.

Surface seal: Yes ☑ No ☐ To what depth? 14 ft.
Material used in seal Bentt
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: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level ...... ft.
Static level 6" ft. below top of well Date 9/10/85
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 15 gal./min. with @150 ft. drawdown after 4 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
Sand Loam	0	7
Boulders & gravel	7	12
gravel w B	12	13
clay Brown	13	21
Compacted gravel	21	39
Sand wood w Brown	39	68
clay Blue	68	98
Sand & wood w Blue	98	109
clay Blue	109	140
clay Brown	140	142
Sand & wood w Blue	142	147
clay Brown	147	152
Sand wood Brown	152	159
clay Brown	159	160
gravel w B	160	162

'86 MAY 21 AM 11:07

Work started 9/6, 1985 Completed 9/10, 1985

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 Louie's Well DRILLING (Person, firm, or corporation) (Type or print)

Address 1650 [illegible] Port Angeles, W

[Signed] [signature] (Well Driller)

License No. 0848 Date 9-11, 1985

(USE ADDITIONAL SHEETS IF NECESSARY)

Table 4. -- Well Logs. -- Continued

Materials	Thickness (feet)	Depth (feet)
Shot-hole 30/4W-10Q1 -- Continued		
Gravel	34	42
Sand	8	50

Shot-hole 30/4W-11D1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 90 feet.

Materials	Thickness (feet)	Depth (feet)
Clay (soil and silt)	10	10
Gravel	50	60
Clay	58	118
Gravel	22	140

Shot-hole 30/4W-11D2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 92 feet.

Materials	Thickness (feet)	Depth (feet)
Clay (soil)	6	6
Gravel	49	55
Clay	95	150

Shot-hole 30/4W-11E1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 99 feet.

Materials	Thickness (feet)	Depth (feet)
Clay (soil)	6	6
Gravel	54	60
Sand with clay streaks	20	80
Blue clay	80	160

Shot-hole 30/4W-11L2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 110 feet.

Materials	Thickness (feet)	Depth (feet)
Clay (soil)	5	5
Gravel	45	50

Shot-hole 30/4W-11N1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 128 feet.

Materials	Thickness (feet)	Depth (feet)
Clay (soil and silt)	10	10
Gravel	40	50

Shot-hole 30/4W-11P1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 118 feet.

Materials	Thickness (feet)	Depth (feet)
Sand	4	4
Gravel and boulders	46	50

Shot-hole 30/4W-12C1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 123 feet.

Materials	Thickness (feet)	Depth (feet)
Sand and clay (soil and silts)	40	40
Boulders and gravel	60	100

Shot-hole 30/4W-12C2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 123 feet.

Materials	Thickness (feet)	Depth (feet)
Clay (soil and silts)	50	50
Clay and gravel	50	100

Well 30/4W-12M1

Frank Krizo. Altitude about 115 feet. Dug by Jack Ruona, 1957.

Materials	Thickness (feet)	Depth (feet)
Soil	2½	2½
Gravel	11	13½
Hardpan	?	13½

No DD after 10 hrs pumping 120 gpm; SWL 8 ft; irrigates 19 acres.

30-4-11P1

Table 4. -- Well Logs. -- Continued

Materials	Thickness (feet)	Depth (feet)

Shot-hole 30/4W-10Q1 -- Continued

Gravel	34	42
Sand	8	50

Shot-hole 30/4W-11D1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 90 feet.

Clay (soil and silt)	10	10
Gravel	50	60
Clay	58	118
Gravel	22	140

Shot-hole 30/4W-11D2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 92 feet.

Clay (soil)	6	6
Gravel	49	55
Clay	95	150

Shot-hole 30/4W-11E1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 99 feet.

Clay (soil)	6	6
Gravel	54	60
Sand with clay streaks	20	80
Blue clay	80	160

Shot-hole 30/4W-11L2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 110 feet.

Clay (soil)	5	5
Gravel	45	50

Materials	Thickness (feet)	Depth (feet)

Shot-hole 30/4W-11N1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 128 feet.

Clay (soil and silt)	10	10
Gravel	40	50

Shot-hole 30/4W-11P1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 118 feet.

Sand	4	4
Gravel and boulders	46	50

Shot-hole 30/4W-12C1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 123 feet.

Sand and clay (soil and silts)	40	40
Boulders and gravel	60	100

Shot-hole 30/4W-12C2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 123 feet.

Clay (soil and silts)	50	50
Clay and gravel	50	100

Well 30/4W-12M1

Frank Krizo. Altitude about 115 feet. Dug by Jack Ruona, 1957.

Soil	2½	2½
Gravel	11	13½
Hardpan	?	13½

No DD after 10 hrs pumping 120 gpm; SWL 8 ft; irrigates 19 acres.

30-4-11L2

Table 4. -- Well Logs. -- Continued

Materials	Thickness (feet)	Depth (feet)
Shot-hole 30/4W-10Q1 -- Continued		
Gravel	34	42
Sand	8	50

Shot-hole 30/4W-11D1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 90 feet.

Clay (soil and silt)	10	10
Gravel	50	60
Clay	58	118
Gravel	22	140

Shot-hole 30/4W-11D2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 92 feet.

Clay (soil)	6	6
Gravel	49	55
Clay	95	150

Shot-hole 30/4W-11E1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 99 feet.

Clay (soil)	6	6
Gravel	54	60
Sand with clay streaks	20	80
Blue clay	80	160

Shot-hole 30/4W-11L2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 110 feet.

Clay (soil)	5	5
Gravel	45	50

Materials	Thickness (feet)	Depth (feet)
Shot-hole 30/4W-11N1		

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 128 feet.

Clay (soil and silt)	10	10
Gravel	40	50

Shot-hole 30/4W-11P1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 118 feet.

Sand	4	4
Gravel and boulders	46	50

Shot-hole 30/4W-12C1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 123 feet.

Sand and clay (soil and silts)	40	40
Boulders and gravel	60	100

Shot-hole 30/4W-12C2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 123 feet.

Clay (soil and silts)	50	50
Clay and gravel	50	100

Well 30/4W-12M1

Frank Krizo. Altitude about 115 feet. Dug by Jack Ruona, 1957.

Soil	2½	2½
Gravel	11	13½
Hardpan	?	13½

No DD after 10 hrs pumping 120 gpm; SWL 8 ft; irrigates 19 acres.

30-4-11E1

and First Copy with
of Ecology
— Owner's Copy
— Driller's Copy

Carlsborg

WATER WELL REPORT
STATE OF WASHINGTON

30-4-10H1
Application No. ______
Permit No. G 90 Area 4

OWNER: Name [illegible] Address [illegible] Rt 2 Box 171 Sequim

LOCATION OF WELL: County Clallam [illegible] SE ¼ NE ¼ Sec. 10 T. 30 N., R. 4 W.

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) ______
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 38 ft. Depth of completed well 38 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 38 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 ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☐ No ☑ Size of gravel: ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☑ No ☐ To what depth? 18 [illegible]
Material used in seal cement bentonite
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 ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 7 ft. below top of well Date Feb 47
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 [illegible]
Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Artesian flow ______ g.p.m. Date Feb [illegible]
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
[illegible]	0'	5'
[illegible]	5'	15'
[illegible]	15'	22'
[illegible]	22'	25'
[illegible] gravel	25'	35'
[illegible]	35'	38'

4806401223100401

[illegible] BWD
NOH

8/1/22 BWD

[illegible] flows in summer - dry [illegible]

[illegible]

Work started [illegible] 19 [illegible] Completed [illegible]

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 [illegible] (Person, firm, or corporation) (Type or print)
Address [illegible]
[Signed] [illegible] (Well Driller)
License No. [illegible] Date [illegible], 19[illegible]

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (Rev. 4-71)

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

Application No. 30-4-2N2
Permit No. ....

(1) OWNER: Name Donald F. Mills Address Rt. 3, Box 182 Sequim, Wash. 983

(2) LOCATION OF WELL: County Clallam — NW¼ SW¼ Sec. 2 T. 30 N., R. 4W W.M.

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) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 180 ft. Depth of completed well 180 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 175 ft.
Threaded ☐ 5" Diam. from 173 ft. to 175 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 Johnson
Type Stainless Steel Model No. .....
Diam. 5 5/8 Slot size .020 from 175 ft. to 180 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... 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 & clay
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: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level flowing ft. below top of well Date 9/27/78
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 30 gal./min. with 30 ft. drawdown after 3 hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water 49 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
Brown clay	0	4
Brown gravely clay	4	15
Brown cemented soil	15	20
Sand & gravel W/B	20	25
Blue clay	25	30
Gray cemented soil W/B	30	47
Brown gravel W/B	47	49
Brown cemented gravel	49	59
Blue gravely clay	59	62
Blue clay	62	94
Gray sand & gravel W/B	94	97
Blue gravely clay	97	100
Gray cemented soil	100	119
Gray muddy sand & gravel	119	138
Gray silty clay W/B	138	158
Gray cleaner sand	158	166
Blue clay	166	174
Gray sand & gravel W/B	174	180

RECEIVED
OCT 24 1978
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 9/14 19 78 Completed 9/27 19 7

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 Stoican Drilling Co., Inc. (Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wash. 9838

[Signed] Valis Stoican President 04 (Well Driller)

License No. Joe Pike 0391 Date 9/28, 19 7

(USE ADDITIONAL SHEETS IF NECESSARY)

Table 4. -- Well Logs. -- Continued

Material	Thickness (feet)	Depth (feet)

Shot-hole 30/4W-1L1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 122 feet.

Gravel	80	80

Shot-hole 30/4W-1L2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 118 (?) feet.

Sand and clay	60	60
Boulders and gravel	40	100

Shot-hole 30/4W-2D1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 63 feet.

Clay (soil and silt)	5	5
Gravel	35	40

Shot-hole 30/4W-2E1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 64 feet.

Clay (soil and silt)	10	10
Gravel	55	65
Blue clay	15	80
Clay with sand streaks	40	120

Shot-hole 30/4W-2M2

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 68 feet.

Gravel	55	55
Clay	15	70

Material	Thickness (feet)	Depth (feet)

Shot-hole 30/4W-2M3

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 72 feet.

Clay (soil and silt)	7	7
Gravel	56	63
Clay	72	135

Shot-hole 30/4W-2N1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude about 78 feet.

Clay (soil and silt)	6	6
Gravel	46	52
Clay	68	120

Well 30/4W-2P1

R. J. Mantle. Altitude about 82 feet. Memory log of owner.

Soil	7	7
Clay	1	8
Very-fine gravel	1½	9½

DD 4 ft after pumping 50 gpm; rapid recovery; SWL 5.16 ft.

Well 30/4W-8G1

Wm. H. Burdick. Altitude about 140 feet. Drilled by Stolcan, 1960.

Fine, brown sandy clay	7	7
Fine, brown sand and gravel	4	11
Gravel with clay	45	56
Blue, sticky clay	42	98
Coarse, dark sand and gravel	2	100
Cemented sand	4	104

SWL 59 ft.

30-4-2E1

Shot-hole 30/4W-8M1

Drilled for Standard Oil Co. of California by Geophysical Surveys, Inc. Altitude

30/4W-3H3

Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No.

Permit No.

(1) OWNER: Name Tom Cottel Address Rt 3 Box 426 J

(2) LOCATION OF WELL: County ... ¼ ... ¼ Sec. 3 T. 30 N., R. 4 W.M.

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)
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well ... inches.
Drilled 61 ft. Depth of completed well 61 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 58 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 Johnson Stainless Steel
Type Model No.
Diam. 5 Slot size 20 from 56 ft. to 61 ft.
Diam. Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 25 ft. below top of well Date 7/78
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 gal./min. with ft. drawdown after 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
Top Soil	0	2
gravel + sand	2	40
Easy to Drill		
Sand + pea gravel water	40	61
10-23-78 Rt 3 Bx 426-J		
New Owner:		
Ed Lowicki Aug 78		
Hold 50 - 4.0 = 46.0		
E tape corr = 2.0		
[illegible]		
Well 10' N 154' W of NE cor of house [illegible]		

Work started ... 19... Completed ... 19...

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 Lowies Well Drilling
(Person, firm, or corporation) (Type or print)

Address Rt 1 Box ... Port Angeles ...

[Signed] [illegible]
(Well Driller)

License No. 0848 Date ... 19...

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. ....

Permit No. 31-4-35N

(1) OWNER: Name Eric Lidell Address 1032 W. 13 Ave. Ancorage, Alaska 9950

(2) LOCATION OF WELL: County Clallam NE 1/4 SW 1/4 SW 1/4 Sec. 35 T. 31 N., R. 4 W.M.

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)....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well .... inches.
Drilled 130 ft. Depth of completed well .... ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ....." Diam. from ..... ft. to ..... ft.
Threaded ☐ ....." Diam. from ..... ft. to ..... ft.
Welded ☐ 6" Diam. from -01 ft. to 130 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 ....
Type .... Model No. ....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... 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 Benton
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: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 103 ft. below top of well Date 5-31-78
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 8 gal./min. with 15 ft. drawdown after 1 1/2 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
gravel	0	119
gravel & water	119	121
Hardpan	121	129
water & gravel	129	130

RECEIVED
JUL 07 1978
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started May 28, 1978. Completed May 31, 1978

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Louie's Well Drilling (Person, firm, or corporation) (Type or print)

Address 1652 Barr Ext. Rd. Port Angeles,

[Signed] [signature] (Well Driller)

License No. 0848 Date July 3, 19..

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. ....
Permit No. 31-4-35M:

(1) OWNER: Name Jerry J. Smith 4924 Address N.W. 20 Oklahoma City Oklahoma 73

(2) LOCATION OF WELL: County Clallam-John Thornton Donation Land Claim ¼ Sec. 35 T. 31 N., R. 4 W.M.

Bearing and distance from section or subdivision corner See over

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ AIR Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 160 ft. Depth of completed well 160 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 160 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
Welded ☒ ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes ☐ No ☒
Type of perforator used OPEN Bottom
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 OPEN Bottom
Type ...... Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... 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
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: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level APROX 140 ft.
Static level 127 ft. below top of well Date 6-26-79
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 ......
AIR ~~Bailer~~ test 25 gal./min. with ? ft. drawdown after 1 hrs.
Artesian flow ...... g.p.m. Date ......
Temperature of water 48 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
Surface Soil	0	3
Brown Sandy Gravel	3	11
Brown Sandy Clay	11	18
Gray Sand + Gravel	18	70
Brown Sand	70	88
Brown Sandy Clay	88	92
Brown Sand and Gravel	92	115
Gray Clay & Gravel	115	138
Brown Sand & Gravel Water Bearing	138	160

JUL 1 1979

Work started 6-25 1979 Completed 6-26 19

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 Stoican Drilling Co Inc (Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim Wash - 98382

[Signed] Valier Stoican (President) 047 (Well Driller)
Robert Tilla
License No. 0868 Date 6-27 19
Clint Rushton 0618

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. ....

Permit No. 31-4-34H2

(1) OWNER: Name Hal M. Coverdale Address Rt. 3, Box 292-P Sequim, Wa. 98382

(2) LOCATION OF WELL: County Clallam Parcel 1 of Short Plat ¼ Sec. 34 T. 31 N., R. 4 W.M.

Bearing and distance from section or subdivision corner of Bradshaw Donation Claim

(3) PROPOSED USE: Domestic [X] Industrial [ ] Municipal [ ] Irrigation [ ] Test Well [ ] Other [ ]

(4) TYPE OF WORK: Owner's number of well (if more than one)....
New well [X] Method: Dug [ ] Bored [ ]
Deepened [ ] Cable [X] Driven [ ]
Reconditioned [ ] Rotary [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 128 ft. Depth of completed well 122 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 118 ft.
Threaded [ ] ......" Diam. from ...... ft. to ...... ft.
Welded [X] ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes [ ] No [X]
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 [X] No [ ]
Manufacturer's Name Howard Smith
Type Stainless Stl Model No. ......
Diam. 5 5/8 Slot size .030 from 117 ft. to 122 ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes [ ] No [X] Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal Bentonite & Puddle clay
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? ...... Depth of strata ......
Method of sealing strata off ......

(7) PUMP: Manufacturer's Name ......
Type: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level.... Approx. 100 ft.
Static level 85 ft. below top of well Date 12/21/77
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 [X] 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 10 gal./min. with 12 ft. drawdown after 3 hrs.
Artesian flow ...... g.p.m. Date ......
Temperature of water 49 Was a chemical analysis made? Yes [ ] No [X]

(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
Surface soil	0	2
Brown sandy clay	2	90
Brown clay	90	93
Brown cemented gravel	93	95
Muddy gravel W/B	95	96½
Blue clay	96½	98
Brown gravel W/B	98	99
Brown cemented sandy gravel	99	102
Brown muddy gravel	102	104
Brown cemented sand & gravel	104	118
Brown cemented sand & gravel W/B	118	120
Cemented sand & gravel	120	122

RECEIVED
JAN 5 1978
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 12/21, 1977. Completed 12/28, 1977

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 Stoican Drilling Co., Inc. (Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wash. 98382

[Signed] Valier Stoican President 0473 (Well Driller)
Myrl Hancock

License No. 0204 Date 12/28, 1977

(USE ADDITIONAL SHEETS IF NECESSARY)

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 WRC 38802

Application No.
Permit No. 31-4-35D

(1) OWNER: Name Albert W. &/or Gladys E. Foskett Address Rt. 3 Box 410, Sequim, Wa 98382

(2) LOCATION OF WELL: County Clallam — NW ¼ NW ¼ Sec. 35 T. 31 N., R. 4 W.M.

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) ....
1962 — New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 94 ft. Depth of completed well 94 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: ....." Diam. from ..... ft. to ..... ft.
Threaded ☐ ....." Diam. from ..... ft. to ..... ft.
Welded ☒ 6" Diam. from 0 ft. to 94 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
Type ..... Model No.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 14½ ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☒ No ☐
Type of water? Potable Depth of strata 90'
Method of sealing strata off

(7) PUMP: Manufacturer's Name Jacuzzi
Type: Deep-turbine Jet-Sum JD H.P. 3

(8) WATER LEVELS: Land-surface elevation above mean sea level..... ft.
Static level 70 ft. below top of well Date 10/15/62
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? Van Ausdle
Yield: 20 gal./min. with 10 ft. drawdown after 2 hrs.
" 20 " " "
" " " "

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
Standing Water Level (feet below ground) 70'					

Date of test Oct. 15, 1962
Bailer test 20 gal./min. with 10 ft. drawdown after 1 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.

~~This well was drilled in October 1962 by Earl VanAusdal for Al. D. Morton, who then owned this property. We purchased the property in 1969.~~

~~Mr Morton died in 1967 and Mr Van Ausdal is no longer in business.~~

~~I have answered all questions of which I have personal knowledge to the best of my ability. Further information is no longer available.~~

Glenn W. Foskett

MATERIAL	FROM	TO
top soil	1	1½
clay	1½	15
sand	15	37½
sand clay	37½	52
gray clay	52	68
" clay sand	68	75
sand	75	77
sandy gravel	77	88
gravel	88	94

Work started Sept 10, 1962 Completed Sept 20, 1962

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 Earl Van Ausdle (Person, firm, or corporation) (Type or print)

Address R#2 Box 1654 Port Angeles Wash

[Signed] Earl R Van Ausdle (Well Driller)

License No. 223-07-8524 Date Nov. 12, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

STOICAN DRILLING COMPANY
WATER WELL DRILLING

Route 3, Box 175
Port Orchard, Wash.

P.O. Box 161
Sequim, Wash.

№ 88

(31/4W-27

WELL LOG

No. 1

Date Oct 16, 1967

Record by U. Stoican + FRED Kuhn

Source Drilled Well

Location: State of WASHINGTON

County Clallam

Area Anderson Rd Dungeness

Map

___ ¼ ___ ¼ sec. ___ T. ___ N., R. ___ E. W.

Diagram of Section

Drilling Co. Stoican Drilling Co INC

Address Sequim, Wash

Method of Drilling Churn Date Oct 16, 1967

Owner F.D. Bode

Address P.O. Box 478 Sequim, Wash.

Land surface, datum ___ ft. above / below

Correlation	Material	Thickness (feet)	Depth (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If mat… water-bearing, so state and record static level if reported. Give depths in feet below land-surface d… unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of mate… list all casings, perforations, screens, etc.)		
	Surface Soil 0	1	1
	BRown Clay	29	30
	Blue Clay	4	34
	Black Gravel	1	35
	Gray Hard Cemented Gravel	15	50
	Coarse Water Bearing Sand	1	52
	& Gravel		
	Static Water Level 35 ft Bail Test		
	17 GPM		
	5 ft Draw Down		
	All Casing Check Welded With open bottom		
	Drive Shoe		
	Total 6" Casing 52 ft 1⁄2"		

Turn up Sheet ___ of ___ sh

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 WRC35067

Application No. ....
Permit No. 30-5-14H

(1) OWNER: Name RAY H. PETERSEN Address ROUTE 2 BOX 2020 PORT ANGELES

(2) LOCATION OF WELL: County CLALLAM — SE ¼ NE ¼ Sec 14 T 30 N., R 5 W

Bearing and distance from section or subdivision corner (N 208' of S 416' of E 208.5')

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☒ Method: Dug ☐ Bored ☒
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 235 ft. Depth of completed well 231 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 231 ft.
Threaded ☐ ....." Diam. from ..... ft. to ..... ft.
Welded ☒ 6" Diam. from 0 ft. to 231 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 .....
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☐ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☐ No ☐ To what depth? ..... ft.
Material used in seal .....
Did any strata contain unusable water? Yes ☒ No ☐
Type of water? VERY SOFT Depth of strata 177'
Method of sealing strata off DROVE CASING PAST

(7) PUMP: Manufacturer's Name ?
Type: SUBMERSIBLE H.P. 3/4 or 1

(8) WATER LEVELS: Land-surface elevation above mean sea level ..... ft.
Static level 15' ft. below top of well Date 4-23-66
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? EARL VANAUSDLE
Yield: 1½ gal./min. with 100 ft. drawdown after 6 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 ..... gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water VERY COLD 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
GRAVEL	0	60
SHALE	60	149
SAND STONE	149	162
ROCK	162	177
LARGE HOLE	177	18[illegible]
CLAY - SAND & GRAVEL IN LAYERS	190	22[illegible]
WATER BEARING BLUE CLAY & SHORE GRAVEL	225	23[illegible]
HARD CLAY	231	23[illegible]

RECEIVED
OCT 3 1973
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started APRIL, 19 66 Completed 4-23, 19[illegible]

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME EARL VANAUSDLE
(Person, firm, or corporation) (Type or print)

Address SEQUIM

[Signed] NOT AVAILABLE

License No. ? Date ....., 19.....

THIS REPORT INFO. FROM LOG KEPT BY OWNER
Ray H. Petersen

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

30-4-18 L?

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

Application No.

Permit No.

(1) OWNER: Name Sam Jinny Address 1709 Garn rd Pt

(2) LOCATION OF WELL: County Gallup NE 1/4 NW 1/4 Sec. 18 T. 30 N., R. 4 W.M.

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)
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 119 ft. Depth of completed well 117 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: " Diam. from ft. to ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☑ 6" Diam. from 01 ft. to 120 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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 Bent
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 65 ft. below top of well Date 3/18/55
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 25 gal./min. with C 110 ft. drawdown after 1 1/2 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
Sand loam clay	0	6
Sand	6	37
hard pan	37	54
gravel & Sand w.B	54	57
hard pan Brn.	57	65
Sand & wood w.B brn	65	90
hard pan gray	90	118
gravel w.B	118	117 (119)

Set pump @ 115 Ft

Chuck 20

DEPARTMENT ... RECEIVED ... 85 APR 10 A10:43

Work started March 15 1955 Completed March 18 19

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 Louie's well Drilling (Person, firm, or corporation) (Type or print)

Address Box 45A Barr ... Rd.

[Signed] (Well Driller)

License No. 0844 Date 3/18, 1

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. 30-4-18R2
Permit No.

(1) OWNER: Name Ed Creasey Address Rt. 6, Box 202 Sequim, Wash.

(2) LOCATION OF WELL: County Clallam — SE ¼ SE ¼ Sec. 18 T. 30 N., R. 4W W.M.

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)....

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 117 ft. Depth of completed well 116 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 111 ft.
Threaded ☐ 5" Diam. from 109'6" ft. to 111 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
Type Stainless Steel Model No.
Diam. 5 5/8 Slot size 12 from 111 ft. to 116 ft.
Diam. Slot size from ft. to 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 & clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 87 ft. below top of well Date 8/15/78
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 7 gal./min. with full ft. drawdown after 3 hrs.
Artesian flow g.p.m. Date
Temperature of water 49 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
Brown sandy clay & soil	0	6
Packed rocks & gravel	6	12
Cemented rocks & gravel	12	24
Packed sandy clay	24	44
Sandy pea gravel & clay W/B	44	45
Packed sandy clay	45	55
Gray fine packed sandy clay	55	79
Air pocket	79	80
Packed fine sandy clay	80	91
Fine sandy clay W/B	91	99
Sandy & clay particles W/B	99	116
Gray clay	116	117

RECEIVED
SEP 29 1978
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 8/8, 19 78 Completed 8/15, 19

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 Stoican Drilling Co., Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wash. 98

[Signed] Valier Stoican President 0473
(Well Driller)
Carl Rishton

License No. 0427 Date 8/22, 19 7

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

Application No

Permit No.

(1) OWNER: Name John Pilch Address Rt. 6, Box 356 Sequim, Wa. 98382

(2) LOCATION OF WELL: County Clallam SE ¼ SW ¼ Sec 17 T 30 N., R 4 W.M.

Bearing and distance from section or subdivision corner 30-4-17P1

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 70 ft. Depth of completed well 66 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 59'6" ft.
Threaded ☐ 5 " Diam. from 58'6" ft. to 61 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
Type Stainless Stl Model No.
Diam. 5 5/8 Slot size .040 from 61 ft. to 66 ft.
Diam. Slot size from ft. to 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 & clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level Approx. 260 ft.
Static level 38½ ft. below top of well Date 1/26/78
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 18 gal./min. with 1 ft. drawdown after 9 hrs.
Artesian flow g.p.m. Date
Temperature of water 49 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
Rocky gravely clay	0	13
Sandy clay	13	29
Brown hard clay	29	40
Blue hard clay	40	41
Brown hard clay	41	48
Strattified gravel W/B	48	59
Conglomert clay	59	62
Washed rocks & gravel W/B	62	64
Gravel, sand & clay W/B	64	66
Rocky clay	66	70
Back filled to 66 ft. & set screen.		

Work started 1/20 1978 Completed 1/26 197

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Stoican Drilling Co., Inc. (Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wash. 98

[Signed] Valies Stoican President (Well Driller)
Carl Rushton
License No. 0427 Date 1/27 197

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. ....
Permit No. 30-4-20

(1) OWNER: Name Odie Baker Address 1014 E. 4th Port Angeles, Wa.

(2) LOCATION OF WELL: County Clallam W½ W½ - NW¼ NE¼ Sec. 20 T. 30 N., R. 4 W
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) 1
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 345 ft. Depth of completed well 345 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 345 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
Welded ☒ ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes ☒ No ☐
Type of perforator used Mills
SIZE of perforations 1/8 in. by 1 1/4 in.
~~2022~~ 3 perforations from 209 ft. to 212 ft.
6 perforations from 225 ft. to 235 ft.
2 perforations from 251 ft. to 252 ft.
6 " " 261 268
3 " " 269 278
6 " 301 309

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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 & Clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ...... ft.
Static level 204 ft. below top of well Date 2/14/79
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 5 gal./min. with 68 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water 49 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, a show thickness of aquifers and the kind and nature of the material in eac stratum penetrated, with at least one entry for each change of formatio*

MATERIAL	FROM	TO
Surface soil, sod & sand	0	2
Brown sandy clay & gravel	2	12
Brown cemented sandy clay & gravel	12	52
Brown sand (slight W/B)	52	54
Brown fine sand, some clay	54	97
Brown cemented sand & gravel	97	11
Brown cemented sand, gravel & some clay	116	12
Brown cemented sandy gravel	121	12
Brown cemented sandy & gravel (holds strong vacuum)	125	14
Brown semi cemented sand & gravel, some clay	140	18
Brown cemented soil	182	20
Brown sandy semi cemented clay	201	20
Broken rock & gravel W/B	209	2
Brown sandy clay	212	21
Dark gray sand, gravel, clay	218	22
Blue sandy clay	220	2
Blue clay & gravel	235	25
Gray gravel & clay W/B	251	25
Gray shale	252	2
Gray cemented gravel Some W.	261	2
Gray gravely clay	269	27
Gray shale	278	3
Gray cemented gravel	301	3
Gray shale on clay	309	34

Work started 10/25, 19 78 Completed 2/14, 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Stoican Drilling Co., Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim, Wash. 98

[Signed] President 047
(Well Driller)
Clint Rushton 0618
License No. Joe Pike 0391 Date 2/15, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

30-4-20B1
Application No.
Permit No.

(1) OWNER: Name [illegible] Address [illegible] Sequim [illegible]

(2) LOCATION OF WELL: County Clallam [illegible] Sec. 20 T. 30 N., R. 4 W.

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)
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 85 ft. Depth of completed well 85 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 79-7 ft.
Threaded ☐ " Diam. from ft. to 79-7 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
Type Stainless Steel Model No.
Diam. 5½ Slot size 12 from 79.7 ft. to 85 ft.
Diam. Slot size from ft. to 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 + Clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level. APPROX 300 ft.
Static level 43' ft. below top of well Date 5-30-77
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 5-30-77
Bailer test 20 gal./min. with 12 ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 49 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
Brown Cemented Sand & Gravel	0	50
Brown Sand Fine	50	53
Brown Sand Very Fine	53	85
[illegible]		

BWD - 9-15-78(?)
good supply - good quality
behind building in wooden pumphouse
49.76
-5.1
44.7
-1.0 MP top casing
43.7 (red plastic cap)
permission to meas. monthly
see air photo
OLY-71-383-49A-19

Work started 5/25 1977 Completed 5/30 1977

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 Stoican Drilling Co. Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 161 Sequim Wash. [illegible]

[Signed] Dallas Stoican (President) [illegible]
(Well Driller)
Charles Sheid

License No. 0458 Date 6-7 1977

William Weber 0535

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

30-4-17R2
Application No.
Permit No.

(1) OWNER: Name Larry Tozier Address Rt.6 Box 270 Sequim, Wash. 98382

(2) LOCATION OF WELL: County Clallam SW ¼ SW ¼ Sec. 17 T. 30 N., R. 4 W.M.

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)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 211 ft. Depth of completed well 211 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: " Diam. from ft. to ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ 6 " Diam. from -1 ft. to 211 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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 Bent. & Clay
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 180 ft. below top of well Date July 25
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 10 gal./min. with 10 ft. drawdown after 1½ 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
Sand	0	45
Sand clay Brown	45	55
Sand & Blue clay	55	80
Blue Clay	80	162
Clay & gravel Blue	162	175
Sand	175	200
Clay & Sand Brown	200	205
Clay Hard Blue	205	209
Hard pan	209	211
gravel w B	211	

RECEIVED
SEP - 7 1978
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started July 20, 1978. Completed July 25, 1978

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Louie's Well Dribling
(Person, firm, or corporation) (Type or print)

Address 1652 Barr Ext. Rd. Port Angeles,

[Signed] (Well Driller)

License No. 0848 Date Aug. 25, 1978

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Application No. 30-4-20A1
Permit No. ....

(1) OWNER: Name Paul Kessler Address Rt.6 Box 332 A Sequim, Wash.9838[illegible]

(2) LOCATION OF WELL: County Clallam NW¼ SE ¼ NE ¼ Sec 20 T 30 N., R 4 W.M.

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) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 265 ft. Depth of completed well 265 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ...." Diam. from .... ft. to .... ft.
Threaded ☐ ...." Diam. from .... ft. to .... ft.
Welded ☐ 6" Diam. from ~~[illegible]~~ 0 ft. to 265 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 ....
Type .... Model No. ....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... 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 Bent[illegible]
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: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 225 ft. below top of well Date July 2-79
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 17 gal./min. with 10 ft. drawdown after 1½ 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
Sand & clay	0	20
clay Brown	20	50
gravel & Sand	50	85
clay Brown	85	115
gravel	115	200
clay & Sand Brown	200	22[illegible]
gravel & Sand	225	23[illegible]
clay Blue	235	25[illegible]
Sand pea	250	26[illegible]
gravel & w.B.	260	26[illegible]

RECEIVED
AUG 28 1979
DEPARTMENT OF ECOLOGY
[illegible] REGIONAL OFFICE

Work started .... 19 79 Completed July 2 19 7[illegible]

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Louie's Well Drilling
(Person, firm, or corporation) (Type or print)
Address 1652 Barr Ext. Rd. Port Angeles,W[illegible]

[Signed] [signature]
(Well Driller)

License No. 0848 Date Aug. 1[illegible], 19....

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

Application No.
Permit No. 30-4-16P

(1) OWNER: Name Gerald Bull Address Rt 2 ... Port ...

(2) LOCATION OF WELL: County Clallam — SE ¼ SW ¼ Sec. 16 T. 30 N., R. 4 W.M.

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)....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6" inches.
Drilled 144 ft. Depth of completed well 144 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from -1 ft. to 144 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.....
Type..... Model No.....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... 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 Benite and Clay
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: ..... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level..... ft.
Static level 100 ft. below top of well Date July 4 1977
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 25 gal./min. with 4 ft. drawdown after 6 hrs.
Artesian flow 6 gal per Ft g.p.m. Date July 4-1977
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
Hard pan. Light in clay and gravel Drilled Hard	0	12
clay. Blue Drilled Easy	12	96
Red clay. Drilled Easy	96	105
Sand Stone. Red in color, Drilled Hard	105	118
Red Clay. Drilled Easy	118	125
Sand and gravel red in color Drilled Easy	125	131
Hard pan red Drilled Hard	131	136
Gravel + clay "water" red in color. Drilled Easy	136	141
clean gravel no clay No screen. very good well	141	Well

Work started June 30, 1977 Completed July 4, 1977

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Louis Well Drilling (Person, firm, or corporation) (Type or print)

Address RT 2 BX 1652 PORT ANGELES

[Signed] ..... (Well Driller)

License No. 0948 Date 7-4, 1977

(USE ADDITIONAL SHEETS IF NECESSARY)

...nd First Copy with
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...y — Owner's Copy
...y — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

30-4-21G3
Application No.
CC 190 Area 3
Permit No.

(1) OWNER: Name Dick Rutledge Address 637 Kirk Rd. Sequim, Wash. [illegible]

(2) LOCATION OF WELL: County Clallam SW 1/4 SW 1/4 NE 1/4 Sec. 21 T. 30 N., R. 4 W.M.

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)
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 54 ft. Depth of completed well 54 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ____" Diam. from ____ ft. to ____ ft.
Threaded ☐ ____" Diam. from ____ ft. to ____ ft.
Welded ☐ 6" Diam. from +1 ft. to 50 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 Johnson
Type Stainless Steel Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. 5 Slot size 20 from 50 ft. to 54 ft.

Gravel packed: Yes ☐ No ☑ Size of gravel: ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☑ No ☐ To what depth? 15 ft.
Material used in seal Bentonite
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: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level 29 ft. below top of well Date ____
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 4 gal./min. with 19 ft. drawdown after 1 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
Hard pan	0	41
Brown clay & sand	41	47
Sand & gravel	47	54
Sept. 15-78 BWD		
good [illegible]		
[illegible]		
26.08		
.51		
20.0		
MP TOP OF CASING		
20.0		
Permission to measure		
[illegible] photo plastic [illegible]		
[illegible] from front door		
[illegible] air photo OLY-71 383-49A		

Work started June 29, 1976 Completed [illegible]

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 [illegible] Well Drilling
(Person, firm, or corporation) (Type or print)

Address [illegible] Park Ext. Rd. Port Angeles, Wa.

[Signed] [signature]
(Well Driller)

License No. 0848 Date July [illegible], 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

[illegible]al and First Copy with [illegible]t of Ecology
[illegible]opy — Owner's Copy
[illegible]opy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 30-4-2121

Permit No.

OWNER: Name [illegible] Luce Address Rt 6 Box 530 Sequim Wn 98382

LOCATION OF WELL: County Clallam SE ¼ SW ¼ Sec 21 T. 30 N., R. 4 W.M.

[Bear]ing and distance from section or subdivision corner

PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

DIMENSIONS: Diameter of well 6 inches.
Drilled 326 ft. Depth of completed well 326 ft.

CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 321 ft.
Threaded ☐ 5" Diam. from 319 ft. to 321 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
Type Stainless Steel Model No.
Diam. 6" Slot size 40 from 321 ft. to 326 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite [illegible]
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

PUMP: Manufacturer's Name
Type: H.P.

WATER LEVELS: Land-surface elevation above mean sea level 345 ft.
Static level 293 ft. below top of well Date 1-5-77
Artesian pressure lbs. per square inch Date
Artesian water is controlled by
(Cap, valve, etc.)

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 1-5-77
Bailer test 15 gal./min. with 20 ft. drawdown after [illegible] hrs.
Artesian flow g.p.m. Date
Temperature of water 48 Was a chemical analysis made? Yes ☐ No ☐

Iron - 1 Part Per Million

(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
Brown Surface Soil	0	[illegible]
[illegible] Sandy Clay	[illegible]	[illegible]
Brown Gravelly Clay Boulders	4	7
Brown Gravel and Clay	7	19
Brown Gravel & Clay Boulders	19	21
Brown Sandy Clay	21	25
Brown Gravelly Clay to Gray	25	26
Brown [illegible] Boulders	26	27
Brown Cemented Gravel	27	37
Yellow [illegible]	37	63
Brown Cemented Gravel	63	68
Yellow [illegible] Clay	68	74
Yellow Sandy Clay	74	93
Gray Brown Gravel Clay	93	99
Yellow Sandy Clay		
Stratified	99	233
Brown Sandy fine Gravel	[illegible]	[illegible]
Some Water	234	235
Brown Sandy Gravel	235	238
Brown Gravelly Clay	238	239
Brown Sandy Clay	239	291
Brown Silty Clay	291	297
Brown Sandy Clay [illegible]	[illegible]	[illegible]
Some [illegible] Gravel	[illegible]	[illegible]
Water Bearing	[illegible]	[illegible]
Brown Clean Water	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Gravel	[illegible]	326
10-25-78 Rt 6 Box 530		
10-26-78 Name [illegible]		
11-9-78 [illegible]		
Will be [illegible]		

Work started 12-15 1976 Completed 1-5 1977

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 Stoican Drilling Co. Inc.
(Person, firm, or corporation) (Type or print)

Address PO Box 161 Sequim Wash 98382

[Signed] Julius Stoican (President)
(Well Driller)
Carl D. Rushton

License No. 0427 Date 1-7 1977

(USE ADDITIONAL SHEETS IF NECESSARY) 280
-.66

[illegible] 050-1-20

30-4-22E1

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Carlsborg

WATER WELL REPORT

STATE OF WASHINGTON

Application No. G2-2171
Permit No. G2-21711

(1) OWNER: Name J.M. SPENCER Address Rt. 4 BOX 826 - SEQUIM WA. 9838

(2) LOCATION OF WELL: County CLALLAM - PORTION of the SW ¼ NW ¼ Sec 22 T 30 N., R 4W W.M.
Bearing and distance from section or subdivision corner #1 450' S. & 990' E. from NW Cor. SW¼ NW¼

(3) PROPOSED USE: Domestic ☒ (Comm.) Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) #1
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 70 ft. Depth of completed well 70 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 68'3" 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 ___
Type ___ Model No. ___
Diam. ___ Slot size ___ from ___ ft. to ___ ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Drilling Mud
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: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level Approx 175 ft.
Static level 55 ft. below top of well Date 8/24/71
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 25 gal./min. with 2 ft. drawdown after ___ hrs.
Artesian flow ___ g.p.m. Date 8/24/71
Temperature of water 48° 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
SURFACE / SOIL	0	1
BROWN / Cemented gravel	1	10
GRAY cemented / clay	10	14
FIRM GRAY Sandy / Clay	14	40
BROWN cemented / gravel	40	44
BROWN Sandy / Clay	44	57
BROWN cemented / gravel	57	68
" W.B / Sand & gravel	68	70

480455123110501

RECEIVED
APR 21 1975
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

12.5
15
12.5
62.5
[illegible]
90

Calling pump set at 67'; dd = 17'

Work started 8/20 1971. Completed 8/24 1971

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 STOICAN DRILLING CO INC. (Person, firm, or corporation) (Type or print)

Address P.O BOX 161 SEQUIM WA. 983

[Signed] Viller Stoican (President) (Well Driller)

License No. 0473 Date APRIL 11, 1975

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

Application No. ....
Permit No. 30-4-22N2

(1) OWNER: Name Bill M Lohr. Address Box 1765 Balboa Canal Zone.

(2) LOCATION OF WELL: County Clallam SE ¼ SW ¼ Sec. 22 T 30 N., R. 4 W.M.

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)....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 416 ft. Depth of completed well 409 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 409 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____
Type____ Model No.____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ 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
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: ____ H.P.____

(8) WATER LEVELS: Land-surface elevation above mean sea level. APROX 400 ft.
Static level 242 ft. below top of well Date 11-11-76
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 2 ½ gal./min. with 152 ft. drawdown after 4 hrs.
Artesian flow____ g.p.m. Date____
Temperature of water 50 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
Brown Gravelly Clay	0	35
Brown cemented sand & gravel	35	70
Brn. cemented sand & gravel clay	70	85
Brn sand & gravel loose	85	165
Brn fine sand & clay silt	165	195
Brn fine sand & silt (muddy) w/B	195	197
Brn clay conglomerate firm	197	265
Brn clay-hard streaks of sand sepeage (20 gph)	265	280
Brn. clay hard & fractured	280	352
Blue clay	352	358
Brn. clay & coarse sand	358	359
Blue clay	359	372
Blue clay - sandy	372	405
Brn gravel cemented	405	409
Brn gravel tight w/B	409	410
Brn gravely clay	410	418

Work started 10-11, 1976. Completed 11-11, 197[illegible]

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report i[s] true to the best of my knowledge and belief.

NAME Stoican Drilling Co INC (Person, firm, or corporation) (Type or print)

Address P.O. Box 141 Sequim Wash-9[illegible]

[Signed] Valer Stoican (President) (Well Driller)
William Weber

License No. 0535 Date 12-2, 197[illegible]

Charles Sherk - 0458

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

...ent of Ecology
Copy — Owner's Copy
Copy — Driller's Copy Carlsborg

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 30-4-23Q4
Permit No.

(1) OWNER: Name Erwin Schildorf Address [illegible]

(2) LOCATION OF WELL: County Clallam N½ N [illegible] ¼ SE ¼ Sec 23 T 30 N., R 4W W.M.

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)....
New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 57 ft. Depth of completed well 57 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 58 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 OPEN BOTTOM
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite & puddle clay
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

(8) WATER LEVELS: Land-surface elevation above mean sea level [illegible]
Static level 35 ft. below top of well Date 4/2/74
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 10 gal./min. with 4 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date 4/2/74
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
TOP SOIL	0	5
CONSOLIDATED BROWN CLAY SAND & BOULDERS	5	23
BROWN CLAY, SAND, SOME ROCKS	23	27
W.B. GRAVEL, pea SIZED WITH BROWN CLAY	27	30
CONSOLIDATED BROWN CLAY WITH SAND, SOME HARD GRAVEL	30	48
CONSOLIDATED GRAVEL WITH CLAY	48	51
W.B. SAND & GRAVEL CLAY	51	53
WATER BEARING SAND & GRAVEL	53	57

48045012309T504

Sept. 15-79 RWD

35.90
-5.1 (e-top)

30.8ft
-1 (MP)

29.8 see air photo
OLY-71-383-48A-16

between house + garage
under wooden door

Work started 3/28 1974 Completed 4/2 1974

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 Stoican Drilling Co. Inc. (Person, firm, or corporation) (Type or print)
Address P.O. Box 161 Sequim WA 98[illegible]
[Signed] Valer Stoican (Well Driller)
License No. 0473 Date April 2 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 No. 7356—OS—(Rev. 4-71).

37627

480447123080901 ... 3044-2492

Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Simmons, Anna

Application No. 3044-2492

Permit No. G0 90 A

(1) OWNER: Name [illegible] Address Rt 7, Box 285 [illegible]

(2) LOCATION OF WELL: County [illegible] ¼ ¼ Sec 21 T [illegible] N., R 40 W.M.

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)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 79 ft. Depth of completed well 7[illegible] ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 78 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 open bottom
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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 [illegible]
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level [illegible] ft.
Static level [illegible] ft. below top of well Date [illegible]
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 [illegible] gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date [illegible]
Temperature of water [illegible] 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
Surface soil	0	1
Brown consolidated material & boulders	1	59
Brown gravel water bear	59	72
Brown gravel clay	72	73
Brown gravel W.B.	73	79
10-23-78 Rt 4 Bx 909		
10-25-78 No access to well		
[illegible] 1/56 [illegible] 46.56		
12/[illegible] 46.56 below from MP		
MP is [illegible] above ground level		
[illegible] domestic [illegible]		

Work started [illegible] 19 [illegible]. Completed [illegible] 19 [illegible]

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 [illegible] Drilling [illegible]
(Person, firm, or corporation) (Type or print)

Address [illegible]

[Signed] [illegible]
(Well Driller)

License No. [illegible] Date [illegible], 19[illegible]

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WATER WELL REPORT

STATE OF WASHINGTON

30-4-24K1

Application No. 22CC17

Permit No. 22CC17

(1) OWNER: Name Carl Berger Address Rt 1 Box 85, Sequim, Wa.

(2) LOCATION OF WELL: County Clallam — SE ¼ SE ¼ Sec 24 T. 30 N., R. 4 W.M.

Bearing and distance from section or subdivision corner South 30 acres of

(3) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 276 ft. Depth of completed well 276 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 272 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 VAN Ausdle
Type Stainless mesh Model No.....
Diam. 6 Slot size ..... from 272 ft. to 276 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... 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 Cement Bentonite
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: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level..... ft.
Static level 61 ft. below top of well Date MAY 22
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 30 gal./min. with Approx. 60 ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date MAY 22
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
Top Soil	0'	1
Clay Brown Cobbles	1	17
Clay Brown Cem gravel	17	35
~~Clay Lt Brown gravel~~	~~35~~	~~48~~
Clay Tan Cem gravel	35	48
Clay Lt Brown gravel	48	63
Clay Brown Fine Sand	63	70
Clay Brown	70	80
Clay Brown fine Sand	80	123
Clay Blue Silt	123	225
Clay Brown Sand	225	272
Sand gravel	272	276

Work started MAY 12 19 75 Completed MAY 22 19 75

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 VAN Ausdle Well Drilling, Inc (Person, firm, or corporation) (Type or print)

Address 1430 E. 3rd, Pt. Angeles, W

[Signed] Melvin Williams (Well Driller)

License No. 0524 Date MAY 28, 19 75

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

WATER WELL DRILLING

~~Route 3, Box 175~~
~~Port Orchard, Wash.~~

P.O. Box 161
Sequim, Wash.

No. 375

30/3W-19M2

WELL LOG

No. 1

Date 2/15, 1971

Record by Albert Genereux

Source

Location: State of WASHINGTON

County Chhllam

Area West Sequim Hy 101

Map The Church of Latter DaySaints

¼ ¼ sec. T. N., R. E. W.

Diagram of Section

Drilling Co. Stoican Drilling Co. INC

Address P.O. Box 161 Sequim Wash

Method of Drilling Churn Date 2/25, 1971

Owner The Church of Latter Day Saints

Address Rt 1 Box 70 Sequim, Wash 98382

Land surface, datum APRX 150 ft. above below Sea Level

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
1	Surface Soil	1	1
	Loose Rocks + Gravel	7	8
	Brown Cemented Gravel + Rocks	34	42
	Brown Simic Cemtel Gravel	12	54
	" Loose Gravel (Water Ber)	8	62
	Brown Cemented Gravel	13	75
	Lumpy Gray Clay	17	92
	Brown Clay	9	101
	Brown Water Berring Sand + Gravel	13	114
	Brown Semic Cemented Gravel	30	144
	Brown Cemtel Gravel	15	159
"	Water Berring Sand + Gravel	6	165
	About 4 GPM		

Turn up Over Sheet of sheets

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

Application No. ....
Permit No. ....

(1) OWNER: Name Rick Croot Address 311 W. Bell, Sequim Wn.

(2) LOCATION OF WELL: County Chattam — SE ¼ SW ¼ Sec. 19 T. 30 N., R. 3 W.M.

Bearing and distance from section or subdivision corner 30-3-19 P?

(3) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 207 ft. Depth of completed well 207 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 202 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
Welded ☑ 5" Diam. from 201 ft. to 207 ft.

Perforations: Yes ☑ No ☐
Type of perforator used 6' x 5" perforated
SIZE of perforations Liner in. by ...... in.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.

Screens: Yes ☐ No ☑
Manufacturer's Name ....
Type .... Model No. ....
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... 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
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: .... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level ...... ft.
Static level 112 ft. below top of well Date Mar 10
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 20 gal./min. with approx. 70 ft. drawdown after ...... hrs.
Artesian flow ...... g.p.m. Date Mar 10
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
clay Brown cobbles	0'	53'
clay Brown	53'	60'
clay Brown gravel	60'	90'
clay Brown Sand	90'	163'
clay Brown fine Sand	163'	190'
sand gravel	190'	207

RECEIVED
86 NOV 12 AM 1:37

Work started Feb 26, 1986 Completed Mar 10, 1986

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 Mel Williams Drilling
(Person, firm, or corporation) (Type or print)

Address 181 W. Sequim Bay Rd. - Sequim

[Signed] Mel Williams
(Well Driller)

License No. 524 Date Mar 12, 198

(USE ADDITIONAL SHEETS IF NECESSARY)

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

Start Card No 030600

Water Right Permit No.

(1) OWNER: Name Dave Highlander Address 580 Dunlap St Sequim, Wa. 98

(2) LOCATION OF WELL: County Clallam SW NE ¼ Sec 19 T 30 N., R 3 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) 30-3-19G ?

(3) PROPOSED USE: ☒ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 60 feet. Depth of completed well 60 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: " Diam. from ft. to ft.
Welded ☒ 6 " Diam. from 0 ft. to 60 ft.
Liner installed ☐
Threaded ☐ " 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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 Benite
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 28 ft. below top of well Date 5/15/89
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 25 gal./min. with @ ft. drawdown after 55 hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
Top Soil	0	3
Balders	3	14
hard pan Brown	14	26
Balders	26	33
hard pan Brown	33	54
gravel W.B.	54	60

Work started 5/15/89, 19. Completed 5/15/89, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME LOUIE'S WELL DRILLING (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 1652 BARR Ext Rd PORT ANGELES, W
(Signed) [signature] (WELL DRILLER) License No 0848
Contractor's Registration No. LOUIEWD137PW Date 5-17-, 1989

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

First Copy with Ecology
Owner's Copy
Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No.

Permit No. CG'90 Agg-5

(1) OWNER: Name Stanley Hecke Address P.O. Box 461 Sequim Wash 98382

(2) LOCATION OF WELL: County Clallam ¼ ¼ Sec. T. 30 N., R. 3 W.M.

Bearing and distance from section or subdivision corner 30-3-20E1

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6-5 inches.
Drilled 71'3" ft. Depth of completed well 71'3" ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 65'9" ft.
Threaded ☐ 5" Diam. from 64' ft. to 66'3" 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
Type Stainless Steel Model No.
Diam 5 5/8 Slot size 20 from 66 ft. to 71'3" ft.
Diam Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level APPX 225 ft.
Static level 26 ft. below top of well Date 10-11-75
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 ? ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water 49 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
Brown Surface Soil	0	7
Brown Cemented Gravel	7	21
Brown W/B Gravel	21	36
Brown Sandy Cemented Gravel	36	61
Brown W/B Gravel	61	96

10-3-79

see air photo
OLY-71-38 49A-9

no problem

was checked by Cruff
did not like Sequim Driller

check at home
for okay

Work started 10-10 1975. Completed 10-11 1975.

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 Strican Drilling Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 461 Sequim Wash 98382

[Signed] Walter Strican (Well Driller)

License No. 0343 Date 10-13 1975

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (Rev. 4-71)
ECY 070-28

30-3-20Q1
P.1 of 2

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

WELL LOG

Appli. #8017

Record by Driller

Source Driller's Record

Location: State of WASHINGTON

County Clallam

Area

Map

SW ¼ SE ¼ sec. 20 T. 30 N., R. 3 W.

Diagram of Section

Drilling Co. Earl Van Ausdle

Address Route 2, Box 1654, Port Angeles, Wash.

Method of Drilling Cable Date May 20, 1966

Owner W. J. Belfield

Address Sequim, Washington

Land surface, datum ft. above/below

SWL: 36' Date May 20, 1966 Dims. 6" x 236'

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	From (feet)	To (feet)
	Domestic supply		
	Topsoil, rock & clay	1	14
	Clay, gravel & hardpan	14	29
	Gravel, sandy, & water	29	32
	Clay, brown, sandy	32	79
	Clay, blue	79	87
	Clay, brown, sandy & gravel	87	155
	Gravel, sand, & water	155	159
	Clay, sandy & gravel	159	177
	Clay, blue	177	185
	Rock, lge., blue clay & hardpan	185	220
	Gravel, fine, & water	220	226
	Gravel, blue clay, & water	226	235
	Casing: 6" from 0-236'		
	Screen installed from 225-236'		

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30-3-20Q1
p. 2 of 2

WELL LOG.—Continued No......./.......-.......

CORRELATION	MATERIAL	From (feet)	To (feet)
	Depth forward	———	
	Surface sealed to 15' with driller's mud		
	Yield: Bailer test:		
	30 gpm with 42' DD after 2 hrs.		
	Test made 5-20-66		

S. F. No. 7449—OS—12-65.

Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 30-3-21M

Permit No. [illegible]

(1) OWNER: Name [illegible] Address [illegible]

(2) LOCATION OF WELL: County [illegible] — [illegible] ¼ [illegible] ¼ Sec. [illegible] T. 30 N., R. [illegible] W.M.

Bearing and distance from section or subdivision corner [illegible]

(3) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ......

New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 68 ft. Depth of completed well 68 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 65 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 VAN Ausdle
Type Stainless mesh Model No. ......
Diam. ...... Slot size [illegible] from 65 ft. to 68 ft.
Diam. 6" Slot size ...... from 65 ft. to 68 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 Cement bentonite
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: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level ...... ft.
Static level 13 ft. below top of well Date Oct 6
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 approx. [illegible]
Bailer test 6 gal./min. with 47 ft. drawdown after [illegible] hrs.
Airtest ...... gal./min. with stem set at ...... ft. for ...... hrs.
Artesian flow ...... g.p.m. Date Oct [illegible]
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
clay brown	0	10
clay brown sand & gravel	10	18
clay blue cemented gravel	18	25
clay grey cemented gravel	25	27
[illegible] gravel	27	34
[illegible] sandy	34	48
clay dk brown	48	56
clay blue sandy	56	65
sand course [illegible]	65	68
clay blue	68	68

480443123044301

at 68 - [illegible] well

deepened to 107 [illegible]

Mel Williams

good quality [illegible]

Work started Oct 1, 1975. Completed Oct [illegible], 19[illegible]

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 Van Ausdle [illegible]
(Person, firm, or corporation) (Type or print)

Address 1430 E 3rd [illegible]

[Signed] Melvin Williams
(Well Driller)

License No. 0524 Date Oct [illegible], 19[illegible]

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 No.7356—OS—(Rev. 4-71).

11 27 [illegible]

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

Application No. 30-3-21K3
Permit No.

(1) OWNER: Name Art Nelson Address Rt 5 Box 1110 Sequim Wash 9838[…]

(2) LOCATION OF WELL: County Clallam — ¼ ¼ Sec. 21 T. 30 N., R. 3 W[…]

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)
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 280 ft. Depth of completed well 280 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from 0 ft. to 280 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to 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
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: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level. APRX 280 ft.
Static level 107' 6" ft. below top of well Date
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 ~~BHS~~ 7/15/76
Bailer test 6 gal./min. with 110'6" ft. drawdown after 3 hrs.
Artesian flow g.p.m. Date
Temperature of water 49 Was a chemical analysis made? Yes ☐ No ☑

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, show thickness of aquifers and the kind and nature of the material in […] stratum penetrated, with at least one entry for each change of format[…]

MATERIAL	FROM	TO
Surface	0	1
Br. Sandy Clay	1	8
Br Gravely Clay	8	11
Brown Cemented Gravely Clay	11	13
Gray to Brown Cemented Gravely Clay	13	32[…]
Gray Dry Sand	30	41
Coarse Gray Sand Dry	41	56
Gray Tight Sand & Gravel	56	58
Gray Fine Sand	58	63
Gray Brown Cemented Gravel	63	74
Gray Silty Sand & Gravel	74	83
Blue to Gray fine Sand	83	85
Gray Sandy Clay	88	99
Gray Silty Sand	99	12[…]
Gray Sandy Clay Layers of Rts	123	14[…]
Gray Muddy Clay	141	14[…]
Blue Silty Clay (Sticky)	143	18[…]
Gray Firm Blue Clay	181	21[…]
Gray Clay	215	23[…]
Gray Shaley Clay	231	23[…]
Gray to Blue	238	25[…]
Brown Cemented Gravel	255	26[…]
Brown Tight Gravel W.B. 4½ GPM	264	27[…]
Brown Water Bear Gravel	276	280

RECEIVED
AUG 5 1976
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 6/26 1976 Completed 7/15 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this repo[…] true to the best of my knowledge and belief.

Stoican Drilling Co INC
NAME Valier Stoican (President)
(Person, firm, or corporation) (Type or print)

Address PO Box 161 Sequim Wash - 983[…]

[Signed] Valier Stoican 6473
Charles Shirk (Well Driller)

License No. 0458 Date 7/23 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30-3 22N1

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. 30 / 3W - 22N1

Date 8-11, 1960

Record by J. B. Noble

Source V. Stoican

Location: State of WASHINGTON

County Clallam

Area

Map Sequim

SW ¼ SW ¼ sec. 22 T. 30 N., R. 3 W.

Diagram of Section: 22, N1

Drilling Co. Stoican

Address Port Orchard

Method of Drilling ______ Date ______, 19__

Owner George Eberly

Address Sequim

Land surface, datum 205 ft. above/below

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	Cemented gravel	24	24
	Clay, sand, gravel	36	60
	small gravel	27	87
	gray clay	12	99
	cemented gravel	49	148
	sandy clay	6	154
	cemented gravel	3	157
	gray clay & cemented gravel layers	22	179

Turn up

Sheet ____ of ____ sheets

30/3-22N1

Appendix B

Primary and Secondary Water Quality Standards

TABLE 1

GROUND WATER QUALITY CRITERIA

CONTAMINANT	CRITERION	
I. PRIMARY AND SECONDARD CONTAMINANTS AND RADIONUCLIDES		
A. PRIMARY CONTAMINANTS		
Barium*	1.0	milligrams/liter (mg/l)
Cadmium*	0.01	mg/l
Chromium*	0.05	mg/l
Lead*	0.05	mg/l
Mercury*	0.002	mg/l
Selenium*	0.01	mg/l
Silver*	0.05	mg/l
Fluoride	4	mg/l
Nitrate (as N)	10	mg/l
Endrin	0.0002	mg/l
Methoxychlor	0.1	mg/l
1,1,1-Trichloroethane	0.20	mg/l
2-4 D	0.10	mg/l
2,4,5-TP Silvex	0.01	mg/l
Total Coliform Bacteria	1/100	ml
B. SECONDARY CONTAMINANTS		
Copper*	1.00	mg/l
Iron*	0.30	mg/l
Manganese*	0.05	mg/l
Zinc*	5.	mg/l
Chloride	250	mg/l
Sulfate	250	mg/l
Total Dissolved Solids	500	mg/l
Foaming Agents	0.5	mg/l
pH	6.5-8.5	
Corrosivity	non-corrosive	
Color	15 color units	
Odor	3 threshold odor units	
C. RADIONUCLIDES		
Gross Alpha Particle Activity	15	picoCuries/liter (pCi/l)
Gross Beta Particle Activity		
Gross Beta Activity	~~20~~ 50	pCi/l
Tritium	20,000	pCi/L
Strontium-90	8	pCi/l
Radium 226 & 228	5	pCi/l
Radium -226	3	pCi/l

* Metals are measured as total metals

CONTAMINANT	CRITERION
II. CARCINOGENS	
Acrylamide	0.02 micrograms/liter (ug/l)
Acrylonitrile	0.07 ug/l
Aldrin	0.005 ug/l
Aniline	14 ug/l
Aramite	3 ug/l
Arsenic*	0.05 (ug/l)
Azobenzene	0.7 ug/l
Benzene	1.0 ug/l
Benzidine	0.0004 ug/l
Benzo(a)pyrene	0.008 ug/l
Benzotrichloride	0.007 ug/l
Benzyl chloride	0.5 ug/l
Bis(chloroethyl)ether	0.07 ug/l
Bis(chloromethyl)ether	0.0004 ug/l
Bis(2-ethylhexyl) phthalate	6.0 ug/l
Bromodichloromethane	0.3 ug/l
Bromoform	5 ug/l
Carbazole	5 ug/l
Carbon tetrachloride	0.3 ug/l
Chlordane	0.06 ug/l
Chlorodibromomethane	0.5 ug/l
Chloroform	7.0 ug/l
4 Chloro-2-methyl aniline	0.1 ug/l
4 Chloro-2-methyl analine hydrochloride	0.2 ug/l
o-Chloronitrobenzene	3 ug/l
p-Chloronitrobenzene	5 ug/l
Chlorthalonil	30 ug/l
Diallate	1 ug/l
DDT (includes DDE and DDD)	0.3 ug/l
1,2 Dibromoethane	0.001 ug/l
1,4 Dichlorobenzene	4 ug/l
3,3' Dichlorobenzidine	0.2 ug/l
1,1 Dichloroethane	1.0 ug/l
1,2 Dichloroethane (ethylene chloride)	0.5 ug/l
1,2 Dichloropropane	0.6 ug/l
1,3 Dichloropropene	0.2 ug/l
Dichlorvos	0.3 ug/l
Dieldrin	0.005 ug/l
3,3' Dimethoxybenzidine	6 ug/l
3,3' Dimethylbenzidine	0.007
1,2 Dimethylhydrazine	60 ug/l
2,4 Dinitrotoluene	0.1 ug/l
2,6 Dinitrotoluene	0.1 ug/l
1,4 Dioxane	7 ug/l
1,2 Diphenylhydrazine	0.09 ug/l

CONTAMINANT	CRITERION
II. CARCINOGENS	
Direct Black 38	0.009 ug/l
Direct Blue 6	0.009 ug/l
Direct Brown 95	0.009 ug/l
Epichlorohydrin	8 ug/l
Ethyl acrylate	2 ug/l
Ethylene dibromide	0.001 ug/l
Ethylene thiourea	2 ug/l
Folpet	20 ug/l
Furazolidone	0.02 ug/l
Furium	0.002 ug/l
Furmecyclox	3 ug/l
Heptachlor	0.02 ug/l
Heptachlor Epoxide	0.009 ug/l
Hexachlorobenzene	0.05 ug/l
Hexachlorocyclohexane (alpha)	0.001 ug/l
Hexachlorocyclohexane (technical)	0.05 ug/l
Hexachlorodibenzo-p-dioxin, mix	0.00001 ug/l
Hydrazine/Hydrazine sulfate	0.03 ug/l
Lindane	0.06 ug/l
2 Methoxy-5-nitroaniline	2 ug/l
2 Methylaniline	0.2 ug/l
2 Methylaniline hydrochloride	0.5 ug/l
4,4' Methylene bis(N,N'-dimethyl) aniline	2 ug/l
Methylene chloride (dichloromethane)	5 ug/l
Mirex	0.05 ug/l
Nitrofurazone	0.06 ug/l
N-Nitrosodiethanolamine	0.03 ug/l
N-Nitrosodiethylamine	0.0005 ug/l
N-Nitrosodimethylamine	0.002 ug/l
N-Nitrosodiphenylamine	17 ug/l
N-Nitroso-di-n-propylamine	0.01 ug/l
N-Nitrosopyrrolidine	0.04 ug/l
N-Nitroso-di-n-butylamine	0.02 ug/l
N-Nitroso-N-methylethylamine	0.004 ug/l
PAH	0.01 ug/l
PBBs	0.01 ug/l
PCBs	0.01 ug/l
o-Phenylenediamine	0.005 ug/l
Propylene oxide	0.01 ug/l
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.0000006 ug/l
Tetrachloroethylene (perchloroethylene)	0.8 ug/l
para, alpha, alpha, alpha-Tetrachlorotoluene	0.004 ug/l
2,4 Toluenediamine	0.002 ug/l

CONTAMINANT	CRITERION
II. CARCINOGENS	
o-Toluidine	0.2 ug/l
Toxaphene	0.08 ug/l
Trichloroethylene	3 ug/l
2,4,6-Trichlorophenol	4 ug/l
Trimethyl phosphate	2 ug/l
Vinyl chloride	0.02 ug/l

Appendix C

GLOSSARY OF COMMON TERMS

GLOSSARY OF COMMON WATER-RESOURCE RELATED TERMS AND ACRONYMS

Alluvium — Sediment such as clay, silt, sand, gravel, or other similar material deposited by running water.

Aquifer — A body of rock or sediment able to store and conduct significant quantities of ground water.

Aquitard — A layer of rock or sediment that retards the flow of ground water to or from an adjacent layer of rock or sediment.

Arsenic — A naturally occurring element that may be toxic in certain compounds and concentrations.

Artesian — An adjective referring to ground water confined under hydrostatic pressure.

Bedrock — A term for the solid rock that underlies soil or uncompacted sediments.

Braided Stream — A stream that divides into an interlacing network of channels typically found in areas of heavy erosion.

Coliform Bacteria — Coliform bacteria comprises all aerobic, gram-negative, non-spore forming, rod shaped bacteria that ferment lactose with gas formation within forty-eight hours at 35°C. They include bacteria of fecal origin and those that live in the soil.

Confined — A condition of an aquifer bounded above and below by lower permeability rock or sediment layers.

Contaminant — A naturally occurring or human generated compound that is undesirable or injurious and found in ground water.

Cross-Section	A schematic representation of geologic layers as seen in a side view.
Dangerous Waste	Washington State regulated human generated materials that are potentially ignitable, corrosive, reactive, or toxic.
Discharge	Ground water that flows out of an aquifer into an adjacent aquifer or to the surface into a spring or river.
DOH	Department of Health.
Drift	A general term applied to all rock material transported by glacial action.
Drinking Water Standards	Federal or state water quality regulations that limit the contaminant levels of certain compounds for drinking water.
Ecology	Department of Ecology.
EIS	Environmental Impact Statement.
Erosion	The physical and chemical processes that remove and transport natural materials at the surface.
Ethylene Dibromide	A human generated chemical used in the agricultural industry as a pesticide.
Geology	The study of earth materials, processes, and history.
gmp	Gallons per minute.
GMA	Growth Management Act.
Ground Water	All water that is located below the surface; more specifically, subsurface water below the water table.
GWMA	Ground Water Management Area.
GWMP	Ground Water Management Program.

Hazardous Waste	Federally regulated human generated waste that is ignitable, corrosive, reactive, or toxic.
Hydraulic Conductivity	The rate of flow of water through an area of permeable material at a constant pressure.
Hydraulic Connection	The condition in which two water-bearing layers or bodies may freely transmit water between them.
Hydrogeologic	Pertaining to subsurface water and water-bearing rock or sediment layers.
Hydrostratigraphy	The assemblage of layers of aquifers and aquitards.
Igneous	A type of rock solidified from molten material.
Impermeable	An adjective used to describe rock, soils, or sediments that impede the flow of water.
Infiltration	The downward movement of rain water or surface water into soil.
Mesozoic	A broad period of Earth's history estimated to be 225 to 65 million years ago.
Metamorphic	A rock that has been physically and/or chemically changed from an original texture and/or composition, usually by very high temperatures or pressures below the Earth's surface.
mg/l	Milligrams per liter; a unit of concentration in water equivalent to a part per million or 0.0001 percent.
mgd	Million gallons per day.
Nitrate	A compound commonly associated with domestic and agricultural waste.
Outwash	Layered sediments removed or washed out from a glacier by melt water streams deposited in front of a glacier.

Peat	A non-compacted deposit of organic material commonly developed from bogs or swamps.
Pentachlorophenol	A human generated chemical commonly used as a wood preservative.
Permeable	The condition under which water may be transmitted through rock or sediment.
Pleistocene	A period of Earth's history estimated to be 2 million to 10,000 years ago.
ppm	Part per million. A unit of concentration equivalent to 0.0001 percent.
Recent	Less than 10,000 years ago in Earth's history.
Recharge	The process of absorption and addition of water to a layer of soil, rock, or sediment.
Saltwater Intrusion	The displacement of ground water in an aquifer by saline or sea water.
SDWA	Safe Drinking Water Act.
Sedimentary	A rock type formed from fragments of weathered natural material.
SEPA	State Environmental Policy Act.
Stade	A substage of glacial advancement during a major glacial stage.
Stratigraphic	Pertaining to the composition and position of layers of rock or sediment.
Tertiary	A period of Earth's history estimated to have occurred between 2 and 65 million years ago.
Till	A complex non-layered mixture of clay, silt, sand, and gravel deposited directly by and underneath an active glacier.

Topographic	Pertaining to the general configuration of a land surface.
Transmissivity	The rate at which ground water flows through a certain thickness of aquifer under a certain pressure.
Unconfined	Ground water in an aquifer that is not covered by an impermeable layer.
Water Table	The subsurface level dividing the zone of saturation (ground water) and the zone of aeration.
Weathering	The destructive process(es) by which the atmosphere and surface water chemically change the character of a rock or unconsolidated deposit.

Appendix F

Recommendations for Groundwater Data Collection

Recommendations for Groundwater Data Collection

1. Sampling Network

a. Wells

Generally, the sampling plan should take into account the best available knowledge of the hydrogeology, and the current and projected future distribution of land and water uses. It should aim to provide the county with baseline data and the ability to generalize from the particular wells to surrounding areas. Wells should be chosen when the following minimum conditions are met:

a) 1980 nitrate data exists,
b) a detailed well report (driller's log) is available,
and c) the well's location is mapped.

Several wells in the vicinity of highest nitrate concentrations should be selected specifically for localized investigations. Also, several wells should be chosen near the shoreline of the Strait and Dungeness Bay for chloride testing.

b. Surface Water

A summary of historical and ongoing surface water (streams, ditches, and ponds) nitrate data should be written. If gaps in current data exist in the vicinity of highest nitrate concentrations in wells, sampling and testing of surface water systems should begin.

2. Sampling Schedule

Samples should be obtained twice yearly for the entire well and surface water network, during the months of August and February. For a subset of the network, testing for nitrates and bacteria and measurement of water levels should follow a more intense schedule for a period of two years, in order to determine possible seasonal fluctuations. Quarterly is recommended for the subset of sites.

Also, a sampling plan should be designed to investigate the relation of contaminant concentration to rainfall events.

SUMMARY OF CLALLAM COUNTY GROUNDWATER DATA

DATA	# WELLS	SOURCE	DATA FLOW/WHERE STORED
NO_3	130	1980 USGS	Drost 1983, DSHS 1982: hard copy only; DWQ: notes
	39	1990, 91 DWQ	DWQ: Excel spreadsheet
	(1 w/ each bldg. pmt.)	7/90+ Env.H	DEH: copies of analyses are kept with individual septic permits DWQ: monthly summaries compiled by Katie (since April 1991)
Bacteria	36	1990, 91 DWQ	DWQ: Excel spreadsheet
	av. 30/week	Env.H Drinking Wtr Lab	(no records kept)
	(1 w/ each bldg. pmt.)	7/90+ Env.H	DEH: copies of analyses are kept with individual septic permits
Cl	~25	1968, 78 USGS	Dion, et. al. 1984: hard copy only
pH, conductivity, temperature	39	1990, 91 DWQ	DWQ sampling records
Water levels (single meas.)	130	1980 USGS	Drost 1983, DSHS 1982: hard copy only
	~2500	Well reports	DWQ blue binders
Water levels (continuous)	14	Ecol. SW Reg'l Office	DOE pub. 90-57 (records for 1976-89); recent records also available
	40+	USGS	USGS database - summary from Drost 4/91 (records for 1978-80)

5/22/91 AS

Appendix G

Hydrogeologic Sensitive Area Criteria and Rationale

HYDROGEOLOGIC SENSITIVE AREA DESIGNATION
PROPOSED RATIONALE AND CRITERIA

The vulnerability of Clallam County's ground water resources to contamination is related to both hydrogeologic conditions and land uses. In order to evaluate the overall risk to ground water, Sweet-Edwards/EMCON, Inc. developed a preliminary qualitative aquifer vulnerability rating system. The rating system consists of ten specific hydrogeologic and land use criteria.

These criteria were developed to assist Clallam County staff in evaluating the relative potential risks to ground water quality from land use activities. For this study, criteria have been applied on a regional scale using existing information and concentrating on those areas considered as having a high potential for ground water recharge (critical aquifer recharge areas). Since hydrogeologic systems are complex and include a great many interrelated variables, a considerable amount of data and experience are required to properly evaluate hydrogeologic systems and their susceptibility to contamination. These criteria focus solely on basic regional hydrogeologic information and specific land use activities or conditions. They are general guidelines for evaluating aquifer vulnerability, and should not be construed as:

- Sole and complete grounds for changing or restricting land use activities in a specific area

- Proof that ground water contamination will or will not occur

Site- or area-specific evaluations should be performed by qualified professionals to verify the applicability of the regional vulnerability classification.

1. CRITERIA DEVELOPMENT

The hydrogeologic land use criteria categories to be considered in evaluating aquifer vulnerability include:

- aquifer separation
- depth to ground water (thickness of unsaturated zone)
- aquifer material
- beneficial use of ground water
- waste disposal sites
- hazardous waste sites
- septic tank density
- transportation corridors
- land use zoning
- irrigation ditches

Each rating criterion is further subdivided into a number of potential hydrogeologic or land use conditions that may be present in certain portions of the study area. These conditions are then assigned a qualitative rating factor from one to five, with one being the lowest risk and five being the highest. In addition, each rating criterion is given a factor multiplier depending on its relative risk importance compared to the other rating categories. The factor multipliers ranged from one to three. Table 1 shows the rating factors and factor multiplier for each rating criterion. One criterion not explicitly identified in this rating system, soil type, is included through the classification of a critical aquifer recharge area. In these areas, soil types have to be either excessively or well drained. A brief discussion for the rationale of each rating factor used is given below.

Aquifer Separation

In many portions of the Sequim-Dungeness watershed, shallow aquifers overly intermediate or deeper aquifer systems. In many cases aquitards separate the aquifers. Aquitards are geologic units that exhibit sufficiently low permeabilities, preventing the yield of water to wells and inhibiting the flow of water and contaminants between aquifers.

The areal extent of aquitards is often limited and in places may be absent. Where an aquitard is absent, aquifers may be in direct hydraulic connection, increasing the potential vulnerability of the overall aquifer system. This

Table 1

Aquifer Vulnerability Rating Criteria

Rating Criteria Categories	Rating Factor	Factor Multiplier
Aquifer Separation:		x2
None	5	
Discontinuous	3	
Continuous	1	
Depth to Ground Water:		x2
0 - 10 feet	5	
10 - 50 feet	4	
50 - 100 feet	3	
100 - 200 feet	2	
200+ feet	1	
Aquifer Material:		x2
Coarse sand and gravel	5	
Fine to coarse sand	4	
Fine sand and silt	3	
Bedrock	2	
Beneficial Use:		x2
Sole source aquifer	5	
Primary water supply aquifer	4	
Secondary water supply aquifer	3	
Minor water supply aquifer	2	
Waste Disposal Site Present:		x2
Active old facility (unlined and uncapped)	5	
Closed old facility	3	
Active new facility (lined)	1	
Hazardous Waste Site Present (MTCA Site):		x2
Confirmed site	5	
Potential hazardous waste site	3	
No hazardous waste found	1	

Table 1

Aquifer Vulnerability Rating Criteria
(Continued)

Rating Criteria Categories	Rating Factor	Factor Multiplier
Septic System Density:		x1
3+/acre	5	
1 - 2/acre	3	
1/5+ acre	1	
Transportation Corridors:		x3
Primary	5	
Secondary	3	
Local	1	
Land Use:		x2
Commercial/Industrial	5	
Urban Residential	3	
Rural Residential	2	
Forested	1	
Irrigation Ditches:		x2
Input from urban/commercial/ industrial area	5	
Input from agricultural area	3	
Input from forested area	1	

condition of hydraulic connection between adjacent aquifers, was given the highest rating factor. Where aquitards appear continuous, the potential vulnerability is lower and the rating factor was reduced.

Depth to Ground Water

The depth to the water table is proportional to the potential for ground water contamination. The deeper the ground water, the greater the opportunity for contaminant attenuation in the unsaturated zone. Contaminants may be decomposed or held fixed in the soils and sediments above the water table, unable to move downward into aquifers.

The water table that is referred to in this category is the regional water table and not ground water perched seasonally in shallow surficial soils.

Aquifer Material

This category addresses the earth materials beneath the study area and considers their permeability and the potential for contaminant attenuation. For example, unconsolidated coarse-grained material (e.g., gravel) would have a high permeability and little or no capacity for decomposing or storing attenuating contaminants (e.g., sorption, cation exchange capacity, and so forth). A fine-grained material such as clay or till would retard the downward movement of water and attenuate selected potential contaminants, particularly heavy metals.

Beneficial Use

Many areas in the Sequim-Dungeness watershed are heavily dependent on ground water for potable water, while other areas (City of Sequim) obtain their supplies from surface water sources. The dependance of an area on ground water to meet its water supplies determine the relative importance of an aquifer compared to other areas where alternative supply sources are available. All other risks being equal, an area with no feasible alternative sources of water is much more vulnerable to the potential impacts, particularly economic, from land use activities than is an area like the City of Sequim, which has an existing surface water source.

Waste Disposal Sites

Certain land use activities carry a much higher risk to ground water. Solid waste disposal facilities, particularly older ones, have historically been placed in areas where potential impacts to ground water are high. Today, technology and strict regulatory requirements have greatly reduced the risk to ground water from new solid waste facilities. The relative aquifer vulnerability from a solid waste facility can be related to such factors as age, construction, and closure conditions. The highest-risk sites are considered to be active or closed unlined and uncapped landfills. The rating factor for each site is applied to the entire area within a one-mile radius of the site boundary.

Hazardous Waste Sites

Similar to solid waste facilities, hazardous waste sites pose a relatively high potential threat to ground water quality. For this evaluation, hazardous waste facilities listed on Department of Ecology (Ecology)'s draft list (November 15, 1989) are used to evaluate aquifer vulnerability. Sites where Ecology has evidence that hazardous substances have been released to the environment (confirmed site) pose the greatest risk to underlying aquifers. As with the solid waste sites, the rating factor for a hazardous waste site is applied to the entire area within a one-mile radius of the site boundary.

Septic System Density

Septic systems present a potential threat to underlying aquifers, particularly in areas where ground water is shallow and geologic materials favor rapid infiltration and have limited attenuation capacities. For this study, septic tank densities were derived from current land use zoning patterns. Areas zoned as urban residential, commercial, or industrial have the potential for the highest septic tank densities. Forested areas have the lowest potential. Since some of the urban residential, commercial, or industrial zoned areas are served by sewers, this method is a conservative approach, which is somewhat balanced by the low weighing factor given to this criteria.

Transportation Corridors

Traffic accidents involving hazardous waste represent a significant, though infrequent, risk to ground water quality. State-wide information suggests that approximately 1 in 10,000 reported motor vehicle collisions involve vehicles transporting hazardous waste. Actual accident rates vary from roadway to roadway depending on speed limit, traffic load, and highway conditions. In the Sequim-Dungeness watershed highways and roads will be divided into three categories depending on their relative importance as a transportation route. Roads such as major state highways are classified as primary transportation corridors; these present the greatest potential risk. Areas served by roads that normally handle only local residential traffic are considered the lowest risk.

Land Use

Land use activities can have a significant impact on ground water quality. As population grows, consumptive use of ground water will increase, particularly if alternative sources are not sufficient to meet demands. The risk of contamination of ground water resources is likely to increase as development densities increase.

Using general zoning information from the Clallam County Department of Community Development aquifer vulnerability factors were assigned to each of the four major land uses. Commercial/industrial areas are given the highest (greatest risk) rating factor, while forested areas are assigned the lowest rating factor. No attempt will be made to evaluate land use activities actually occurring in any of the zoning areas. Presently, agricultural practices are allowed in each of the four zoning areas. No attempt was made to incorporate agricultural practices into the development of the criteria.

Irrigation Ditches

The Sequim-Dungeness watershed is criss-crossed with numerous irrigation ditches which may potentially receive and discharge contaminants. Previous studies (Drost 1983) have shown that water from irrigation ditches in the study area are a significant source of ground water recharge. Run-off from land use activities adjacent to the ditches may contribute contaminant loadings which increases the vulnerability of aquifer recharge areas adjacent to the ditches.

Recharge areas adjacent to irrigation ditches which have crossed (upstream) commercial/industrial zoned areas are given the highest rating factor, while forested areas are assigned the lowest rating factor. For this evaluation the average flow in each ditch is assumed to be equal.

2. General Aquifer Vulnerability Conditions

The vulnerability rating criteria will be applied to the critical aquifer recharge areas in the study area. The highest possible score would be 110. After the distribution of scores are evaluated a population mean and median score will be calculated. Based on the statistical distribution of the data the rating scores will be placed in one of three vulnerability categories:

Low
Moderate
High

The numerical ranges for each vulnerability category will be assigned after the statistical analyses of the scores is completed. Again, because of the regional nature of the data used, the results can only be expected to represent an initial attempt at defining aquifer vulnerability in the study area. As more area-specific data are available and can be evaluated, some high-vulnerability areas will likely be delineated in areas shown in this study as having low- or moderate-vulnerability. Conversely, some of the high-vulnerability areas will be determined to be at a lower risk.

Appendix H

Recharge Potential Mapping Criteria and Rationale

RECHARGE POTENTIAL MAPPING CRITERIA AND RATIONALE

MAPPING CRITERIA

Ground water systems are replenished (recharged) by the addition of water to the zone of saturation (aquifer) through precipitation, runoff, and infiltration from surface water bodies. An area in which water reaches an aquifer by surface infiltration and where there is a downward components of hydraulic head (pressure head), is considered a recharge area. The likelihood that water will infiltrate and pass through the surface materials to recharge the underlying aquifer system (recharge potential) is dependent on a number of relatively static (non-changing) physical conditions. These conditions include:

o Soil permeability

o Surfical geologic materials

o Depth to water

o Topography

For this study only existing information will be used to evaluate the occurence of these physical conditions in the Sequim - Dungeness area. In addition only the recharge potential of the uppermost aquifer system will be evaluated. The presence of a downward component of hydraulic head cannot be determined without extensive research on water levels, well completetion and well location data. In order to provide a conservative estimate, a downward component of hydraulic head is assumed to be present in all areas.
The specific approach proposed to evaluate the physical conditions are described briefly below for each condition (criterion).

Soils

The recharge potential of the surface material (soils) will be mapped by grouping soil units as defined by the Soil Conservation Service (SCS) in the Soil Survey of Clallam County Area (SCS, 1987), by recharge potential classifications. These classifications are based on the permeabilities of each soil unit, as defined by the SCS. A summary of the soil units and their recharge potential classification is provided in Table 1.

Geologic Materials

Information on the surfical geologic materials will be obtained from USGS geologic maps. The relative recharge potential of each major geologic

Table 1
Dungeness Watershed
Soil Unit Recharge Potential and Consolidation Classifications

SCS Map Symbol	SCS Soil Unit Name	Recharge Potential Classification	Consolidation Classification
1	Agnew silt loam, 0-8% slopes	L	Unconsolidated
3	Beaches	U	Unconsolidated
4	Bellingham silty clay loam	L	Unconsolidated
6	Carlsborg gravelly sandy loam, 0-5% slopes	H	Unconsolidated
7	Carlsborg-Dungeness complex, 0-5% slopes	H/M	Unconsolidated
8	Casey silty clay loam, 0-10% slopes	L	Unconsolidated
9	Cassolary fine sandy loam, 0-8% slopes	M	Unconsolidated
10	Catla gravelly sandy loam, 2-15% slopes	L	Unconsolidated
12	Clallam gravelly sandy loam, 0-15% slopes	L	Unconsolidated
13	Clallam gravelly sandy loam, 15-30% slopes	L	Unconsolidated
16	Dick loamy sand, 0-15% slopes	H	Unconsolidated
17	Dungeness silt loam	M	Unconsolidated
19	Dystric Xerorthents, extremely steep	M	Unconsolidated
20	Elwha gravelly sandy loam, 0-15% slopes	L	Unconsolidated
21	Elwha gravelly sandy loam, 15-35% slopes	L	Unconsolidated
23	Hoypus gravelly sandy loam, 0-15% slopes	H	Unconsolidated
24	Hoypus gravelly sandy loam, 15-30% slopes	H	Unconsolidated
25	Hoypus gravelly loamy sand, 30-65% slopes	H	Unconsolidated
34	Louella gravelly loam, 10-30% slopes	M	Consolidated, forms over basalt and flow breccia
35	Louella gravelly loam, 30-65% slopes	M	Consolidated, forms over basalt and flow breccia
36	Louella gravelly loam, 65-90% slopes	M	Consolidated, forms over basalt and flow breccia
38	Lummi silt loam	M	Unconsolidated

Table 1
Dungeness Watershed
Soil Unit Recharge Potential and Consolidation classifications
(Continued)

SCS Map Symbol	SCS Soil Unit Name	Recharge Potential Classification	Consolidation Classification
42	McKenna gravelly silt loam	L	Unconsolidated
43	Mukilteo muck	M	Unconsolidated
44	Neilton very gravelly loamy sand, 30-70% slopes	H	Unconsolidated
45	Neilton very gravelly sandy loam, 5-30% slopes	H	Unconsolidated
46	Neilton very cobbly sandy loam, 0-5% slopes	H	Unconsolidated
52	Pits	U	Unconsolidated
53	Puget silt loam	M	Unconsolidated
57	Riverwash	U	Unconsolidated
59	Schnorbush loam, 0-20% slopes	L	Unconsolidated
60	Schnorbush loam, 20-55% slopes	L	Unconsolidated
63	Sequim very gravelly sandy loam	H	Unconsolidated
64	Sequim-McKenna-Mukilteo complex	H/L/M	Unconsolidated
70	Terbies very gravelly sandy loam, 30-65% slopes	L	Consolidated, forms over sandstone, siltstone, and conglomerate
75	Yeary gravelly loam, 0-15% slopes	L	Unconsolidated

NOTES:
L = Low recharge potential
M = Moderate recharge potential
H = High recharge potential
U = Unclassifiable recharge potential

unit in the study area will be classified using a conservative approach that assumes internal uniformity of each unit. For example, glacial outwash will have a relatively high recharge potential even though in some areas, the outwash materials are fine grained and may not permit a significant amount of recharge. See Table 3.

Depth To Water

Depth to water below ground surface will be determined from drillers logs and previous investigations. Perched or seasonal water bearing zones will not be used. Existing water table elevation maps will be used to derive the depth to water by subtracting the elevation of the water table from the elevation of the land surface. In areas of rapidly changing topography, an average value will be used.

Topography

The effect of topography on the recharge potential will be determined by evaluating the slope of the land suface. The percent slope of an area will be determined both from information in the SCS soil survey of Clallam County and from topographic maps.

MAPPING RATIONALE

An overlay map will be prepared for each of the physical parameters (criterion). The relative recharge potential of any one area compared to another area in the Sequim - Dungeness area will then be determined using a rating system. Each criterion will be subdivided into a number of potential conditions which are present in the study area. These conditions are assigned a qualitative rating factor from 1 to 5 with 1 being the lowest recharge potential and 5 being the highest. A numerical score will then be determined for each criterion and a total score calculated. Table 2 shows the potential conditions and associated rating factor for each criterion.
After the distribution of scores are determined, the scores will be placed in one of three recharge potential catagories (high, moderate, or low). A composite map will then be prepared which shows the relative surface recharge potential of the Sequim - Dungeness area based on the total rating score.

TABLE 2
PHYSICAL CONDITIONS RATING CRITERION

Rating Criterion Catagories	Rating Factor
Soil Permeability:	
o rapid to very rapid permeablity(high)	5
o moderately slow to moderately rapid permeablity	3
o very slow to slow permeability(low)	1
Surfical Geologic Materials:	
o glacial outwash	5
o alluvium	3
o glacial till/drift	2
o bedrock	1
Depth To Water(feet):	
o 0 - 50	5
o 50 - 100	3
o > 100	1
Topography	
o < 40 %	5
o 40 - 80 %	3
o > 80 %	1

Table 3 *

Recharge Potential of Surficial Geologic Units in the Sequim Study Area

Geologic Map Symbol	Geologic Material	Recharge Potential Classification
af	Artificial fill	Unclassifiable
Qa	Alluvium	High
Qaf	Alluvial fans	High
Qb	Quarternary beach deposits	Unclassified
Qdu	Pre-Vashon diamictons, undifferentiated	Low
Qe	Everson glaciomarine drift	Low
Qes	Everson sand	High
Qgm	Pre-Vashon glaciomarine drift	Low
Qls	Landslides	Moderate
Qoa	Older alluvium	High
Qp	Peat and marsh deposits	Moderate
Qpg	Pre-Vashon gravels	High
Qps	Pre-Vashon-till sands (may include Esperence sand)	High
Qpsc	Pre-Vashon silts and clays	Low
Qu, Qsu	Quaternary deposits, undifferentiated (Qsu in Morse Creek quadrangle only)	Unclassifiable
Qv, Qvd	Vashon drift, undifferentiated	Low
Qva	Vashon advance outwash	Moderate
Qvo	Vashon outwash, undiffferentiated	High
Qvr	Vashon recessional outwash and ice-contact stratified drift	High
Qvri	Vashon recessional, ice-contact stratified gravels etc.	High
Qvt, Qvat	Vashon till (Qvat in Morse Creek quadrangle only)	Low
Qvt/b	Vashon till overlying bedrock	Low
Qvtr	Reworked Vashon till (sand and gravel/stream and lag deposits)	High
Tal	Aldwell Formation	Low
Tbm	Blue Mountain unit of Tabor and Cady (1978)	Low
Tcb	Crescent Formation basalt	Low
Ttr	Twin River Formation, undifferentiated	Low
Ttrl	Twin River Formation, lower member	Low

*Table 3 taken from the report: "Evaluation of Aquifer Recharge and Geologic Hazards, Clallam County"

Appendix I

Management Programs Relating to Ground Water Quality and/or Quantity

MANAGEMENT PROGRAMS RELATING TO GROUND WATER QUALITY AND/OR QUANTITY

Prepared for

Clallam County, Washington

Prepared by

Adolfson Associates, Inc.

December 3, 1990

GROUND WATER MANAGEMENT RELATED ACRONYMS

APA - A taxing district established under authority of RCW Title 36 by a simple majority of voters within a geographic area for purposes of funding ground water protection activities.

CAPA - A Critical Aquifer Protection Area established under the federal Safe Drinking Water Act. A CAPA is a highly vulnerable or sensitive recharge area within a Sole Source Aquifer boundary.

CWSP - A Coordinated Water System Plan developed under the Washington Public Water Supply Coordination Act of 1977 (RCW 70.116).

CWSSA - A Critical Water Supply Service Area established under the Washington Public Water Supply Coordination Act of 1977 (RCW 70.116). A CWSSA is an area that has been determined to have significant problems concerning water quality, unreliable public water service, or a lack coordinated public water system planning.

DOH - The Washington Department of Health (Formerly Department of Social and Health Services (DSHS)).

EPA - The U.S. Environmental Protection Agency.

Ecology - The Washington Department of Ecology (formerly referred to as DOE).

GSA - A Geologically Sensitive Area established by the Clallam County Board of Health. A GSA is an area that is unusually vulnerable to aquifer, drinking water supply, or surface water contamination.

GWAC - A Ground Water Advisory Committee formed under provisions of WAC 173-100. The GWAC is the oversight group for development of a Ground Water Management Program.

GWMA - A Ground Water Management Area established under provisions of WAC 173-100. The GWMA is the designated planning area for a Ground Water Management Program.

GWMP - A Ground Water Management Program prepared under procedures found in WAC 173-100.

SEPA - The State Environmental Policy Act, RCW 43.21C. SEPA is administered in the Sequim/Dungeness area under rules established by Ecology in WAC 197-11 and under regulations contained in Clallam County Code 27.01.

SPA - A Special Protection Area established under the Washington Ground Water Quality Standards, WAC 173-200. SPAs are areas where special consideration may be given by Ecology in regulating activities, developing regulations, and allocating Ecology resources for ground water quality protection activities.

SSA - A Sole Source Aquifer designated by the Environmental Protection Agency under the Safe Drinking Water Act.

WHP - A Wellhead Protection Program developed under provisions of the 1986 Safe Drinking Water Act Amendments.

WHPA - A Wellhead Protection Area delineated for protection under provisions of the Wellhead Protection Program of the 1986 Safe Drinking Water Act Amendments.

WUCC - A Water Utility Coordinating Committee appointed under provisions of the Washington Public Water Supply Coordination Act of 1977 (RCW 70.116) to oversee development of a Coordinated Water System Plan.

GROUND WATER QUALITY AND/OR QUANTITY MANAGEMENT PROGRAMS

There are a number of existing or emerging state and federal ground water management and protection programs that could be considered for implementation in the Sequim/Dungeness area. These state and federal programs include:

- The Sole Source Aquifer Program of the Safe Drinking Water Act,
- Environmentally Sensitive Area provisions of the State Environmental Policy Act,
- Aquifer Protection Areas under Title 36 RCW,
- The Wellhead Protection Program of the Safe Drinking Water Act Amendments of 1986,
- Coordinated Water System Planning under the Public Water Supply Coordination Act of 1977, and
- The State's Ground Water Management Program.

The following is a summary of these programs.

SOLE SOURCE AQUIFER PROGRAM

The Sole Source Aquifer (SSA) Program was established under section 1424 (e) of the Safe Drinking Water Act of 1977 and is administered by the Environmental Protection Agency (EPA). The intent of this program is to prevent federal financially assisted projects from contaminating aquifers representing the sole or principal source of drinking water for an area.

In order to qualify under the Sole Source Program, an aquifer must meet the following basic criteria:

1) It must supply 50% or more of the drinking water consumed within the area for which the aquifer is supplying water, and

2) Alternative sources of drinking water must be of inadequate quantity or not be economically feasible to develop as a replacement for the aquifer.

When those two basic criteria are met, the EPA Administrator is authorized to declare a ground water system to be a Sole Source Aquifer upon receipt of a petition requesting such a designation. The petition must contain sufficient technical documentation to demonstrate that the aquifer meets the criteria for Sole Source designation. A petition can be submitted by any individual, corporation, company, partnership, municipality, state, or federal agency.

A Sole Source Aquifer designation provides only limited direct protection of ground water quality, specifically, preventing federal financially assisted projects from contaminating underlying ground water. Federal financially assisted projects are projects for which the federal government is providing a portion, but not 100%, of the funding. An example of a project with federal financial assistance would be a highway construction project funded jointly by the federal government and the State of Washington.

Within the boundaries of a Sole Source Aquifer, EPA will review all federal financially assisted projects to determine their potential for contaminating the aquifer. Should it be determined that a project may contaminate the aquifer, the commitment for federal financial assistance may be withdrawn unless mitigation measures are implemented.

Probably the most beneficial aspect of a Sole Source Aquifer designation is its indirect impact on public awareness. Sole Source Aquifer designation can help people to recognize that an aquifer is unique or valuable and is worthy of protection. The designation can serve as a rallying point around which support for ground water protection and management efforts can coalesce.

Sole Source Aquifer designation may also increase opportunities for future federal grant funding for aquifer protection activities. The 1986 Safe Drinking Water Act Amendments created a new grant program to fund demonstration projects designed to protect vital portions of Sole Source Aquifers, termed Critical Aquifer Protection Areas (CAPA's). However, in spite of its inclusion in the 1986 Safe Drinking Water Act Amendments, Congress has not yet appropriated funding for the grant program.

There are currently six Sole Source Aquifers in Washington State including: Spokane Valley/Rathdrum (Spokane County), Camano Island (Island County), Whidbey Island (Island County), Cross Valley (Snohomish County), Newberg (Snohomish County), and Cedar Valley (King County). The Cedar Valley Sole Source Aquifer includes portions of the South King County GWMA. EPA has been petitioned to designate two additional Sole Source Aquifers in Washington State, Western Pierce County and Tulalip (Snohomish County).

<u>Boundary Delineation Procedures</u>. EPA recently established new policies concerning Sole Source Aquifer boundary delineation that affect the program's suitability for use in the Sequim Dungeness area. EPA now requires that a Sole Source Aquifer must be demonstrably separate from other aquifer systems. Sole Source Aquifer boundaries are now based on regional ground water divides such as the crest of mountain ranges, marine waters, or major rivers in deeply incised valley.

If Sole Source Aquifer designation is pursued, the boundaries of the aquifer would be many times larger than the Sequim/Dungeness Area. Based on EPA policies, the southern boundary would likely be the Olympic Mountains, the northern boundary the Straits of Juan de Fuca, the western boundary Morse Creek or the Elwha River, and the eastern boundary the Lake Leland/Discovery Bay trough.

Such a large Sole Source Aquifer area would have several potential draw backs. First, should the City of Port Angeles be included within the boundary, the area may not qualify as a Sole Source Aquifer because EPA might consider the city's Elwha River Ranney Well system to be a surface water source of drinking water. Secondly, the public awareness value of Sole Source designation would be diminished because attention would be focused on a large portion of the entire northern Olympic Peninsula rather than on the Sequim/Dungeness area. However, the latter problem could be partially rectified by seeking Critical Aquifer Protection Area status for Sequim/Dungeness area.

ENVIRONMENTALLY SENSITIVE AREA DESIGNATION UNDER THE STATE ENVIRONMENTAL POLICY ACT

The State Environmental Policy Act (SEPA) (RCW 43.21C) is intended to provide decision makers and the public with sufficient information to evaluate the environmental consequences of proposed land, air, or water-use activities; particularly when those activities involve an action by a governmental agency. The provisions of SEPA attempt to outline a process for distinguishing between actions that are likely to have a significant adverse environmental impact and those that are not.

The State Legislature authorized the Department of Ecology (Ecology) to develop rules for the implementation of SEPA. The rules that were subsequently developed and adopted by Ecology (WAC 197-11) are intended to:

1) Provide a uniform environmental review process in all political jurisdictions within the state,

2) Help define what constitutes a significant adverse environmental impact, and

3) Outline the content of environmental documents prepared under SEPA.

Categorical Exemptions. In developing the SEPA rules, Ecology determined that some classes or types of activities, because of their size or nature, are not likely to represent a significant environmental impact and should, under ordinary circumstances, be exempt from SEPA requirements. Section 197-11-800 (WAC) of the SEPA rules contains a list of the exempted types of activities, termed categorical exemptions. The categorical exemptions include some activities, such as construction of farm buildings of less than 10,000 square feet and commercial buildings of less than 4,000 square feet, that could potentially represent a significant adverse environmental impact in areas of unusual ground water sensitivity.

The Clallam County Environmental Policy, Clallam County Code (CCC) Chapter 27.01, adopts the state SEPA Rules by reference including sections pertaining to categorical exemptions. However, CCC Chapter 27.01.080 grants the Clallam County Planning Director considerable discretion in determining those activities which must undergo environmental review and those which are exempt.

Environmentally Sensitive Areas. Since some areas of the state are unusually vulnerable to the adverse affects of land and water-use activities, Section 197-11-908 (WAC) of the SEPA regulations grants authority for counties and cities to designate certain portions of their jurisdictions as Environmentally Sensitive Areas. In designating a portion of their jurisdictional area to be Environmentally Sensitive under SEPA, a county or city can eliminate some or all of the categorical exemptions found in Section 197-11-800 (WAC). CCC Chapter 27.01.290 establishes the process for designation of Environmentally Sensitive Areas within Clallam County but does not make direct reference to categorical exemptions.

In addition to the elimination of certain categorical exemptions, an Environmentally Sensitive Area designation may provide several important benefits for an area of ground water vulnerability. It would assist in raising the level of awareness of both the public and governmental agencies regarding the sensitivity of the aquifer system to contamination from overlying land-use activities. Additionally, the Clallam County Commissioners could adopt a ground water policy framework concerning land and water-use activities that potentially affect the viability of an aquifer that has been declared to be environmentally sensitive. That policy framework could be referenced in CCC Chapter 27.01. The ground water policy framework would provide substantive authority for requiring mitigation of probable adverse environmental impacts under SEPA.

AQUIFER PROTECTION AREAS

The 1986 Washington State Legislature adopted Substitute House Bill 1116 which provided the authority for creation of local Aquifer Protection Areas (APAs) to help establish a funding base for ground water protection, preservation, and rehabilitation programs. An Aquifer Protection Area can only be established through an election ballot issue requiring approval by a simple majority of voters.

Within an Aquifer Protection Area, a county can collect a modest user fee on water connections and septic tanks. Collected revenues can be distributed to all political jurisdictions within the Aquifer Protection Area.

Revenues generated through an Aquifer Protection Area can be used for preparing ground water protection plans, constructing ground water treatment facilities, constructing wastewater treatment facilities, and monitoring and inspecting on-site sewage treatment systems. As currently written, the law does not specifically authorize the use of Aquifer Protection Area revenues for ground water monitoring or for management programs to control pollution sources such as underground storage tanks, hazardous wastes, or agricultural practices.

During the 1990 legislative session, a bill was introduced to broaden the language of the original Aquifer Protection Area legislation to allow funding of ground water monitoring programs, ground water protection programs, and the construction of public water systems. The bill, Substitute House Bill No. 2724, failed to pass but may be reintroduced in the future.

WELLHEAD PROTECTION PROGRAM

Section 1428 of the 1986 amendments to the Safe Drinking Water Act established a Wellhead Protection (WHP) Program intended to safeguard ground waters that supply public water system wells or wellfields. Section 1428 requires each state to develop and implement a Wellhead Protection Program in accordance with criteria established by the Environmental Protection Agency (EPA).

The first step in implementation of a Wellhead Protection Program is to establish the physical area to be protected, the Wellhead Protection Area (WHPA). A WHPA is defined in the Safe Drinking Water Act as "the surface and subsurface area around a well or wellfield supplying a public water system through which contaminants are reasonably likely to move toward and reach such water well or wellfield".

EPA has established the following goals for WHPA delineation:

1) To provide a <u>remedial action zone</u> around a well or wellfield to allow adequate cleanup response time in the event of a contaminant release,

2) To provide an <u>attenuation zone</u> to reduce concentrations of known contaminants in ground water before they reach the wellhead, and

3) To provide a well or wellfield <u>management zone</u> for regulating land-use in all or part of a well or wellfield's existing or potential recharge area.

The boundaries of WHPAs will be established through use of any of a number of criteria including distance of contaminant travel, time of contaminant travel, the extent of aquifer drawdown, flow system boundaries, and the capacity of the aquifer to assimilate or attenuate contaminants. The Washington Department of Health (DOH) and the Department of Ecology (Ecology) will select the criteria or combination of criteria that will be used to delineate WHPAs and determine what specific threshold levels will be established for each criteria.

EPA envisions that once a WHPA has been delineated, a management program will be developed outlining strategies for protection of the well or wellfield from three categories of threats: (1) the direct introduction of contaminants around the well casing, (2) microbial contaminants, and (3) chemical contaminants.

The immediate vicinity of the well or wellfield should be protected from accidental spills and road runoff. The magnitude of management activities that will be necessary in the remainder of the WHPA will be determined through an inventory of existing contamination sources within the WHPA boundaries. For areas that are undeveloped or under-developed, the potential future land-use of the WHPA must be considered.

EPA recommends a number of tools that could be implemented by local governments to control sources of pollution in a WHPA including: zoning ordinances, facility design standards, prohibition of land-use categories, purchase of property or development rights, and public education.

The Wellhead Protection Program for Washington State is not sufficiently developed to ascertain its specific approach to land-use management within a WHPA. It is currently estimated that the development of the state program will require an additional two years of preparation (Rowe, 1990). However, it is already apparent that there is a significant obstacle to the successful implementation of this program; public water systems generally lack land use management authority.

Municipal purveyors such as the City of Sequim can easily implement a Wellhead Protection Program designed to safeguard municipally owned wells, provided, those wells are located within their corporate boundaries. However, in unincorporated areas where public well owners do not control surrounding land-use, the success of a Wellhead Protection Program will depend upon the willingness of Clallam County government to impose necessary land-use restrictions. Considering the numerous public water system wells within Clallam County, there may be some reluctance on the part of the county to embark on a program of "spot" or "micro" zoning because of the difficulty in administering such a program.

DOH and Ecology recognize the potential difficulties associated with implementation of a Wellhead Protection Program in unincorporated areas and are developing strategies to facilitate county acceptance of the program (Rowe, 1990). These strategies include requesting the Washington State Legislature to provide explicit authority for counties to implement Wellhead Protection requirements and to provide financial incentives and assistance for local government involvement in Wellhead Protection Programs.

WATER SUPPLY COORDINATION ACT/ COORDINATED WATER SYSTEM PLAN

In 1977, the Washington State Legislature passed the Public Water System Coordination Act (RCW 70.116). The purpose of this act was:

1) To provide for the establishment of Critical Water Supply Service Areas based on the need for water utility planning,

2) To provide for the development of minimum public water system planning and design standards to ensure that public water systems are developed in accordance with regional needs, and

3) To assist public water systems in meeting reasonable standards for quality, quantity, and pressure.

The Public Water Supply Coordination Act created a step-by-step process to facilitate planning among water utilities and to assist water utilities in providing future water service in the most efficient manner possible.

Under the Public Water Supply Coordination Act, jurisdictional county governments or the Washington Department of Health (DOH) may initiate a Preliminary Assessment of water system needs within a geographic area to identify problems associated with water quality, unreliable public water service, or lack of coordinated water system planning. Based on the findings of the Preliminary Assessment, a county government, in conjunction the with DOH, may declare an area to be a Critical Water Supply Service Area (CWSSA). Once the external boundaries of the CWSSA have been formalized by the county legislative authority, no new public water systems can be created unless existing systems are unable to provide service in a timely and reasonable manner.

The CWSSA external boundaries define the area for which a Coordinated Water System Plan (CWSP) must be developed. A CWSP is intended to:

o Delineate existing and future service areas for public water systems,

o Establish uniform water system design standards, and

o Coordinate public water system planning with land-use planning.

The Coordinated Water System Plan provides individual public water systems with a firm planning base for determining the level of required water resources as well as the extent of utility capital improvements (mains, storage facilities, etc.) that will be necessary to meet future demand associated with population growth within their existing and future service areas. The Coordinated Water System Plan also identifies local and regional water supply options for water utilities when it appears that existing, developed water resources will not be adequate to satisfy future demand.

Oversight of Coordinated Water System Plan development is provided by a Water Utility Coordinating Committee (WUCC) appointed by the county legislative authority. The membership of the WUCC must include representation from:

o The county legislative authority;

o The county planning Agency;

o The county health agency;

o Water utilities with over 50 service connections;

o DOH;

o Other agencies, utilities, or interested persons appointed at the discretion of the county or DOH.

GROUND WATER MANAGEMENT PROGRAMS
(WAC 173-100)

Under amendments to the Regulation of Public Ground Water Act (RCW 90.44), the 1985 Washington State Legislature established a process for the development of Ground Water Management Programs (GWMPs). The legislation was intended to set forth procedures for development of ground water management strategies that are consistent with both local needs and state water resource policies and management objectives. Such strategies should provide for protection of water quality, assurance of quantity, and efficient management of resources to meet future needs.

Ground Water Management Programs must be developed under procedural regulations that have been established by the Department of Ecology (WAC 173-100). Under the Ecology regulations, local governments, water user groups, or the state can request that certain geographic regions be declared Ground Water Management Areas (GWMAs). The request must document the ground water quantity and quality problems of the region. The Department of Ecology is authorized to accept the request and declare a geographic region to be a Ground Water Management Area provided that it meets any or all of the following criteria:

1) Geographic regions where ground water quality is threatened;

2) Aquifers that are declining due to restricted recharge or over-utilization;

3) Aquifers where over-appropriation may have occurred and adjudication of water rights has not yet been completed;

4) Aquifers reserved or being considered for water supply reservation under chapter 90.54 RCW for future beneficial uses;

5) Aquifers identified as the primary source of supply for public systems;

6) Aquifers underlying a Critical Water Supply Service Area where a Coordinated Water System Plan (established pursuant to Chapter 70.116 RCW) has identified the need for a Ground Water Management Program;

7) Aquifers designated as Sole Source Aquifers by EPA;

8) Geographic regions where the ground water is susceptible to contamination or degradation due to land use activities;

9) Aquifers threatened by sea water intrusion; and

10) Aquifers from which major ground water withdrawals have been proposed or appear imminent (WAC 173-100-050).

Once a region has been declared to be a Ground Water Management Area, the Department of Ecology, with concurrence of the jurisdictional county or counties, selects a lead agency for coordinating and undertaking the activities necessary for development of the program. The Department of Ecology in cooperation with the lead agency and affected local governments appoints a Ground Water Advisory Committee (GWAC) to oversee development of the Ground Water Management Program.

WAC 173-100-090 stipulates that the membership of the GWAC must represent a broad spectrum of public interests. The GWAC should consist of representatives from the following groups:

1) Local government legislative authorities within the designated area (eg. County Commissioners, City Councils);

2) Planning agencies having jurisdiction within the designated area;

3) Health agencies having jurisdiction within the designated area;

4) Ground water user groups within the designated area, including domestic well owners;

5) The Department of Ecology;

6) Other local, state and federal agencies;

8) Tribal governments, where a ground water management program may affect tribal waters; and

9) Public and special interest groups such as agriculture, well drilling, forestry, environmental, business and/or industrial groups within the area.

The purpose of the GWAC is to advise and assist the lead agency in the development of the Ground Water Management Program and to help to achieve consensus on critical issues. The broad based composition of the GWAC is consistent with the stated intent of WAC 173-100 to "forge a partnership between a diversity of local, state, tribal, and federal interests in cooperatively protecting the states ground water resources".

To assist in financing the development of a Ground Water Management Program, the state can make available 50 percent Centennial Clean Water Act Grants to the lead agency. The 50 percent grants must be matched with either direct financial participation by local governments or water user groups or through some form of local in-kind services.

The initial step in the development of the Ground Water Management Program is to identify and evaluate the severity of all existing and potential ground water quality and quantity problems in the Ground Water Management Area. Goals and objectives are then developed for addressing each problem, and alternative management strategies are identified for achieving the goals and objectives.

Alternative management strategies may include:

- o Proposed ordinances;
- o Proposed changes to existing ordinances or legislation;
- o Interagency agreements;
- o Recommended governmental policy statements;
- o Proposed amendments to local comprehensive plans, Coordinated Water System Plans, and basin management programs.

The alternative management strategies are screened or evaluated based on effectiveness, cost, ease of implementation and other factors. The GWAC selects a group of preferred or recommended alternative management strategies and develops plans for the implementation of each strategy. The preferred alternatives and the implementation plans collectively become the draft Ground Water Management Program.

Once a draft Ground Water Management Program has been completed, affected local governments (counties, cities, water districts, etc.) are given 90 days to concur with the program. After the concurrence process is completed, the Department of Ecology can certify the Ground Water Management Program. Following certification, state agencies and units of local governmental are required under WAC 173-100-120 to implement the provisions of the Ground Water Management Program. The state procedural regulations concerning Ground Water Management Programs require periodic review and update of those programs.

The Ground Water Management Program is different than other management structures described in this document in that it is comprehensive in nature. It allows a wide variety of regional water quantity and quality issues to be addressed within a single management framework.

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GROUND WATER MANAGEMENT PROGRAMS

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Appendix J

Nitrate Loading Model Documentation

NOTE: THIS IS A FINAL DOCUMENT

DRAFT

CLALLAM COUNTY
Dungeness Aquifer
Analytical Nitrate Loading Model Documentation

PURPOSE OF THE MODEL

The model has been developed to estimate annual nitrate-nitrogen loads infiltrating from surface sources in the Dungeness aquifer and to estimate the nitrate-nitrogen concentration in ground water when nitrate from the infiltrating sources are added to the background concentration in ground water.

Surface sources of infiltrating nitrate include general agricultural activity, animal husbandry, natural biological land cover sources, atmospheric contributions, ditch seepage, residential lawns and pets, and residential , commercial, and industrial septic systems. Agricultural activity is classified into the following farm types: general agriculture, row crops, field crops, alfalfa, and pasture. Biological sources are generically classified as cover type 1 and cover type 2. Cover type 1 is described as fir/oak forest. Type 2 has not been described at this time. Septic sources are classified by zoning type:

- RR1
- RR2
- RR3
- UR1
- UR2
- UR3
- C1
- C2
- M1
- F1
- F2
- F3
- X (unzoned residential areas).

CALCULATIONS

The calculations of nitrate-nitrogen loading is arranged on the spreadsheet into rows and columns. Each row corresponds to the calculations for a specific parcel of land. Each parcel is identified by township and range, section, and subsection or parcel. The total area in acres for each parcel is required, since the calculations are on a per-acre basis.

The model can be used on either a quarter section containing a parcel or on the parcel itself. The level of accuracy of prediction will vary with size. Until field tested, the size range for use should be 10 to 640 acres.

Certain information must be supplied by the user. The information can be classified broadly into two classes: default or global parameters and row specific values. The entry area at the top right corner of the spreadsheet contains the parameters used by all row calculations. These are the default global parameters. Parcel-specific information is entered where needed in each row of calculations. Data that needs to be entered is indicated by an "X" at the top of the column.

GLOBAL PARAMETERS

The global parameters and their initial or default values in the entry area are as follows:

Table 1

Global Parameters/Default Values

Nitrate-N loading from farm animals[1]	2.0 lb/ac/yr
Nitrate-N loading from cover type 1[2]	5.9 lb/ac/yr
Nitrate-N loading from cover type 2[3]	0.0 lb/ac/yr
Nitrate-N loading from the atmosphere	4.9 lb/ac/yr
Rate of irrigated water seepage from ditches[4]	796.4 ft^3/ft/yr
Concentration of nitrate in ditches[5]	1.0 mg/L
Nitrate loading from residential lawns[6]	4.4 lb/ac/yr
Nitrate loading from residential pets[7]	2.4 lb/ac/yr
Nitrate loading from residential septic systems	7.9 lb/du/yr
Hydraulic conductivity[8]	0.01 cm/sec
Water table gradient[8]	-0.008 ft/ft
Nitrate concentration in ground water[9]	0.5 mg/L
Annual rainfall infiltration rate[10]	0.28 ft/yr

1 Applied to General Agriculture and Pasture areas only. From Soil Conservation Service Data.
2 Oak-fir forest
3 Non defined
4 If no value is given for the number of feet of ditch in the parcel, the model assume a value equal to the square root of the area.
5 From Soil Conservation Service Data
6 Assumes equal lawn area for RR1, RR2, and RR3 areas only.
7 Assumes equal pet density for RR1, RR2, and RR3 areas only.
8 Used in calculating velocity and under flow volume.
9 From USGS data
10 From USGS/NOAA data

All these values are default parameter values and should be changed only if more accurate values become available. Note that nitrate loading from residential septic systems is expressed in terms of pounds per dwelling unit per year. Values for other zoning types are based on the "equivalent number of dwelling units. Note also that the water table gradient is a negative quantity, indicating a vertical drop per unit horizontal distance. Finally, units conversions are performed in the cells adjacent to ditch concentration, conductivity, and underflow concentration; the contents of these unit conversion cells should not be altered since these values are used in spreadsheet calculations. All entries should be converted to the units shown.

The remaining global parameters in the entry area are for agricultural loadings by farm type and the number of dwelling units per acre by zoning type. The default parameter values for agricultural nitrate loadings have been set at 10 lb/ac/yr for each farm type (agricultural, row crop, field crop, alfalfa, and pasture). These values should be changed based on newer data. The equivalent number of dwelling units per acre by zoning type are as follows:

Table 2

Equivalent DUs/Acre by Zoning

RR1	0.21
RR2	0.41
RR3	1.00
UR1	2.00
UR2	2.00
UR3	4.76
C1	3.45
C2	3.45
M1	3.45
F1	0.05
F2	0.11
F3	0.21
X	0.00

The above global parameters apply to all land parcels if it has the land use in question.

Parcel Specific Data

Values for a specific parcel of land must be entered into the spreadsheet within the appropriate row. The columns requiring row specific information are identified by an "X" in the table heading and include the following:

- Township and range, section, sub-section
- Total acreage for each parcel
- Percent acreage by farm type (agricultural, row crops, field crops, alfalfa, and pasture). The default values are indicated in the initial row.
- Percent acreage of biological/land cover areas by cover type, for which initial default values are indicated in Row 1.
- Percent acreage of residential area by zoning type, for which initial default values are indicated in Row 1.

Note that all these values must be entered as a percent of the total parcel size, e.g., if there are 4 acres of C1 and the parcel size is 160 acres, enter 2.5 percent. Note also that the allocation of acreage into components (agricultural, natural cover, zoned land, other) should total 100 percent. The default landuse component values are as follows:

- 20 percent of the parcel in agricultural usage with the following breakdown:

  - 4 percent agriculture (Ag)
  - 4 percent row crops (R)
  - 4 percent field crops (F)
  - 4 percent alfalfa (Af)
  - 4 percent pasture (P)

- 20 percent of the parcel in natural biological cover areas with the following breakdown:

  - 20 percent cover type 1
  - 0 percent cover type 2

  Note that unless a cover type 2 is defined, this percent will always equal 0 percent.

- 60 percent in residential areas, with the following breakdown:

  - 5 percent RR1
  - 5 percent RR2
  - 5 percent RR3
  - 5 percent UR1
  - 5 percent UR2
  - 5 percent UR3
  - 5 percent C1
  - 5 percent C2
  - 5 percent M1
  - 5 percent F1
  - 5 percent F2
  - 5 percent F3
  - 0 percent unzoned

Note that the sum of percent acreage for RR1, RR2, and RR3 is used in calculations for pet and lawn loading, and the sum of the acreage for general agriculture and pasture (Ag and P) is used for agricultural animal calculations.

At the far right of each row (columns ___ to __) are a summary of the calculations showing annual nitrate-N loads from infiltrating sources, total infiltrating nitrate-N load, and an estimate of the resulting ground water nitrate concentration.

The nitrate-N concentration in ground water beneath the parcel is calculated assuming all infiltrating loads are evenly mixed in a volume of water composed of underground flow, ditch seepage and rainfall infiltration. The values for these aquifer volumes is shown. The aquifer under flow volume is based on an assumption of a 20-foot-thick upper aquifer zone.

The symbols used in this area of the spreadsheet are summarized as follows:

- Ag - total agricultural loading

- An - animal husbandry loading

- Nt - natural cover loading (biological)

- Atm - atmospheric loading

- Dt - ditch loading (from seepage)
- Lw - lawn loading
- Pt - pet loading
- Rs - residential loading

As noted previously, the length of ditches in a land parcel is assumed to equal the square root of the area composing the parcel expressed in feet unless expressly calculated; ditch loads are calculated as the square root of area times the seepage rate times the ditch nitrate-N concentration. Total nitrate-N load is the sum of the nitrate loads from each of the infiltrating nitrate sources (background underflow, ditch seepage, and land surface sources).

CALCULATIONS

The remaining calculations, leaving out unit conversions, are performed as follows:

- Ditch load and the sum of the remaining loads (Ag+An+Nt+Atm+Lw+Pt+Rs) are given.
- Underflow load is calculated as the ground water nitrate concentration times the calculated underflow volume. Infiltrating load equals the calculated total land surface loading. Underflow concentration is given a default value of 0.5 mg/L but can also be calculated if upgradient well data are available to give a "real" concentration value.
- Ditch volume is calculated as ditch seepage rate times the total length of ditches in the parcel.
- Infiltrating volume is calculated as infiltration rate times the area composing the land parcel.
- Underflow volume is calculated as the negative product of conductivity times gradient times the square root of the area composing the land parcel.
- The downgradient concentration is calculated as the sum of the ditch, infiltrating, and underflow loads divided by the sum of ditch, infiltrating, and underflow volumes.

COMMENTS

purport

The model has not been calibrated at this time and should be used judiciously, primarily to compare the relative size of impacts of proposed changes. In particular, until the default global parameter values are refined and the model calibrated, the model does not ~~propert??~~? to represent actual concentration impacts with a great deal of accuracy. However, since the model is systematic and based on "reasonable" values, the relative impacts of different scenarios should be more reliable.

DRAFT

Appendix K

Review and Recommendations for Parkwood Monitoring Program

MEMORANDUM

TO: Bill White
DATE: June 13, 1991

FROM: Jim Bailey

RE: Review of Parkwood Monitoring Plan
Proposed Ground Water Monitoring
Parkwood Adult Community
Clallam County, Washington

At your request, Sweet-Edwards/EMCON, Inc. (SE/E) has completed a preliminary review of the ground water monitoring portions of the following two documents:

- Parkwood waiver request, February 7, 1989, prepared by Northwestern Territories, Inc. (NTI)
- Operation and Maintenance Manual, December 1989, prepared by Northwestern Territories, Inc. (NTI)
- First Quarter, 1990 Parkwood sewage flow and ground water monitoring report.

It is apparent that NTI has prepared a fairly comprehensive plan to monitor sewage flow and ground water quality at the Parkwood site. Based on the documents SE/E has reviewed, some additional clarification is needed. In addition, SE/E recommends certain modifications to the monitoring plan.

1. A Sampling Plan should be prepared that includes a quality assurance (QA) program and sampling methodologies plan to ensure that all ground water quality samples are collected uniformly and that all data are scientifically defensible.

2. A site plan showing well locations, drainfield(s), site layout and adjacent land use should be attached to all ground water quarterly sampling reports.

3. Prepare an assessment/justification for using the sampling wells identified in the above two documents. The evaluation should address the following:

   - Do the wells meet minimum Ecology standards for construction of wells (WAC 173-160)?

   - Is the screened zone of each well located in the upper portion of the uppermost aquifer?

   - Where is the location of ground water sample collection with respect to each well (i.e., at well head after pressure tank, at outside faucet, inside house . . .)?

4. At the time of ground water sample collection, the following field measurements should be collected and presented in quarterly sampling reports for each well:

   - pH, temperature, specific conductance

   - Depth to ground water (measured to nearest 0.10 foot

5. A survey for vertical elevation of each well be completed at reference point location where depth to ground water level measurements are collected.

6. Based on ground water elevations for each well and for each quarterly sampling event, a ground water elevation contour map should be prepared showing direction of ground water flow. A discussion of the effectiveness of the downgradient well locations should be included.

7. At a minimum, the following parameters should be tested during each sampling event.

   - Nitrate
   - Chloride
   - Sulphate
   - Total dissolved solids

- pH
- specific conductance
- Total/fecal coliform

8. Presently, it is our understanding that there are three upgradient wells (M-1, M-2, and M-3) and two downgradient wells (M-4 and M-5). At least one additional downgradient well should be added to the monitoring network. The locations of the downgradient wells must be positioned (and screened) in order to assess potential impacts from the drainfield to the uppermost aquifer.

9. An additional upgradient monitoring well located between the Parkwood and Green Acres development would be useful to evaluate ground water flow directions and water quality conditions in this area. A previous flow map show a ground water divide in this area which, if shifted to the north, would make Green Acres upgradient of the Parkwood site. In exchange for a well in this area, one of the other upgradient wells, ideally M-1, could be dropped.

Appendix L

Evaluation of On-Site System Standards

EVALUATION OF
CLALLAM COUNTY ENVIRONMENTAL HEALTH DIVISION
ON-SITE SEWAGE DISPOSAL SYSTEM STANDARDS

PREPARED BY:

ADOLFSON ASSOCIATES, INC.

IN COLLABORATION WITH

SWEET-EDWARDS/EMCON, INC.

PREPARED FOR:

CLALLAM COUNTY

DEPARTMENT OF COMMUNITY DEVELOPMENT

OCTOBER 25, 1991

(incorporates data available as of June 4, 1991)

ADOLFSON ASSOCIATES, INC.
MEMORANDUM

ADDENDUM

TO: Ann Soule

OF: Clallam County DCD Water Quality Division (683-2037)

FROM: Derek Sandison

DATE: 6/7/91

SUBJECT: Report Concerning Adequacy of On-Site Sewage System Regulatory Framework

In the draft document, I omitted one recommendation concerning possible improvements of the Environmental Health Division Regulations (CCHR Chapter 4). The recommendation concerns a section of CCHR 4 (030) that establishes deviation from the Class B freshwater quality standards for surface waters as the threshold for determining when contamination of water is of public health significance. I would recommend that, with respect to ground water, contamination of public health significance should be determined by deviation from the drinking water maximum contaminant levels established in the Rules and Regulations of the State Board of Health Regarding Public Water Supplies (WAC 246-290) or the numeric ground water Criteria contained in the Water Quality Standards for the State of Washington (WAC 173-200).

This recommendation will be included in the final draft of the above referenced document.

INTRODUCTION

The purpose of this report is to assess the consistency of the on-site sewage regulations utilized by the Clallam County Department of Community Development Environmental Health Division with applicable state regulations concerning on-site sewage disposal. The assessment is comprised of several parts. First, a direct comparison is made between the content of Washington State Board of Health On-Site Sewage System Regulations and Chapter 4 of the Clallam County Health Regulation. Second, the review of the Environmental Health Division's On-Site Sewage Program conducted in 1988 by the Washington State Department of Health is analyzed to provide insight into the procedural and administrative aspects of the local program. Finally, the provisions of the new Washington State Ground Water Quality Standards (WAC 173-200) are summarized and the manner in which those standards will impact local on-site sewage disposal management programs is assessed. The report concludes with recommendations concerning potential modifications to the local on-site sewage program that might be prompted by state regulations or policy.

By way of background, the regulatory framework for management of on-site sewage disposal in Washington State is presented in the following section.

EXISTING REGULATORY FRAMEWORK

Regulatory responsibility for on-site sewage disposal system use in Clallam County is divided among the Department of Ecology (Ecology), the Washington State Department of Health (DOH) (formerly the Department of Social and Health Services (DSHS)), and the Clallam County Environmental Health Division (CCEHD). Primary jurisdictional authority is apportioned among each of these departments based upon on-site sewage system capacity.

SYSTEMS RECEIVING 14,500 OR MORE GALLONS PER DAY FLOW

Ecology is responsible for the largest on-site sewage systems, those with common point wastewater flows of 14,500 gallons per day or more (*). These systems are regulated under the State Waste Discharge Program (WAC 173-216).

Ecology's regulations governing submission of plans and reports for construction of wastewater facilities, WAC 173-240, have virtually precluded the use of such systems since 1983. WAC 173-240-035 states that:

> "Domestic wastewater facilities utilizing subsurface sewage treatment and disposal, as defined in WAC 173-240-020(5), are prohibited

except under those extraordinary circumstances where no other reasonable alternatives exist".

WAC 173-240-035 also requires public ownership, operation, and management of such systems.

If a project proponent can demonstrate that no other alternative to a 14,500 or more gallons per day system exists and could arrange for public management, Ecology would require the preparation of a thorough engineering report for the proposed system. The engineering report must demonstrate that through a combination of natural attenuation of pollutants and treatment technology, operation of the system will not adversely affect the beneficial uses of underlying ground water and will not result in a violation of primary drinking water standards.

In October of 1990, Ecology adopted new regulations for ground water quality that are to be used by that department in establishing performance standards and operational requirements for permits issued under the State Waste Discharge Program and other permit programs administered by Ecology. The new regulations, Washington Ground Water Quality Standards (WAC 173-200) are discussed in more detail in a later section of this document. The net effect of the stringent requirements of the Ground Water Quality Standards may be to eliminate any possibility of receiving Ecology approval for on-site sewage systems with 14,500 or more gallons per day common point flow.

((*) Note: Under WAC 173-240-020, Ecology is responsible for regulating any system utilizing subsurface disposal, regardless of size, if that system is funded through a state construction grant or federal construction grant under the Federal Water Pollution Control Act.)

SYSTEMS RECEIVING BETWEEN 3,500 AND 14,499 GALLONS PER DAY FLOW

DOH is normally responsible for directly regulating on-site sewage systems with common point wastewater flows of between 3,500 and 14,499 gallons of effluent per day. However, in Clallam County, DOH contracts with CCEHD to assume responsibility for regulation of such systems. Systems with common point flows of between 3,500 and 14,499 gallons of effluent per day are commonly referred to as "larger" on-site sewage systems. Such systems are regulated under Section 075 of the State Board of Health On-Site Sewage System Regulations (WAC 248-96).

The design of larger on-site sewage systems is governed by guidelines that were developed by DOH with assistance from Ecology (DOH and Ecology, 1987). These guidelines or their earlier predecessors have been in effect in Clallam County since

1979. The larger on-site sewage system guidelines impose limitations concerning density and special system design criteria for areas with coarse textured soils. Coarse textured soils are referred to in the larger system guidelines as Type 1 soils. Allowable development densities for larger on-site sewage systems installed in Type 1 soils are limited to 2 units per acre and pressure distribution and sand filtration technology must be employed. Pressure distribution and sand filtration of effluent greatly enhances the treatment capability of on-site sewage systems installed in coarse textured soils.

Provisions of the larger on-site sewage system guidelines attempt to avoid concentrating wastewater in a limited area by dividing larger on-site sewage system drainfields into sub-drainfields and enforcing setbacks between the sub-drainfields. At least three sub-drainfields are required for each larger on-site sewage system. Each sub-drainfield is sized to accept 50% of the estimated wastewater flow from a facility or development providing a total capacity of 150%. This allows each one of the three sub-drainfields to be rested alternately on a rotating basis. Under the larger on-site sewage system guidelines, each of the sub-drainfields must be separated by at least 15 feet and two different larger on-site sewage systems must be separated by at least 50 feet.

An application for a larger on-site sewage system must be accompanied by an engineering report demonstrating that the system and surrounding soil can adequately treat and assimilate the design wastewater flow. The application must also identify an entity responsible for management of the system.

SYSTEMS RECEIVING LESS THAN 3,500 GALLONS PER DAY FLOW

CCEHD is responsible for regulating the use of on-site sewage disposal systems receiving less than 3,500 gallons of wastewater per day. This category can be divided into three sub-categories: smaller community systems that serve a number of residences or commercial facilities under separate ownership, commercial facilities or multifamily units under a single ownership, and individual systems serving a single family residence.

DOH maintains a general oversight role in the local CCEHD program. This includes auditing the effectiveness of the CCEHD program. Such an audit was conducted in August 1988 by DOH staff. The results of that audit are reported in the section of this report entitled "Review of the Clallam County Environmental Health Division On-Site Sewage Program Conducted by the Washington Department of Health".

DOH is also responsible for establishing the minimum standards to be used by local governments in regulating on-site sewage disposal systems use. The On-Site Sewage System Regulations (WAC 248-96) adopted by DOH's governing body, the State Board of Health, serve as the basis for the CCEHD regulations.

The state regulations requires local boards of health to adopt on-site rules and regulations that are at least as stringent as those contained in WAC 248-96. Accordingly, Clallam County Health Regulation Chapter 4 must incorporates all applicable requirements of WAC 248-96.

COMPARISON BETWEEN THE STATE BOARD OF HEALTH REGULATIONS AND CLALLAM COUNTY HEALTH REGULATION CHAPTER 4

The following is a point by point comparison between the principal state regulation concerning on-site sewage disposal, the State Board of Health On-Site Sewage System Regulations (WAC 248-96) and the local on-site sewage regulations, the Clallam County Health Regulation Chapter 4. This comparison focuses on regulatory aspects relating to or potentially impacting ground water quality.

Generally, the number of the section of either the state or local regulations pertaining to each provision described in the following text will be presented in parentheses at the end of the sentence regarding that specific provision. For instance, if a portion of the text concerning the state regulations is describing the requirements found in Section 110 of WAC 248-96 concerning maximum depth requirements for on-site sewage systems, (110) will appear at the end of the applicable portion of the text.

References are frequently made in this section, as well as in the document as a whole, to the State Board of Health On-Site Sewage System Regulations as being WAC 248-96. This administrative code was recently recodified to WAC 246-272. Since The Department of Health has not reprinted the on-site sewage regulations with the new codification, the public is generally only familiar with WAC 248-96. Therefore, the state on-site regulations are described in this document based on the sections found in WAC 248-96.

STATE BOARD OF HEALTH ON-SITE SEWAGE SYSTEM REGULATIONS (WAC 248-96)

Purpose.

The stated purpose of the State Board of Health On-Site Sewage Regulations (hereafter referred to as the Department of Health (DOH) Regulations) is to assure protection of public health by minimizing:

(a) Public health effects of on-site sewage systems on surface and ground waters, and

(b) Potential for public exposure to sewage (011).

Local Regulations.

The DOH Regulations are intended to provide local boards of health with a uniform framework for the establishment for local on-site sewage rules and regulations. The provisions of such local rules and regulations must be at least as restrictive as the DOH regulations. Local rules and regulations are subject to review and approval by DOH .

Nothing in the DOH Regulations prohibits the adoption and enforcement of more stringent regulations by local health departments where such regulations are needed to protect public health (025).

Special Standards to Protect Drinking Water Aquifers.

Under the DOH Regulations, local boards of health are required to develop special standards for on-site sewage system use in areas where underground sources of drinking water are vulnerable to contamination. Such areas are defined as those with soils or other conditions that are ineffective in retaining and/or removing substances of public health significance prior to entry to underground sources of drinking water. The level of control exerted by such special requirements is to be commensurate with the degree of protection deemed necessary for the underground source of drinking water by the local health authority and DOH (025).

Ground Water Definition.

The DOH Regulations define ground water as a subsurface water occupying the zone of saturation, permanently, seasonally, or as the result of tides (the top surface of which is usually referred to as the water table) which may be demonstrated by one or all of the following methods:

(a) Water seeping into or standing in an open excavation from the soil surrounding the excavation,

(b) Spots or blotches of different colors or shades interspersed with a dominant color in soil, commonly referred to as mottling...(020)

Soil Classification.

The DOH Regulations identify six basic soil types upon which design criteria and, to a large extent, density or minimum lot size are based. The soil types are listed in Table 1.

TABLE 1

SOIL TYPE	SOIL TEXTURAL CLASSIFICATION
1	Coarse sand or coarser
2	Medium sand
3	Fine sand, loamy sand
4	Sandy loams, loams
5	Porous, well developed structure in silt and silt loams
6	Other silt loams, silty clay loams, clay loams

Under the DOH Regulations, Type 1 Soils have both a narrow definition as coarse textured, rapidly permeable soils and a broader definition that includes other soils and/or conditions where the treatment potential is ineffective in retaining and/or removing substances of public health significance to underground sources of drinking water (094).

Designer Requirements.

The DOH Regulations require that on-site systems be designed by a professional engineer, registered sanitarian, or designer certified by a local health department (110). The regulations also specify basic criteria for certification of designers (130).

Designs of Larger On-Site Sewage Systems (3,500 gallons per day flow) may only be prepared and submitted by a professional engineer registered by the State of Washington in accordance with Chapter 18.34 RCW (075).

Design Criteria.

The design of on-site sewage disposal systems must conform to the EPA "Design Manual: On-Site Wastewater Treatment and Disposal Systems" (EPA 1980) (110).

Vertical Separation.

Vertical separation is defined as the depth of unsaturated, original, undisturbed soil that exists between the bottom of a subsurface absorption system and a restrictive layer or water table. The DOH Regulations require that, generally, a three foot vertical separation must be maintained. However, a reduction in vertical separation to one foot is permissible provided the system is designed by a professional engineer, a registered sanitarian, or an on-site sewage system designer certified by the county. Local health authorities are empowered to require vertical separation greater than three feet when the aquifer underlying an on-site sewage system is used as a drinking water supply (100).

System Depth.

The bottom of a subsurface absorption system cannot be deeper than three feet from finished grade except under special conditions approved by the local health authority. If approved under special conditions, the bottom of the system can placed as deep as 10 feet from finished grade (110).

Alternative System Guidelines.

The DOH Regulations provide for the establishment of guidelines to govern the use of alternative on-site sewage systems (consisting of treatment and/or disposal components other than a septic tank and subsurface absorption systems). Alternative systems approved for use in Washington State include mounds, sand filters, composting toilets, and aerobic treatment units (046).

Minimum Horizontal Separation.

Subsurface absorption systems are required to be separated from a water well by at least 100 feet. A reduction to 75 feet may be allowed by the local health jurisdiction if it can be demonstrated that the reduction will not have an adverse effect (100).

Density/Lot Size Specifications.

The DOH Regulations establish limits on the allowable density of on-site sewage systems. Densities are expressed in residential unit volumes per acre. A unit volume is defined by DOH as 450 gallons of effluent per day, the estimated quantity of wastewater generated by a 3 bedroom home. The maximum number of residential unit volumes allowed per acre is 3.5 or a total of 1570 gallons of wastewater per acre per day (090).

In the DOH Regulations, allowable density is determined through establishing a minimum gross land area for each unit volume of sewage. Gross land area is defined as the

> "lot area which is bounded by the centerline of adjoining road or street right-of-ways within the boundaries of the proposed development" (020).

DOH provides two options for establishing minimum gross land area, termed Method I and Method II. Method I prescribes specific gross land area requirements based on soil conditions and the source of water. For developments to be served by a public water system, gross land areas range from 12,500 square feet in Type 2 soil to one acre for Type 1 soil (090). For developments served by individual wells, gross land area requirements are either one acre for Type 2, 3, and 4 soils or 2 acres for Type 1, 5, and 6 soils (See Table 2).

TABLE 2

TYPE OF SOIL	LOT SIZE WITH PUBLIC WATER SYSTEM	LOT SIZE WITH INDIVIDUAL WELLS
1	1 ACRE	2 ACRES
2	12,500 SQ. FT.	1 ACRE
3	15,000 SQ. FT.	1 ACRE
4	18,000 SQ. FT.	1 ACRE
5	20,000 SQ. FT.	2 ACRES
6	22,000 SQ. FT.	2 ACRES

The DOH Method II is much more ambiguous than Method I. Minimum gross land area requirements are not clearly spelled out but are determined, within certain limits, by consideration of a variety of factors concerning the site including soil conditions, impacts on ground water, topography, geology, climatic conditions, and area growth patterns (090). These factors must be analyzed by the developer's engineer or designer and the results incorporated into a report used to justify a proposed gross land area.

Minimum gross land areas determined under Method II are subject to the 3.5 residential unit volumes per acre or 1570 gallons of wastewater per acre per day limitations. Thus, Method II is of little use in areas of Type 2 soils. However, under Method II, it is possible to gain reductions in the minimum gross land area requirements established under Methods I for Type 1, 3, 4, 5, and 6 soils.

If the Method II report indicates that Type 1 soils (or Type 1 conditions) exist at the site, gross land area can be reduced below one acre only if mound systems, sand filters, or equivalent technology are used to treat the wastewater. However, even with use of such enhanced treatment technology, minimum gross land area per unit volume of sewage cannot be less than one-half acre (090).

Subdivision Review Requirements.

Preliminary tests for subdivisions that are intended to utilize on-site sewage disposal systems must include at least one soil log per acre or tract (095). All site evaluations must be performed by or under the direct supervision of the local health department, a registered sanitarian, a professional engineer, a registered soil scientist, or a designer certified by the local health department (094).

CLALLAM COUNTY HEALTH REGULATION CHAPTER 4

In this subsection, the provisions of Clallam County Health Regulation 4 are reviewed for consistency with the basic provisions of the DOH Regulations presented in the previous subsection.

Purpose.

Clallam County Health Regulation Chapter 4 (CCHR 4) contains a statement of purpose that is virtually identical to that of the DOH Regulations, specifically:

to assure protection of public health by minimizing:

(a) Public health effects of on-site sewage systems on surface and ground waters, and

(b) Potential for public exposure to sewage (010).

CCHR 4 also states that compliance with the intent of DOH Regulations is an objective of the local regulations.

Local Regulations.

CCHR 4 represents Clallam County's version of the local rules and regulations allowed under the DOH Regulations. Under Section 015, CCHR 4 adopts the DOH Regulations by reference. As specified in the DOH Regulations, CCHR 4 has been reviewed by DOH for consistency with their regulations and has received approval from that department.

Special Standards to Protect Drinking Water Aquifers.

In addition to the statement of purpose, several portions of CCHR 4 address ground water contamination. The definition of on-site sewage system failure in Section 020 includes effluent discharges that result in contamination of ground water, surface water, or potable water supplies. In Section 030, discharges that cause "contamination of public health significance to any ground water" is prohibited. However, "contamination of public health significance" is defined based on deviation from Class B freshwater standards found in the Washington Surface Water Quality Standards, WAC 173-201.

The Class B standards under WAC 173-201 describe surface waters of a quality that is generally not suitable as a drinking water source (drinking water supply is not listed as a characteristic use of Class B waters). Criteria established under WAC 173-201 for Class B waters include fecal coliform (mean 100/100 mL), dissolved oxygen, total dissolved gas, temperature, pH, and turbidity.

CCHR 4 also establishes a special designation referred to as Geologically Sensitive Areas (GSAs). GSAs are areas that are subject to ground water, surface water, or drinking water supply contamination. Specific GSAs, with defined geographic boundaries, can be established through action of the Clallam County Board of Health (020).

Under CCHR 4, the designation of a GSA has two primary policy implications: one related to maximum density limitations and the other pertaining to on-site system designer requirements, both discussed in more detail elsewhere in this section. In both cases, the GSA requirements are identical to requirements for Type 1 soils.

Ground Water Definition.

CCHR 4 does not contain a definition of ground water. However, since CCHR 4 adopts the DOH Regulations by reference, the definition of ground water found in those regulations is the operative definition for Clallam County concerning on-site sewage disposal (015). Specifically, ground water is defined in the DOH Regulations as:

"...a subsurface water occupying the zone of saturation, permanently, seasonally, or as the result of tides (the top surface of which is usually referred to as the water table) ..."

Soil Classification.

CCHR 4 utilizes the soil classification system described in the DOH Regulations. However, CCHR 4 does not provide a description or definition of the various soil types described in the classification system.

The DOH classification system identifies six soil categories, Type 1 through Type 6, based on the U.S. Department of Agriculture textural classification system. Type 1 soils consist of the coarsest textured soils (e.g. coarse sands or coarser) while Type 6 soils consist of the finest textured soils (e.g. clay, clay loams). Type 2 through Type 5 soils consist of intermediate textures (See Table 1 - DOH Regulations Section). Design criteria and, to a large extent, density or minimum lot size are based on these soil types.

Designer Requirements.

Section 090 of CCHR 4 requires that on-site sewage systems be designed by a professional engineer, registered sanitarian, or designer certified by the Clallam County Health Division. Although, the Clallam County Health Division retains the right to design on-site sewage systems internally as well.

Two classes of certified designer are designated under CCHR 4: "Class A" and "Class B". Class A designers, professional engineers, and registered sanitarians may submit designs for all sites and conditions. Class A designers, professional engineers, and registered sanitarians are responsible for designing alternative systems and systems in GSAs or in areas where a "Type 1 soil condition" has been identified and an aquifer is considered at risk (091). Class B designers are primarily limited to preparing designs for conventional on-site sewage systems in geographic areas lacking any unique environmental sensitivity and where a three foot vertical separation can be maintained (091) (see Vertical Separation).

The regulations also specify basic criteria for certification of designers. Designers must successfully complete a written and/or field examination and demonstrate evidence of at least two years experience as an on-site sewage system designer.

Consistent with the requirements of the DOH Regulations, designs of Larger on-site sewage systems (3,500 - 14,499 gallons per day flow) may only be prepared and submitted by a professional engineer registered by the State of Washington in accordance with Chapter 18.34 RCW.

Design Criteria.

CCHR 4 adopts by reference the "Design Manual, On-Site Wastewater Treatment and Disposal Systems (015). Chapter 7 of the Design Manual provides recommendations concerning the design, construction, operation and maintenance of subsurface absorption systems including drainfields, beds, and mounds. The recommendations cover such critical design considerations as effluent application rates and effluent distribution techniques.

The only other reference made in CCHR 4 concerning design criteria pertains to conditions for reduction of lot sizes under Method II in an area of Type 1 soil conditions or a Geologically Sensitive Area. CCHR 4 states that in such areas, reduction of lot size below that prescribed under Method I can be allowed only if an alternative system is utilized that is capable of providing treatment equal or greater to that provided by a mound system or sand filter (055).

Vertical Separation.

CCHR 4 adopts by reference the vertical separation requirements of the DOH Regulations. Specifically, that a three foot vertical separation must be maintained. However, a reduction in vertical separation to one foot is permissible provided the system is designed by a professional engineer, a registered sanitarian, or an on-site sewage system designer certified by the county.

System Depth.

CCHR 4 adopts by reference the requirement in the DOH Regulations stipulating that the bottom of a subsurface absorption system cannot be deeper than three feet from finished grade except under special conditions approved by the local health authority. If approved those under special conditions, the bottom of the system can placed as deep as 10 feet from finished grade.

Alternative System Guidelines.

CCHR 4 allows use of alternative systems such as mounds and sand filters provided such systems are designed, constructed, and monitored in accordance with Alternative System Guidelines prepared by DOH and its Technical Review Committee (041).

Minimum Horizontal Separation.

CCHR 4 adopts by the reference the vertical separation requirements of the DOH Regulations. Specifically, that subsurface absorption systems are required to be separated from a water well by at least 100 feet. A reduction to 75 feet may be allowed if it can be demonstrated that the reduction will not have an adverse effect on the well.

Density/Lot Size Specification.

CCHR 4 contains provisions that are virtually identical to the DOH Regulations concerning the methods for determining minimum lot sizes (055). The DOH Method I and Method II lot size determination procedures are designated as the appropriate methodologies for Clallam County. These methodologies allow development densities of between 1 and 3.5 units per acre for areas with public water supplies and 0.5 to 1 units per acre with individual wells. Method II is used to justify smaller lot sizes than are specified outright under Method I, however, the maximum development density remains 3.5 units per acre.

The only significant difference between the DOH density/lot size provisions and those of CCHR 4 is that under CCHR 4, Geologically Sensitive Areas are treated in a manner equivalent to Type 1 soils when lot size reductions are considered under Method II. The requirement that reduction of lot size below that prescribed under Method I can be allowed only if an alternative system is utilized that is capable of providing treatment equal or greater to that provided by a mound system or sand filter applies to Geologically Sensitive Areas as well as areas with Type 1 soil conditions. Thus, the requirement can extend to areas with either ground water or surface water vulnerability.

Subdivision Review Requirements.

CCHR 4 adopts by reference the DOH preliminary subdivision review requirements. Preliminary tests for subdivisions that are intended to utilize on-site sewage disposal systems must include at least one soil log per acre or tract. All site evaluations must be performed by or under the direct supervision of the local health department, a registered sanitarian, a professional engineer, a registered soil scientist, or a designer certified by the local health department.

Additional subdivision review authority is provided CCEHD in the Clallam County Land Division Ordinance (Chapter 29.01). Section 17 of that ordinance stipulates that prior to preliminary approval of a subdivision, the applicant must demonstrate to the satisfaction of CCEHD that an adequate source of water is available to serve the subdivision. An adequate source is a public water system utilizing surface or ground water resources that are available and considered "safe" for use on a long term basis. If an adequate public water supply is not available and the use of individual wells is proposed, the applicant must demonstrate that each well will tap into a ground water supply that provides a year-round supply of water that is adequate for domestic requirements and is "safe from septic tank drainfield and surface water contaminants".

Adequacy of water supply requirements are also contained in Section 63 of the Growth Management Act of 1990 (SHB 2929).

REVIEW OF THE CLALLAM COUNTY ENVIRONMENTAL HEALTH DIVISION ON-SITE SEWAGE PROGRAM CONDUCTED BY THE WASHINGTON DEPARTMENT OF HEALTH

DESCRIPTION

One of the primary roles of the Washington Department of Health (DOH) on-site sewage program is to provide oversight of local on-site sewage programs. In that capacity, DOH conducted an audit of the Clallam County Environmental Health Division (CCEHD) on-site sewage program in August 1988 by DOH staff. The results of that audit were reported in a DOH publication entitled Clallam County Division of Environmental Health On-Site Sewage Program Review. The principal objectives of the audit were to:

- o Determine the extent to which the on-site sewage program regulations and policies incorporated recommendations of the 1987 Puget Sound Water Quality Management Plan;

- o Evaluate program results against stated program plans, goals, and objectives;

- o Gather information on educational, training, or technical assistance needs of local program staff; and

- o Provide strategies for local program improvement.

The DOH audit was performed through conducting file searches, completing a detailed questionnaire, and interviewing key program staff. The audit addressed a broad spectrum of program activities including:

- o Program Organization and Administration,

- o Program Staffing,

- o Designer and Installer Certification Programs,

- o General Program Activities,

- o Permit Review, and

o Subdivision Review.

This section of the report is intended to review the findings and recommendations of the DOH audit concerning aspects of the CCEHD on-site sewage program relating to ground water protection.

FINDINGS

Program Organization and Administration.

The audit concluded that the on-site sewage program lacked a current written program plan containing goals, objectives, methods for achieving objectives, and evaluation methods.

Program Staffing.

There was an indication that staff levels may be less than adequate with a total of only 1.5 FTEs assigned to the sewage program. In spite of its small size, the sewage program staff was responsible for producing about 85 percent of the on-site sewage system designs reviewed as part of the audit.

Additionally, staff training needs were identified in the areas of soils, system siting criteria, and system operation and maintenance.

Designer and Installer Certification Programs.

The on-site sewage system designer and installer programs operated by CCEHD were found to be adequate and consistent with the provisions of the DOH regulations.

General Program Activities.

The audit concluded that general program activities were consistent with recognized best management practices. Special recognition was given to the efforts of the CCEHD staff in promoting the use of alternative treatment technology. Alternative systems were specified in 25% of the repair permits and 17% of the new construction permits reviewed through the audit.

Permit Review - New Systems.

The audit revealed that critical information influencing on-site system performance was not being recorded during field reviews of permits and site evaluations. However, the audit did not determine that CCEHD failed to consider that information in the plans and specifications for the on-site systems. Eleven percent of the permits and site evaluations reviewed as part of the audit did not indicated soil texture. None of the permits or site evaluations indicated depth to water table and 96 percent did not indicated the depth to a restrictive layer.

In addition, the audit concluded that specific design criteria for new on-site sewage systems was lacking for Geologically Sensitive Areas.

Permit Review - Repairs.

The audit indicated similar gaps in record keeping soil texture and vertical separation data on repair permits.

Subdivision Review.

The audit revealed that some subdivision applications on file with CCEHD did not contain thorough information concerning the specific nature of the proposal and the characteristics of the site. The missing information included the number and size of lots, the proposed water supply, the location of wells, and the intended land use.

RECOMMENDATIONS OF THE PROGRAM REVIEW

The following are the primary recommendations of the DOH review of the CCEHD on-site sewage program. These recommendations are organized in a format intended to correspond to the format used for the previously presented findings.

Program Organization and Administration.

CCEHD should establish an up-to-date on-site sewage program plan containing goals, objectives, and methods.

Program Staffing.

CCEHD should totally transfer responsibility for designing on-site systems to the private sector allowing the CCEHD staff to spend more time conducting site evaluations and design review.

Staff attendance at training sessions should continue to be encouraged with emphasis placed on soils and site evaluation courses.

Designer and Installer Certification Programs.

No recommendations were offered concerning the certification programs.

General Program Activities.

No significant recommendations were offered concerning general program activities.

Permit Review.

The CCEHD staff should endeavor to obtain complete information concerning site characteristics, in particular soils and water table data, and should require comprehensive designs for all on-site sewage disposal systems installed in the county.

In addition, criteria should be developed for the design of on-site sewage disposal systems in Geologically Sensitive Areas.

Subdivision Review.

CCEHD should require that more complete, detailed information be submitted concerning proposed subdivisions. Obtaining that information could be facilitated by redesigning subdivision application forms.

CONCLUSIONS OF THE PROGRAM REVIEW

The primary conclusion of the DOH audit was that the CCEHD staff was fulfilling its responsibility for appropriately administering the DOH Regulations (WAC 248-96). DOH considered the CCEHD staff committed towards achieving proper siting, design, installation, and maintenance of on-site sewage systems. DOH further determined that the staff had knowledge of regulations and the technical aspects of on-site sewage disposal systems.

WATER QUALITY STANDARDS FOR GROUND WATERS OF THE STATE OF WASHINGTON WAC 173-200

INTRODUCTION

In October of 1990, the Department of Ecology adopted WAC 173-200, the Water Quality Standards for Ground Waters of the State of Washington. Consistent with the Water Resources Act, RCW 90.54, and the Water Pollution Control Act, RCW 90.48, these standards assert the state's "antidegradation policy" concerning ground water. Under the antidegradation policy, contaminants proposed for entry to ground water must be provided with all known, available, and reasonable methods of prevention, control, and treatment (**AKART**) prior to entry. In addition, degradation of ground water that would interfere with or become injurious to beneficial uses is prohibited (Section 030).

PROVISIONS

The most significant provisions of the ground water quality standards are as follows:

Affected Ground Waters.

The ground water quality standards apply to all waters of the State of Washington that occur in a saturated zone or stratum beneath the surface of the land or below a surface water body. The standards identify several subcategories of ground water which may be given special consideration under the provisions of WAC 173-200. The subcategories of ground water include:

- o **Artificial Ground Water** - ground water that has been put in place through means other than naturally occurring recharge such as irrigation;
- o **Isolated Ground Water** - ground water fully separated from other ground waters by an impermeable rock formation or stratum; and
- o **Seasonal Ground Water** - ground water that exists for a temporary period of the year and is usually associated with a "particular activity or phenomenon".

Ground Water Quality Criteria.

WAC 173-200-040 establishes numeric ground water quality **Criteria** for 127 contaminants including:

- o The 15 primary drinking water contaminants specified in WAC 248-54 (State Board of Health Drinking Water Regulations) consisting of heavy metals, fluoride, nitrate, several pesticides, and total coliform;
- o The 12 secondary drinking water contaminants specified in WAC 248-54 including metals such as iron and manganese, several anions such

as chloride and sulfate, total dissolved solids, pH, and color;

- o 6 radionuclides; and
- o 94 carcinogens with Criteria set at levels that would result in a total incremental human cancer risk of less than a 1 in 1,000,000 based on a consumption of 2 liters of water per day for a period of 30 years.

The Criteria are presented within Section 040 of the regulation as the "maximum contaminant concentrations for the protection of a variety of beneficial uses of Washington's ground water". In other words, the Criteria represent the point at which contaminant concentrations will significantly impact beneficial uses.

However, the Criteria cannot be viewed as a limit up to which ground waters can be legally contaminated. Under the antidegradation policy enunciated in Section 030 of the regulation, whenever ground waters are of a higher quality than the Criteria established for those waters, the existing water quality shall be protected. Thus, through enforcement of WAC 173-200, Ecology will attempt to prevent significant deterioration of existing ground water quality (Winters, Personal Communication, 1991).

Enforcement Limits

WAC 173-200-050 identifies protocols for establishing the **Enforcement Limit** for any contaminant or potential contaminant. An Enforcement Limit is assigned to a contaminant for the purpose of regulating the release of that contaminant from a specific source or activity. The Enforcement Limit for a contaminant is nearly always less than the ground water quality **Criteria**.

The Enforcement Limit for a contaminant being released by a source or activity is generally established at a level that is as close as "practical" to the level at which that contaminant would normally be observed under natural conditions in ground waters within the vicinity of the source or activity. For a large number of contaminants, that level would usually be zero or below the **Practical Quantification Level**, the level at which concentrations of a contaminant can be reliably quantified with available analytical technology.

This section of the ground water standards also contains procedures for determining the Enforcement Limit for contaminants for which ground water quality Criteria have not been established.

Point of Compliance.

WAC 173-200-060 identifies methods of determining the **Point of Compliance**, the horizontal and vertical location where the specified **Enforcement Limit** for contaminants must be met. Generally the Point of Compliance is as close to the source of contamination as physically possible.

Early Warning Values.

WAC 173-200-070 establishes procedures for setting **Early Warning Values** for contaminants. Early Warning Values may be established by Ecology whenever the **Enforcement Limit** exceeds the background (upgradient) level of a specific contaminant. Early Warning Values are threshold contaminant levels used in evaluating ground water monitoring data obtained near a contaminant source. The Early Warning Values are intended to serve as a bench mark that provides early indication of increasing contaminant concentrations that may approach or exceed the **Enforcement Limit**.

Evaluation.

WAC 173-200-080 establishes minimum requirements for evaluating the impacts of an activity on ground water quality to determine compliance with the regulation. Under the ground water quality standards, if Ecology determines that the potential for pollution of ground water associated with an activity exists, it can require the holder of a permit for that activity or the responsible **Person** to prepare and submit a ground water quality evaluation. A responsible Person can be any political subdivision, government agency, municipality, industry, public or private corporation, partnership, association, firm, or individual (WAC 173-200-020).

The ground water quality evaluation may be required to include ground water, vadose zone, and effluent quality monitoring; information concerning contaminant properties and characteristics; and hydrogeologic interpretations. Ecology has the authority to require ground water evaluations of any site, area, facility, structure, vehicle, installation, or discharge which may produce pollution.

Evaluation of Activities Not Directly Regulated by Ecology.

Ecology's authority to require ground water quality evaluations extends to activities which are not directly regulated under Ecology permits, including, activities regulated by other state and local agencies (e.g. on-site sewage systems, gravel mining operations). In cases where an evaluation will be required of an activity regulated by another state or local agency, Ecology will pursue a memorandum of understanding with that agency.

Enforcement.

Should any violation of the ground water quality standards be identified, Ecology can initiate any of a number of enforcement mechanisms available to it under RCW 90.48 and other applicable statutes. Such mechanisms include permit modifications, compliance orders, civil penalties, court imposed sanctions, and civil damage proceedings.

Effect on Permitted Activities.

Activities which are in full compliance with the conditions and requirements of permits issued by Ecology and other state and local agencies can be determined to be out of compliance with the ground water quality standards. This includes, among other activities, solid waste facilities operated in accordance with WAC 173-304 and on-site sewage disposal systems operated in accordance with WAC 248-96 (State Board of Health On-Site Sewage System Regulations). In such situations, Ecology will precede any civil or criminal penalty with a compliance order.

Special Protection Areas.

WAC 173-200-090 establishes the process by which Ecology will designate **Special Protection Areas**; areas that require increased ground water protection because of one or more unique characteristics. Special Protection Areas will be given extraordinary consideration by Ecology when developing regulations, guidelines, and policies; when regulating activities; and when prioritizing Ecology resources for ground water quality protection programs. Special Protection Areas are described in more detail in the section to entitled: Special Protection Areas Established Under WAC 173-200.

IMPACTS REGARDING ON-SITE SEWAGE SYSTEM USE

According to a spokesperson for Ecology (Winters, 1991), that department's highest priority for implementation of the Ground Water Quality Standards will be given to developing requirements for permits, licenses, authorizations, or any equivalent control documents issued under Ecology administered programs. This includes State Waste Discharge Permits issued pursuant to WAC 173-216, permits for dangerous waste facilities issued pursuant to Chapter 173-303, and permits for ground water withdrawals issued pursuant to RCW 90.44. The next level of priority will be given to the development of the memoranda of understanding with other state agencies that permit or otherwise regulate activities that may be out of compliance with the standards. This includes the Department of Health and their on-site sewage regulations.

Ecology has not, as yet, formally determined that adherence to the DOH on-site sewage regulations necessarily will result violation of the Ground Water Quality Standards (ibid). However, there is considerable speculation that they could eventually do so. Even though the Clallam County Environmental Health Division does not have expressed authority to enforce the Ground Water Quality Standards, their existence must be reconciled on at least a policy level. Thus, the adoption of the Ground Water Quality Standards is resulting in a re-evaluation of on-site sewage disposal system policies at both a state and local level.

With regard to ground water protection, historically, the yardstick by which the effectiveness and adequacy of local on-site sewage system regulations and policies have been measured has been consistency or compatibility with the regulations and policies of the Washington Department of Health. The Department of Health's primary focus in regulating on-site sewage system practices has been the protection of public health. Thus, on-site sewage system policies concerning ground water have been primarily health based (i.e. preventing excedence of drinking water maximum contaminant levels (MCLs)).

However, with the adoption of the Ground Water Quality Standards, the effectiveness of local on-site sewage regulations in protecting ground water quality must now be viewed in the context of broader resource based considerations, specifically, the state's Antidegradation Policy. The Antidegradation Policy is similar to the health based policies upon which existing on-site sewage system regulations are founded in that it requires that the adequacy of as a drinking water source be maintained (existing beneficial uses protected). But, the Antidegradation Policy also requires, essentially, that any deterioration of ground water quality from "natural" levels be prevented.

The latter requirement or condition of the Antidegradation Policy presents a serious quandary for on-site sewage system policy makers. Although existing, available on-site sewage treatment technology can provide efficient removal of most contaminants present in domestic wastewater, that technology can achieve, at best, only about a 50% removal of the nitrogen present. In many cases, removal of only about 10% of the nitrogen can be achieved. The residual nitrogen is free to migrate to underlying ground water. Because natural levels of nitrogen in ground water are typically quite low, the release of nitrogen from an on-site sewage system will virtually always cause the quality of ground water directly underlying an on-site system to deteriorate, to some degree, from natural levels. This is a phenomenon that is not related to the density at which on-site sewage systems are installed.

The application of the Ground Water Quality Standards to the regulation of on-site sewage system use is obviously a complex issue; one which may ultimately need to be resolved on a site by site basis. Ecology has expressed intent to develop a memorandum of understanding with the Washington Department of Health concerning the linkage between the Ground Water Quality Standards and that department's on-site sewage regulations. Such a memorandum will provide guidance to local health departments in determining the extent of changes in local regulations that may be necessary as a result of the adoption of the Ground Water Quality Standards. However, the memorandum of understanding is not likely to be completed for perhaps several years.

CONCLUSIONS AND RECOMMENDATIONS

COMPATIBILITY WITH STATE BOARD OF HEALTH/DEPARTMENT OF HEALTH REGULATIONS

After careful evaluation of the Clallam County Health Regulations utilized by the Environmental Health Division for management of on-site sewage disposal system use, it is apparent that those regulations are in compliance with the State Board of Health On-Site Sewage System Regulations (referred to as the Department of Health (DOH) Regulations). This conclusion is supported by the findings of the 1988 review of the Clallam County Environmental Health Division On-Site Sewage Program conducted by the Washington Department of Health (DOH).

However, it should be recognized that meeting the test of consistency with the DOH Regulations essentially demonstrates compliance with minimum standards that are intended to be implemented state-wide. Adherence to the minimum state standards for on-site sewage disposal system use does not necessarily optimize for ground water protection.

The effectiveness of the local on-site sewage system regulations in protecting ground water could potentially be improved through several modifications. First, the local regulations could be reconstructed as a stand-alone document with less reliance on adoption by reference of the DOH Regulations and the EPA Design Manual. Within the revised local regulations, Type 1 soil conditions should be more clearly explained and methodologies for identifying the presence of Type 1 soil conditions developed. The local regulations should also provide specific design criteria such as loading rates and vertical separation requirements.

A second, more substantive recommendation is to develop specific regulations and standards concerning on-site sewage system use in Geologically Sensitive Areas (GSAs). A similar recommendation was made in the 1988 DOH program review as previously noted in this document. Since GSAs can be related to either surface water systems or ground water systems, development of two sets of regulations and standards would be necessary. The types of management strategies employed to protect surface water bodies such as Sequim Bay are different than those used to protect ground water. This recommendation focuses strictly on strategies for protection of ground water GSAs; areas which are closely tied to the presence of Type 1 soil conditions in the Clallam County Health Regulations.

The basic state requirements concerning on-site sewage disposal systems installed in Type 1 soils are density limitations of two units per acre utilizing mound technology or one unit per acre with conventional systems. These densities represent maximum allowable densities or the highest levels of development that can be allowed in Type 1 soils. Use of maximum density criteria should be limited to areas where adverse ground water impacts, at least from a public health standpoint, are satisfactorily mitigated.

However, in areas such as Sequim/Dungeness where underlying ground water is highly vulnerable to contamination and potential adverse impacts are difficult to successfully mitigate, more restrictive standards may be indicated. At a minimum, reduction in lot size below one acre in Type 1 soil conditions may be deemed inappropriate. In addition, a blanket requirement for use of mound systems or sand lined trench systems (with pressure distribution) in coarse textured soils should be considered. Use of such systems will virtually eliminate the potential for biological contamination of ground water associated with on-site sewage systems installed in coarse textured soils and may significantly reduce nitrate loading.

Under the DOH regulations, Type 1 soils do not refer strictly to coarse textured, excessively permeable soils. The Type 1 category also includes other soils or "conditions" where the treatment potential is inadequate to achieve significant retention or removal of contaminants of public health significance from percolating effluent prior to entry into underground sources of drinking water. Since nitrate removal efficiency apparently does not improve with decreasing soil particle size, the concept that special densities and design criteria must be developed for coarse textured soils but not for medium and fine textured soils may be invalid. Thus, unless mitigation of adverse impacts can be demonstrated, special GSA conditions should also apply to on-site sewage system use in soil Types 2 through 6. Special GSA requirements for these soil types could include pressure distribution and more restrictive lot size/density standards than are currently found under Method 1 procedures in both the state and local on-site regulations.

As a final recommendation, the GSA designation should be integrated with the Pollution Problem Area designation in Chapter 31.30 of the Clallam County Comprehensive Plan and the Aquifer Recharge Area designation under the 1990 Growth Management Act. Such an action would broaden existing protection efforts, oriented primarily towards on-site sewage systems, to address other sources of contamination.

COMPATIBILITY WITH THE WASHINGTON GROUND WATER QUALITY STANDARDS

The question of the compatibility with the Washington Ground Water Quality Standards is considerably more problematic. Since the Ground Water Quality Standards are designed for site-by-site interpretation and implementation, comparison with on-site sewage regulations that are generic in nature and are intended to apply county wide is difficult.

The Ecology Ground Water Quality Standards seek to prevent any significant contamination of ground water, regardless of its use. In addition, the Ecology standards demand essentially the same level of protection for shallow, seasonal perched water tables as they do for deep, permanent regional aquifer systems that serve as major sources of drinking water supply. In contrast, the scope of the DOH and Clallam County on-site sewage system regulations is much narrower; being primarily oriented towards protection of public health. As that applies to ground water, the state and local on-site sewage system regulations seek to prevent contamination from such systems that might be significant enough to preclude the use of underlying ground water as a drinking water supply.

In the absence of definitive guidance from Ecology regarding how the Ground Water Quality Standards should affect on-site sewage system use, interim policy will need to be developed at the local level. The primary concern should be whether the county's on-site sewage policies and regulations are consistent with the State's "antidegradation policy" concerning ground water.

Compliance with the antidegradation policy can be viewed as passing the following three tests:

1) Contaminants proposed for entry to ground water must be provided with all known, available, and reasonable methods of prevention, control, and treatment (AKART) prior to entry.

2) Degradation of ground water that would interfere with or become injurious to beneficial uses is prohibited.

3) Water that is of higher quality than the criteria will not be allowed to be significantly contaminated unless such contamination is deemed an overriding consideration of the public interest.

Concerning test number 1, a strong case can be built that the DOH Regulations (WAC 248-96) identify mound/sand filter system technology as AKART for protection of vulnerable ground waters from domestic wastewater. Implementation of the GSA standards recommended above should help demonstrate Clallam County's intent to utilize the best available technology for treatment of on-site sewage in areas of vulnerable ground waters.

The critical issue with test number 2 is ensuring that on-site sewage system use does not alter the potential beneficial uses of ground water, in other words, that "pollution" is prevented. "Pollution", as defined in state law, is not synonymous with contamination. "Pollution" is contamination that is significant enough to adversely impact beneficial uses. In the case of the Sequim/Dungeness area, drinking water supply is the beneficial use that demands the highest ground water quality. Thus, since the goal of the DOH and Clallam County on-site sewage regulations is to prevent adverse impacts on ground waters used for drinking water supply, there should be little doubt that the intent of the on-site regulations is to comply with this portion of the Antidgradation Policy.

The third test is the most difficult to interpret and meet. It is a concept similar to Prevention of Significant Deterioration (PSD) in federal air pollution law. It is based on the recognition that ground water is often of higher quality than the Criteria established in Ground Water Quality Standards (WAC 173-200-040) and the Criteria must not be viewed as a limit up to which ground water can be contaminated. However, it is important to recognize that this is an "antidegradation" policy as opposed to a "non-degradation" policy. Thus, to meet this test, existing water quality must be preserved to the maximum extent possible within the context of existing AKART.

Until Ecology determines otherwise, density should be an AKART consideration. Since, the ability of on-site sewage disposal systems and the soil column to remove nitrate is limited, if such systems are to be used at all, some level of dilution must be accepted as a means of controlling nitrate impacts. In the recommended GSA standards discussed above, 1 unit per acre is suggested as the maximum development density since it is the most conservative lot size (with public water supply availability) identified in the DOH Regulations. It is possible that more restrictive on-site sewage system densities than those contained in the recommended GSA standards will be suggested by Ecology. Because the effect of an individual on-site sewage system on underlying ground water is not density dependant, it is doubtful that issue of what represents an acceptable density or lot size will be resolved in the near future. The inability to identify a "magic number" for acceptable density argues in favor of comprehensive geohydrologic investigations to determine impact threshold limits for ground water quality in specific portions of the county.

Finally, conversion to composting toilets from traditional flush toilets should be considered by Clallam County as a method of reducing nitrogen loading associated with on-site sewage systems. Since toilet wastes (black water) account for approximately 78% of the nitrogen in the domestic waste stream, use of composting toilets could substantially reduce the amount of nitrogen that is discharged to an on-site sewage system. However, this alternative is not likely to receive public acceptance on a widespread basis because the use of composting toilets typically involves a considerable lifestyle change.

Although there is considerable variability in the performance and characteristics of different styles and models of composting toilets, their performance may prove less reliable than flush toilets and they may have unfavorable aesthetic characteristics. Depending on the type of system selected, structural modifications to the design of homes may be necessary to accommodate the installation of such systems. In addition, the handling and disposal of residual "compost" from such systems, which must be removed up to three times per year, creates a new set of public health concerns. If the use of composting toilets is promoted, the plumbing code should be modified to require use of small diameter pipe in the building plumbing to minimize the number of covert conversions to flush toilets after permits and other approvals have been issued by the county.

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Appendix M

Predictive Tool for Groundwater Contamination Potential

CONCEPTUAL DESIGN AND NARRATIVE:

PREDICTIVE TOOL FOR GROUND WATER CONTAMINATION POTENTIAL

ASSOCIATED WITH

ON-SITE SEWAGE DISPOSAL SYSTEMS

PREPARED BY:

ADOLFSON ASSOCIATES, INC.

IN COLLABORATION WITH

SWEET-EDWARDS/EMCON, INC.

PREPARED FOR:

CLALLAM COUNTY

DEPARTMENT OF COMMUNITY DEVELOPMENT

OCTOBER 25, 1991

(incorporates data available as of June 4, 1991)

INTRODUCTION

Elevated nitrate levels have been observed in a number of wells within the Sequim/Dungeness study area. In several cases, nitrate levels have approached or exceeded the drinking water maximum contaminant level (mcl) of 10 milligrams per liter (mg/l). Potential sources of the nitrate present in study area ground waters include on-site sewage systems, commercial agricultural activities, non-commercial agricultural activities (hobby farms), lawn and garden fertilizer use, domestic animals, and natural releases (e.g. atmospheric and biological habitat).

On-site sewage disposal systems are of special interest because they represent the only source of nitrogen that is directly regulated at the local level, specifically, under Clallam County Health Regulation Chapter 4. Based on an estimated per capita nitrogen production of 0.024 pounds (11 grams) per day in domestic wastewater (Siegrist et. al., 1977) and an average household occupancy of 2.24 individuals (James from Soule, Feb. 1991), each household produces about 20 pounds (9 kilograms) of nitrogen per year. Because of the general inability of soils to remove nitrogen present in percolating septic system effluent, a large percentage of the nitrogen released to an on-site sewage system is free to migrate to underlying ground water in the form of nitrate.

The purpose of this report is to assist the county in developing a predictive tool to identify portions of the Sequim/Dungeness study area where the risk of nitrate contamination of ground water associated with on-site sewage disposal system use would be greatest. Secondarily, this report is intended to assess the potential for other contaminants associated with on-site sewage systems to reach ground water and to identify land use activities, not directly related to on-site sewage disposal systems, that should be factored into a predictive tool or risk model.

The fundamental elements of the ground water contamination potential predictive tool presented in this report have been incorporated into the design of the nitrate loading model provided to the Clallam County Department of Community Development, under the terms of the Sequim/Dungeness Project.

ON-SITE SEWAGE SYSTEM PERFORMANCE

DESCRIPTION OF ON-SITE SEWAGE SYSTEMS

On-site sewage systems typically consist of a septic tank and some form of subsurface absorption system, usually a drainfield, bed, or drywell. A drainfield, consists of perforated distribution pipes buried in shallow, two to three foot wide gravel filled trenches. A bed is similar in nature to a drainfield except that it consists of trenches that are greater than three feet in width and generally involve placement of multiple distribution pipes in the same trench. A drywell, also known as a seepage pit, is a pit that is usually dug to a depth of from 5 to 10 feet and filled with gravel. The integrity of the pit is sometimes maintained by installing a perforated concrete chamber or stacking concrete culvert pipe in the pit prior to backfilling with gravel. Under current regulations, the use of bed style systems is greatly restricted and the use of drywells is virtually precluded. However, such systems may be serving older residences and commercial facilities within the study area.

Prior to entering a subsurface absorption system, the wastewater flow from a residence or building passes through the septic tank. The septic tank serves three principal functions. It separates solid portions of the waste stream from the residual liquid known as effluent, provides storage for those solids, and provides an environment for anaerobic decomposition of the solids. The effluent passes from the septic tank to the subsurface absorption system where, under ideal circumstances, it is assimilated and treated within the soil column.

When on-site sewage disposal systems are properly designed and constructed, installed in adequate soils, and used at acceptable development densities (*), they can represent a satisfactory long-term form of domestic (residential or equivalent) wastewater disposal. However, if they are improperly designed or constructed, installed in inadequate soils, used at too high of a development density, or used to dispose of non-domestic wastewaters they can adversely impact surface and ground water quality as well as public health.

((*) Note: Under Washington State Department of Health Regulations (WAC 248-96), acceptable development densities range from less than one residential unit per acre to 3.5 units per acre dependent upon site and soil conditions.)

ON-SITE SEWAGE SYSTEM DISPOSAL CAPACITY

The performance of an on-site sewage system has typically been judged by its ability to accept the wastewater that is discharged to it. The "failure" of a subsurface absorption system has generally been associated with the loss of absorptive or disposal capacity rather than inadequacies in treatment efficiency. That is, in the traditional sense, failure occurs when the volume of effluent entering a subsurface absorption system exceeds the acceptance capacity of the surrounding soils resulting in the release of sewage to the ground surface or the back-up of sewage into the building plumbing.

The disposal capacity of an on-site sewage system is determined primarily by soil conditions and the design of the system. Soils surrounding a subsurface absorption system must be capable of accepting effluent on a year-round basis. In order to allow dewatering of such a system, the surrounding soils must be unsaturated and should be at least moderately permeable.

The rate at which a subsurface absorption system can dewater is regulated at the interface between the system and the native soil. As effluent is applied to the soil surface, growth of certain soil organisms is stimulated at the interface. As this occurs, metabolic by-products of the organisms, particularly polysaccharide slimes, begin to accumulate at the interface forming what is commonly referred to as the biological crust. The biological crust restricts the ability of the subsurface absorption system to dewater. As a result, the rate at which effluent can pass through the interface diminishes significantly over time (EPA, 1977).

Eventually, the soil's acceptance rate reaches a reasonably predictable equilibrium level known as a long-term acceptance rate (Anderson et. al., 1981). Provided that the rate at which effluent enters the subsurface absorption system does not exceed the long-term acceptance rate, a properly maintained subsurface absorption system should continue to assimilate effluent on an indefinite basis (ibid).

Generally, coarsest textured soils have the highest infiltrative capacity. The long-term acceptance rates for soils that are considered suitable for on-site sewage disposal system use range from about 1.2 gallons per day per square foot of absorption area for medium sand to about 0.45 gallons per day per square foot for silt loam (ibid).

Unfortunately, the concept of long-term acceptance rates was not well understood until the mid to late 1970's and was not incorporated wholesale into the on-site sewage system design criteria of the Clallam County Environmental Health Division until about 1984 (Soule, May 1991). Design criteria used prior to that time were based largely on the initial percolative rate or capacity of soils, a rate that diminishes significantly over time as effluent is applied and the biological crust develops. Thus, surfacing of effluent from on-site sewage systems that were installed prior to the mid 1980's, particularly those installed before 1974, have become a problem in some areas of the county (White, undated).

This form of on-site sewage system failure, surfacing effluent or sewage, prompted concerns by the Clallam County Environmental Health Division and the Washington Department of Ecology over the impacts of surfacing effluent on public health and on the quality of surface water bodies such as Sequim Bay and streams within that drainage basin. However, concerns in recent years have also focused on a more insidious form of on-site sewage system failure, the failure of the system and the surrounding soil to provide adequate treatment before effluent reaches underlying ground water. This form of failure is extremely difficult to detect on an individual basis because, unlike surfacing sewage, there are usually no visual manifestations of the problem. Problems with inadequate treatment of effluent from on-site sewage systems are most often detected through an overall deterioration of ground water quality in an area resulting from the cumulative affects of many different on-site sewage systems.

TREATMENT EFFICIENCY OF ON-SITE SEWAGE SYSTEMS

The ability of an on-site sewage system and the underlying or surrounding soil to provide removal of contaminants from septic system effluent is referred to as treatment efficiency. The treatment efficiency of a fine or medium textured soil (silt to medium sand) is generally a function of hydraulic loading and the vertical separation between the bottom of a subsurface absorption system and the underlying water table or impervious layer.

Soil treatment mechanisms typically require unsaturated flow conditions within the soil profile in order to operate properly. Unsaturated flow conditions can be achieved by applying effluent to a soil in relatively small increments allowing the high capillary attraction of the smaller soil pores to direct effluent away from larger, more highly conductive soil pores. Unsaturated flow through the smaller pores enhances purification processes such as physical filtration, biochemical reactions, and adsorption processes.

Conversely, when saturated flow conditions are created by applying effluent to the soil surface in large increments or in surges, effluent will tend to migrate rapidly in a relatively untreated state through the larger soil pores. The untreated effluent can either move vertically and contaminate ground water or it can travel laterally across the surface of an underlying impervious layer, such as glacial till or clay, until it is released to the surface water environment.

Gravity fed subsurface absorption systems promote rapid saturated flow of effluent through the soil profile. Such systems generally consist of 4-inch perforated pipe laid level or at a gentle, uniform slope within a trench and surrounded by washed gravel. Effluent tends to trickle out the holes nearest the inlet to the subsurface absorption system or at points of lowest elevation within the system (EPA, 1977).

Thus, the entire wastewater flow is concentrated at a few points in the subsurface absorption system. Wastewater will continue to be concentrated at those points until a mature biological crust develops. Effluent will then flow to and concentrate at some other point in the system until the biological crust develops there as well. This process continues until eventually the entire infiltrative surface is crusted. Once biological crust development matures throughout the gravity system, effluent is then released to the soil at a more controlled rate with a greater potential for establishment of unsaturated flow conditions. As discussed previously, the establishment of unsaturated flow conditions increases the treatment efficiency of the soil. In addition, bacterial removal is increased through straining, filtering, entrapment, and adsorption mechanisms within the biological crust itself (McGauhey and Krone, 1967).

Unsaturated flow conditions can be induced from the very start of on-site sewage system operation if effluent is equally distributed throughout the subsurface absorption system in controlled doses. Equal distribution can be accomplished through the use of a pump or a dosing siphon to feed a pressurized distribution system composed of small diameter pipe with small orifices.

If unsaturated flow conditions can be maintained, vertical travel of effluent through two to three feet of fine to medium textured soil will generally result in an adequate level of treatment of most contaminants (Tyler et.al., 1977). However, coarse textured, excessively permeable soils such as coarse sands are generally ineffective in removing contaminants from septic system effluent even when unsaturated flows can be maintained over long vertical distances (EPA, 1980).

Coarse textured, excessively permeable soils in the Sequim/Dungeness study area sometimes overly unprotected aquifer zones that are used for public water supply. Unprotected aquifers lack a thick sequence of relatively impervious glacial till or clay separating the aquifer surface from the ground surface. Thus, on-site systems installed in coarse textured, excessively permeable soils represent a relatively high risk of contamination to underlying ground water.

The Soil Survey of Clallam County (USDA, 1987), prepared by the Soil Conservation Service (SCS) in 1987, inventoried and classified soils over most of Clallam County including those of the Sequim/Dungeness study area. The SCS survey indicates that coarse textured, excessively permeable soils can be found over much of the study area. These soils are typically formed in deep gravelly glacial outwash or alluvial fan deposits.

Coarse textured soils which are frequently encountered in the Sequim/Dungeness study area include the following SCS series: Carlsborg gravelly sandy loam, Dick loamy sand, Hoypus gravelly sandy loam, Nielton very gravelly sandy loam, and Sequim very gravelly sandy loam.

The risk of contamination associated with on-site sewage disposal systems installed in these coarse textured, excessively permeable soils is particularly high if gravity fed sub-surface absorption systems are utilized. With gravity distribution, poorly treated effluent will tend to migrate rapidly through the large soil pores to ground water (Franks, 1972) (Converse et.al., 1974). The tendency towards saturated flow may diminish to some degree after biological crust formation is complete.

If the sub-surface absorption system is a drywell or seepage pit, the problem will be exacerbated. Because such systems are installed relatively deep in the soil profile, the travel distance to an underlying aquifer can be greatly reduced and the operating hydraulic head can be substantially higher than that of a drainfield.

GROUND WATER CONTAMINATION POTENTIAL OF ON-SITE SEWAGE SYSTEMS

"Sewage" is defined in The Department of Health on-site system regulations (WAC 248-96-020) as:

> "... the water-carried human or domestic waste from residences, buildings, industrial establishments or other facilities, together with ground water infiltration that may be present".

Ground water contamination associated with domestic sewage or wastewater may involve a number of contaminants including nitrate, bacteria, viruses, organic compounds, chloride, and phosphorus. Because the likelihood of contaminant entry to ground water can be profoundly impacted by the particle size and related pore size of overlying soils, it is necessary to distinguish between soils of differing textural quality. In this section, for simplicity, soils are generically grouped according to three textural categories: fine, moderate, or coarse. In the text, these descriptions are tied to the textural classification system found in the Washington Department of Health on-site sewage regulations (WAC 248-96). That classification system is presented in Table 1.

TABLE 1

SOIL TYPE	SOIL TEXTURAL CLASSIFICATION
1	Coarse sand or coarser
2	Medium sand
3	Fine sand, loamy sand
4	Sandy loams, loams
5	Porous, well developed structure in silt and silt loams
6	Other silt loams, silty clay loams, clay loams

Within this section, the potential for each of the contaminants associated with domestic sewage to adversely affect ground water quality is analyzed.

Nitrate.

Nitrate, formed when ammonia released from the septic tank oxidizes in the subsurface absorption system, is often considered the most significant contaminant associated with domestic wastewater since it is highly resistant to removal within either the on-site sewage system itself or the soil profile. Thus, nitrate is a common contaminant of underlying ground water. The maximum contaminant level (MCL) of nitrate in drinking water is 10 milligrams per liter (mg/l). Nitrate is the indirect causative agent of methemoglobinemia, also known as blue baby disease. Methemoglobinemia is a disorder involving an interruption in the ability of a babies blood to carry oxygen.

The estimated waste load of nitrogen in domestic sewage is 0.024 pounds (11 grams) per capita per day (Siegrist et. al., 1977). Based on an average household occupancy within Clallam County of 2.24 individuals (James from Soule, Feb. 1991), each household produces about 20 pounds (9 kilograms) of nitrogen per year.

It is estimated that perhaps 10% of the nitrogen released to an on-site sewage system is captured in the septic tank and stored within the septage (Laak and Nasr, 1982). However, the remainder of the nitrogen enters the subsurface absorption system, primarily in the form of ammonium. Under aerobic conditions, conversion by soil microorganisms of the ammonium to nitrate occurs rapidly in the soils profile, usually within the first 12 inches (30 centimeters). Unless some rather specific conditions exist to promote denitrification, nitrate removal is limited to seasonal uptake by plants as the effluent percolates through the root zone. With deeply installed on-site sewage systems or soils with a shallow root zone, plant uptake of nitrate is unlikely to occur.

The specific conditions necessary for denitrification, the reduction of nitrate by soil organisms to various nitrogen gases, are as follows:

- Ammonium-nitrogen must be first converted to nitrate-nitrogen (aerobic treatment),
- The nitrate laden effluent must then percolate through a biologically active anaerobic environment or zone, and
- An organic carbon source must be present as an energy source for the denitrifying bacteria (Lance, 1974),

Such conditions generally do not naturally exist, except potentially, in highly stratified soils. However, in some soils, particularly the Type 1 soils, they can be created. This is typically accomplished through equal distribution of septic system effluent over about two feet of an imported medium sand or fine sand fill directly overlying the native coarse textured soils. Equal distribution, through controlled dosing of effluent by pump or dosing siphon, maintains unsaturated flow conditions in the sand fill promoting nitrification. The sharp textural difference between the fill material and the underlying, native Type 1 soil creates a discrete zone of saturation at the interface between the two soils (Gardner, 1964). This occurs because the relatively small pores of the sand fill have a much greater capillary attraction for the percolating effluent than the larger pored native soil. In order for effluent to pass through the interface with the native soil, all adhesive and cohesive forces within the portion of the sand-fill lying nearest the interface must be satisfied (ibid).

Provided the effluent is applied with low volume, frequent doses (perhaps 6 times per day), anaerobic conditions can be maintained at the interface creating an environment where denitrification can occur. Organic carbon, in this instance, is provided by the septic system effluent itself (Bezdicek, 1979), thus, satisfying the third requirement for denitrification.

This form of enhanced treatment can be accomplished through the use of mound systems or sand lined drainfield trenches. Mound systems are sand-fills constructed directly above the natural ground surface. Effluent, distributed through a pressurized bed system installed within the upper portion of the mound, percolates from the fill directly into the underlying native soils. Mound systems must be constructed in accordance with guidelines produced by the Washington State DOH. Sand lined trenches are constructed by over-excavating a standard subsurface drainfield trench and placing sand-fill beneath the drainrock and pressure distribution pipe.

These systems are capable of removing roughly 40% to 50% of the nitrate from percolating effluent (Hill, 1979)(Harkin et. al., 1979) (Lenning, 1991). While this level of removal is significant, development densities must still be maintained at relatively low levels to prevent an unacceptable build up of nitrate in an underlying unprotected aquifer.

It is important to bear in mind that the maintenance of an anaerobic zone beneath the zone in which nitrification takes place is essential for denitrification. For this to occur, significant soil textural differences must exist. Thus, use of a self-contained sand filter system with discharge to a drainfield (pressure or gravity fed) constructed directly in a Type 1 soil (drainrock directly overlying native soil), is not likely to result in denitrification. Similarly, conventional septic tanks and gravity fed subsurface absorption systems constructed in Type 1 soils are likely to accomplish little more than conversion of all nitrogen present in the effluent to the nitrate form prior to reaching ground water.

With on-site systems installed in deep, medium textured soils (Type 2, Type 3, Type 4), the conditions necessary for denitrification to occur would not normally exist and are difficult to create. Thus, unless some physical barrier to the migration of percolating effluent exists, a significant amount of nitrate released from on-site sewage systems installed in such soils would be expected to reach underlying ground water. Attempting to create the conditions necessary for denitrification through construction of a mound composed of finer textured fill materials (e.g. silt loam) over the native medium textured soils, would be largely unworkable from a practical standpoint due to physical problems. Problems such as smearing, over-compaction, and damage to the structure of the fill material would normally be anticipated in constructing fill systems out of fine textured materials. These problems are not normally encountered in mound systems constructed of fine or medium sand.

Conditions necessary for denitrification would not normally exist with on-site sewage systems installed in deep, free draining fine textured soils (Type 5, Type 6) but may be more easily created than is the case with medium textured soils. Denitrification in fine textured native soils should be possible through use of mound system technology. By constructing a mound system composed of fine or medium sand over the fine textured native soils, a discrete anaerobic zone is again created at the fill/native soil interface. In this instance, the saturated zone is created because effluent is able to move relatively quickly through the sand fill but is accepted slowly by the fine textured native soils at the interface (Gardner, 1964).

The fate of nitrogen released to septic tanks and subsurface absorption systems in soils with a shallow, relatively impervious layer such as glacial till or clay (pan) is not clear. It is questionable whether gravity fed systems installed in such soils would consistently provide sufficient vertical unsaturated travel distance for conversion from ammonium to nitrate to occur, at least during the winter months. Further, it is not clear whether the level of biological activity within a till or clay layer is sufficient to promote denitrification. What is certain is that the nitrogen leaving the septic tank must be conserved. Thus, the nitrogen must either be taken up by plants, be somehow entrained in the impervious layer, or migrate laterally on the surface of the impervious layer and escape to the surface water environment.

<u>Bacteria</u>.

A second parameter of concern associated with domestic septic system effluent is bacteria. Mean concentrations of fecal coliform bacteria in septic system effluent are between one and two million organisms per 100 milliliters (ml) (Tyler et. al., 1977). Total bacterial loading of septic system effluent is about 30 million organisms per 100 ml (ibid). While coliform bacteria are associated with only mild forms of illness, they are considered indicators of more pathogenic microorganisms which are difficult to test for on a routine basis.

Owing to differences in soil temperature, native microbial populations, soil texture, and thickness of the unsaturated zone, the bacterial attenuation efficiency of soils can vary widely. Although, it is generally accepted that, in fine to medium textured soils, bacterial contaminants are generally removed from effluent within the first three feet of migration through unsaturated soil materials surrounding the sub-surface absorption system (Ziebel, 1975). Removal mechanisms include filtering action, die off by attrition of nutrients, and the action of materials toxic to the bacteria, either naturally present in the environment or produced by the organisms themselves (Tyler et. al., 1977).

However, coarse textured, excessively permeable soils (Type 1) are ineffective in removing bacteria. Based on past studies concerning the potential for ground water contamination of the Rathdrum aquifer in Spokane, at least 20 and possibly up to 50 feet of vertical filtration through unsaturated sandy and gravelly glacial outwash deposits may be necessary to remove bacterial contamination from septic system effluent (Crosby et. al., 1968). While it is not possible to accurately quantify estimated bacterial loadings to an aquifer, it is possible to make a qualitative assessment of risk. Bacterial contamination should be of greatest concern in areas where ground water is encountered at relatively shallow depths, where conventional on-site sewage disposal system densities are highest, and where soils are formed predominately in deposits of coarse sands and gravels.

Bacteriological contamination associated with the use of on-site sewage disposal systems in coarse textured soils can be mitigated through employment of enhanced treatment devices. Systems utilizing sand filtration and pressure distribution technology such as mound/fill systems, self-contained sand filters, and sand lined trench systems are capable of removing virtually all bacterial contamination from effluent (Hill, 1979).

<u>Viruses</u>.

Unlike bacteria, comparatively little information is available concerning the risks posed by viruses in septic system effluent. While viral contamination of ground water associated with the operation of on-site sewage systems has been documented, some researchers believe the presence of viruses in septic system effluent is sporadic in nature and that between 90% and 100% of viral organisms present in raw wastewater are retained or inactivated in the septic tank (Hill, 1979). The high rate of removal in the septic tank is attributed to digestion of viruses by proteolytic enzymes as well as precipitation and entrapment in the sludge (EPA, 1977). However, free and suspended particle-sorbed viruses will occasionally be released due to turbulent conditions in the septic tank (ibid).

Viruses can be attenuated during migration through a few feet of fine to medium textured unsaturated soils (EPA, 1977). Viral attenuation occurs as a result of the combined effects of sorption, inactivation, and retention. Generally, viruses are rapidly adsorbed to solid surfaces as they enter the soil and once adsorbed, are inactivated in a spontaneous process that is temperature dependent, being most effective at higher temperatures (ibid). The spontaneous inactivation process will normally operate unless saturated flow conditions prevent contact between viruses and soil particles.

In coarse textured, excessively permeable (Type 1) soils, viruses can migrate rapidly with poorly treated effluent to ground water. Once in ground water, viruses can remain viable after moving laterally for thousands of feet (Yates, 1985). Viral removal in coarse textured soils can be greatly improved through the use of sand filtration and pressure distribution technology (Hill, 1979)(Harkin, 1979).

By maintaining unsaturated flow conditions and providing a treatment medium capable of rapid entrapment of viruses, sand filtration with uniform, low-level wastewater application rates should substantially improve treatment efficiency where natural conditions prove inadequate (Hill, 1979).

<u>Organic Compounds</u>.

Although the research is not extensive, available information suggests that domestic effluent often contains volatile and semi-volatile organic compounds, albeit at very low levels. These organic chemicals are generally residues from household cleaning and paint products. Contaminants of this type are referred to as household hazardous wastes.

One of the few definitive studies concerning concentration of low-level organic compounds in septic system effluent was conducted in the Lakewood area of the central Pierce County by the University of Washington in 1980 (De Walle et. al., 1982). In that study, the influent and effluent of a 33,000 gallon septic tank serving 97 residences was monitored daily for volatile organic compounds during a one week period. One of the most frequently observed compounds and the one observed at the highest levels was toluene. Toluene had an average influent concentration of 34.6 ug/l, average effluent concentrations of 38.8 ug/l, and a peak concentration of 56.9 ug/l. The suspected source of the toluene entering the septic tank was cleaning solvents and paint thinners.

Influent levels of toluene and other volatile compounds such as tetrachloroethane, trichloroethylene, benzene, and ethylbenzene were observed to be considerably higher on weekends than weekdays. Presumably, the higher weekend levels of those contaminants were related to increased discretionary household maintenance activities such as house painting and cleaning and related use of paints, thinners, degreasers, and toilet bowl cleaners. Essentially no removal of organic compounds was found to occur in the septic tank, particularly with higher molecular weight compounds. No attempt was made to determine the fate of these compounds once the septic system effluent entered the drainfield.

Based on the results of other research, it appears that removal of organic compounds from effluent percolating through the soil is least likely to occur in relatively coarse textured soils with a low organic content (Wilson, J.T., et. al., 1981).

Chloride.

Like nitrate, chloride is generally resistant to removal in either on-site systems or soils underlying such systems. Chloride levels in untreated septic system effluent are about 50 to 80 mg/L (Salvato, 1972). Those levels are 1/3 to 1/5 of the drinking water standard for chloride of 250 mg/L (WAC 248-54). The drinking water standard for chloride was not based on public health concerns, but for aesthetic (specifically taste) considerations.

Phosphate.

Phosphorus concentrations in septic system effluent generally range between 6.25 and 30 mg/l (Peavy and Groves, 1977). However, phosphorus accumulation in ground water beneath septic systems is rare since it is rapidly immobilized in soils with a pH of less than 7 by sorption reactions or by the formation of insoluble phosphate precipitates of aluminum or iron (Hausenbuiller, 1978).

Even in areas with excessively permeable soils overlying unconfined aquifers phosphorus contamination has not proven to be a significant problem. For example, in the late 1970's, the Washington Department of Health conducted extensive tests on drinking water wells in an area of central Pierce County with coarse textured soils. The area was served exclusively by on-site sewage disposal systems and had an approximately 40 year history of development (Littler, et al., 1981). 74% of the 87 wells tested indicated total phosphorus levels below the detection limit of 0.2 mg/L. These wells ranged in depth from between 30 to 408 feet. 31 wells were completed at depths of less than 100 feet and a number of those were tapping an unconfined aquifer (TPCHD, 1985).

The remaining 26% of the wells, ranging in depth from 30 to 507 feet, demonstrated total phosphorus levels between 0.25 and 1.1 mg/L. Both the median and mean phosphorus level in these 23 wells was 0.6 mg/L. A maximum contaminant level has not been established for phosphorus in drinking water.

While phosphorus is generally not a significant contaminant of ground water aquifers, because it is a biostimulant and can induce rapid growth or blooms of algae and phytoplankton, it does have significant environmental effects when released to surface water systems.

EFFECTS OF COMMUNITY ON-SITE SEWAGE SYSTEMS

Community on-site sewage systems generally involve application of the same treatment technology that has been described above. Because a community system discharges a relatively large amount of sewage to a small area of land, nitrate loading to ground water in the immediate vicinity of a community system can be unacceptable. This can occur even if a low overall development density is maintained.

Since community on-site sewage systems can be placed as close as 100 feet from a public water supply well, localized ground water impacts from the operation of such systems could potentially have serious consequences.

COMMERCIAL, INDUSTRIAL, INSTITUTIONAL SYSTEMS

Commercial, industrial and institutional use of on-site sewage disposal systems represent several problems. First, some commercial and institutional facilities, such as laundromats, restaurants, and schools generate large volumes of wastewater. Wastewaters from these large volume generators are typically discharged to one or more sizable on-site sewage systems. As with residential community systems, concentration of wastewater in one discrete area can have a significant impact on the quality of underlying ground water in the immediate vicinity of the on-site sewage system.

Secondly, the characteristics of sewage generated by commercial and institutional facilities can be considerably different from that discharged from residential units. Only domestic wastewater can be legally discharged under an on-site sewage disposal system permit issued by the Clallam County Environmental Health Division. However, in commercial, industrial, or institutional facilities where products containing volatile and semi-volatile organic compounds are used or stored, there is a potential for deliberate or unintentional discharges of such chemical materials through sinks or other plumbing fixtures. Such discharges may result from solvent rinsing of machine parts over a sink at an auto repair shop or disposal of used cleaning solutions at nearly any type of commercial, industrial, or institutional establishment. Instead of the relatively low concentration of organic compound that are occasionally found in wastewater from residential sources, wastewater from these non-residential sources can contain significant quantities of organic compounds. These compounds are ingredients in many solvents, degreasers, fuel products, and paint products.

Because volatile and semi-volatile organic compounds are not effectively degraded or adsorbed during migration through coarse textured soils such as sands or gravelly sands, once released to the on-site sewage system these compounds may migrate to underlying ground water (Wilson et. al., 1981).

CONCEPTUAL DESIGN OF THE PREDICTIVE TOOL

This section describes the conceptual design of a tool or methodology for identifying portions of the Sequim/Dungeness study area with a relatively high risk of significant ground water contamination associated with on-site sewage disposal system use. Development of this predictive tool was prompted by the past successful development by the Clallam County Environmental Health Division of similar methodologies for identifying areas where on-site sewage systems were adversely impacting the water quality of Sequim Bay.

The Sequim Bay project was clearly surface water oriented. That project focused on the identification of malfunctioning on-site sewage systems that were contributing to coliform bacteria contamination of Sequim Bay and tributary streams. The "performance indicator" used to assess the treatment efficiency of on-site sewage systems as part of that project was the estimated failure rate in a given area. Failure, in this instance, is the hydraulic overload of an on-site system due to inadequate design or operation of systems in seasonally saturated soils resulting in surfacing of effluent or the back-up of sewage into the building sewer. The failure rate was established based on a search of Clallam County Environmental Health Division records concerning the issuance of on-site sewage system repairs permits in each portion of the study area.

In contrast, the Sequim/Dungeness ground water study is ground water oriented. As a performance indicator, the incidence of traditional failures (that is, surfacing sewage problems) is of little consequence from a ground water perspective. The performance indicator that is currently available for use in the Sequim/Dungeness study is, primarily, the presence or absence of contaminants in ground water that are associated with on-site sewage disposal systems, particularly nitrate. For obvious reasons, from a ground water protection perspective, this is not an acceptable performance standard.

Therefore, a methodology must be developed to identify areas where the potential for ground water contamination associated with on-site sewage systems appears to be greatest. Such a methodology can assist in the design of further ground water quality investigations and the development of non-point source prevention and control programs associated with existing development, as well as, help guide decisions concerning the advisability of additional development.

The approach taken to the identification of areas of high ground water contamination risk must be different than the approach taken to the identification of potential surface water quality problems. In designing the conceptual ground water predictive tool, the following factors and/or limitations should be considered:

1) Virtually all on-site sewage systems contribute to contamination of underlying ground water to some extent. However, the focus of the predictive tool is public health oriented, thus, its purpose is to identify areas where impacts of on-site sewage systems on ground water quality are likely to be most profound. This approach could be viewed as inconsistent with the Washington Ground Water Quality Standards (WAC 173-200) which are both health based and water resource based. Under those standards, virtually <u>any</u> increase in the contaminant concentrations over <u>natural levels</u> could be considered significant. With a ubiquitous and highly mobile contaminant such as nitrate, any portion of the study area where human activity has or is now occurring will likely show evidence of nitrate contamination; including both sewered and unsewered areas (Eckhardt et. al., 1989).

2) Water quality data concerning elevated nitrate levels in the Sequim/Dungeness study area have been obtained, primarily, from existing individual and public drinking wells, not from specially constructed or located monitoring wells. The data from the drinking water wells do not necessarily provide a comprehensive representation of nitrate levels in the aquifer system as a whole. Improper well construction or siting problems may be a factor in at least a portion of the elevated nitrate levels observed in the study area. The potential for these types of problems may not be identified through a predictive tool using regional land-use, geohydrologic, and soil information.

3) The focus of this effort is primarily oriented towards identifying nitrate contamination potential associated with on-site sewage systems. However, the Sequim/Dungeness aquifer system is a complex system with significant amounts of recharge from overlying surface waters, particularly from irrigation ditches and canals. In addition to on-site sewage disposal systems, a wide variety of other nitrogen sources could be contributing to the presence of nitrate in ground waters including commercial agricultural activities (fertilizers and animal waste), non-commercial agricultural activities (hobby farms), lawn and garden fertilizer use, sewer exfiltration, domestic animals, and natural releases (e.g. atmospheric and

biological habitat). Thus, limiting the predictive tool to identifying the potential for significant contamination from on-site sewage systems may not provide insight into the potential for nitrate contamination from other sources.

RISK FACTORS

Factor 1: Soil Conditions.

Soil conditions are a significant factor in determining the potential for ground water contamination. As part of the development of the predictive tool, the Soil Survey of Clallam County (SCS 1987) was used to evaluate the characteristics of the soil series that are present within the Sequim/Dungeness study area. Where appropriate, soil series with similar characteristics are grouped into a single category. For instance, all somewhat excessively drained, highly permeable soils, those referred to as Type 1 soils in the Department of Health on-site sewage regulations, are grouped into a single category. This includes Carlsborg gravelly sandy loam, Dick loamy sand, Hoypus gravelly sandy loam, Nielton very gravelly sandy loam, and Sequim very gravelly sandy loam. A brief description of the soils series present within the Sequim/Dungeness study area are presented in Appendix A.

The soils series or soil groups are also categorized based upon the degree to which their physical properties facilitate the migration of contaminants. Soil series or groups of soils are assigned a low, moderate, or high risk value as presented in Appendix B. Type 1 soils are assigned the highest level of risk because, without special precautions, there is a strong potential for a number of different contaminants associated with on-site sewage systems installed in such soils to migrate to underlying ground water. Lowest levels of risk are assigned to poorly drained soils with thick, underlying clay sequences separating the surface soils from the first permanent aquifer zone. This categorization will allow the Water Quality Division to assign a contamination weighting value or factor to soils within the study area. Obviously, soil conditions, in and of themselves, do not result in contamination of ground water. Thus, the risk associated with a soil series or soils group must be linked to sources of contamination, either existing or future.

Based on the SCS soil survey, the approximate distribution of each soil series or soil group has been estimated as a percentage of the total acreage of each quarter section within the study area*. This data has been incorporated into the Sweet-Edwards/EMCON (SE/E) contaminant loading model. Using this model, the Water Quality Division can identify quarter sections within the study area with substantial percentages of moderate and high risk soil series or soil groups. The distribution of soils by quarter section is presented in Appendix C.

(*Note: Soil distribution was determined for the smallest unit of land for which corresponding land use data is available. Generally, this is a quarter section, however, occasionally it is a smaller or larger unit of land.)

Limitations of Approach to Risk Factor 1. In determining the approximate distribution of soils within each quarter section, the accuracy of limitations of the SCS Soil Survey are acknowledged. Within any mapping unit, approximately 10 percent to 30% of the land area may be occupied by soils of a different nature than the mapping unit indicates.

Factor 2: Density of On-Site Systems.

The second risk factor to be considered in the determination of the potential for ground water contamination associated with on-site sewage disposal systems is the density of such systems within a given geographic area. This factor may be approached both from the standpoint of the number of systems that may already be in existence and the number of systems that could potentially exist in the future.

Using information supplied by the Clallam County Planning Division, Long Range Planning Group, a number of different scenarios for on-site sewage system densities were developed. Current or near term densities were estimated through determining the number of existing platted lots and parcels within each quarter section. Since not all platted lots and parcels are developed at this time, estimates of existing loading based upon these numbers are undoubtedly high.

Alternatives to the use of total platted lots and parcels as an indication of the existing level of development were explored. This involved reviewing data sets generated by the River Basin Team and sets generated by the Clallam County Environmental Health Division.

The River Basin Team provided data concerning the number of improvements within the study area. Estimates of existing on-site sewage system density based on this data are likely to be more indicative of actual current conditions. However, data concerning the number of improvements are available only on a section level, not on a quarter section level as are the soil and platted lots and parcels data. In addition, improvements located in sewered areas and unsewered areas are not currently differentiated.

The Clallam County Environmental Health Division conducted a file search to determine the total number of permitted on-site sewage systems. The file search was conducted for about half the study area. Similar to the information concerning improvements from the River Basin Team, the permit information is currently available on a section level only. In addition, on-site sewage system permitting requirements in Clallam County have only been routinely enforced since about 1975 (Soule, 1991). Thus, use of the number of septic tank permits appears to under estimate the number of on-site sewage systems, especially in areas of older development. A comparison of data sets available for estimating existing on-site sewage system density is presented in Appendix D.

To provide an assessment of long term density potential, Long Range Planning also prepared estimates concerning the maximum number of residential unit equivalents that could eventually be permitted under existing zoning designations within each quarter section. Long Range Planning developed similar estimates concerning the maximum number of residential unit equivalents that could potentially be allowed under Planned Unit Development provisions of the zoning code.

In addition, utilizing the Method I lot size determination procedures found in the Clallam County Health Regulation Chapter 4, the SE/E team assigned to each SCS soil series and soil group present in the Sequim/Dungeness study area a value indicating the maximum development density that could potentially be achieved using on-site sewage disposal systems. Two values are assigned for each soil series or group, maximum density based on public water system availability and maximum density based on use of individual wells. This information is also contained within Appendix A. When coupled with the distribution of soils in each quarter section discussed under Risk Factor 1, the approximate number of units that could obtained under Method I in each quarter section can be calculated. This information is presented in Appendix E. The Method I information is intended to assist in determining the likelihood that densities allowed under current zoning or Planned Unit Developments could be attained.

The SE/E loading model has incorporated the data concerning numbers existing lots, the maximum zoning buildout scenario, the maximum Planned Unit Development buildout scenario, and the Method I development potential. A breakdown of potential loading based on each of these scenarios in presented in Appendix F.

A determination will need to be made concerning the threshold level above which on-site sewage system density levels indicate a relatively high risk of nitrate contamination. A density of 1 unit per acre could be selected as the threshold. 1 unit per acre represents the most conservative density requirement identified in the Washington Department of Health on-site sewage system regulations (WAC 248-96). In addition, the Clallam County Comprehensive Plan (Title 31) considers 1 unit per acre as the dividing point between low density rural environments and higher density urban or suburban environments.

However, based on consideration of the Washington Ground Water Quality Standards, a lower threshold may be justified. The Department of Ecology has suggested that thresholds of between 1 unit per 1.5 acres to 1 unit per 16 acres may be appropriate (Kinsley, 1991).

Limitations of Approach to Risk Factor 2. Regardless of whether densities are estimated on a per section or per quarter section basis, there is a certain margin of error associated with the distribution of on-site sewage systems within that given unit of land. Dividing a total number of on-site sewage systems by 640 acres or 160 acres provides an average density within a section or quarter section. However, it is unlikely that development within those areas is uniformly distributed. Development is much more likely to be sporadically concentrated in mobile home parks, short plats, and subdivisions. Thus, even though overall loading within a section or quarter section may appear to be low, within discrete portions of the section or quarter section, density of on-site sewage systems can be much higher than average and result in significant localized impacts on ground water.

Aside from economic pressures to lower marginal development costs by maximizing the density of development, institutional pressures for concentration of development exist as well. The Clallam County Comprehensive Plan (Title 31) encourages innovative development options which allow higher residential densities in the Sequim/Dungeness Area as an incentive to establish open space reservation.

Accordingly, the Clallam County Zoning Code (Title 33) encourages clustering of development within the Sequim/Dungeness area through an Open Land Development Option (OLDO). Portions of the Sequim/Dungeness area that are zoned Rural Residential (RR) 1, RR 2, and RR 3 may be developed under this option. Under the OLDO, development is concentrated in a relatively small portion of a parcel or parcels of no less than 19 acres in aggregate (referred to as the Development Section). A large tract of undeveloped property to be used for open space and agriculture is then left undeveloped in perpetuity (referred to as the Open Land Reservation).

While the OLDO approach represents sound land use management from a number of perspectives, the concentration of wastewater in a relatively small physical area and associated elevated nitrate levels in ground water immediately under the developed area need to be reconciled.

Factor 3: Community On-Site Sewage Systems.

Partially in response to the limitations noted previously for Risk Factor 2, one aspect of the predictive tool should be oriented towards identifying areas where "Larger" on-site community systems are located, particularly systems installed before 1979, the date when the larger system guidelines were implemented by the Washington Department of Health. In addition, areas with a proliferation of smaller community systems or systems serving high volume commercial or institutional facilities should be identified.

Limitations of Approach to Risk Factor 3. No significant limitations are identified except the time and effort involved in identifying such systems.

Factor 4: On-Site Sewage System Age. Since enhanced treatment technology requirements (pressure distribution and alternative systems) were not implemented in Clallam County until about 1984 (Soule, 1991), it can be assumed that most on-site sewage systems installed prior to that time are gravity fed, suggesting limited treatment efficiency. It is also likely that use of drywells, now prohibited, would be associated with older on-site sewage systems. Efforts to identify potential problems associated with this factor should be concentrated on areas with deep medium or coarse textured soils and a relatively large number of systems installed before 1984, with special emphasis placed on system installed before 1976 (implementation date of WAC 248-96).

File surveys conducted by the Clallam County Environmental Health Division and the Water Quality Division suggest that most areas have a mix of systems of varying ages. However, some areas show significant numbers of pre-1984 (and 1976) systems. These areas include:

- T. 30 N, R. 3 W, Section 18;
- T. 30 N, R. 4 W, Section 1;
- T. 30 N, R. 4 W, Section 7; and
- T. 30 N, R. 4 W, Section 13.

Limitations of Approach to Risk Factor 4. The applicability of system age to ground water contamination is less clear than other factors. After maturity of the biological crust, even gravity systems can promote unsaturated flow, which would suggest that nitrogen is the contaminant of primary concern in the long term. Since only mounds and sand lined trenches installed in Type I soils appear to have significant potential for nitrate removal, system age may only be of marginal concern. In design of the predictive tool, on-site sewage system age should be of an order of magnitude lesser importance than soil and system density.

ASSESSMENT OF FACTORS UNRELATED TO ON-SITE SEWAGE DISPOSAL

As indicated in the introduction to this section, identification of portions of the Sequim/Dungeness study area where ground waters may be significantly impacted by contaminants associated with on-site sewage systems addresses only a single source of a single contaminant, nitrate. Within the Sequim/Dungeness study area, there are a several additional nitrate sources and a number of sources of a variety of other ground water contaminants. Longer term, a more comprehensive approach to identifying and controlling risks to ground water quality should be considered. In that regard, the following recommendations are offered.

Agricultural Impacts.

The River Basin Team has identified total acreage of commercial agriculture lands within each section of the Sequim/Dungeness study area. Currently, the specific nature of agricultural activities on these lands has not been inventoried. If surveys were conducted of agriculture activities, an appropriate per acre nitrogen loading could be assigned. The Conservation District should be consulted in the development of nitrate loading values. To accommodate agricultural data and estimated loading values that may be developed in the future, the SE/E loading model has incorporated data entry fields for four types of commercial agricultural land uses including dairy/livestock, row crop, hay, and orchard. Similar classifications may be suitable for non-commercial agricultural data if it is ever developed.

Commercial, Industrial, Institutional Impacts.

The nitrate contamination problems that have been identified in the Sequim/ Dungeness study area indicate that underlying ground waters are vulnerable to contaminants generated through land surface activities. In addition to nitrate, there are a number of other types of contaminants that could adversely affect ground water. Of greatest concern, would be hazardous materials that may be used, stored, or disposed of during operations at commercial, industrial, and institutional facilities. Examples of potential sources of hazardous materials include service stations, dry cleaners, automotive repair shops, agricultural supply facilities, bulk fuel storage, and pesticide applicators. These types of sources should be identified, the relative risk associated with their operations assessed, and, if necessary, controlled or regulated. Special attention should be given to facilities utilizing underground storage tanks.

The River Basin Team has identified the number of commercial improvements in each section within the study area. This should provide a starting point for an inventory of the specific types of commercial facilities that these improvements represent.

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APPENDIX A

SOIL INTERPRETATIONS
SEQUIM/DUNGENESS STUDY AREA

SCS SOILS SERIES AND SOILS GROUPS

CODE numbers (e.g. **CODE 24**) correspond to identification numbers used for soil series and groups in the Sweet-Edwards/Emcon (SE/E) nitrate loading model. The number preceeding each specific soil series (e.g. 6 Carlsborg) is the mapping unit number for that specific soil as found in the SCS Soil Survey for Clallam County (SCS, 1987).

CODE 24 = Type 1 soils including:

- 6, Carlsborg gravelly sandy loam 0-5% slope (Typic Xerorthents), deep, somewhat excessively drained soils on river terraces and alluvial fans formed in alluvium.

- 16, Dick loamy sand 0 - 15% slope (Alfic Xeropsamments), deep, somewhat excessively drained soils on outwash terraces formed in glacial outwash.

- 23, Hoypus gravelly sandy loam 0-15% slope, (Typic Xerorthents), deep, somewhat excessively drained soils on terraces and terrace escarpments formed in glacial outwash.

- 24, Hoypus gravelly sandy loam 15-30% slope (Typic Xerorthents), deep, somewhat excessively drained soils on terraces and terrace escarpments formed in glacial outwash.

- 25, Hoypus gravelly sandy loam 30-65% slope (Typic Xerorthents), deep, somewhat excessively drained soils on terraces and terrace escarpments formed in glacial outwash.

- 44, Neilton very gravelly sandy loam 30-70% slope (Dystric Xerorthents), deep, somewhat excessively drained soils on outwash terraces and terrace escarpments formed in glacial outwash.

- 45, Neilton very gravelly sandy loam 5-30% slope (Dystric Xerorthents), deep, somewhat excessively drained soils on outwash terraces and terrace escarpments formed in glacial outwash.

- 46, Neilton very gravelly coarse sandy loam 0 - 5% slope (Dystric Xerorthents), deep, somewhat excessively drained soils on outwash terraces and terrace escarpments formed in glacial outwash.

- 63, Sequim very gravelly sandy loam (Entic Haploxerolls), deep somewhat excessively drained soils on terraces and alluvial fans formed in old alluvium.

<u>Interpretation</u>: Type 1 soils, due to their coarse texture and rapid permeability, are considered to represent the highest level of threat to ground water quality.

Allowable On-site System Density: With public water system availability, 1 dwelling unit (du)/acre for conventional (septic tank and gravity drainfield) on-site systems. Conventional systems installed in Type 1 soils are considered a source of not only nitrate contamination of ground water, but bacterial, viral, trace organics, and, potentially, phosphorous contamination as well.

2 du/acre is allowed when mound system technology (pressure distribution and sand filtration) is utilized. The treatment efficiency of such systems is exceptionally high with nearly 100% removal of bacteriological and viral contaminants and 44-50% removal of nitrate. Since nitrate is the contaminant of immediate concern, 2 du/acre with mound type systems are considered equivalent (in terms of loading) to 1 du/acre served by a conventional system.

With individual wells, allowable density is 0.5 du/acre.

CODE 1 - Agnew silt loam:

- 1, Agnew silt loam 0 - 8% (Aquic Haploxeralfs), very deep, somewhat poorly drained soils formed in glaciomarine sediments. Much of the soil profile is occupied by slowly permeable clay loam. Some denitrification is possible due to high degree of stratification in the soil profile. A seasonal water table at 2 to 4 feet limits effective rooting depth.

Interpretation: This is a Type 6 soil. The shallow water table is perched on slowly permeable deposits.

Allowable on-site system density: Density with public water system would be 2.0 du/acre.

With individual wells, density would be 0.5 du/acre.

CODE 9 - Cassolary fine sandy loam:

- 9, Cassolary fine sandy loam 0 - 8% slope (Typic Xerochrept), deep, moderately well drained soils on hills formed in reworked glacial drift and marine sediments. Soils consist of moderately slowly permeable fine sandy loam and loam. A seasonal water table at 3 to 4 feet limits effective rooting depth.

Interpretation: This is probably a Type 4 soil. The water table is perched on a slowly permeable layer, thus, lateral flow and release to the surface water system is possible.

Allowable on-site system density: With public water system availability, density would be 2.4 du/acre.

With individual wells, density would be 1 du/acre.

CODE 12 - Gravelly sandy loam overlying compact till at shallow depth, including:

- o 10, Catla gravelly sandy loam 2 to 15% slope (Dystric Xerochrepts), shallow, moderately well drained soil on hills formed in compact glacial till (glacial till at 14 inches). A perched seasonal water table is present at 0.5 to 1.5 feet.

- o 12, Clallam gravelly sandy loam 0 to 15% slope (Dystric Xerochrepts), moderately deep, moderately well drained soils on hills formed in glacial compact glacial till (dense glacial till at 28 inches). A perched seasonal water table is present at 1.5 to 3.0 feet.

- o 13, Clallam gravelly sandy loam 15 - 30 % (Dystric Xerochrepts), moderately deep, moderately well drained soils on hills formed in compact glacial till (glacial till at 28 inches). A perched seasonal water table is present at 1.5 to 3.0 feet.

- o 20, Elwha gravelly sandy loam 0-15% (Dystric Xerochrepts), moderately deep, moderately well drained soils on hills formed in compact glacial till (glacial till at 33 inches). A perched seasonal water table is present at 1.5 to 3.0 feet.

- o 21, Elwha gravelly sandy loam 15 - 35% (Dystric Xerochrepts), moderately deep, moderately well drained soils on hills formed in compact glacial till (glacial till at 33 inches). A perched seasonal water table is present at 1.5 to 3.0 feet.

Interpretation: The glacial till layer acts as a significant barrier to vertical migration of effluent. Denitrification could conceivably occur at the interface with the till when seasonal water table is not present. Soil depth may not be adequate to provide treatment of biological contaminants. Soils of this group may represent a risk of surface water contamination.

Allowable on-site system density: Maximum density with public water system availability for these Type 4 soils would be 2.4 du/acre.

With individual wells, density would be 1.0 du/acre.

CODE 17 - Dungeness silt loam:

- o 17, Dungeness silt loam (Mollic Xerofluvents), deep, well drained soils on flood plains and low river terraces formed in alluvium. The profile is stratified and consists of silt loam, very fine sandy loam, and silty clay loam. Below 56 inches are deposits of fine and medium sand. Depth to water is greater than 60 inches.

Interpretation: Dungeness is a moderately permeable soil with an effective rooting depth of more than 60 inches. Owing to the highly stratified nature of this soil, arguably, once an unsaturated flow regime is established (mature gravity system or pressure distribution), nitrate removal efficiencies similar to that of mound systems could be possible. This is predicated on systems being installed at a shallow depth.

The nitrate removal should be augmented seasonally by uptake in the deep root zone. Thus, in terms of nitrate, effective density in this Type 3 or 4 soil could be 1.5 (50% reduction) to 3 du/acre (0% reduction). Efficiency of removal of other conventional parameters by mature systems should be high.

Allowable on-site system density: With public water system availability, density would be between 2.4 and 3.0 du/acre.

With individual wells, density would be 1.0 units per acre.

CODE 34 = Louella series soils including:

- o 34, Louella gravelly loam 10 to 30% slope (Ultic Haploxerolls), deep well drained on mountainsides, formed in residuum and colluvium derived from basalt and flow breccia.

- o 35, Louella gravelly loam 30 to 65% slope (Ultic Haploxerolls), deep well drained on mountainsides, formed in residuum and colluvium derived from basalt and flow breccia (portions of this unit are unsuitable due to excessive slope).

Interpretation: The presence of an impervious layer that would restrict migration to ground water aquifer is not noted in the SCS description, although one may exist. Due to the lack of an identifiable denitrification mechanism, conservatively, an assumption should be made that 100% of nitrogen should reach ground water in the form of nitrate. Efficiency of removal of other conventional parameters by mature systems should be high.

Allowable On-Site System Density: Since this is a variable Type 3 or Type 4 soil, maximum density with public water system

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availability should range from 2.4 to 3.0 du/acre.

With individual wells, allowable density would be 1 du/acre.

CODE 53 - Puget silt loam:

- 53, Puget silt loam (Aeric Fluvaquents), deep, poorly drained soils on low terraces and flood plains formed in recent alluvium. Soils are a moderately slowly permeable silty clay loam below 9 inches. A seasonal water table is present at 4 to 6 feet. Under natural conditions, the water table would be considerably higher, however, areas of Puget soils have been extensively drained.

Interpretation: This is a Type 6 soil. The question of how effectively nitrate could migrate through the slowly permeable silty clay loam is complicated by extensive artificial drainage. Such drainage system could be a conduit for nitrogen release to surface water systems.

Allowable on-site system density: With public water system availability, density would be 2.0 du/acre.

With individual wells, density would be 0.5 du/acre.

CODE 60 - Schnorbush soils, including:

- 59, Schnorbush loam 0 to 20% (Dystric Xerorchrepts), deep, well drained soils formed in glacial till and residuum derived from siltstone. The profile typically consists of loam over silty clay loam (massive, very hard, very firm, sticky, plastic).

- 60, Schnorbush loam 20-55% (Dystric Xerorchrepts), deep, well drained soils formed in glacial till and residuum derived from siltstone. The profile typically consists of loam over silty clay loam (massive, very hard, very firm, sticky, plastic).

Interpretation: The silty clay loam layer could conceivably support denitrification. Rooting depth is more than 60 inches. These could be considered Type 4 or Type 6 soils.

Allowable on-site system density: Allowable density with public water system availability would be 2.0 or 2.4 du/acre.

With individual wells, density could be as high as 1.0 units per acre.

Code 75 - Yeary, gravelly clay loam, including:

o 75, Yeary gravelly loam 0-15% (Dystric Xerochrepts), moderately deep, moderately well drained soil on hills formed in reworked marine sediments overlying compact glacial till. Soil between 13 and 38 inches is typically gravelly clay loam, glacial till is present at about 38 inches (can be as shallow as 20 inches). A seasonal water table is present at 1.5 to 3.0 feet.

o 76, Yeary gravelly loam 15-30% slope (Dystric Xerochrepts), moderately deep, moderately well drained soil on hills formed in reworked marine sediments overlying compact glacial till. Soil between 13 and 38 inches is typically gravelly clay loam, glacial till is present at about 38 inches (can be as shallow as 20 inches). A seasonal water table is present at 1.5 to 3.0 feet.

Interpretation: The till layer restricts the vertical migration of septic tank effluent. Denitrification could conceivably occur at the interface with the till when the seasonal water table is not present. Soil depth may not be adequate to provide treatment of biological contaminants. Soils of this group may represent a risk of surface water contamination.

Allowable on-site system density: Allowable density with public water system availability in these Type 4 or Type 6 soils is 2.0 du/acre.

With individual wells, density may be as high as 1 du/acre.

CODE 7 = Carlsborg/Dungeness Complex 0-5% slope:

o 17, This complex consists of 50% Carlsborg (See: Code 24); 30% Dungeness (See Code 17); 20% inclusions riverwash (Unsuitable), Hoypus (See Code 24), Puget (See Code 53) and Sequim (See Code 24).

Interpretation: The complex is too intricately intermingled to accurately map at the scale of the SCS Soil Maps.

Allowable On-Site System Density: With public water system availability, density would be variable. At least 50% of the complex is subject to the Type 1 requirements explained above.

The Dungeness portion of the complex could support up to 3.0 du/acre.

With individual wells, allowable density in the Dungeness portion of the complex would be 1 du/acre.

CODE 64 - Sequim, Mc Kenna, Muckilteo complex.

- o 64, Approximate distribution is 35% Sequim (Type 1 soil described above under Code 24), 35% Mc Kenna, and 20% Muckilteo muck. The remaining 10% consists of small areas of Bellingham (Unsuitable), Carlsborg (See Code 24), and Clallam (See Code 12) soils.

- o 42, Mc Kenna gravelly silt loam (Mollic Haplaquept), moderately deep poorly drained soils in basins and drainage ways formed in glacial till (depth to compact glacial till 20 to 40 inches).

- o 43, Muckilteo Muck (Typic Medihemists), soil composed of sapric and hemic materials from deciduous trees, shrubs, and sedges.

Interpretation: The Mc Kenna and Muckilteo portions of the complex are unsuitable for use of on-site sewage systems. Thus, this mapping unit is approximately 35 to 45% usable soils, nearly all of which would be Type 1.

Allowable on-site system density: 45% of mapping unit = 1 du/acre (adjusted loading = 0.45 du/acre) for conventional (septic tank and gravity drainfield) on-site systems. Conventional systems installed in Type 1 soils are considered a source of not only nitrate contamination of ground water, but bacterial, viral, trace organics, and potentially phosphorous contamination as well. 0.90 du/acre when mound system technology (pressure distribution and sand filtration) is utilized. The treatment efficiency of such systems is exceptionally high with nearly 100% removal of bacteriological and viral contaminants and 44-50% removal of nitrate. Since nitrate is the contaminant of concern, 0.90 du/acre with mound type systems are considered equivalent (in terms of loading) to 1 du/acre served by a conventional system.

55% of mapping unit = 0.0 du/acre.

APPENDIX B

SEQUIM/DUNGENESS AREA SOILS

GROUND WATER CONTAMINATION RISK LEVELS

KEY TO SOIL CODES:

1 = Agnew silt loam.

7 = Carlsborg/Dungeness Complex.

9 = Cassolary fine sandy loam.

12 = Sandy loams over glacial till.

17 = Dungeness silt loam.

24 = Type 1 soils.

34 = Louella soils.

53 = Puget silt loam.

60 = Schnorbush Soils.

64 = Sequim, Mc Kenna, Muckilteo Complex.

75 = Yeary gravelly clay loam.

SEQUIM-DUNGENESS SOIL TYPE RISK CATEGORIES

1) **Risk Category - High.**

Soil Codes: 24, 7 part, 63 part.

Description: Deep, somewhat excessively drained, coarse textured soils. Confining layer over first permanent aquifer zone may be absent.

Treatment Efficiency:

- Conventional on-site sewage disposal systems: Poor for all parameters due to rapid permeability.

- Mound systems or sand lined trenches w/pressure distribution: Good for all parameters except nitrogen. Approximately 50% nitrogen removal efficiency possible if system proper designed/installed.

2) **Risk Category - Moderate to High.**

Deep, well drained, medium textured soils. Confining layer over first permanent aquifer zone may be absent.

Soil Codes: 17, 34, 60, 7 part.

Treatment Efficiency:

- Conventional on-site sewage disposal systems: Good for all parameters except nitrogen, **provided**, unsaturated flow conditions maintained. The highly stratified nature of the Code 17 and part of Code 7 soils may be conducive to nitrogen removal.

- Mound Systems: Good for all parameters except nitrogen. Nitrogen removal efficiency of up to 50% is questionable because fill material may be too similar in texture to the native soils to promote anaerobic conditions at the interface.

3) **Risk Category - Moderate.**

Soil Codes: 12, 75, 9

Moderately deep, moderately well drained, medium textured soils overlying gravelly glacial till or compacted material of similar texture. Till layer separates the first permanent aquifer from the surface, however, thickness and permeability of till is variable.

Treatment Efficiency:

- Conventional on-site sewage disposal systems: Poor for all parameters due to inadequate unsaturated soil depth.

- Mound systems: Good for all parameters except nitrogen. Nitrogen removal efficiency of up to 50% is questionable because fill material may be too similar in texture to the native soils to promote saturated conditions at the interface.

4) **Risk Category - Low to Moderate.**

Soil Codes: 1, 53

Somewhat poorly to poorly drained soils overlying relatively impermeable clay layers. Clay layers separate the first permanent aquifer from the surface.

Treatment Efficiency:

- Conventional on-site sewage disposal systems: Moderate to poor for all parameters due to inadequate unsaturated soil depth. Treatment efficiency may be slightly higher than the previous category due to finer soil texture. Highly stratified nature of these soils may promote denitrification.

- Mound systems: Good for all parameters except nitrogen. Nitrogen removal efficiency of up to 50% possible.

APPENDIX C

SEQUIM/DUNGENESS AREA SOILS

DISTRIBUTION OF SOILS BY QUARTER SECTION

KEY TO SOIL CODES:

1 = Agnew silt loam.

7 = Carlsborg/Dungeness Complex.

9 = Cassolary fine sandy loam.

12 = Sandy loams over glacial till.

17 = Dungeness silt loam.

24 = Type 1 soils.

34 = Louella soils.

53 = Puget silt loam.

60 = Schnorbush Soils.

64 = Sequim, Mc Kenna, Muckilteo Complex.

75 = Yeary gravelly clay loam.

X indicates that data in these columns are supplied by user;
remaining column values are calculated quantities.

location	sec	part	acres	UNSUIT	1	7	9	12	17	24	34	53	60	64	75	SUM
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
				percentage of soil type for location,section,part												
T29N R3W	2	NE50	40					50		50						100
*T29N R3W	2	E50NW25	80													0
T29N R3W	2	W50NW25	80												100	100
T29N R3W	2	SW	160	5				25		65					5	100
T29N R3W	2	SE	112					60		40						100
T29N R3W	3	NE	160	25				25							50	100
T29N R3W	3	NW	160	60				5							35	100
T29N R3W	3	SW	130	5				20			35				40	100
T29N R3W	3	SE	228					25		20					55	100
T29N R3W	4	NE	160	75											25	100
T29N R3W	4	NW	160	25				55							20	100
T29N R3W	4	SW	160	45				45		10						100
T29N R3W	4	SE	160	25				45		20					10	100
T29N R3W	5	S50	320	20				20							60	100
T29N R3W	5	NE	160	5				80							15	100
T29N R3W	5	NW	160	20				60							20	100
T29N R3W	6	ALL	608	50				35			5				10	100
SUBTOTALS																
T29N R4W	1	E50	320	20				80								100
T29N R4W	1	NW	160	30				60		10						100
T29N R4W	1	SW	160	50				15		35						100
T29N R4W	2	NE	160	5				15		80						100
T29N R4W	2	NW	160					100								100
T29N R4W	2	SW	160					90			10					100
T29N R4W	2	SE	143					75		25						100
T29N R4W	3	ALL	320					70			30					100
T29N R4W	4	ALL	640	35				15			50					100
T29N R4W	5	ALL	640	5				30			50		15			100
T29N R4W	6	ALL	698	20				55		20	5					100
SUBTOTALS																
T29N R5W	1	NE	160	20				80								100
T29N R5W	1	NW	160					100								100
T29N R5W	1	SW	160					100								100
T29N R5W	1	SE	160					100								100
T29N R5W	2	ALL	640	30				60		10						100
SUBTOTALS																
T30N R3W	4	N50SW25	88.2	10								90				100
T30N R3W	4	S50SW25	80.9	70						10		20				100
T30N R3W	4	SE25	62.4	100												100
T30N R3W	5	NE	105	5						80		15				100
T30N R3W	5	NW	164									100				100
T30N R3W	5	SW	160						30	20		50				100
T30N R3W	5	SE	155.6						25	10		65				100
T30N R3W	6	NE	165	60						20		20				100
T30N R3W	6	NW	208	5	15					80						100
T30N R3W	6	SW	160		50		20			30						100
T30N R3W	6	SE	160	5	20				20	55						100
T30N R3W	7	NE	161		30				70							100
T30N R3W	7	NW	161		20	5			70	5						100
T30N R3W	7	SW	165						30	70						100

T30N R3W 7 SE	162		30					70				100
T30N R3W 8 NE	162		75				25					100
T30N R3W 8 NW	161		50				50					100
T30N R3W 8 SW	161		25					75				100
T30N R3W 8 SE	161		55		25			20				100
T30N R3W 9 NE	160	34	33					33				100
T30N R3W 9 NW	160	45	20					10		25		100
T30N R3W 9 SW	160		25		30					45		100
T30N R3W 9 SE	160		60		20	20						100
T30N R3W 10 NW	23		20					80				100
T30N R3W 10 SW	108		90			10						100
T30N R3W 15 E50NW	96		30			50		20				100
T30N R3W 15 W50NW	80					75		25				100
T30N R3W 15 W50SW	80					95		5				100
T30N R3W 15 E50SW	119					100						100
T30N R3W 15 SE	13		10			90						100
T30N R3W 16 NE	160		90			10						100
T30N R3W 16 NW	160				25	15		30		30		100
T30N R3W 16 SW	160	10				55		30		5		100
T30N R3W 16 SE	160		45			35		20				100
T30N R3W 17 NE	160		15			10		15		60		100
T30N R3W 17 NW	160							100				100
T30N R3W 17 SW	160					5		70		25		100
T30N R3W 17 SE	160	5				80		5		10		100
T30N R3W 18 NE	160							100				100
T30N R3W 18 NW	160			5				95				100
T30N R3W 18 SW	56							100				100
T30N R3W 18 SE	123							100				100
T30N R3W 19 NW	12							100				100
T30N R3W 19 SW	61							100				100
T30N R3W 20 NE	56	5				10		70		15		100
T30N R3W 20 NE25NW25	22					20		80				100
T30N R3W 20 NW25NW25	23							100				100
T30N R3W 20 SW	61					20		80				100
T30N R3W 20 SE	63					40		50		10		100
T30N R3W 21 NE	89	20				30		50				100
T30N R3W 21 NW	136	5						45		50		100
T30N R3W 21 SW	145					65		10		25		100
T30N R3W 21 SE	160	5				95						100
T30N R3W 22 NE	25	95				5						100
T30N R3W 22 E50NW	55	30				30		40				100
T30N R3W 22 W50NW	82	35				25		40				100
T30N R3W 22 SW	160	60						10			30	100
T30N R3W 22 NW25ofSE	33	50									50	100
T30N R3W 22 SW25ofSE	28							30			70	100
T30N R3W 27 NE	64							5			95	100
T30N R3W 27 NW	160							10			90	100
T30N R3W 27 SW	160	15				10		25			50	100
T30N R3W 27 SE	77	15				15		60			10	100
T30N R3W 28 NE	160	20				10					70	100
T30N R3W 28 NW	160					30					70	100
T30N R3W 28 SW	160	30									70	100
T30N R3W 28 SE	160	80				20						100
T30N R3W 29 NE	160					15					85	100
T30N R3W 29 NW	94					15					85	100
T30N R3W 29 SW	121										100	100
T30N R3W 29 SE	160								30		70	100
T30N R3W 30 NE	8					15		20			65	100
T30N R3W 30 NW	79					30		60		5	5	100
T30N R3W 30 SW	138					95		5				100
T30N R3W 30 SE	160					70					30	100
T30N R3W 31 NE	160	35				65						100
T30N R3W 31 NW	160	70				30						100
T30N R3W 31 SW	160	70				30						100
T30N R3W 31 SE	160					90					10	100
T30N R3W 32 NE	160								70		30	100

T30N R3W 32 NW	160	10									90	100
T30N R3W 32 SW	160										100	100
T30N R3W 32 SE	160								10		90	100
T30N R3W 33 NE	160	60									40	100
T30N R3W 33 NW	160								40		60	100
T30N R3W 33 SW	160								30		70	100
T30N R3W 33 SE	160	80									20	100
T30N R3W 34 NE	122							30			70	100
T30N R3W 34 NW	160	30				40		5			25	100
T30N R3W 34 SW	160	60				35					5	100
T30N R3W 34 SE	160	15									85	100
T30N R3W 35 NW	9										100	100
T30N R3W 35 SW	80							40			60	100
SUBTOTALS												
T30N R4W 1 NE	160	10		10				80				100
T30N R4W 1 NW	160			20			65	15				100
T30N R4W 1 SW	160		25	20			25	30				100
T30N R4W 1 SE	160		60					40				100
T30N R4W 2 NE	160	40					20			40		100
T30N R4W 2 NW	160	20					10			70		100
T30N R4W 2 SW	160	20					20			60		100
T30N R4W 2 SE	160			10			80			10		100
T30N R4W 3 NE	160	15						65		20		100
T30N R4W 3 NW	160	70						30				100
T30N R4W 3 SW	160							100				100
T30N R4W 3 SE	160							60		40		100
T30N R4W 4 NE	160	10	25					30		35		100
T30N R4W 4 NW	160		30		5			25		40		100
T30N R4W 4 SW	160		10					70		20		100
T30N R4W 4 SE	160		10					90				100
T30N R4W 5 NE	87	15	35		15			10		25		100
T30N R4W 5 SW	144		50		50							100
T30N R4W 5 SE	160	25			75							100
T30N R4W 6 ALL	51		100									100
T30N R4W 7 NE	160		60		40							100
T30N R4W 7 NW	160		80		10			10				100
T30N R4W 7 SW	149		60		20	10		10				100
T30N R4W 7 SE	160		10		70			20				100
T30N R4W 8 NE	160	25			35					40		100
T30N R4W 8 NW	160		20		75			5				100
T30N R4W 8 SW	160	10	5		45			20		20		100
T30N R4W 8 SE	160	10								90		100
T30N R4W 9 NE	160							15		85		100
T30N R4W 9 W50	320							20		80		100
T30N R4W 9 SE	160	35								65		100
T30N R4W 10 NE	160						10	60		30		100
T30N R4W 10 NW	160							85		15		100
T30N R4W 10 SW	160	10						45		45		100
T30N R4W 10 SE	160						15	45		40		100
T30N R4W 11 N50	247			30			50			20		100
T30N R4W 11 SW	160						95			5		100
T30N R4W 11 SE	160			85			10	5				100
T30N R4W 12 NE	160		30	25			20	25				100
T30N R4W 12 NW	160		5	30			40	25				100
T30N R4W 12 SW	160			60			40					100
T30N R4W 12 SE	160			85			15					100
T30N R4W 13 NE	160			70				30				100
T30N R4W 13 NW	160			70			30					100
T30N R4W 13 SW	160			65			35					100
T30N R4W 13 SE	160			35				65				100
T30N R4W 14 NE	160	10		40			20	30				100
T30N R4W 14 NW	160						55	45				100
T30N R4W 14 SW	160			5			40	55				100
T30N R4W 14 SE	160	20		20			55	5				100

T30N R4W 15 NE	160					10	40		50			100
T30N R4W 15 NW	160	5							95			100
T30N R4W 15 SW	160				30		35		35			100
T30N R4W 15 SE	160						70		30			100
T30N R4W 16 NE	160	55			10				35			100
T30N R4W 16 NW	160	15		15	30				40			100
T30N R4W 16 SW	203	10		5	50		35					100
T30N R4W 16 SE	160				100							100
T30N R4W 17 NE	160			60	15		5		20			100
T30N R4W 17 NW	160	15		55	5		10		15			100
T30N R4W 17 SW	160			5	40		55					100
T30N R4W 17 SE	160			5	15		80					100
T30N R4W 18 NE	160			85			15					100
T30N R4W 18 NW	160	30		40	10		20					100
T30N R4W 18 SW	160				100							100
T30N R4W 18 SE	160	20		15	40		25					100
T30N R4W 19 ALL	640	10			30		60					100
T30N R4W 20 NE	160				100							100
T30N R4W 20 NW	160	5			35		45			15		100
T30N R4W 20 SW	160				30		45			25		100
T30N R4W 20 SE	160				80					20		100
T30N R4W 21 NE	160	15			85							100
T30N R4W 21 NW	160				100							100
T30N R4W 21 SW	160				100							100
T30N R4W 21 SE	160				100							100
T30N R4W 22 NE	160				5		95					100
T30N R4W 22 NW	160	10			80		10					100
T30N R4W 22 SW	160				100							100
T30N R4W 22 SE	160				45		55					100
T30N R4W 23 NE	160	15	20			10	55					100
T30N R4W 23 NW	160		80				20					100
T30N R4W 23 SW	160		75				25					100
T30N R4W 23 SE	160	15	50			10	25					100
T30N R4W 24 NE	138		20				80					100
T30N R4W 24 NW	160		75			25						100
T30N R4W 24 SW	160		20			30	50					100
T30N R4W 24 SE	160						100					100
T30N R4W 25 NE	160						100					100
T30N R4W 25 NW	160						100					100
T30N R4W 25 SW	160						100					100
T30N R4W 25 SE	160				20		40			40		100
T30N R4W 26 NE	160	15	25			45	15					100
T30N R4W 26 NW	160		40		40		20					100
T30N R4W 26 SW	160	10	25		65							100
T30N R4W 26 SE	160	15	25			50	10					100
T30N R4W 27 NE	160				100							100
T30N R4W 27 NW	160				100							100
T30N R4W 27 SW	160				100							100
T30N R4W 27 SE	160				100							100
T30N R4W 28 ALL	667	15			85							100
T30N R4W 29 NE	160				70		30					100
T30N R4W 29 NW	160				25		75					100
T30N R4W 29 S50	320	10			60		30					100
T30N R4W 30 ALL	640	20			20		60					100
T30N R4W 31 ALL	640	25			40		35					100
T30N R4W 32 ALL	640	10			85			5				100
T30N R4W 33 ALL	640	15			75			10				100
T30N R4W 34 NE	160				100							100
T30N R4W 34 NW	160				100							100
T30N R4W 34 SW	160	15			85							100
T30N R4W 34 SE	160				55		10				35	100
T30N R4W 35 NE	160	10	85			5						100
T30N R4W 35 NW	160	30	20		30						20	100
T30N R4W 35 SW	160	15	20		20		20				25	100
T30N R4W 35 SE	160	10	90									100
T30N R4W 36 NE	160	40			40		15			5		100

T30N R4W 36 W50	320	5			20	75				100
T30N R4W 36 SE	160	30			70					100
SUBTOTALS										
T30N R5W 1 ALL	16		90	10						100
T30N R5W 2 SW	91	20		20	20	40				100
T30N R5W 2 SE	40	30	60	10						100
T30N R5W 11 NE	160	25		50		25				100
T30N R5W 11 NW	160	15		15	15	55				100
T30N R5W 11 SW	160	15		20	35	30				100
T30N R5W 11 SE	160	25	5	20	35	15				100
T30N R5W 12 NE	160		20	60		20				100
T30N R5W 12 NW	160		30	40		30				100
T30N R5W 12 SW	160			65		35				100
T30N R5W 12 SE	160		50	15	20	15				100
T30N R5W 13 NE	160	25	20	55						100
T30N R5W 13 NW	160	5		50		45				100
T30N R5W 13 SW	160	5			75	15		5		100
T30N R5W 13 SE	160	5			80	15				100
T30N R5W 14 NE	160	20		15	25	40				100
T30N R5W 14 NW	160	50		5	40	5				100
T30N R5W 14 SW	160	15		15	10	60				100
T30N R5W 14 SE	160	30			30	40				100
T30N R5W 23 NE	160	30			25	45				100
T30N R5W 23 NW	149	5			95					100
T30N R5W 23 SW	160				100					100
T30N R5W 23 SE	160	30			45	25				100
T30N R5W 24 NE	160				50	50				100
T30N R5W 24 NW	160				45	55				100
T30N R5W 24 SW	160	5			90	5				100
T30N R5W 24 SE	160				100					100
T30N R5W 25 NE	160	10			90					100
T30N R5W 25 NW	160	20			80					100
T30N R5W 25 SW	160				100					100
T30N R5W 25 SE	160	10			90					100
T30N R5W 26 NE	160	20			80					100
T30N R5W 26 NW	160	30			70					100
T30N R5W 26 SW	160	50			40	10				100
T30N R5W 26 SE	160				100					100
T30N R5W 35 NE	160				100					100
T30N R5W 35 NW	160	50			25	25				100
T30N R5W 35 SW	160	60			10	30				100
T30N R5W 35 SE	160	20			70	10				100
T30N R5W 36 E50	320				55	45				100
T30N R5W 36 NW	160				100					100
T30N R5W 36 SW	160	30				70				100
SUBTOTALS										
T31N R3W 30 ALL	145	100								100
T31N R3W 31 N50	260	100								100
T31N R3W 31 S50	320	90					10			100
T31N R3W 32 ALL	97	55					45			100
SUBTOTALS										
T31N R4W 25 NE	27	100								100
T31N R4W 25 NW	21	100								100
T31N R4W 25 SW	137	35		10		55				100
T31N R4W 25 SE	160	95				5				100
T31N R4W 26 NE	9	100								100
T31N R4W 26 SW	107		10	30					60	100
T31N R4W 26 SE	132	20	15	15	10	20			20	100
T31N R4W 27 SW	42	10				90				100
T31N R4W 27 SE	49					25			75	100

T31N R4W 28 ALL	0.27	100							100
T31N R4W 33 E50	432	40	5				55		100
T31N R4W 33 SW	87	45					50	5	100
T31N R4W 34 NE	160		5		20		75		100
T31N R4W 34 NW	160						100		100
T31N R4W 34 SW	160	20					80		100
T31N R4W 34 SE	160	20					80		100
T31N R4W 35 NE	160	25			15		60		100
T31N R4W 35 NW	160		25		25		50		100
T31N R4W 35 SW	160					20	60	20	100
T31N R4W 35 SE	160	25				15	20	40	100
T31N R4W 36 NE	160	80					20		100
T31N R4W 36 NW	160	10			30		50	10	100
T31N R4W 36 SW	160	10				70		20	100
T31N R4W 36 SE	160	40		20		40			100

SUBTOTALS

TOTALS

③

X indicates that data in these columns are supplied by user;
remaining column values are calculated quantities.

location (X)	sec (X)	part (X)	UNSUIT	1	7	9	12	17	24	34	53	60	64	75	SUM
			USEABLE ACREAGE BY SOIL TYPE												
T29N R3W	2	NE50	0.0	0.0	0.0	0.0	20.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	40
*T29N R3W	2	E50NW25	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
T29N R3W	2	W50NW25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	80
T29N R3W	2	SW	8.0	0.0	0.0	0.0	40.0	0.0	104.0	0.0	0.0	0.0	0.0	8.0	160
T29N R3W	2	SE	0.0	0.0	0.0	0.0	67.2	0.0	44.8	0.0	0.0	0.0	0.0	0.0	112
T29N R3W	3	NE	40.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	160
T29N R3W	3	NW	96.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	160
T29N R3W	3	SW	6.5	0.0	0.0	0.0	26.0	0.0	0.0	45.5	0.0	0.0	0.0	52.0	130
T29N R3W	3	SE	0.0	0.0	0.0	0.0	57.0	0.0	45.6	0.0	0.0	0.0	0.0	125.4	228
T29N R3W	4	NE	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	160
T29N R3W	4	NW	40.0	0.0	0.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	160
T29N R3W	4	SW	72.0	0.0	0.0	0.0	72.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T29N R3W	4	SE	40.0	0.0	0.0	0.0	72.0	0.0	32.0	0.0	0.0	0.0	0.0	16.0	160
T29N R3W	5	S50	64.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	192.0	320
T29N R3W	5	NE	8.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	24.0	160
T29N R3W	5	NW	32.0	0.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	160
T29N R3W	6	ALL	304.0	0.0	0.0	0.0	212.8	0.0	0.0	30.4	0.0	0.0	0.0	60.8	608
SUBTOTALS			831	0	0	0	991	0	262	76	0	0	0	798	2958
T29N R4W	1	E50	64.0	0.0	0.0	0.0	256.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	320
T29N R4W	1	NW	48.0	0.0	0.0	0.0	96.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T29N R4W	1	SW	80.0	0.0	0.0	0.0	24.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	160
T29N R4W	2	NE	8.0	0.0	0.0	0.0	24.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	160
T29N R4W	2	NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R4W	2	SW	0.0	0.0	0.0	0.0	144.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	160
T29N R4W	2	SE	0.0	0.0	0.0	0.0	107.3	0.0	35.8	0.0	0.0	0.0	0.0	0.0	143
T29N R4W	3	ALL	0.0	0.0	0.0	0.0	224.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	320
-T29N R4W	4	ALL	224.0	0.0	0.0	0.0	96.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	640
T29N R4W	5	ALL	32.0	0.0	0.0	0.0	192.0	0.0	0.0	320.0	0.0	96.0	0.0	0.0	640
T29N R4W	6	ALL	139.6	0.0	0.0	0.0	383.9	0.0	139.6	34.9	0.0	0.0	0.0	0.0	698
SUBTOTALS			596	0	0	0	1707	0	375	787	0	96	0	0	3561
T29N R5W	1	NE	32.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	1	NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	1	SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	1	SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	2	ALL	192.0	0.0	0.0	0.0	384.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	640
SUBTOTALS			224	0	0	0	992	0	64	0	0	0	0	0	1280
T30N R3W	4	N50SW25	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.4	0.0	0.0	0.0	88.2
T30N R3W	4	S50SW25	56.6	0.0	0.0	0.0	0.0	0.0	8.1	0.0	16.2	0.0	0.0	0.0	80.9
T30N R3W	4	SE25	62.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.4
T30N R3W	5	NE	5.3	0.0	0.0	0.0	0.0	0.0	84.0	0.0	15.8	0.0	0.0	0.0	105
T30N R3W	5	NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	164.0	0.0	0.0	0.0	164
T30N R3W	5	SW	0.0	0.0	0.0	0.0	0.0	48.0	32.0	0.0	80.0	0.0	0.0	0.0	160
T30N R3W	5	SE	0.0	0.0	0.0	0.0	0.0	38.9	15.6	0.0	101.1	0.0	0.0	0.0	155.6
T30N R3W	6	NE	99.0	0.0	0.0	0.0	0.0	0.0	33.0	0.0	33.0	0.0	0.0	0.0	165
T30N R3W	6	NW	10.4	31.2	0.0	0.0	0.0	0.0	166.4	0.0	0.0	0.0	0.0	0.0	208
T30N R3W	6	SW	0.0	80.0	0.0	32.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W	6	SE	8.0	32.0	0.0	0.0	0.0	32.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W	7	NE	0.0	48.3	0.0	0.0	0.0	112.7	0.0	0.0	0.0	0.0	0.0	0.0	161
T30N R3W	7	NW	0.0	32.2	8.1	0.0	0.0	112.7	8.1	0.0	0.0	0.0	0.0	0.0	161
T30N R3W	7	SW	0.0	0.0	0.0	0.0	0.0	49.5	115.5	0.0	0.0	0.0	0.0	0.0	165

T30N R3W 7 SE	0.0	48.6	0.0	0.0	0.0	0.0	113.4	0.0	0.0	0.0	0.0	0.0	162
T30N R3W 8 NE	0.0	121.5	0.0	0.0	0.0	40.5	0.0	0.0	0.0	0.0	0.0	0.0	162
T30N R3W 8 NW	0.0	80.5	0.0	0.0	0.0	80.5	0.0	0.0	0.0	0.0	0.0	0.0	161
T30N R3W 8 SW	0.0	40.3	0.0	0.0	0.0	0.0	120.8	0.0	0.0	0.0	0.0	0.0	161
T30N R3W 8 SE	0.0	88.6	0.0	40.3	0.0	0.0	32.2	0.0	0.0	0.0	0.0	0.0	161
T30N R3W 9 NE	54.4	52.8	0.0	0.0	0.0	0.0	52.8	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 9 NW	72.0	32.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	40.0	0.0	160
T30N R3W 9 SW	0.0	40.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	72.0	0.0	160
T30N R3W 9 SE	0.0	96.0	0.0	32.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 10 NW	0.0	4.6	0.0	0.0	0.0	0.0	18.4	0.0	0.0	0.0	0.0	0.0	23
T30N R3W 10 SW	0.0	97.2	0.0	0.0	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108
T30N R3W 15 E50NW	0.0	28.8	0.0	0.0	48.0	0.0	19.2	0.0	0.0	0.0	0.0	0.0	96
T30N R3W 15 W50NW	0.0	0.0	0.0	0.0	60.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	80
T30N R3W 15 W50SW	0.0	0.0	0.0	0.0	76.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	80
T30N R3W 15 E50SW	0.0	0.0	0.0	0.0	119.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119
T30N R3W 15 SE	0.0	1.3	0.0	0.0	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13
T30N R3W 16 NE	0.0	144.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 16 NW	0.0	0.0	0.0	40.0	24.0	0.0	48.0	0.0	0.0	0.0	48.0	0.0	160
T30N R3W 16 SW	16.0	0.0	0.0	0.0	88.0	0.0	48.0	0.0	0.0	0.0	8.0	0.0	160
T30N R3W 16 SE	0.0	72.0	0.0	0.0	56.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 17 NE	0.0	24.0	0.0	0.0	16.0	0.0	24.0	0.0	0.0	0.0	96.0	0.0	160
T30N R3W 17 NW	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 17 SW	0.0	0.0	0.0	0.0	8.0	0.0	112.0	0.0	0.0	0.0	40.0	0.0	160
T30N R3W 17 SE	8.0	0.0	0.0	0.0	128.0	0.0	8.0	0.0	0.0	0.0	16.0	0.0	160
T30N R3W 18 NE	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 18 NW	0.0	0.0	8.0	0.0	0.0	0.0	152.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 18 SW	0.0	0.0	0.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	56
T30N R3W 18 SE	0.0	0.0	0.0	0.0	0.0	0.0	123.0	0.0	0.0	0.0	0.0	0.0	123
T30N R3W 19 NW	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	12
T30N R3W 19 SW	0.0	0.0	0.0	0.0	0.0	0.0	61.0	0.0	0.0	0.0	0.0	0.0	61
T30N R3W 20 NE	2.8	0.0	0.0	0.0	5.6	0.0	39.2	0.0	0.0	0.0	8.4	0.0	56
T30N R3W 20 NE25NW25	0.0	0.0	0.0	0.0	4.4	0.0	17.6	0.0	0.0	0.0	0.0	0.0	22
T30N R3W 20 NW25NW25	0.0	0.0	0.0	0.0	0.0	0.0	23.0	0.0	0.0	0.0	0.0	0.0	23
T30N R3W 20 SW	0.0	0.0	0.0	0.0	12.2	0.0	48.8	0.0	0.0	0.0	0.0	0.0	61
T30N R3W 20 SE	0.0	0.0	0.0	0.0	25.2	0.0	31.5	0.0	0.0	0.0	6.3	0.0	63
T30N R3W 21 NE	17.8	0.0	0.0	0.0	26.7	0.0	44.5	0.0	0.0	0.0	0.0	0.0	89
T30N R3W 21 NW	6.8	0.0	0.0	0.0	0.0	0.0	61.2	0.0	0.0	0.0	68.0	0.0	136
T30N R3W 21 SW	0.0	0.0	0.0	0.0	94.3	0.0	14.5	0.0	0.0	0.0	36.3	0.0	145
T30N R3W 21 SE	8.0	0.0	0.0	0.0	152.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 22 NE	23.8	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25
T30N R3W 22 E50NW	16.5	0.0	0.0	0.0	16.5	0.0	22.0	0.0	0.0	0.0	0.0	0.0	55
T30N R3W 22 W50NW	28.7	0.0	0.0	0.0	20.5	0.0	32.8	0.0	0.0	0.0	0.0	0.0	82
T30N R3W 22 SW	96.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	48.0	160
T30N R3W 22 NW25ofSE	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	33
T30N R3W 22 SW25ofSE	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	19.6	28
T30N R3W 27 NE	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	60.8	64
T30N R3W 27 NW	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	144.0	160
T30N R3W 27 SW	24.0	0.0	0.0	0.0	16.0	0.0	40.0	0.0	0.0	0.0	0.0	80.0	160
T30N R3W 27 SE	11.6	0.0	0.0	0.0	11.6	0.0	46.2	0.0	0.0	0.0	0.0	7.7	77
T30N R3W 28 NE	32.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0	160
T30N R3W 28 NW	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0	160
T30N R3W 28 SW	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0	160
T30N R3W 28 SE	128.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 29 NE	0.0	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	136.0	160
T30N R3W 29 NW	0.0	0.0	0.0	0.0	14.1	0.0	0.0	0.0	0.0	0.0	0.0	79.9	94
T30N R3W 29 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	121.0	121
T30N R3W 29 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	112.0	160
T30N R3W 30 NE	0.0	0.0	0.0	0.0	1.2	0.0	1.6	0.0	0.0	0.0	0.0	5.2	8
T30N R3W 30 NW	0.0	0.0	0.0	0.0	23.7	0.0	47.4	0.0	0.0	0.0	4.0	4.0	79
T30N R3W 30 SW	0.0	0.0	0.0	0.0	131.1	0.0	6.9	0.0	0.0	0.0	0.0	0.0	138
T30N R3W 30 SE	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	160
T30N R3W 31 NE	56.0	0.0	0.0	0.0	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 31 NW	112.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 31 SW	112.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R3W 31 SE	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	160
T30N R3W 32 NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	48.0	160

T30N R3W 32 NW	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.0	160
T30N R3W 32 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160.0	160
T30N R3W 32 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	144.0	160
T30N R3W 33 NE	96.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	160
T30N R3W 33 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	96.0	160
T30N R3W 33 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	112.0	160
T30N R3W 33 SE	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	160
T30N R3W 34 NE	0.0	0.0	0.0	0.0	0.0	0.0	36.6	0.0	0.0	0.0	0.0	85.4	122
T30N R3W 34 NW	48.0	0.0	0.0	0.0	64.0	0.0	8.0	0.0	0.0	0.0	0.0	40.0	160
T30N R3W 34 SW	96.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	160
T30N R3W 34 SE	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136.0	160
T30N R3W 35 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	9
T30N R3W 35 SW	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	48.0	80
SUBTOTALS	1549	1196	16	192	1946	515	2589	288	489	0	443	2361	11584
T30N R4W 1 NE	16.0	0.0	16.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 1 NW	0.0	0.0	32.0	0.0	0.0	104.0	24.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 1 SW	0.0	40.0	32.0	0.0	0.0	40.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 1 SE	0.0	96.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 2 NE	64.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	64.0	0.0	0.0	0.0	160
T30N R4W 2 NW	32.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	112.0	0.0	0.0	0.0	160
T30N R4W 2 SW	32.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	96.0	0.0	0.0	0.0	160
T30N R4W 2 SE	0.0	0.0	16.0	0.0	0.0	128.0	0.0	0.0	16.0	0.0	0.0	0.0	160
T30N R4W 3 NE	24.0	0.0	0.0	0.0	0.0	0.0	104.0	0.0	32.0	0.0	0.0	0.0	160
T30N R4W 3 NW	112.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 3 SW	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 3 SE	0.0	0.0	0.0	0.0	0.0	0.0	96.0	0.0	64.0	0.0	0.0	0.0	160
T30N R4W 4 NE	16.0	40.0	0.0	0.0	0.0	0.0	48.0	0.0	56.0	0.0	0.0	0.0	160
T30N R4W 4 NW	0.0	48.0	0.0	8.0	0.0	0.0	40.0	0.0	64.0	0.0	0.0	0.0	160
T30N R4W 4 SW	0.0	16.0	0.0	0.0	0.0	0.0	112.0	0.0	32.0	0.0	0.0	0.0	160
T30N R4W 4 SE	0.0	16.0	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 5 NE	13.1	30.5	0.0	13.1	0.0	0.0	8.7	0.0	21.8	0.0	0.0	0.0	87
T30N R4W 5 SW	0.0	72.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144
T30N R4W 5 SE	40.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 6 ALL	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51
T30N R4W 7 NE	0.0	96.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 7 NW	0.0	128.0	0.0	16.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 7 SW	0.0	89.4	0.0	29.8	14.9	0.0	14.9	0.0	0.0	0.0	0.0	0.0	149
T30N R4W 7 SE	0.0	16.0	0.0	112.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 8 NE	40.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	160
T30N R4W 8 NW	0.0	32.0	0.0	120.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 8 SW	16.0	8.0	0.0	72.0	0.0	0.0	32.0	0.0	32.0	0.0	0.0	0.0	160
T30N R4W 8 SE	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	160
T30N R4W 9 NE	0.0	0.0	0.0	0.0	0.0	0.0	24.0	0.0	136.0	0.0	0.0	0.0	160
T30N R4W 9 W50	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	256.0	0.0	0.0	0.0	320
T30N R4W 9 SE	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.0	0.0	0.0	0.0	160
T30N R4W 10 NE	0.0	0.0	0.0	0.0	0.0	16.0	96.0	0.0	48.0	0.0	0.0	0.0	160
T30N R4W 10 NW	0.0	0.0	0.0	0.0	0.0	0.0	136.0	0.0	24.0	0.0	0.0	0.0	160
T30N R4W 10 SW	16.0	0.0	0.0	0.0	0.0	0.0	72.0	0.0	72.0	0.0	0.0	0.0	160
T30N R4W 10 SE	0.0	0.0	0.0	0.0	0.0	24.0	72.0	0.0	64.0	0.0	0.0	0.0	160
T30N R4W 11 N50	0.0	0.0	74.1	0.0	0.0	123.5	0.0	0.0	49.4	0.0	0.0	0.0	247
T30N R4W 11 SW	0.0	0.0	0.0	0.0	0.0	152.0	0.0	0.0	8.0	0.0	0.0	0.0	160
T30N R4W 11 SE	0.0	0.0	136.0	0.0	0.0	16.0	8.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 12 NE	0.0	48.0	40.0	0.0	0.0	32.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 12 NW	0.0	8.0	48.0	0.0	0.0	64.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 12 SW	0.0	0.0	96.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 12 SE	0.0	0.0	136.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 13 NE	0.0	0.0	112.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 13 NW	0.0	0.0	112.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 13 SW	0.0	0.0	104.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 13 SE	0.0	0.0	56.0	0.0	0.0	0.0	104.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 14 NE	16.0	0.0	64.0	0.0	0.0	32.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 14 NW	0.0	0.0	0.0	0.0	0.0	88.0	72.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 14 SW	0.0	0.0	8.0	0.0	0.0	64.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 14 SE	32.0	0.0	32.0	0.0	0.0	88.0	8.0	0.0	0.0	0.0	0.0	0.0	160

T30N R4W 15 NE	0.0	0.0	0.0	0.0	0.0	16.0	64.0	0.0	80.0	0.0	0.0	0.0	160
T30N R4W 15 NW	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	152.0	0.0	0.0	0.0	160
T30N R4W 15 SW	0.0	0.0	0.0	0.0	48.0	0.0	56.0	0.0	56.0	0.0	0.0	0.0	160
T30N R4W 15 SE	0.0	0.0	0.0	0.0	0.0	0.0	112.0	0.0	48.0	0.0	0.0	0.0	160
T30N R4W 16 NE	88.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	160
T30N R4W 16 NW	24.0	0.0	0.0	24.0	48.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	160
T30N R4W 16 SW	20.3	0.0	0.0	10.2	101.5	0.0	71.1	0.0	0.0	0.0	0.0	0.0	203
T30N R4W 16 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 17 NE	0.0	0.0	0.0	96.0	24.0	0.0	8.0	0.0	32.0	0.0	0.0	0.0	160
T30N R4W 17 NW	24.0	0.0	0.0	88.0	8.0	0.0	16.0	0.0	24.0	0.0	0.0	0.0	160
T30N R4W 17 SW	0.0	0.0	0.0	8.0	64.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 17 SE	0.0	0.0	0.0	8.0	24.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 18 NE	0.0	0.0	0.0	136.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 18 NW	48.0	0.0	0.0	64.0	16.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 18 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 18 SE	32.0	0.0	0.0	24.0	64.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 19 ALL	64.0	0.0	0.0	0.0	192.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	640
T30N R4W 20 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 20 NW	8.0	0.0	0.0	0.0	56.0	0.0	72.0	0.0	0.0	0.0	24.0	0.0	160
T30N R4W 20 SW	0.0	0.0	0.0	0.0	48.0	0.0	72.0	0.0	0.0	0.0	40.0	0.0	160
T30N R4W 20 SE	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	160
T30N R4W 21 NE	24.0	0.0	0.0	0.0	136.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 21 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 21 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 21 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 22 NE	0.0	0.0	0.0	0.0	8.0	0.0	152.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 22 NW	16.0	0.0	0.0	0.0	128.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 22 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 22 SE	0.0	0.0	0.0	0.0	72.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 23 NE	24.0	0.0	32.0	0.0	0.0	16.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 23 NW	0.0	0.0	128.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 23 SW	0.0	0.0	120.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 23 SE	24.0	0.0	80.0	0.0	0.0	16.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 24 NE	0.0	0.0	27.6	0.0	0.0	0.0	110.4	0.0	0.0	0.0	0.0	0.0	138
T30N R4W 24 NW	0.0	0.0	120.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 24 SW	0.0	0.0	32.0	0.0	0.0	48.0	80.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 24 SE	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 25 NE	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 25 NW	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 25 SW	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 25 SE	0.0	0.0	0.0	0.0	32.0	0.0	64.0	0.0	0.0	0.0	64.0	0.0	160
T30N R4W 26 NE	24.0	0.0	40.0	0.0	0.0	72.0	24.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 26 NW	0.0	0.0	64.0	0.0	64.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 26 SW	16.0	0.0	40.0	0.0	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 26 SE	24.0	0.0	40.0	0.0	0.0	80.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 28 ALL	100.1	0.0	0.0	0.0	567.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	667
T30N R4W 29 NE	0.0	0.0	0.0	0.0	112.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 29 NW	0.0	0.0	0.0	0.0	40.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 29 SSO	32.0	0.0	0.0	0.0	192.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 30 ALL	128.0	0.0	0.0	0.0	128.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	640
T30N R4W 31 ALL	160.0	0.0	0.0	0.0	256.0	0.0	224.0	0.0	0.0	0.0	0.0	0.0	640
T30N R4W 32 ALL	64.0	0.0	0.0	0.0	544.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	640
T30N R4W 33 ALL	96.0	0.0	0.0	0.0	480.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	640
T30N R4W 34 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 34 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 34 SW	24.0	0.0	0.0	0.0	136.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 34 SE	0.0	0.0	0.0	0.0	88.0	0.0	16.0	0.0	0.0	0.0	0.0	56.0	160
T30N R4W 35 NE	16.0	0.0	136.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 35 NW	48.0	0.0	32.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	160
T30N R4W 35 SW	24.0	0.0	32.0	0.0	32.0	0.0	32.0	0.0	0.0	0.0	0.0	40.0	160
T30N R4W 35 SE	16.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 36 NE	64.0	0.0	0.0	0.0	64.0	0.0	24.0	0.0	0.0	0.0	8.0	0.0	160

T30N R4W 36 W50	16.0	0.0	0.0	0.0	64.0	0.0	240.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 36 SE	48.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
SUBTOTALS	1845	835	2182	1141	6339	1540	5821	96	2071	0	168	128	22166
T30N R5W 1 ALL	0.0	14.4	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16
T30N R5W 2 SW	18.2	0.0	0.0	18.2	18.2	0.0	36.4	0.0	0.0	0.0	0.0	0.0	91
T30N R5W 2 SE	12.0	24.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40
T30N R5W 11 NE	40.0	0.0	0.0	80.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 11 NW	24.0	0.0	0.0	24.0	24.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 11 SW	24.0	0.0	0.0	32.0	56.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 11 SE	40.0	8.0	0.0	32.0	56.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 12 NE	0.0	32.0	0.0	96.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 12 NW	0.0	48.0	0.0	64.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 12 SW	0.0	0.0	0.0	104.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 12 SE	0.0	80.0	0.0	24.0	32.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 13 NE	40.0	32.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 13 NW	8.0	0.0	0.0	80.0	0.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 13 SW	8.0	0.0	0.0	0.0	120.0	0.0	24.0	0.0	0.0	8.0	0.0	0.0	160
T30N R5W 13 SE	8.0	0.0	0.0	0.0	128.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 14 NE	32.0	0.0	0.0	24.0	40.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 14 NW	80.0	0.0	0.0	8.0	64.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 14 SW	24.0	0.0	0.0	24.0	16.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 14 SE	48.0	0.0	0.0	0.0	48.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 23 NE	48.0	0.0	0.0	0.0	40.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 23 NW	7.5	0.0	0.0	0.0	141.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	149
T30N R5W 23 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 23 SE	48.0	0.0	0.0	0.0	72.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 24 NE	0.0	0.0	0.0	0.0	80.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 24 NW	0.0	0.0	0.0	0.0	72.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 24 SW	8.0	0.0	0.0	0.0	144.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 24 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 25 NE	16.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 25 NW	32.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 25 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 25 SE	16.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 26 NE	32.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 26 NW	48.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 26 SW	80.0	0.0	0.0	0.0	64.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 26 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 35 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 35 NW	80.0	0.0	0.0	0.0	40.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 35 SW	96.0	0.0	0.0	0.0	16.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 35 SE	32.0	0.0	0.0	0.0	112.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 36 E50	0.0	0.0	0.0	0.0	176.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	320
T30N R5W 36 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 36 SW	48.0	0.0	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	160
SUBTOTALS	998	238	0	704	3176	0	1412	0	0	8	0	0	6536
T31N R3W 30 ALL	145.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145
T31N R3W 31 N50	260.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	260
T31N R3W 31 S50	288.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	320
T31N R3W 32 ALL	53.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.7	0.0	0.0	0.0	97
SUBTOTALS	746	0	0	0	0	0	0	0	76	0	0	0	822
T31N R4W 25 NE	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27
T31N R4W 25 NW	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21
T31N R4W 25 SW	48.0	0.0	0.0	13.7	0.0	0.0	75.4	0.0	0.0	0.0	0.0	0.0	137
T31N R4W 25 SE	152.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 26 NE	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9
T31N R4W 26 SW	0.0	10.7	0.0	32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.2	107
T31N R4W 26 SE	26.4	19.8	0.0	19.8	13.2	0.0	26.4	0.0	0.0	0.0	0.0	26.4	132
T31N R4W 27 SW	4.2	0.0	0.0	0.0	0.0	0.0	37.8	0.0	0.0	0.0	0.0	0.0	42
T31N R4W 27 SE	0.0	0.0	0.0	0.0	0.0	0.0	12.3	0.0	0.0	0.0	0.0	36.8	49

T31N R4W 28 ALL	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.27
T31N R4W 33 E50	172.8	21.6	0.0	0.0	0.0	0.0	237.6	0.0	0.0	0.0	0.0	0.0	432
T31N R4W 33 SW	39.2	0.0	0.0	0.0	0.0	0.0	43.5	0.0	4.4	0.0	0.0	0.0	87
T31N R4W 34 NE	0.0	8.0	0.0	32.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 34 NW	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 34 SW	32.0	0.0	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 34 SE	32.0	0.0	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 35 NE	40.0	0.0	0.0	24.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 35 NW	0.0	40.0	0.0	40.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 35 SW	0.0	0.0	0.0	0.0	0.0	32.0	96.0	0.0	32.0	0.0	0.0	0.0	160
T31N R4W 35 SE	40.0	0.0	0.0	0.0	0.0	24.0	32.0	0.0	64.0	0.0	0.0	0.0	160
T31N R4W 36 NE	128.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	160
T31N R4W 36 NW	16.0	0.0	0.0	48.0	0.0	0.0	80.0	0.0	16.0	0.0	0.0	0.0	160
T31N R4W 36 SW	16.0	0.0	0.0	0.0	0.0	112.0	0.0	0.0	32.0	0.0	0.0	0.0	160
T31N R4W 36 SE	64.0	0.0	32.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	160
SUBTOTALS	868	100	32	210	13	232	1393	0	148	0	0	127	3123
TOTALS	7657	2369	2230	2247	15164	2286	11917	1247	2785	104	611	3415	52030

APPENDIX D

COMPARISON OF DATA SOURCES

CONCERNING EXISTING LEVEL OF DEVELOPMENT

TEST COMPARISON OF DATA SOURCES

CODE:

LRP = CLALLAM COUNTY LONG RANGE PLANNING
RBT = RIVER BASIN TEAM
DCD = CLALLAM COUNTY COMMUNITY DEVELOPMENT

NOTE:

LRP LOTS = UNINCORPORATED COUNTY ONLY
RBT LOTS = UNINCORPORATED COUNTY AND CITY OF SEQUIM

RANGE 3 - TOWNSHIP 30

SECTION: 5

NUMBER OF LOTS FROM LRP: 353

NUMBER OF LOTS FROM RBT: 331

NUMBER OF IMPROVEMENTS FROM RBT: 112

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 104

SECTION: 7

NUMBER OF LOTS FROM LRP: 76

NUMBER OF LOTS FROM RBT: 82

NUMBER OF IMPROVEMENTS FROM RBT: 37

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 46

SECTION: 17

NUMBER OF LOTS FROM LRP: 96

NUMBER OF LOTS FROM RBT: 110

NUMBER OF IMPROVEMENTS FROM RBT: 64

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 37

SECTION: 18

NUMBER OF LOTS FROM LRP: 343

NUMBER OF LOTS FROM RBT: 388

NUMBER OF IMPROVEMENTS FROM RBT: 273

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 150

SECTION: 19

NUMBER OF LOTS FROM LRP: 10

NUMBER OF LOTS FROM RBT: 1073

NUMBER OF IMPROVEMENTS FROM RBT: 864

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 45 + 29 COMMUNITY SYSTEM CONNECTIONS

SECTION: 20

NUMBER OF LOTS FROM LRP: 106

NUMBER OF LOTS FROM RBT: 1425

NUMBER OF IMPROVEMENTS FROM RBT: 931

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 54 + 12 COMMUNITY SYSTEM CONNECTIONS

<u>RANGE 4 TOWNSHIP 30</u>

SECTION: 4

NUMBER OF LOTS FROM LRP: 300

NUMBER OF LOTS FROM RBT: 313

NUMBER OF IMPROVEMENTS FROM RBT: 148

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 136

SECTION: 5

NUMBER OF LOTS FROM LRP: 141

NUMBER OF LOTS FROM RBT: 133

NUMBER OF IMPROVEMENTS FROM RBT: 60

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 57 + 9

SECTION: 8

NUMBER OF LOTS FROM LRP: 212

NUMBER OF LOTS FROM RBT: 207

NUMBER OF IMPROVEMENTS FROM RBT: 75

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 76

SECTION: 10

NUMBER OF LOTS FROM LRP: 164

NUMBER OF LOTS FROM RBT: 170

NUMBER OF IMPROVEMENTS FROM RBT: 88

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 78

SECTION: 21

NUMBER OF LOTS FROM LRP: 139

NUMBER OF LOTS FROM RBT: 141

NUMBER OF IMPROVEMENTS FROM RBT: 84

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 68 + 54 COMMUNITY SYSTEM CONNECTIONS

SECTION: 23

NUMBER OF LOTS FROM LRP: 178

NUMBER OF LOTS FROM RBT: 283

NUMBER OF IMPROVEMENTS FROM RBT: 247

NUMBER OF SEPTIC TANK PERMITS FROM DCD: 0 + 205

COMMENTS: IF RBT IMPROVEMENTS ARE TO BE USED INSTEAD OF LRP LOTS IN LOADING MODEL, SOME MECHANISM WILL BE NEEDED TO ADJUST FOR SEWERED AREAS. IT APPEARS THAT SEPTIC TANK PERMITS UNDER-REPRESENT ACTUAL NUMBERS OF SYSTEMS, WHILE TOTAL LOTS OR PARCELS OVER-REPRESENTS THE NUMBER OF SYSTEMS.

APPENDIX E

ESTIMATED MAXIMUM DWELLING UNIT DENSITY

BASED ON METHOD I LOT SIZE DETERMINATION PROCEDURES

AND

APPROXIMATE SOIL DISTRIBUTION

KEY TO SOIL CODES:

1 = Agnew silt loam.

7 = Carlsborg/Dungeness Complex.

9 = Cassolary fine sandy loam.

12 = Sandy loams over glacial till.

17 = Dungeness silt loam.

24 = Type 1 soils.

34 = Louella soils.

53 = Puget silt loam.

60 = Schnorbush Soils.

64 = Sequim, Mc Kenna, Muckilteo Complex.

75 = Yeary gravelly clay loam.

X indicates that data in these columns are supplied by user;
remaining column values are calculated quantities.

location (X)	sec (X)	part (X)	DWELLINGS UNITS BY SOIL TYPE (WITHOUT WELLS) UNSUIT	1	7	9	12	17	24	34	53	60	64	75	ONSITE DU
T29N R3W	2	NE50	0.0	0.0	0.0	0.0	48.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	88
*T29N R3W	2	E50NW25	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
T29N R3W	2	W50NW25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160.0	160
T29N R3W	2	SW	0.0	0.0	0.0	0.0	96.0	0.0	208.0	0.0	0.0	0.0	0.0	16.0	320
T29N R3W	2	SE	0.0	0.0	0.0	0.0	161.3	0.0	89.6	0.0	0.0	0.0	0.0	0.0	251
T29N R3W	3	NE	0.0	0.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0	160.0	256
T29N R3W	3	NW	0.0	0.0	0.0	0.0	19.2	0.0	0.0	0.0	0.0	0.0	0.0	112.0	131
T29N R3W	3	SW	0.0	0.0	0.0	0.0	62.4	0.0	0.0	136.5	0.0	0.0	0.0	104.0	303
T29N R3W	3	SE	0.0	0.0	0.0	0.0	136.8	0.0	91.2	0.0	0.0	0.0	0.0	250.8	479
T29N R3W	4	NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	80
T29N R3W	4	NW	0.0	0.0	0.0	0.0	211.2	0.0	0.0	0.0	0.0	0.0	0.0	64.0	275
T29N R3W	4	SW	0.0	0.0	0.0	0.0	172.8	0.0	32.0	0.0	0.0	0.0	0.0	0.0	205
T29N R3W	4	SE	0.0	0.0	0.0	0.0	172.8	0.0	64.0	0.0	0.0	0.0	0.0	32.0	269
T29N R3W	5	S50	0.0	0.0	0.0	0.0	153.6	0.0	0.0	0.0	0.0	0.0	0.0	384.0	538
T29N R3W	5	NE	0.0	0.0	0.0	0.0	307.2	0.0	0.0	0.0	0.0	0.0	0.0	48.0	355
T29N R3W	5	NW	0.0	0.0	0.0	0.0	230.4	0.0	0.0	0.0	0.0	0.0	0.0	64.0	294
T29N R3W	6	ALL	0.0	0.0	0.0	0.0	510.7	0.0	0.0	91.2	0.0	0.0	0.0	121.6	724
SUBTOTALS			0	0	0	0	2378	0	525	228	0	0	0	1596	4727
T29N R4W	1	E50	0.0	0.0	0.0	0.0	614.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	614
T29N R4W	1	NW	0.0	0.0	0.0	0.0	230.4	0.0	32.0	0.0	0.0	0.0	0.0	0.0	262
T29N R4W	1	SW	0.0	0.0	0.0	0.0	57.6	0.0	112.0	0.0	0.0	0.0	0.0	0.0	170
T29N R4W	2	NE	0.0	0.0	0.0	0.0	57.6	0.0	256.0	0.0	0.0	0.0	0.0	0.0	314
T29N R4W	2	NW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T29N R4W	2	SW	0.0	0.0	0.0	0.0	345.6	0.0	0.0	48.0	0.0	0.0	0.0	0.0	394
T29N R4W	2	SE	0.0	0.0	0.0	0.0	257.4	0.0	71.5	0.0	0.0	0.0	0.0	0.0	329
T29N R4W	3	ALL	0.0	0.0	0.0	0.0	537.6	0.0	0.0	288.0	0.0	0.0	0.0	0.0	826
T29N R4W	4	ALL	0.0	0.0	0.0	0.0	230.4	0.0	0.0	960.0	0.0	0.0	0.0	0.0	1190
T29N R4W	5	ALL	0.0	0.0	0.0	0.0	460.8	0.0	0.0	960.0	0.0	230.4	0.0	0.0	1651
T29N R4W	6	ALL	0.0	0.0	0.0	0.0	921.4	0.0	279.2	104.7	0.0	0.0	0.0	0.0	1305
SUBTOTALS			0	0	0	0	4097	0	751	2361	0	230	0	0	7439
T29N R5W	1	NE	0.0	0.0	0.0	0.0	307.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	307
T29N R5W	1	NW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T29N R5W	1	SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T29N R5W	1	SE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T29N R5W	2	ALL	0.0	0.0	0.0	0.0	921.6	0.0	128.0	0.0	0.0	0.0	0.0	0.0	1050
SUBTOTALS			0	0	0	0	2381	0	128	0	0	0	0	0	2509
T30N R3W	4	N50SW25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	158.8	0.0	0.0	0.0	159
T30N R3W	4	S50SW25	0.0	0.0	0.0	0.0	0.0	0.0	16.2	0.0	32.4	0.0	0.0	0.0	49
T30N R3W	4	SE25	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
T30N R3W	5	NE	0.0	0.0	0.0	0.0	0.0	0.0	168.0	0.0	31.5	0.0	0.0	0.0	200
T30N R3W	5	NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	328.0	0.0	0.0	0.0	328
T30N R3W	5	SW	0.0	0.0	0.0	0.0	0.0	144.0	64.0	0.0	160.0	0.0	0.0	0.0	368
T30N R3W	5	SE	0.0	0.0	0.0	0.0	0.0	116.7	31.1	0.0	202.3	0.0	0.0	0.0	350
T30N R3W	6	NE	0.0	0.0	0.0	0.0	0.0	0.0	66.0	0.0	66.0	0.0	0.0	0.0	132
T30N R3W	6	NW	0.0	62.4	0.0	0.0	0.0	0.0	332.8	0.0	0.0	0.0	0.0	0.0	395
T30N R3W	6	SW	0.0	160.0	0.0	76.8	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	333
T30N R3W	6	SE	0.0	64.0	0.0	0.0	0.0	96.0	176.0	0.0	0.0	0.0	0.0	0.0	336
T30N R3W	7	NE	0.0	96.6	0.0	0.0	0.0	338.1	0.0	0.0	0.0	0.0	0.0	0.0	435
T30N R3W	7	NW	0.0	64.4	24.2	0.0	0.0	338.1	16.1	0.0	0.0	0.0	0.0	0.0	443
T30N R3W	7	SW	0.0	0.0	0.0	0.0	0.0	148.5	231.0	0.0	0.0	0.0	0.0	0.0	380

T30N R3W 7 SE	0.0	97.2	0.0	0.0	0.0	0.0	226.8	0.0	0.0	0.0	0.0	0.0	324
T30N R3W 8 NE	0.0	243.0	0.0	0.0	0.0	121.5	0.0	0.0	0.0	0.0	0.0	0.0	365
T30N R3W 8 NW	0.0	161.0	0.0	0.0	0.0	241.5	0.0	0.0	0.0	0.0	0.0	0.0	403
T30N R3W 8 SW	0.0	80.5	0.0	0.0	0.0	0.0	241.5	0.0	0.0	0.0	0.0	0.0	322
T30N R3W 8 SE	0.0	177.1	0.0	96.6	0.0	0.0	64.4	0.0	0.0	0.0	0.0	0.0	338
T30N R3W 9 NE	0.0	105.6	0.0	0.0	0.0	0.0	105.6	0.0	0.0	0.0	0.0	0.0	211
T30N R3W 9 NW	0.0	64.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	18.0	0.0	114
T30N R3W 9 SW	0.0	80.0	0.0	115.2	0.0	0.0	0.0	0.0	0.0	0.0	32.4	0.0	228
T30N R3W 9 SE	0.0	192.0	0.0	76.8	76.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	346
T30N R3W 10 NW	0.0	9.2	0.0	0.0	0.0	0.0	36.8	0.0	0.0	0.0	0.0	0.0	46
T30N R3W 10 SW	0.0	194.4	0.0	0.0	25.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220
T30N R3W 15 E50NW	0.0	57.6	0.0	0.0	115.2	0.0	38.4	0.0	0.0	0.0	0.0	0.0	211
T30N R3W 15 W50NW	0.0	0.0	0.0	0.0	144.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	184
T30N R3W 15 W50SW	0.0	0.0	0.0	0.0	182.4	0.0	8.0	0.0	0.0	0.0	0.0	0.0	190
T30N R3W 15 E50SW	0.0	0.0	0.0	0.0	285.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	286
T30N R3W 15 SE	0.0	2.6	0.0	0.0	28.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31
T30N R3W 16 NE	0.0	288.0	0.0	0.0	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	326
T30N R3W 16 NW	0.0	0.0	0.0	96.0	57.6	0.0	96.0	0.0	0.0	0.0	21.6	0.0	271
T30N R3W 16 SW	0.0	0.0	0.0	0.0	211.2	0.0	96.0	0.0	0.0	0.0	3.6	0.0	311
T30N R3W 16 SE	0.0	144.0	0.0	0.0	134.4	0.0	64.0	0.0	0.0	0.0	0.0	0.0	342
T30N R3W 17 NE	0.0	48.0	0.0	0.0	38.4	0.0	48.0	0.0	0.0	0.0	43.2	0.0	178
T30N R3W 17 NW	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R3W 17 SW	0.0	0.0	0.0	0.0	19.2	0.0	224.0	0.0	0.0	0.0	18.0	0.0	261
T30N R3W 17 SE	0.0	0.0	0.0	0.0	307.2	0.0	16.0	0.0	0.0	0.0	7.2	0.0	330
T30N R3W 18 NE	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R3W 18 NW	0.0	0.0	24.0	0.0	0.0	0.0	304.0	0.0	0.0	0.0	0.0	0.0	328
T30N R3W 18 SW	0.0	0.0	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	112
T30N R3W 18 SE	0.0	0.0	0.0	0.0	0.0	0.0	246.0	0.0	0.0	0.0	0.0	0.0	246
T30N R3W 19 NW	0.0	0.0	0.0	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	24
T30N R3W 19 SW	0.0	0.0	0.0	0.0	0.0	0.0	122.0	0.0	0.0	0.0	0.0	0.0	122
T30N R3W 20 NE	0.0	0.0	0.0	0.0	13.4	0.0	78.4	0.0	0.0	0.0	3.8	0.0	96
T30N R3W 20 NE25NW25	0.0	0.0	0.0	0.0	10.6	0.0	35.2	0.0	0.0	0.0	0.0	0.0	46
T30N R3W 20 NW25NW25	0.0	0.0	0.0	0.0	0.0	0.0	46.0	0.0	0.0	0.0	0.0	0.0	46
T30N R3W 20 SW	0.0	0.0	0.0	0.0	29.3	0.0	97.6	0.0	0.0	0.0	0.0	0.0	127
T30N R3W 20 SE	0.0	0.0	0.0	0.0	60.5	0.0	63.0	0.0	0.0	0.0	2.8	0.0	126
T30N R3W 21 NE	0.0	0.0	0.0	0.0	64.1	0.0	89.0	0.0	0.0	0.0	0.0	0.0	153
T30N R3W 21 NW	0.0	0.0	0.0	0.0	0.0	0.0	122.4	0.0	0.0	0.0	30.6	0.0	153
T30N R3W 21 SW	0.0	0.0	0.0	0.0	226.2	0.0	29.0	0.0	0.0	0.0	16.3	0.0	272
T30N R3W 21 SE	0.0	0.0	0.0	0.0	364.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	365
T30N R3W 22 NE	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
T30N R3W 22 E50NW	0.0	0.0	0.0	0.0	39.6	0.0	44.0	0.0	0.0	0.0	0.0	0.0	84
T30N R3W 22 W50NW	0.0	0.0	0.0	0.0	49.2	0.0	65.6	0.0	0.0	0.0	0.0	0.0	115
T30N R3W 22 SW	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	96.0	128
T30N R3W 22 NW25ofSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.0	33
T30N R3W 22 SW25ofSE	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	39.2	56
T30N R3W 27 NE	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	121.6	128
T30N R3W 27 NW	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	288.0	320
T30N R3W 27 SW	0.0	0.0	0.0	0.0	38.4	0.0	80.0	0.0	0.0	0.0	0.0	160.0	278
T30N R3W 27 SE	0.0	0.0	0.0	0.0	27.7	0.0	92.4	0.0	0.0	0.0	0.0	15.4	136
T30N R3W 28 NE	0.0	0.0	0.0	0.0	38.4	0.0	0.0	0.0	0.0	0.0	0.0	224.0	262
T30N R3W 28 NW	0.0	0.0	0.0	0.0	115.2	0.0	0.0	0.0	0.0	0.0	0.0	224.0	339
T30N R3W 28 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	224.0	224
T30N R3W 28 SE	0.0	0.0	0.0	0.0	76.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77
T30N R3W 29 NE	0.0	0.0	0.0	0.0	57.6	0.0	0.0	0.0	0.0	0.0	0.0	272.0	330
T30N R3W 29 NW	0.0	0.0	0.0	0.0	33.8	0.0	0.0	0.0	0.0	0.0	0.0	159.8	194
T30N R3W 29 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	242.0	242
T30N R3W 29 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	224.0	368
T30N R3W 30 NE	0.0	0.0	0.0	0.0	2.9	0.0	3.2	0.0	0.0	0.0	0.0	10.4	16
T30N R3W 30 NW	0.0	0.0	0.0	0.0	56.9	0.0	94.8	0.0	0.0	0.0	1.8	7.9	161
T30N R3W 30 SW	0.0	0.0	0.0	0.0	314.6	0.0	13.8	0.0	0.0	0.0	0.0	0.0	328
T30N R3W 30 SE	0.0	0.0	0.0	0.0	268.8	0.0	0.0	0.0	0.0	0.0	0.0	96.0	365
T30N R3W 31 NE	0.0	0.0	0.0	0.0	249.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	250
T30N R3W 31 NW	0.0	0.0	0.0	0.0	115.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	115
T30N R3W 31 SW	0.0	0.0	0.0	0.0	115.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	115
T30N R3W 31 SE	0.0	0.0	0.0	0.0	345.6	0.0	0.0	0.0	0.0	0.0	0.0	32.0	378
T30N R3W 32 NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	336.0	0.0	0.0	0.0	96.0	432

T30N R3W 32 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	288.0	288
T30N R3W 32 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	320.0	320
T30N R3W 32 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	288.0	336
T30N R3W 33 NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128.0	128
T30N R3W 33 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	192.0	0.0	0.0	0.0	192.0	384
T30N R3W 33 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	224.0	368
T30N R3W 33 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	64
T30N R3W 34 NE	0.0	0.0	0.0	0.0	0.0	0.0	73.2	0.0	0.0	0.0	0.0	170.8	244
T30N R3W 34 NW	0.0	0.0	0.0	0.0	153.6	0.0	16.0	0.0	0.0	0.0	0.0	80.0	250
T30N R3W 34 SW	0.0	0.0	0.0	0.0	134.4	0.0	0.0	0.0	0.0	0.0	0.0	16.0	150
T30N R3W 34 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	272.0	272
T30N R3W 35 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0	18
T30N R3W 35 SW	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	96.0	160
SUBTOTALS	0	2392	48	461	4670	1544	5178	864	979	0	199	4722	21057
T30N R4W 1 NE	0.0	0.0	48.0	0.0	0.0	0.0	256.0	0.0	0.0	0.0	0.0	0.0	304
T30N R4W 1 NW	0.0	0.0	96.0	0.0	0.0	312.0	48.0	0.0	0.0	0.0	0.0	0.0	456
T30N R4W 1 SW	0.0	80.0	96.0	0.0	0.0	120.0	96.0	0.0	0.0	0.0	0.0	0.0	392
T30N R4W 1 SE	0.0	192.0	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 2 NE	0.0	0.0	0.0	0.0	0.0	96.0	0.0	0.0	128.0	0.0	0.0	0.0	224
T30N R4W 2 NW	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	224.0	0.0	0.0	0.0	272
T30N R4W 2 SW	0.0	0.0	0.0	0.0	0.0	96.0	0.0	0.0	192.0	0.0	0.0	0.0	288
T30N R4W 2 SE	0.0	0.0	48.0	0.0	0.0	384.0	0.0	0.0	32.0	0.0	0.0	0.0	464
T30N R4W 3 NE	0.0	0.0	0.0	0.0	0.0	0.0	208.0	0.0	64.0	0.0	0.0	0.0	272
T30N R4W 3 NW	0.0	0.0	0.0	0.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	96
T30N R4W 3 SW	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 3 SE	0.0	0.0	0.0	0.0	0.0	0.0	192.0	0.0	128.0	0.0	0.0	0.0	320
T30N R4W 4 NE	0.0	80.0	0.0	0.0	0.0	0.0	96.0	0.0	112.0	0.0	0.0	0.0	288
T30N R4W 4 NW	0.0	96.0	0.0	19.2	0.0	0.0	80.0	0.0	128.0	0.0	0.0	0.0	323
T30N R4W 4 SW	0.0	32.0	0.0	0.0	0.0	0.0	224.0	0.0	64.0	0.0	0.0	0.0	320
T30N R4W 4 SE	0.0	32.0	0.0	0.0	0.0	0.0	288.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 5 NE	0.0	60.9	0.0	31.3	0.0	0.0	17.4	0.0	43.5	0.0	0.0	0.0	153
T30N R4W 5 SW	0.0	144.0	0.0	172.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	317
T30N R4W 5 SE	0.0	0.0	0.0	288.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	288
T30N R4W 6 ALL	0.0	102.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102
T30N R4W 7 NE	0.0	192.0	0.0	153.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	346
T30N R4W 7 NW	0.0	256.0	0.0	38.4	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	326
T30N R4W 7 SW	0.0	178.8	0.0	71.5	35.8	0.0	29.8	0.0	0.0	0.0	0.0	0.0	316
T30N R4W 7 SE	0.0	32.0	0.0	268.8	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	365
T30N R4W 8 NE	0.0	0.0	0.0	134.4	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	262
T30N R4W 8 NW	0.0	64.0	0.0	288.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	368
T30N R4W 8 SW	0.0	16.0	0.0	172.8	0.0	0.0	64.0	0.0	64.0	0.0	0.0	0.0	317
T30N R4W 8 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	288.0	0.0	0.0	0.0	288
T30N R4W 9 NE	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	272.0	0.0	0.0	0.0	320
T30N R4W 9 W50	0.0	0.0	0.0	0.0	0.0	0.0	128.0	0.0	512.0	0.0	0.0	0.0	640
T30N R4W 9 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	208.0	0.0	0.0	0.0	208
T30N R4W 10 NE	0.0	0.0	0.0	0.0	0.0	48.0	192.0	0.0	96.0	0.0	0.0	0.0	336
T30N R4W 10 NW	0.0	0.0	0.0	0.0	0.0	0.0	272.0	0.0	48.0	0.0	0.0	0.0	320
T30N R4W 10 SW	0.0	0.0	0.0	0.0	0.0	0.0	144.0	0.0	144.0	0.0	0.0	0.0	288
T30N R4W 10 SE	0.0	0.0	0.0	0.0	0.0	72.0	144.0	0.0	128.0	0.0	0.0	0.0	344
T30N R4W 11 N50	0.0	0.0	222.3	0.0	0.0	370.5	0.0	0.0	98.8	0.0	0.0	0.0	692
T30N R4W 11 SW	0.0	0.0	0.0	0.0	0.0	456.0	0.0	0.0	16.0	0.0	0.0	0.0	472
T30N R4W 11 SE	0.0	0.0	408.0	0.0	0.0	48.0	16.0	0.0	0.0	0.0	0.0	0.0	472
T30N R4W 12 NE	0.0	96.0	120.0	0.0	0.0	96.0	80.0	0.0	0.0	0.0	0.0	0.0	392
T30N R4W 12 NW	0.0	16.0	144.0	0.0	0.0	192.0	80.0	0.0	0.0	0.0	0.0	0.0	432
T30N R4W 12 SW	0.0	0.0	288.0	0.0	0.0	192.0	0.0	0.0	0.0	0.0	0.0	0.0	480
T30N R4W 12 SE	0.0	0.0	408.0	0.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	0.0	480
T30N R4W 13 NE	0.0	0.0	336.0	0.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	432
T30N R4W 13 NW	0.0	0.0	336.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	480
T30N R4W 13 SW	0.0	0.0	312.0	0.0	0.0	168.0	0.0	0.0	0.0	0.0	0.0	0.0	480
T30N R4W 13 SE	0.0	0.0	168.0	0.0	0.0	0.0	208.0	0.0	0.0	0.0	0.0	0.0	376
T30N R4W 14 NE	0.0	0.0	192.0	0.0	0.0	96.0	96.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 14 NW	0.0	0.0	0.0	0.0	0.0	264.0	144.0	0.0	0.0	0.0	0.0	0.0	408
T30N R4W 14 SW	0.0	0.0	24.0	0.0	0.0	192.0	176.0	0.0	0.0	0.0	0.0	0.0	392
T30N R4W 14 SE	0.0	0.0	96.0	0.0	0.0	264.0	16.0	0.0	0.0	0.0	0.0	0.0	376

T30N R4W 15 NE	0.0	0.0	0.0	0.0	0.0	48.0	128.0	0.0	160.0	0.0	0.0	0.0	336
T30N R4W 15 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	304.0	0.0	0.0	0.0	304
T30N R4W 15 SW	0.0	0.0	0.0	0.0	115.2	0.0	112.0	0.0	112.0	0.0	0.0	0.0	339
T30N R4W 15 SE	0.0	0.0	0.0	0.0	0.0	0.0	224.0	0.0	96.0	0.0	0.0	0.0	320
T30N R4W 16 NE	0.0	0.0	0.0	0.0	38.4	0.0	0.0	0.0	112.0	0.0	0.0	0.0	150
T30N R4W 16 NW	0.0	0.0	0.0	57.6	115.2	0.0	0.0	0.0	128.0	0.0	0.0	0.0	301
T30N R4W 16 SW	0.0	0.0	0.0	24.4	243.6	0.0	142.1	0.0	0.0	0.0	0.0	0.0	410
T30N R4W 16 SE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 17 NE	0.0	0.0	0.0	230.4	57.6	0.0	16.0	0.0	64.0	0.0	0.0	0.0	368
T30N R4W 17 NW	0.0	0.0	0.0	211.2	19.2	0.0	32.0	0.0	48.0	0.0	0.0	0.0	310
T30N R4W 17 SW	0.0	0.0	0.0	19.2	153.6	0.0	176.0	0.0	0.0	0.0	0.0	0.0	349
T30N R4W 17 SE	0.0	0.0	0.0	19.2	57.6	0.0	256.0	0.0	0.0	0.0	0.0	0.0	333
T30N R4W 18 NE	0.0	0.0	0.0	326.4	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	374
T30N R4W 18 NW	0.0	0.0	0.0	153.6	38.4	0.0	64.0	0.0	0.0	0.0	0.0	0.0	256
T30N R4W 18 SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 18 SE	0.0	0.0	0.0	57.6	153.6	0.0	80.0	0.0	0.0	0.0	0.0	0.0	291
T30N R4W 19 ALL	0.0	0.0	0.0	0.0	460.8	0.0	768.0	0.0	0.0	0.0	0.0	0.0	1229
T30N R4W 20 NE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 20 NW	0.0	0.0	0.0	0.0	134.4	0.0	144.0	0.0	0.0	0.0	10.8	0.0	289
T30N R4W 20 SW	0.0	0.0	0.0	0.0	115.2	0.0	144.0	0.0	0.0	0.0	18.0	0.0	277
T30N R4W 20 SE	0.0	0.0	0.0	0.0	307.2	0.0	0.0	0.0	0.0	0.0	14.4	0.0	322
T30N R4W 21 NE	0.0	0.0	0.0	0.0	326.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	326
T30N R4W 21 NW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 21 SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 21 SE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 22 NE	0.0	0.0	0.0	0.0	19.2	0.0	304.0	0.0	0.0	0.0	0.0	0.0	323
T30N R4W 22 NW	0.0	0.0	0.0	0.0	307.2	0.0	32.0	0.0	0.0	0.0	0.0	0.0	339
T30N R4W 22 SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 22 SE	0.0	0.0	0.0	0.0	172.8	0.0	176.0	0.0	0.0	0.0	0.0	0.0	349
T30N R4W 23 NE	0.0	0.0	96.0	0.0	0.0	48.0	176.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 23 NW	0.0	0.0	384.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	448
T30N R4W 23 SW	0.0	0.0	360.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	440
T30N R4W 23 SE	0.0	0.0	240.0	0.0	0.0	48.0	80.0	0.0	0.0	0.0	0.0	0.0	368
T30N R4W 24 NE	0.0	0.0	82.8	0.0	0.0	0.0	220.8	0.0	0.0	0.0	0.0	0.0	304
T30N R4W 24 NW	0.0	0.0	360.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	480
T30N R4W 24 SW	0.0	0.0	96.0	0.0	0.0	144.0	160.0	0.0	0.0	0.0	0.0	0.0	400
T30N R4W 24 SE	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 25 NE	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 25 NW	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 25 SW	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 25 SE	0.0	0.0	0.0	0.0	76.8	0.0	128.0	0.0	0.0	0.0	28.8	0.0	234
T30N R4W 26 NE	0.0	0.0	120.0	0.0	0.0	216.0	48.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 26 NW	0.0	0.0	192.0	0.0	153.6	0.0	64.0	0.0	0.0	0.0	0.0	0.0	410
T30N R4W 26 SW	0.0	0.0	120.0	0.0	249.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	370
T30N R4W 26 SE	0.0	0.0	120.0	0.0	0.0	240.0	32.0	0.0	0.0	0.0	0.0	0.0	392
T30N R4W 27 NE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 27 NW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 27 SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 27 SE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 28 ALL	0.0	0.0	0.0	0.0	1360.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1361
T30N R4W 29 NE	0.0	0.0	0.0	0.0	268.8	0.0	96.0	0.0	0.0	0.0	0.0	0.0	365
T30N R4W 29 NW	0.0	0.0	0.0	0.0	96.0	0.0	240.0	0.0	0.0	0.0	0.0	0.0	336
T30N R4W 29 S50	0.0	0.0	0.0	0.0	460.8	0.0	192.0	0.0	0.0	0.0	0.0	0.0	653
T30N R4W 30 ALL	0.0	0.0	0.0	0.0	307.2	0.0	768.0	0.0	0.0	0.0	0.0	0.0	1075
T30N R4W 31 ALL	0.0	0.0	0.0	0.0	614.4	0.0	448.0	0.0	0.0	0.0	0.0	0.0	1062
T30N R4W 32 ALL	0.0	0.0	0.0	0.0	1305.6	0.0	0.0	96.0	0.0	0.0	0.0	0.0	1402
T30N R4W 33 ALL	0.0	0.0	0.0	0.0	1152.0	0.0	0.0	192.0	0.0	0.0	0.0	0.0	1344
T30N R4W 34 NE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 34 NW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 34 SW	0.0	0.0	0.0	0.0	326.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	326
T30N R4W 34 SE	0.0	0.0	0.0	0.0	211.2	0.0	32.0	0.0	0.0	0.0	0.0	112.0	355
T30N R4W 35 NE	0.0	0.0	408.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	432
T30N R4W 35 NW	0.0	0.0	96.0	0.0	115.2	0.0	0.0	0.0	0.0	0.0	0.0	64.0	275
T30N R4W 35 SW	0.0	0.0	96.0	0.0	76.8	0.0	64.0	0.0	0.0	0.0	0.0	80.0	317
T30N R4W 35 SE	0.0	0.0	432.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	432
T30N R4W 36 NE	0.0	0.0	0.0	0.0	153.6	0.0	48.0	0.0	0.0	0.0	3.6	0.0	205

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T30N R4W 36 W50	0.0	0.0	0.0	0.0	153.6	0.0	480.0	0.0	0.0	0.0	0.0	0.0	634
T30N R4W 36 SE	0.0	0.0	0.0	0.0	268.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	269
SUBTOTALS	0	1670	6545	2738	15214	4619	11642	288	4142	0	76	256	47190
T30N R5W 1 ALL	0.0	28.8	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33
T30N R5W 2 SW	0.0	0.0	0.0	43.7	43.7	0.0	72.8	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 2 SE	0.0	48.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58
T30N R5W 11 NE	0.0	0.0	0.0	192.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	272
T30N R5W 11 NW	0.0	0.0	0.0	57.6	57.6	0.0	176.0	0.0	0.0	0.0	0.0	0.0	291
T30N R5W 11 SW	0.0	0.0	0.0	76.8	134.4	0.0	96.0	0.0	0.0	0.0	0.0	0.0	307
T30N R5W 11 SE	0.0	16.0	0.0	76.8	134.4	0.0	48.0	0.0	0.0	0.0	0.0	0.0	275
T30N R5W 12 NE	0.0	64.0	0.0	230.4	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	358
T30N R5W 12 NW	0.0	96.0	0.0	153.6	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	346
T30N R5W 12 SW	0.0	0.0	0.0	249.6	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	362
T30N R5W 12 SE	0.0	160.0	0.0	57.6	76.8	0.0	48.0	0.0	0.0	0.0	0.0	0.0	342
T30N R5W 13 NE	0.0	64.0	0.0	211.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	275
T30N R5W 13 NW	0.0	0.0	0.0	192.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	336
T30N R5W 13 SW	0.0	0.0	0.0	0.0	288.0	0.0	48.0	0.0	0.0	19.2	0.0	0.0	355
T30N R5W 13 SE	0.0	0.0	0.0	0.0	307.2	0.0	48.0	0.0	0.0	0.0	0.0	0.0	355
T30N R5W 14 NE	0.0	0.0	0.0	57.6	96.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	282
T30N R5W 14 NW	0.0	0.0	0.0	19.2	153.6	0.0	16.0	0.0	0.0	0.0	0.0	0.0	189
T30N R5W 14 SW	0.0	0.0	0.0	57.6	38.4	0.0	192.0	0.0	0.0	0.0	0.0	0.0	288
T30N R5W 14 SE	0.0	0.0	0.0	0.0	115.2	0.0	128.0	0.0	0.0	0.0	0.0	0.0	243
T30N R5W 23 NE	0.0	0.0	0.0	0.0	96.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	240
T30N R5W 23 NW	0.0	0.0	0.0	0.0	339.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340
T30N R5W 23 SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R5W 23 SE	0.0	0.0	0.0	0.0	172.8	0.0	80.0	0.0	0.0	0.0	0.0	0.0	253
T30N R5W 24 NE	0.0	0.0	0.0	0.0	192.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	352
T30N R5W 24 NW	0.0	0.0	0.0	0.0	172.8	0.0	176.0	0.0	0.0	0.0	0.0	0.0	349
T30N R5W 24 SW	0.0	0.0	0.0	0.0	345.6	0.0	16.0	0.0	0.0	0.0	0.0	0.0	362
T30N R5W 24 SE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R5W 25 NE	0.0	0.0	0.0	0.0	345.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	346
T30N R5W 25 NW	0.0	0.0	0.0	0.0	307.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	307
T30N R5W 25 SW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R5W 25 SE	0.0	0.0	0.0	0.0	345.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	346
T30N R5W 26 NE	0.0	0.0	0.0	0.0	307.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	307
T30N R5W 26 NW	0.0	0.0	0.0	0.0	268.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	269
T30N R5W 26 SW	0.0	0.0	0.0	0.0	153.6	0.0	32.0	0.0	0.0	0.0	0.0	0.0	186
T30N R5W 26 SE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R5W 35 NE	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R5W 35 NW	0.0	0.0	0.0	0.0	96.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	176
T30N R5W 35 SW	0.0	0.0	0.0	0.0	38.4	0.0	96.0	0.0	0.0	0.0	0.0	0.0	134
T30N R5W 35 SE	0.0	0.0	0.0	0.0	268.8	0.0	32.0	0.0	0.0	0.0	0.0	0.0	301
T30N R5W 36 E50	0.0	0.0	0.0	0.0	422.4	0.0	288.0	0.0	0.0	0.0	0.0	0.0	710
T30N R5W 36 NW	0.0	0.0	0.0	0.0	384.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384
T30N R5W 36 SW	0.0	0.0	0.0	0.0	0.0	0.0	224.0	0.0	0.0	0.0	0.0	0.0	224
SUBTOTALS	0	477	0	1689	7622	0	2825	0	0	19	0	0	12632
T31N R3W 30 ALL	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
T31N R3W 31 N50	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
T31N R3W 31 S50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	64
T31N R3W 32 ALL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.3	0.0	0.0	0.0	87
SUBTOTALS	0	0	0	0	0	0	0	0	151	0	0	0	151
T31N R4W 25 NE	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
T31N R4W 25 NW	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
T31N R4W 25 SW	0.0	0.0	0.0	32.9	0.0	0.0	150.7	0.0	0.0	0.0	0.0	0.0	184
T31N R4W 25 SE	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	16
T31N R4W 26 NE	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
T31N R4W 26 SW	0.0	21.4	0.0	77.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128.4	227
T31N R4W 26 SE	0.0	39.6	0.0	47.5	31.7	0.0	52.8	0.0	0.0	0.0	0.0	52.8	224
T31N R4W 27 SW	0.0	0.0	0.0	0.0	0.0	0.0	75.6	0.0	0.0	0.0	0.0	0.0	76
T31N R4W 27 SE	0.0	0.0	0.0	0.0	0.0	0.0	24.5	0.0	0.0	0.0	0.0	73.5	98

T31N R4W 28 ALL	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
T31N R4W 33 E50	0.0	43.2	0.0	0.0	0.0	0.0	475.2	0.0	0.0	0.0	0.0	0.0	518
T31N R4W 33 SW	0.0	0.0	0.0	0.0	0.0	0.0	87.0	0.0	8.7	0.0	0.0	0.0	96
T31N R4W 34 NE	0.0	16.0	0.0	76.8	0.0	0.0	240.0	0.0	0.0	0.0	0.0	0.0	333
T31N R4W 34 NW	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	320
T31N R4W 34 SW	0.0	0.0	0.0	0.0	0.0	0.0	256.0	0.0	0.0	0.0	0.0	0.0	256
T31N R4W 34 SE	0.0	0.0	0.0	0.0	0.0	0.0	256.0	0.0	0.0	0.0	0.0	0.0	256
T31N R4W 35 NE	0.0	0.0	0.0	57.6	0.0	0.0	192.0	0.0	0.0	0.0	0.0	0.0	250
T31N R4W 35 NW	0.0	80.0	0.0	96.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	336
T31N R4W 35 SW	0.0	0.0	0.0	0.0	0.0	96.0	192.0	0.0	64.0	0.0	0.0	0.0	352
T31N R4W 35 SE	0.0	0.0	0.0	0.0	0.0	72.0	64.0	0.0	128.0	0.0	0.0	0.0	264
T31N R4W 36 NE	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	64
T31N R4W 36 NW	0.0	0.0	0.0	115.2	0.0	0.0	160.0	0.0	32.0	0.0	0.0	0.0	307
T31N R4W 36 SW	0.0	0.0	0.0	0.0	0.0	336.0	0.0	0.0	64.0	0.0	0.0	0.0	400
T31N R4W 36 SE	0.0	0.0	96.0	0.0	0.0	192.0	0.0	0.0	0.0	0.0	0.0	0.0	288
SUBTOTALS	0	200	96	503	32	696	2786	0	297	0	0	255	4864
TOTALS	0	4738	6689	5392	36394	6859	23834	3740	5569	250	275	6829	******

(5)

X indicates that data in these columns are supplied by user;
remaining column values are calculated quantities.

location	sec	part	DWELLINGS UNITS BY SOIL TYPE (WITH WELLS) UNSUIT	1	7	9	12	17	24	34	53	60	64	75	ONSITE DU WITH WELLS
X	X	X													
T29N R3W	2	NE50	0.0	0.0	0.0	0.0	20.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	30
*T29N R3W	2	E50NW25	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
T29N R3W	2	W50NW25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.6	54
T29N R3W	2	SW	0.0	0.0	0.0	0.0	40.0	0.0	52.0	0.0	0.0	0.0	0.0	5.4	97
T29N R3W	2	SE	0.0	0.0	0.0	0.0	67.2	0.0	22.4	0.0	0.0	0.0	0.0	0.0	90
T29N R3W	3	NE	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	53.6	94
T29N R3W	3	NW	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	37.5	46
T29N R3W	3	SW	0.0	0.0	0.0	0.0	26.0	0.0	0.0	45.5	0.0	0.0	0.0	34.8	106
T29N R3W	3	SE	0.0	0.0	0.0	0.0	57.0	0.0	22.8	0.0	0.0	0.0	0.0	84.0	164
T29N R3W	4	NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.8	27
T29N R3W	4	NW	0.0	0.0	0.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4	109
T29N R3W	4	SW	0.0	0.0	0.0	0.0	72.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	80
T29N R3W	4	SE	0.0	0.0	0.0	0.0	72.0	0.0	16.0	0.0	0.0	0.0	0.0	10.7	99
T29N R3W	5	S50	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	128.6	193
T29N R3W	5	NE	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	16.1	144
T29N R3W	5	NW	0.0	0.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4	117
T29N R3W	6	ALL	0.0	0.0	0.0	0.0	212.8	0.0	0.0	30.4	0.0	0.0	0.0	40.7	284
SUBTOTALS			0	0	0	0	991	0	131	76	0	0	0	535	1733
T29N R4W	1	E50	0.0	0.0	0.0	0.0	256.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	256
T29N R4W	1	NW	0.0	0.0	0.0	0.0	96.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	104
T29N R4W	1	SW	0.0	0.0	0.0	0.0	24.0	0.0	28.0	0.0	0.0	0.0	0.0	0.0	52
T29N R4W	2	NE	0.0	0.0	0.0	0.0	24.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	88
T29N R4W	2	NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R4W	2	SW	0.0	0.0	0.0	0.0	144.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	160
T29N R4W	2	SE	0.0	0.0	0.0	0.0	107.3	0.0	17.9	0.0	0.0	0.0	0.0	0.0	125
T29N R4W	3	ALL	0.0	0.0	0.0	0.0	224.0	0.0	0.0	96.0	0.0	0.0	0.0	0.0	320
T29N R4W	4	ALL	0.0	0.0	0.0	0.0	96.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	416
T29N R4W	5	ALL	0.0	0.0	0.0	0.0	192.0	0.0	0.0	320.0	0.0	64.3	0.0	0.0	576
T29N R4W	6	ALL	0.0	0.0	0.0	0.0	383.9	0.0	69.8	34.9	0.0	0.0	0.0	0.0	489
SUBTOTALS			0	0	0	0	1707	0	188	787	0	64	0	0	2746
T29N R5W	1	NE	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128
T29N R5W	1	NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	1	SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	1	SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T29N R5W	2	ALL	0.0	0.0	0.0	0.0	384.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	416
SUBTOTALS			0	0	0	0	992	0	32	0	0	0	0	0	1024
T30N R3W	4	N50SW25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.7	0.0	0.0	0.0	40
T30N R3W	4	S50SW25	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	8.1	0.0	0.0	0.0	12
T30N R3W	4	SE25	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
T30N R3W	5	NE	0.0	0.0	0.0	0.0	0.0	0.0	42.0	0.0	7.9	0.0	0.0	0.0	50
T30N R3W	5	NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.0	0.0	0.0	0.0	82
T30N R3W	5	SW	0.0	0.0	0.0	0.0	0.0	48.0	16.0	0.0	40.0	0.0	0.0	0.0	104
T30N R3W	5	SE	0.0	0.0	0.0	0.0	0.0	38.9	7.8	0.0	50.6	0.0	0.0	0.0	97
T30N R3W	6	NE	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	16.5	0.0	0.0	0.0	33
T30N R3W	6	NW	0.0	15.6	0.0	0.0	0.0	0.0	83.2	0.0	0.0	0.0	0.0	0.0	99
T30N R3W	6	SW	0.0	40.0	0.0	32.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	96
T30N R3W	6	SE	0.0	16.0	0.0	0.0	0.0	32.0	44.0	0.0	0.0	0.0	0.0	0.0	92
T30N R3W	7	NE	0.0	24.2	0.0	0.0	0.0	112.7	0.0	0.0	0.0	0.0	0.0	0.0	137
T30N R3W	7	NW	0.0	16.1	4.7	0.0	0.0	112.7	4.0	0.0	0.0	0.0	0.0	0.0	138
T30N R3W	7	SW	0.0	0.0	0.0	0.0	0.0	49.5	57.8	0.0	0.0	0.0	0.0	0.0	107

T30N R3W 7 SE	0.0	24.3	0.0	0.0	0.0	0.0	56.7	0.0	0.0	0.0	0.0	0.0	81
T30N R3W 8 NE	0.0	60.8	0.0	0.0	0.0	40.5	0.0	0.0	0.0	0.0	0.0	0.0	101
T30N R3W 8 NW	0.0	40.3	0.0	0.0	0.0	80.5	0.0	0.0	0.0	0.0	0.0	0.0	121
T30N R3W 8 SW	0.0	20.1	0.0	0.0	0.0	0.0	60.4	0.0	0.0	0.0	0.0	0.0	81
T30N R3W 8 SE	0.0	44.3	0.0	40.3	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	101
T30N R3W 9 NE	0.0	26.4	0.0	0.0	0.0	0.0	26.4	0.0	0.0	0.0	0.0	0.0	53
T30N R3W 9 NW	0.0	16.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	18.0	0.0	42
T30N R3W 9 SW	0.0	20.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	32.4	0.0	100
T30N R3W 9 SE	0.0	48.0	0.0	32.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112
T30N R3W 10 NW	0.0	2.3	0.0	0.0	0.0	0.0	9.2	0.0	0.0	0.0	0.0	0.0	12
T30N R3W 10 SW	0.0	48.6	0.0	0.0	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59
T30N R3W 15 E50NW	0.0	14.4	0.0	0.0	48.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	72
T30N R3W 15 W50NW	0.0	0.0	0.0	0.0	60.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	70
T30N R3W 15 W50SW	0.0	0.0	0.0	0.0	76.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	78
T30N R3W 15 E50SW	0.0	0.0	0.0	0.0	119.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119
T30N R3W 15 SE	0.0	0.7	0.0	0.0	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12
T30N R3W 16 NE	0.0	72.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88
T30N R3W 16 NW	0.0	0.0	0.0	40.0	24.0	0.0	24.0	0.0	0.0	0.0	21.6	0.0	110
T30N R3W 16 SW	0.0	0.0	0.0	0.0	88.0	0.0	24.0	0.0	0.0	0.0	3.6	0.0	116
T30N R3W 16 SE	0.0	36.0	0.0	0.0	56.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	108
T30N R3W 17 NE	0.0	12.0	0.0	0.0	16.0	0.0	12.0	0.0	0.0	0.0	43.2	0.0	83
T30N R3W 17 NW	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R3W 17 SW	0.0	0.0	0.0	0.0	8.0	0.0	56.0	0.0	0.0	0.0	18.0	0.0	82
T30N R3W 17 SE	0.0	0.0	0.0	0.0	128.0	0.0	4.0	0.0	0.0	0.0	7.2	0.0	139
T30N R3W 18 NE	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R3W 18 NW	0.0	0.0	4.7	0.0	0.0	0.0	76.0	0.0	0.0	0.0	0.0	0.0	81
T30N R3W 18 SW	0.0	0.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0	0.0	0.0	28
T30N R3W 18 SE	0.0	0.0	0.0	0.0	0.0	0.0	61.5	0.0	0.0	0.0	0.0	0.0	62
T30N R3W 19 NW	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	6
T30N R3W 19 SW	0.0	0.0	0.0	0.0	0.0	0.0	30.5	0.0	0.0	0.0	0.0	0.0	31
T30N R3W 20 NE	0.0	0.0	0.0	0.0	5.6	0.0	19.6	0.0	0.0	0.0	3.8	0.0	29
T30N R3W 20 NE25NW25	0.0	0.0	0.0	0.0	4.4	0.0	8.8	0.0	0.0	0.0	0.0	0.0	13
T30N R3W 20 NW25NW25	0.0	0.0	0.0	0.0	0.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	12
T30N R3W 20 SW	0.0	0.0	0.0	0.0	12.2	0.0	24.4	0.0	0.0	0.0	0.0	0.0	37
T30N R3W 20 SE	0.0	0.0	0.0	0.0	25.2	0.0	15.8	0.0	0.0	0.0	2.8	0.0	44
T30N R3W 21 NE	0.0	0.0	0.0	0.0	26.7	0.0	22.3	0.0	0.0	0.0	0.0	0.0	49
T30N R3W 21 NW	0.0	0.0	0.0	0.0	0.0	0.0	30.6	0.0	0.0	0.0	30.6	0.0	61
T30N R3W 21 SW	0.0	0.0	0.0	0.0	94.3	0.0	7.3	0.0	0.0	0.0	16.3	0.0	118
T30N R3W 21 SE	0.0	0.0	0.0	0.0	152.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	152
T30N R3W 22 NE	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
T30N R3W 22 E50NW	0.0	0.0	0.0	0.0	16.5	0.0	11.0	0.0	0.0	0.0	0.0	0.0	28
T30N R3W 22 W50NW	0.0	0.0	0.0	0.0	20.5	0.0	16.4	0.0	0.0	0.0	0.0	0.0	37
T30N R3W 22 SW	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	32.2	40
T30N R3W 22 NW25ofSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	11
T30N R3W 22 SW25ofSE	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	13.1	17
T30N R3W 27 NE	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	40.7	42
T30N R3W 27 NW	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	96.5	104
T30N R3W 27 SW	0.0	0.0	0.0	0.0	16.0	0.0	20.0	0.0	0.0	0.0	0.0	53.6	90
T30N R3W 27 SE	0.0	0.0	0.0	0.0	11.6	0.0	23.1	0.0	0.0	0.0	0.0	5.2	40
T30N R3W 28 NE	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	91
T30N R3W 28 NW	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	123
T30N R3W 28 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	75
T30N R3W 28 SE	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32
T30N R3W 29 NE	0.0	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	91.1	115
T30N R3W 29 NW	0.0	0.0	0.0	0.0	14.1	0.0	0.0	0.0	0.0	0.0	0.0	53.5	68
T30N R3W 29 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.1	81
T30N R3W 29 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	75.0	123
T30N R3W 30 NE	0.0	0.0	0.0	0.0	1.2	0.0	0.8	0.0	0.0	0.0	0.0	3.5	5
T30N R3W 30 NW	0.0	0.0	0.0	0.0	23.7	0.0	23.7	0.0	0.0	0.0	1.8	2.6	52
T30N R3W 30 SW	0.0	0.0	0.0	0.0	131.1	0.0	3.5	0.0	0.0	0.0	0.0	0.0	135
T30N R3W 30 SE	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	32.2	144
T30N R3W 31 NE	0.0	0.0	0.0	0.0	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104
T30N R3W 31 NW	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48
T30N R3W 31 SW	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48
T30N R3W 31 SE	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	155
T30N R3W 32 NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	32.2	144

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T30N R3W 32 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.5	96
T30N R3W 32 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107.2	107
T30N R3W 32 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	96.5	112
T30N R3W 33 NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.9	43
T30N R3W 33 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	64.3	128
T30N R3W 33 SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	75.0	123
T30N R3W 33 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4	21
T30N R3W 34 NE	0.0	0.0	0.0	0.0	0.0	0.0	18.3	0.0	0.0	0.0	0.0	57.2	76
T30N R3W 34 NW	0.0	0.0	0.0	0.0	64.0	0.0	4.0	0.0	0.0	0.0	0.0	26.8	95
T30N R3W 34 SW	0.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	61
T30N R3W 34 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.1	91
T30N R3W 35 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6
T30N R3W 35 SW	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	32.2	48
SUBTOTALS	0	598	9	192	1946	515	1294	288	245	0	199	1582	6868
T30N R4W 1 NE	0.0	0.0	9.4	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	73
T30N R4W 1 NW	0.0	0.0	18.9	0.0	0.0	104.0	12.0	0.0	0.0	0.0	0.0	0.0	135
T30N R4W 1 SW	0.0	20.0	18.9	0.0	0.0	40.0	24.0	0.0	0.0	0.0	0.0	0.0	103
T30N R4W 1 SE	0.0	48.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 2 NE	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	32.0	0.0	0.0	0.0	64
T30N R4W 2 NW	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	56.0	0.0	0.0	0.0	72
T30N R4W 2 SW	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	48.0	0.0	0.0	0.0	80
T30N R4W 2 SE	0.0	0.0	9.4	0.0	0.0	128.0	0.0	0.0	8.0	0.0	0.0	0.0	145
T30N R4W 3 NE	0.0	0.0	0.0	0.0	0.0	0.0	52.0	0.0	16.0	0.0	0.0	0.0	68
T30N R4W 3 NW	0.0	0.0	0.0	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	24
T30N R4W 3 SW	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 3 SE	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	32.0	0.0	0.0	0.0	80
T30N R4W 4 NE	0.0	20.0	0.0	0.0	0.0	0.0	24.0	0.0	28.0	0.0	0.0	0.0	72
T30N R4W 4 NW	0.0	24.0	0.0	8.0	0.0	0.0	20.0	0.0	32.0	0.0	0.0	0.0	84
T30N R4W 4 SW	0.0	8.0	0.0	0.0	0.0	0.0	56.0	0.0	16.0	0.0	0.0	0.0	80
T30N R4W 4 SE	0.0	8.0	0.0	0.0	0.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 5 NE	0.0	15.2	0.0	13.1	0.0	0.0	4.4	0.0	10.9	0.0	0.0	0.0	44
T30N R4W 5 SW	0.0	36.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108
T30N R4W 5 SE	0.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120
T30N R4W 6 ALL	0.0	25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
T30N R4W 7 NE	0.0	48.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112
T30N R4W 7 NW	0.0	64.0	0.0	16.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	88
T30N R4W 7 SW	0.0	44.7	0.0	29.8	14.9	0.0	7.5	0.0	0.0	0.0	0.0	0.0	97
T30N R4W 7 SE	0.0	8.0	0.0	112.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	136
T30N R4W 8 NE	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	88
T30N R4W 8 NW	0.0	16.0	0.0	120.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	140
T30N R4W 8 SW	0.0	4.0	0.0	72.0	0.0	0.0	16.0	0.0	16.0	0.0	0.0	0.0	108
T30N R4W 8 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.0	0.0	0.0	0.0	72
T30N R4W 9 NE	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	68.0	0.0	0.0	0.0	80
T30N R4W 9 W50	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	128.0	0.0	0.0	0.0	160
T30N R4W 9 SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.0	0.0	0.0	0.0	52
T30N R4W 10 NE	0.0	0.0	0.0	0.0	0.0	16.0	48.0	0.0	24.0	0.0	0.0	0.0	88
T30N R4W 10 NW	0.0	0.0	0.0	0.0	0.0	0.0	68.0	0.0	12.0	0.0	0.0	0.0	80
T30N R4W 10 SW	0.0	0.0	0.0	0.0	0.0	0.0	36.0	0.0	36.0	0.0	0.0	0.0	72
T30N R4W 10 SE	0.0	0.0	0.0	0.0	0.0	24.0	36.0	0.0	32.0	0.0	0.0	0.0	92
T30N R4W 11 N50	0.0	0.0	43.7	0.0	0.0	123.5	0.0	0.0	24.7	0.0	0.0	0.0	192
T30N R4W 11 SW	0.0	0.0	0.0	0.0	0.0	152.0	0.0	0.0	4.0	0.0	0.0	0.0	156
T30N R4W 11 SE	0.0	0.0	80.2	0.0	0.0	16.0	4.0	0.0	0.0	0.0	0.0	0.0	100
T30N R4W 12 NE	0.0	24.0	23.6	0.0	0.0	32.0	20.0	0.0	0.0	0.0	0.0	0.0	100
T30N R4W 12 NW	0.0	4.0	28.3	0.0	0.0	64.0	20.0	0.0	0.0	0.0	0.0	0.0	116
T30N R4W 12 SW	0.0	0.0	56.6	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	121
T30N R4W 12 SE	0.0	0.0	80.2	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	104
T30N R4W 13 NE	0.0	0.0	66.1	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	90
T30N R4W 13 NW	0.0	0.0	66.1	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	114
T30N R4W 13 SW	0.0	0.0	61.4	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	117
T30N R4W 13 SE	0.0	0.0	33.0	0.0	0.0	0.0	52.0	0.0	0.0	0.0	0.0	0.0	85
T30N R4W 14 NE	0.0	0.0	37.8	0.0	0.0	32.0	24.0	0.0	0.0	0.0	0.0	0.0	94
T30N R4W 14 NW	0.0	0.0	0.0	0.0	0.0	88.0	36.0	0.0	0.0	0.0	0.0	0.0	124
T30N R4W 14 SW	0.0	0.0	4.7	0.0	0.0	64.0	44.0	0.0	0.0	0.0	0.0	0.0	113
T30N R4W 14 SE	0.0	0.0	18.9	0.0	0.0	88.0	4.0	0.0	0.0	0.0	0.0	0.0	111

T30N R4W 15 NE	0.0	0.0	0.0	0.0	0.0	16.0	32.0	0.0	40.0	0.0	0.0	0.0	88
T30N R4W 15 NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76.0	0.0	0.0	0.0	76
T30N R4W 15 SW	0.0	0.0	0.0	0.0	48.0	0.0	28.0	0.0	28.0	0.0	0.0	0.0	104
T30N R4W 15 SE	0.0	0.0	0.0	0.0	0.0	0.0	56.0	0.0	24.0	0.0	0.0	0.0	80
T30N R4W 16 NE	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0	44
T30N R4W 16 NW	0.0	0.0	0.0	24.0	48.0	0.0	0.0	0.0	32.0	0.0	0.0	0.0	104
T30N R4W 16 SW	0.0	0.0	0.0	10.2	101.5	0.0	35.5	0.0	0.0	0.0	0.0	0.0	147
T30N R4W 16 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 17 NE	0.0	0.0	0.0	96.0	24.0	0.0	4.0	0.0	16.0	0.0	0.0	0.0	140
T30N R4W 17 NW	0.0	0.0	0.0	88.0	8.0	0.0	8.0	0.0	12.0	0.0	0.0	0.0	116
T30N R4W 17 SW	0.0	0.0	0.0	8.0	64.0	0.0	44.0	0.0	0.0	0.0	0.0	0.0	116
T30N R4W 17 SE	0.0	0.0	0.0	8.0	24.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	96
T30N R4W 18 NE	0.0	0.0	0.0	136.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	148
T30N R4W 18 NW	0.0	0.0	0.0	64.0	16.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	96
T30N R4W 18 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 18 SE	0.0	0.0	0.0	24.0	64.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	108
T30N R4W 19 ALL	0.0	0.0	0.0	0.0	192.0	0.0	192.0	0.0	0.0	0.0	0.0	0.0	384
T30N R4W 20 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 20 NW	0.0	0.0	0.0	0.0	56.0	0.0	36.0	0.0	0.0	0.0	10.8	0.0	103
T30N R4W 20 SW	0.0	0.0	0.0	0.0	48.0	0.0	36.0	0.0	0.0	0.0	18.0	0.0	102
T30N R4W 20 SE	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	14.4	0.0	142
T30N R4W 21 NE	0.0	0.0	0.0	0.0	136.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136
T30N R4W 21 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 21 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 21 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 22 NE	0.0	0.0	0.0	0.0	8.0	0.0	76.0	0.0	0.0	0.0	0.0	0.0	84
T30N R4W 22 NW	0.0	0.0	0.0	0.0	128.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	136
T30N R4W 22 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 22 SE	0.0	0.0	0.0	0.0	72.0	0.0	44.0	0.0	0.0	0.0	0.0	0.0	116
T30N R4W 23 NE	0.0	0.0	18.9	0.0	0.0	16.0	44.0	0.0	0.0	0.0	0.0	0.0	79
T30N R4W 23 NW	0.0	0.0	75.5	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	92
T30N R4W 23 SW	0.0	0.0	70.8	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	91
T30N R4W 23 SE	0.0	0.0	47.2	0.0	0.0	16.0	20.0	0.0	0.0	0.0	0.0	0.0	83
T30N R4W 24 NE	0.0	0.0	16.3	0.0	0.0	0.0	55.2	0.0	0.0	0.0	0.0	0.0	71
T30N R4W 24 NW	0.0	0.0	70.8	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	111
T30N R4W 24 SW	0.0	0.0	18.9	0.0	0.0	48.0	40.0	0.0	0.0	0.0	0.0	0.0	107
T30N R4W 24 SE	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 25 NE	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 25 NW	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 25 SW	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T30N R4W 25 SE	0.0	0.0	0.0	0.0	32.0	0.0	32.0	0.0	0.0	0.0	28.8	0.0	93
T30N R4W 26 NE	0.0	0.0	23.6	0.0	0.0	72.0	12.0	0.0	0.0	0.0	0.0	0.0	108
T30N R4W 26 NW	0.0	0.0	37.8	0.0	64.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	118
T30N R4W 26 SW	0.0	0.0	23.6	0.0	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128
T30N R4W 26 SE	0.0	0.0	23.6	0.0	0.0	80.0	8.0	0.0	0.0	0.0	0.0	0.0	112
T30N R4W 27 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 27 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 28 ALL	0.0	0.0	0.0	0.0	567.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	567
T30N R4W 29 NE	0.0	0.0	0.0	0.0	112.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	136
T30N R4W 29 NW	0.0	0.0	0.0	0.0	40.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	100
T30N R4W 29 S50	0.0	0.0	0.0	0.0	192.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	240
T30N R4W 30 ALL	0.0	0.0	0.0	0.0	128.0	0.0	192.0	0.0	0.0	0.0	0.0	0.0	320
T30N R4W 31 ALL	0.0	0.0	0.0	0.0	256.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	368
T30N R4W 32 ALL	0.0	0.0	0.0	0.0	544.0	0.0	0.0	32.0	0.0	0.0	0.0	0.0	576
T30N R4W 33 ALL	0.0	0.0	0.0	0.0	480.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	544
T30N R4W 34 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 34 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R4W 34 SW	0.0	0.0	0.0	0.0	136.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136
T30N R4W 34 SE	0.0	0.0	0.0	0.0	88.0	0.0	8.0	0.0	0.0	0.0	0.0	37.5	134
T30N R4W 35 NE	0.0	0.0	80.2	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	88
T30N R4W 35 NW	0.0	0.0	18.9	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4	88
T30N R4W 35 SW	0.0	0.0	18.9	0.0	32.0	0.0	16.0	0.0	0.0	0.0	0.0	26.8	94
T30N R4W 35 SE	0.0	0.0	85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85
T30N R4W 36 NE	0.0	0.0	0.0	0.0	64.0	0.0	12.0	0.0	0.0	0.0	3.6	0.0	80

T30N R4W 36 W50	0.0	0.0	0.0	0.0	64.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	184
T30N R4W 36 SE	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112
SUBTOTALS	0	417	1287	1141	6339	1540	2911	96	1036	0	76	86	14928
T30N R5W 1 ALL	0.0	7.2	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9
T30N R5W 2 SW	0.0	0.0	0.0	18.2	18.2	0.0	18.2	0.0	0.0	0.0	0.0	0.0	55
T30N R5W 2 SE	0.0	12.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16
T30N R5W 11 NE	0.0	0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	100
T30N R5W 11 NW	0.0	0.0	0.0	24.0	24.0	0.0	44.0	0.0	0.0	0.0	0.0	0.0	92
T30N R5W 11 SW	0.0	0.0	0.0	32.0	56.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	112
T30N R5W 11 SE	0.0	4.0	0.0	32.0	56.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	104
T30N R5W 12 NE	0.0	16.0	0.0	96.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	128
T30N R5W 12 NW	0.0	24.0	0.0	64.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	112
T30N R5W 12 SW	0.0	0.0	0.0	104.0	0.0	0.0	28.0	0.0	0.0	0.0	0.0	0.0	132
T30N R5W 12 SE	0.0	40.0	0.0	24.0	32.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	108
T30N R5W 13 NE	0.0	16.0	0.0	88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104
T30N R5W 13 NW	0.0	0.0	0.0	80.0	0.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	116
T30N R5W 13 SW	0.0	0.0	0.0	0.0	120.0	0.0	12.0	0.0	0.0	5.4	0.0	0.0	137
T30N R5W 13 SE	0.0	0.0	0.0	0.0	128.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	140
T30N R5W 14 NE	0.0	0.0	0.0	24.0	40.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	96
T30N R5W 14 NW	0.0	0.0	0.0	8.0	64.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	76
T30N R5W 14 SW	0.0	0.0	0.0	24.0	16.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	88
T30N R5W 14 SE	0.0	0.0	0.0	0.0	48.0	0.0	32.0	0.0	0.0	0.0	0.0	0.0	80
T30N R5W 23 NE	0.0	0.0	0.0	0.0	40.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	76
T30N R5W 23 NW	0.0	0.0	0.0	0.0	141.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142
T30N R5W 23 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 23 SE	0.0	0.0	0.0	0.0	72.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	92
T30N R5W 24 NE	0.0	0.0	0.0	0.0	80.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	120
T30N R5W 24 NW	0.0	0.0	0.0	0.0	72.0	0.0	44.0	0.0	0.0	0.0	0.0	0.0	116
T30N R5W 24 SW	0.0	0.0	0.0	0.0	144.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	148
T30N R5W 24 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 25 NE	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144
T30N R5W 25 NW	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128
T30N R5W 25 SW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 25 SE	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144
T30N R5W 26 NE	0.0	0.0	0.0	0.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128
T30N R5W 26 NW	0.0	0.0	0.0	0.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112
T30N R5W 26 SW	0.0	0.0	0.0	0.0	64.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	72
T30N R5W 26 SE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 35 NE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 35 NW	0.0	0.0	0.0	0.0	40.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	60
T30N R5W 35 SW	0.0	0.0	0.0	0.0	16.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	40
T30N R5W 35 SE	0.0	0.0	0.0	0.0	112.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	120
T30N R5W 36 E50	0.0	0.0	0.0	0.0	176.0	0.0	72.0	0.0	0.0	0.0	0.0	0.0	248
T30N R5W 36 NW	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160
T30N R5W 36 SW	0.0	0.0	0.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	56
SUBTOTALS	0	119	0	704	3176	0	706	0	0	5	0	0	4710
T31N R3W 30 ALL	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
T31N R3W 31 N50	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
T31N R3W 31 S50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	16
T31N R3W 32 ALL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.8	0.0	0.0	0.0	22
SUBTOTALS	0	0	0	0	0	0	0	0	38	0	0	0	38
T31N R4W 25 NE	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
T31N R4W 25 NW	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
T31N R4W 25 SW	0.0	0.0	0.0	13.7	0.0	0.0	37.7	0.0	0.0	0.0	0.0	0.0	51
T31N R4W 25 SE	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4
T31N R4W 26 NE	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
T31N R4W 26 SW	0.0	5.4	0.0	32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.0	80
T31N R4W 26 SE	0.0	19.9	0.0	19.8	13.2	0.0	13.2	0.0	0.0	0.0	0.0	17.7	74
T31N R4W 27 SW	0.0	0.0	0.0	0.0	0.0	0.0	18.9	0.0	0.0	0.0	0.0	0.0	19
T31N R4W 27 SE	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	24.6	31

T31N R4W 28 ALL	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
T31N R4W 33 E50	0.0	10.8	0.0	0.0	0.0	0.0	118.8	0.0	0.0	0.0	0.0	0.0	130
T31N R4W 33 SW	0.0	0.0	0.0	0.0	0.0	0.0	21.8	0.0	2.2	0.0	0.0	0.0	24
T31N R4W 34 NE	0.0	4.0	0.0	32.0	0.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	96
T31N R4W 34 NW	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0	80
T31N R4W 34 SW	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	64
T31N R4W 34 SE	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	64
T31N R4W 35 NE	0.0	0.0	0.0	24.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	72
T31N R4W 35 NW	0.0	20.0	0.0	40.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	100
T31N R4W 35 SW	0.0	0.0	0.0	0.0	0.0	32.0	48.0	0.0	16.0	0.0	0.0	0.0	96
T31N R4W 35 SE	0.0	0.0	0.0	0.0	0.0	24.0	16.0	0.0	32.0	0.0	0.0	0.0	72
T31N R4W 36 NE	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	16
T31N R4W 36 NW	0.0	0.0	0.0	48.0	0.0	0.0	40.0	0.0	8.0	0.0	0.0	0.0	96
T31N R4W 36 SW	0.0	0.0	0.0	0.0	0.0	112.0	0.0	0.0	16.0	0.0	0.0	0.0	128
T31N R4W 36 SE	0.0	0.0	18.9	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	83
SUBTOTALS	0	50	19	210	13	232	696	0	74	0	0	85	1380
TOTALS	0	1185	1316	2247	15164	2286	5958	1247	1392	70	275	2288	33427

APPENDIX F

ESTIMATED MAXIMUM DWELLING UNIT DENSITY

EXISTING AND POTENTIAL DEVELOPMENT

KEY:

ON-SITE DU = NUMBER OF POTENTIAL DWELLING UNITS ESTABLISHED THROUGH METHOD I DETERMINATION BASED ON PUBLIC WATER SUPPLY AVAILABILITY.

ON-SITE DU WITH WELLS = NUMBER OF POTENTIAL DWELLING UNITS ESTABLISHED THROUGH METHOD I DETERMINATION BASED ON INDIVIDUAL WELLS.

EXISTING DU = ESTIMATED NUMBER OF DWELLING UNITS BASED ON NUMBER OF EXISTING LOTS AND PARCELS.

ZONED DU = NUMBER OF POTENTIAL DWELLING UNITS AT BUILD OUT UNDER EXISTING ZONING DESIGNATIONS.

PUD DU = NUMBER OF POTENTIAL DWELLING UNITS AT BUILD OUT UNDER PLANNED UNIT DEVELOPMENT PROVISIONS.

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X indicates that data in these columns are supplied by user;
remaining column values are calculated quantities.

X location	X sec	X part	ONSITE DU	ONSITE DU WITH WELLS	? ONSITE DU WITH WELLS	X EXISTING DU	X ZONED DU	X PUD DU	ONSITE DU/AC	ONSITE DU/AC W/WELLS	EXISTING DU/AC	ZONED DU/AC	PUD DU/AC
T29N R3W	2	NE50	88	30		17	16	158	2.20	0.75	0.43	0.40	3.95
*T29N R3W	2	E50NW25	0	0		0	0	0	0.00	0.00	0.00	0.00	0.00
T29N R3W	2	W50NW25	160	54		16	33	317	2.00	0.67	0.20	0.41	3.96
T29N R3W	2	SW	320	97		34	67	640	2.00	0.61	0.21	0.42	4.00
T29N R3W	2	SE	251	90		22	47	450	2.24	0.80	0.20	0.42	4.02
T29N R3W	3	NE	256	94		28	68	653	1.60	0.59	0.18	0.43	4.08
T29N R3W	3	NW	131	46		17	68	651	0.82	0.28	0.11	0.43	4.07
T29N R3W	3	SW	303	106		9	54	523	2.33	0.82	0.07	0.42	4.02
T29N R3W	3	SE	479	164		32	89	812	2.10	0.72	0.14	0.39	3.56
T29N R3W	4	NE	80	27		15	70	674	0.50	0.17	0.09	0.44	4.21
T29N R3W	4	NW	275	109		7	58	500	1.72	0.68	0.04	0.36	3.13
T29N R3W	4	SW	205	80		11	8	32	1.28	0.50	0.07	0.05	0.20
T29N R3W	4	SE	269	99		18	69	662	1.68	0.62	0.11	0.43	4.14
T29N R3W	5	S50	538	193		3	29	88	1.68	0.60	0.01	0.09	0.28
T29N R3W	5	NE	355	144		29	67	644	2.22	0.90	0.18	0.42	4.03
T29N R3W	5	NW	294	117		32	151	619	1.84	0.73	0.20	0.94	3.87
T29N R3W	6	ALL	724	284		0	31	122	1.19	0.47	0.00	0.05	0.20
SUBTOTALS			4727	1733	0	290	925	7545					
T29N R4W	1	E50	614	256		5	16	64	1.92	0.80	0.02	0.05	0.20
T29N R4W	1	NW	262	104		13	38	150	1.64	0.65	0.08	0.24	0.94
T29N R4W	1	SW	170	52		30	62	313	1.06	0.33	0.19	0.39	1.96
T29N R4W	2	NE	314	88		33	92	672	1.96	0.55	0.21	0.58	4.20
T29N R4W	2	NW	384	160		44	38	559	2.40	1.00	0.28	0.24	3.49
T29N R4W	2	SW	394	160		7	30	556	2.46	1.00	0.04	0.19	3.48
T29N R4W	2	SE	329	125		18	27	316	2.30	0.88	0.13	0.19	2.21
T29N R4W	3	ALL	826	320		9	73	276	2.58	1.00	0.03	0.23	0.86
T29N R4W	4	ALL	1190	416		11	39	141	1.86	0.65	0.02	0.06	0.22
T29N R4W	5	ALL	1651	576		9	33	129	2.58	0.90	0.01	0.05	0.20
T29N R4W	6	ALL	1305	489		9	36	140	1.87	0.70	0.01	0.05	0.20
SUBTOTALS			7439	2746	0	188	484	3316					
T29N R5W	1	NE	307	128		11	15	45	1.92	0.80	0.07	0.09	0.28
T29N R5W	1	NW	384	160		8	15	46	2.40	1.00	0.05	0.09	0.29
T29N R5W	1	SW	384	160		25	14	44	2.40	1.00	0.16	0.09	0.28
T29N R5W	1	SE	384	160		29	17	50	2.40	1.00	0.18	0.11	0.31
T29N R5W	2	ALL	1050	416		18	32	127	1.64	0.65	0.03	0.05	0.20
SUBTOTALS			2509	1024	0	91	93	312					
T30N R3W	4	N50SW25	159	40	40	3	37	353	1.80	0.45	0.03	0.42	4.00
T30N R3W	4	S50SW25	49	12	12	3	34	324	0.60	0.15	0.04	0.42	4.00
T30N R3W	4	SE25	0	0	0	1	26	250	0.00	0.00	0.02	0.42	4.01
T30N R3W	5	NE	200	50	92	69	59	420	1.90	0.48	0.66	0.56	4.00
T30N R3W	5	NW	328	82	82	53	93	657	2.00	0.50	0.32	0.57	4.01
T30N R3W	5	SW	368	104	72	45	90	641	2.30	0.65	0.28	0.56	4.01
T30N R3W	5	SE	350	97	98	186	65	623	2.25	0.63	1.20	0.42	4.00
T30N R3W	6	NE	132	33	33	60	71	663	0.80	0.20	0.36	0.43	4.02
T30N R3W	6	NW	395	99	98.5	75	304	834	1.90	0.48	0.36	1.46	4.01
T30N R3W	6	SW	333	96	136	66	160	640	2.08	0.60	0.41	1.00	4.00
T30N R3W	6	SE	336	92	92	94	155	642	2.10	0.58	0.59	0.97	4.01
T30N R3W	7	NE	435	137	137	6	161	644	2.70	0.85	0.04	1.00	4.00
T30N R3W	7	NW	443	138	137	3	161	645	2.75	0.85	0.02	1.00	4.01
T30N R3W	7	SW	380	107	107.5	56	165	661	2.30	0.65	0.34	1.00	4.01

T30N R3W 7 SE	324	81	81	11	162	649	2.00	0.50	0.07	1.00	4.01
T30N R3W 8 NE	365	101	101	336	782	1572	2.25	0.63	2.07	4.83	9.70
T30N R3W 8 NW	403	121	121	62	777	1552	2.50	0.75	0.39	4.83	9.64
T30N R3W 8 SW	322	81	80	214	776	1560	2.00	0.50	1.33	4.82	9.69
T30N R3W 8 SE	338	101	100	114	554	1113	2.10	0.63	0.71	3.44	6.91
T30N R3W 9 NE	211	53		1	8	33	1.32	0.33	0.01	0.05	0.21
T30N R3W 9 NW	114	42		1	8	32	0.71	0.26	0.01	0.05	0.20
T30N R3W 9 SW	228	100		1	8	32	1.42	0.63	0.01	0.05	0.20
T30N R3W 9 SE	346	112		2	8	33	2.16	0.70	0.01	0.05	0.21
T30N R3W 10 NW	46	12		1	1	5	2.00	0.50	0.04	0.04	0.22
T30N R3W 10 SW	220	59		3	5	22	2.04	0.55	0.03	0.05	0.20
T30N R3W 15 E50NW	211	72		4	40	386	2.20	0.75	0.04	0.42	4.02
T30N R3W 15 W50NW	184	70		5	33	321	2.30	0.88	0.06	0.41	4.01
T30N R3W 15 W50SW	190	78		1	34	322	2.38	0.98	0.01	0.43	4.03
T30N R3W 15 E50SW	286	119		1	50	477	2.40	1.00	0.01	0.42	4.01
T30N R3W 15 SE	31	12		2	5	51	2.36	0.95	0.15	0.38	3.92
T30N R3W 16 NE	326	88		10	162	650	2.04	0.55	0.06	1.01	4.06
T30N R3W 16 NW	271	110		37	161	643	1.69	0.69	0.23	1.01	4.02
T30N R3W 16 SW	311	116		9	160	640	1.94	0.72	0.06	1.00	4.00
T30N R3W 16 SE	342	108		1	160	641	2.14	0.68	0.01	1.00	4.01
T30N R3W 17 NE	178	83		19	177	640	1.11	0.52	0.12	1.11	4.00
T30N R3W 17 NW	320	80		32	200	644	2.00	0.50	0.20	1.25	4.03
T30N R3W 17 SW	261	82		40	321	642	1.63	0.51	0.25	2.01	4.01
T30N R3W 17 SE	330	139		5	319	638	2.07	0.87	0.03	1.99	3.99
T30N R3W 18 NE	320	80		77	322	645	2.00	0.50	0.48	2.01	4.03
T30N R3W 18 NW	328	81		149	323	646	2.05	0.50	0.93	2.02	4.04
T30N R3W 18 SW	112	28		38	113	225	2.00	0.50	0.68	2.02	4.02
T30N R3W 18 SE	246	62		79	245	491	2.00	0.50	0.64	1.99	3.99
T30N R3W 19 NW	24	6		2	25	50	2.00	0.50	0.17	2.08	4.17
T30N R3W 19 SW	122	31		8	154	234	2.00	0.50	0.13	2.52	3.84
T30N R3W 20 NE	96	29		3	113	226	1.71	0.52	0.05	2.02	4.04
T30N R3W 20 NE25NW25	46	13		17	45	90	2.08	0.60	0.77	2.05	4.09
T30N R3W 20 NW25NW25	46	12		6	56	112	2.00	0.50	0.26	2.43	4.87
T30N R3W 20 SW	127	37		6	155	235	2.08	0.60	0.10	2.54	3.85
T30N R3W 20 SE	126	44		74	169	238	2.01	0.70	1.17	2.68	3.78
T30N R3W 21 NE	153	49		20	114	644	1.72	0.55	0.22	1.28	7.24
T30N R3W 21 NW	153	61		29	118	544	1.13	0.45	0.21	0.87	4.00
T30N R3W 21 SW	272	118		32	64	579	1.87	0.81	0.22	0.44	3.99
T30N R3W 21 SE	365	152		37	68	654	2.28	0.95	0.23	0.43	4.09
T30N R3W 22 NE	3	1		1	11	101	0.12	0.05	0.04	0.44	4.04
T30N R3W 22 E50NW	84	28		5	23	218	1.52	0.50	0.09	0.42	3.96
T30N R3W 22 W50NW	115	37		14	34	328	1.40	0.45	0.17	0.41	4.00
T30N R3W 22 SW	128	40		60	68	652	0.80	0.25	0.38	0.43	4.08
T30N R3W 22 NW25ofSE	33	11		2	10	91	1.00	0.34	0.06	0.30	2.76
T30N R3W 22 SW25ofSE	56	17		4	10	90	2.00	0.62	0.14	0.36	3.21
T30N R3W 27 NE	128	42		70	64	255	2.00	0.66	1.09	1.00	3.98
T30N R3W 27 NW	320	104		56	113	640	2.00	0.65	0.35	0.71	4.00
T30N R3W 27 SW	278	90		73	108	648	1.74	0.56	0.46	0.68	4.05
T30N R3W 27 SE	136	40		30	125	298	1.76	0.52	0.39	1.62	3.87
T30N R3W 28 NE	262	91		22	68	648	1.64	0.57	0.14	0.43	4.05
T30N R3W 28 NW	339	123		14	151	646	2.12	0.77	0.09	0.94	4.04
T30N R3W 28 SW	224	75		8	66	636	1.40	0.47	0.05	0.41	3.98
T30N R3W 28 SE	77	32		33	68	649	0.48	0.20	0.21	0.43	4.06
T30N R3W 29 NE	330	115		50	271	649	2.06	0.72	0.31	1.69	4.06
T30N R3W 29 NW	194	68		18	188	376	2.06	0.72	0.19	2.00	4.00
T30N R3W 29 SW	242	81		35	131	484	2.00	0.67	0.29	1.08	4.00
T30N R3W 29 SE	368	123		90	164	654	2.30	0.77	0.56	1.03	4.09
T30N R3W 30 NE	16	5		1	15	30	2.06	0.69	0.13	1.88	3.75
T30N R3W 30 NW	161	52		32	158	316	2.04	0.66	0.41	2.00	4.00
T30N R3W 30 SW	328	135		23	236	553	2.38	0.97	0.17	1.71	4.01
T30N R3W 30 SE	365	144		43	316	632	2.28	0.90	0.27	1.98	3.95
T30N R3W 31 NE	250	104		14	162	647	1.56	0.65	0.09	1.01	4.04
T30N R3W 31 NW	115	48		62	162	648	0.72	0.30	0.39	1.01	4.05
T30N R3W 31 SW	115	48		24	162	647	0.72	0.30	0.15	1.01	4.04
T30N R3W 31 SE	378	155		24	162	649	2.36	0.97	0.15	1.01	4.06
T30N R3W 32 NE	432	144		31	67	646	2.70	0.90	0.19	0.42	4.04

T30N R3W 32 NW	288	96		39	114	647	1.80	0.60	0.24	0.71	4.04
T30N R3W 32 SW	320	107		15	68	649	2.00	0.67	0.09	0.43	4.06
T30N R3W 32 SE	336	112		32	68	648	2.10	0.70	0.20	0.43	4.05
T30N R3W 33 NE	128	43		26	69	659	0.80	0.27	0.16	0.43	4.12
T30N R3W 33 NW	384	128		21	65	625	2.40	0.80	0.13	0.41	3.91
T30N R3W 33 SW	368	123		26	65	623	2.30	0.77	0.16	0.41	3.89
T30N R3W 33 SE	64	21		7	70	675	0.40	0.13	0.04	0.44	4.22
T30N R3W 34 NE	244	76		26	51	489	2.00	0.62	0.21	0.42	4.01
T30N R3W 34 NW	250	95		53	67	643	1.56	0.59	0.33	0.42	4.02
T30N R3W 34 SW	150	61		27	67	644	0.94	0.38	0.17	0.42	4.03
T30N R3W 34 SE	272	91		28	101	636	1.70	0.57	0.18	0.63	3.98
T30N R3W 35 NW	18	6		7	4	35	2.00	0.67	0.78	0.44	3.89
T30N R3W 35 SW	160	48		34	72	313	2.00	0.60	0.43	0.90	3.91
SUBTOTALS	21057	6868	1620	3389	12570	47025					
T30N R4W 1 NE	304	73		41	185	647	1.90	0.46	0.26	1.16	4.04
T30N R4W 1 NW	456	135		33	158	630	2.85	0.84	0.21	0.99	3.94
T30N R4W 1 SW	392	103		47	160	639	2.45	0.64	0.29	1.00	3.99
T30N R4W 1 SE	320	80		82	161	644	2.00	0.50	0.51	1.01	4.03
T30N R4W 2 NE	224	64		30	105	618	1.40	0.40	0.19	0.66	3.86
T30N R4W 2 NW	272	72		13	88	631	1.70	0.45	0.08	0.55	3.94
T30N R4W 2 SW	288	80		10	85	643	1.80	0.50	0.06	0.53	4.02
T30N R4W 2 SE	464	145		15	161	643	2.90	0.91	0.09	1.01	4.02
T30N R4W 3 NE	272	68		35	138	645	1.70	0.43	0.22	0.86	4.03
T30N R4W 3 NW	96	24		35	161	643	0.60	0.15	0.22	1.01	4.02
T30N R4W 3 SW	320	80		94	160	640	2.00	0.50	0.59	1.00	4.00
T30N R4W 3 SE	320	80		44	138	644	2.00	0.50	0.28	0.86	4.03
T30N R4W 4 NE	288	72		58	161	646	1.80	0.45	0.36	1.01	4.04
T30N R4W 4 NW	323	84		51	99	646	2.02	0.53	0.32	0.62	4.04
T30N R4W 4 SW	320	80		42	34	647	2.00	0.50	0.26	0.21	4.04
T30N R4W 4 SE	320	80		149	161	645	2.00	0.50	0.93	1.01	4.03
T30N R4W 5 NE	153	44		22	18	350	1.76	0.50	0.25	0.21	4.02
T30N R4W 5 SW	317	108		64	30	579	2.20	0.75	0.44	0.21	4.02
T30N R4W 5 SE	288	120		55	34	647	1.80	0.75	0.34	0.21	4.04
T30N R4W 6 ALL	102	26		50	11	205	2.00	0.50	0.98	0.22	4.02
T30N R4W 7 NE	346	112		142	33	638	2.16	0.70	0.89	0.21	3.99
T30N R4W 7 NW	326	88		31	31	604	2.04	0.55	0.19	0.19	3.78
T30N R4W 7 SW	316	97		22	88	596	2.12	0.65	0.15	0.59	4.00
T30N R4W 7 SE	365	136		46	82	614	2.28	0.85	0.29	0.51	3.84
T30N R4W 8 NE	262	88		47	33	642	1.64	0.55	0.29	0.21	4.01
T30N R4W 8 NW	368	140		77	34	646	2.30	0.88	0.48	0.21	4.04
T30N R4W 8 SW	317	108		44	100	647	1.98	0.68	0.28	0.63	4.04
T30N R4W 8 SE	288	72		44	58	642	1.80	0.45	0.28	0.36	4.01
T30N R4W 9 NE	320	80		32	163	650	2.00	0.50	0.20	1.02	4.06
T30N R4W 9 W50	640	160		17	88	1300	2.00	0.50	0.05	0.28	4.06
T30N R4W 9 SE	208	52		34	114	650	1.30	0.33	0.21	0.71	4.06
T30N R4W 10 NE	336	88		56	162	648	2.10	0.55	0.35	1.01	4.05
T30N R4W 10 NW	320	80		24	162	646	2.00	0.50	0.15	1.01	4.04
T30N R4W 10 SW	288	72		44	138	644	1.80	0.45	0.28	0.86	4.03
T30N R4W 10 SE	344	92		40	155	641	2.15	0.58	0.25	0.97	4.01
T30N R4W 11 N50	692	192		16	279	1296	2.80	0.78	0.06	1.13	5.25
T30N R4W 11 SW	472	156		66	162	650	2.95	0.98	0.41	1.01	4.06
T30N R4W 11 SE	472	100		49	162	650	2.95	0.63	0.31	1.01	4.06
T30N R4W 12 NE	392	100		32	162	649	2.45	0.62	0.20	1.01	4.06
T30N R4W 12 NW	432	116		43	160	641	2.70	0.73	0.27	1.00	4.01
T30N R4W 12 SW	480	121		43	160	640	3.00	0.75	0.27	1.00	4.00
T30N R4W 12 SE	480	104		51	163	651	3.00	0.65	0.32	1.02	4.07
T30N R4W 13 NE	432	90		114	175	648	2.70	0.56	0.71	1.09	4.05
T30N R4W 13 NW	480	114		25	162	649	3.00	0.71	0.16	1.01	4.06
T30N R4W 13 SW	480	117		57	162	648	3.00	0.73	0.36	1.01	4.05
T30N R4W 13 SE	376	85		104	160	641	2.35	0.53	0.65	1.00	4.01
T30N R4W 14 NE	384	94		23	163	652	2.40	0.59	0.14	1.02	4.08
T30N R4W 14 NW	408	124		61	163	654	2.55	0.78	0.38	1.02	4.09
T30N R4W 14 SW	392	113		43	173	649	2.45	0.70	0.27	1.08	4.06
T30N R4W 14 SE	376	111		10	162	650	2.35	0.69	0.06	1.01	4.06

T30N R4W 15 NE	336	88	40	118	653	2.10	0.55	0.25	0.74	4.08
T30N R4W 15 NW	304	76	18	68	649	1.90	0.48	0.11	0.43	4.06
T30N R4W 15 SW	339	104	45	68	649	2.12	0.65	0.28	0.43	4.06
T30N R4W 15 SE	320	80	60	460	580	2.00	0.50	0.38	2.88	3.63
T30N R4W 16 NE	150	44	25	68	653	0.94	0.28	0.16	0.43	4.08
T30N R4W 16 NW	301	104	30	118	649	1.88	0.65	0.19	0.74	4.06
T30N R4W 16 SW	410	147	28	162	813	2.02	0.73	0.14	0.80	4.00
T30N R4W 16 SE	384	160	40	68	651	2.40	1.00	0.25	0.43	4.07
T30N R4W 17 NE	368	140	9	162	650	2.30	0.88	0.06	1.01	4.06
T30N R4W 17 NW	310	116	121	166	664	1.94	0.73	0.76	1.04	4.15
T30N R4W 17 SW	349	116	182	177	635	2.18	0.73	1.14	1.11	3.97
T30N R4W 17 SE	333	96	134	195	635	2.08	0.60	0.84	1.22	3.97
T30N R4W 18 NE	374	148	62	163	652	2.34	0.93	0.39	1.02	4.08
T30N R4W 18 NW	256	96	10	157	629	1.60	0.60	0.06	0.98	3.93
T30N R4W 18 SW	384	160	11	113	641	2.40	1.00	0.07	0.71	4.01
T30N R4W 18 SE	291	108	49	138	631	1.82	0.68	0.31	0.86	3.94
T30N R4W 19 ALL	1229	384	44	202	2531	1.92	0.60	0.07	0.32	3.95
T30N R4W 20 NE	384	160	37	202	628	2.40	1.00	0.23	1.26	3.93
T30N R4W 20 NW	289	103	28	68	649	1.81	0.64	0.18	0.43	4.06
T30N R4W 20 SW	277	102	31	51	650	1.73	0.64	0.19	0.32	4.06
T30N R4W 20 SE	322	142	24	51	648	2.01	0.89	0.15	0.32	4.05
T30N R4W 21 NE	326	136	36	67	649	2.04	0.85	0.23	0.42	4.06
T30N R4W 21 NW	384	160	34	78	642	2.40	1.00	0.21	0.49	4.01
T30N R4W 21 SW	384	160	31	34	649	2.40	1.00	0.19	0.21	4.06
T30N R4W 21 SE	384	160	38	34	650	2.40	1.00	0.24	0.21	4.06
T30N R4W 22 NE	323	84	98	322	625	2.02	0.53	0.61	2.01	3.91
T30N R4W 22 NW	339	136	46	129	641	2.12	0.85	0.29	0.81	4.01
T30N R4W 22 SW	384	160	20	96	648	2.40	1.00	0.13	0.60	4.05
T30N R4W 22 SE	349	116	54	346	610	2.18	0.73	0.34	2.16	3.81
T30N R4W 23 NE	320	79	7	166	647	2.00	0.49	0.04	1.04	4.04
T30N R4W 23 NW	448	92	46	218	646	2.80	0.57	0.29	1.36	4.04
T30N R4W 23 SW	440	91	83	319	638	2.75	0.57	0.52	1.99	3.99
T30N R4W 23 SE	368	83	42	191	641	2.30	0.52	0.26	1.19	4.01
T30N R4W 24 NE	304	71	74	139	555	2.20	0.52	0.54	1.01	4.02
T30N R4W 24 NW	480	111	42	162	649	3.00	0.69	0.26	1.01	4.06
T30N R4W 24 SW	400	107	42	196	646	2.50	0.67	0.26	1.23	4.04
T30N R4W 24 SE	320	80	41	334	578	2.00	0.50	0.26	2.09	3.61
T30N R4W 25 NE	320	80	131	270	645	2.00	0.50	0.82	1.69	4.03
T30N R4W 25 NW	320	80	91	162	649	2.00	0.50	0.57	1.01	4.06
T30N R4W 25 SW	320	80	70	163	653	2.00	0.50	0.44	1.02	4.08
T30N R4W 25 SE	234	93	33	288	653	1.46	0.58	0.21	1.80	4.08
T30N R4W 26 NE	384	108	34	162	649	2.40	0.67	0.21	1.01	4.06
T30N R4W 26 NW	410	118	33	162	648	2.56	0.74	0.21	1.01	4.05
T30N R4W 26 SW	370	128	28	162	648	2.31	0.80	0.18	1.01	4.05
T30N R4W 26 SE	392	112	167	162	648	2.45	0.70	1.04	1.01	4.05
T30N R4W 27 NE	384	160	37	149	644	2.40	1.00	0.23	0.93	4.03
T30N R4W 27 NW	384	160	21	101	642	2.40	1.00	0.13	0.63	4.01
T30N R4W 27 SW	384	160	38	68	650	2.40	1.00	0.24	0.43	4.06
T30N R4W 27 SE	384	160	20	68	650	2.40	1.00	0.13	0.43	4.06
T30N R4W 28 ALL	1361	567	13	88	1437	2.04	0.85	0.02	0.13	2.15
T30N R4W 29 NE	365	136	15	12	124	2.28	0.85	0.09	0.08	0.78
T30N R4W 29 NW	336	100	20	34	648	2.10	0.63	0.13	0.21	4.05
T30N R4W 29 S50	653	240	8	41	661	2.04	0.75	0.03	0.13	2.07
T30N R4W 30 ALL	1075	320	75	103	1842	1.68	0.50	0.12	0.16	2.88
T30N R4W 31 ALL	1062	368	5	32	126	1.66	0.58	0.01	0.05	0.20
T30N R4W 32 ALL	1402	576	2	33	131	2.19	0.90	0.00	0.05	0.20
T30N R4W 33 ALL	1344	544	4	69	1003	2.10	0.85	0.01	0.11	1.57
T30N R4W 34 NE	384	160	12	68	650	2.40	1.00	0.08	0.43	4.06
T30N R4W 34 NW	384	160	28	66	636	2.40	1.00	0.18	0.41	3.98
T30N R4W 34 SW	326	136	33	39	349	2.04	0.85	0.21	0.24	2.18
T30N R4W 34 SE	355	134	3	68	650	2.22	0.83	0.02	0.43	4.06
T30N R4W 35 NE	432	88	70	80	650	2.70	0.55	0.44	0.50	4.06
T30N R4W 35 NW	275	88	35	67	644	1.72	0.55	0.22	0.42	4.03
T30N R4W 35 SW	317	94	27	68	652	1.98	0.59	0.17	0.43	4.08
T30N R4W 35 SE	432	85	6	73	643	2.70	0.53	0.04	0.46	4.02
T30N R4W 36 NE	205	80	30	162	647	1.28	0.50	0.19	1.01	4.04

T30N R4W 36 W50	634	184		2	318	1283	1.98	0.58	0.01	0.99	4.01
T30N R4W 36 SE	269	112		24	162	646	1.68	0.70	0.15	1.01	4.04
SUBTOTALS	47190	14928	0	5284	15563	79463					
T30N R5W 1 ALL	33	9		11	3	62	2.04	0.55	0.69	0.19	3.88
T30N R5W 2 SW	160	55		6	33	378	1.76	0.60	0.07	0.36	4.15
T30N R5W 2 SE	58	16		13	9	159	1.44	0.40	0.33	0.23	3.98
T30N R5W 11 NE	272	100		23	42	605	1.70	0.63	0.14	0.26	3.78
T30N R5W 11 NW	291	92		11	66	629	1.82	0.58	0.07	0.41	3.93
T30N R5W 11 SW	307	112		52	103	625	1.92	0.70	0.33	0.64	3.91
T30N R5W 11 SE	275	104		23	76	622	1.72	0.65	0.14	0.48	3.89
T30N R5W 12 NE	358	128		21	34	643	2.24	0.80	0.13	0.21	4.02
T30N R5W 12 NW	346	112		56	33	633	2.16	0.70	0.35	0.21	3.96
T30N R5W 12 SW	362	132		60	126	633	2.26	0.83	0.38	0.79	3.96
T30N R5W 12 SE	342	108		19	105	649	2.14	0.68	0.12	0.66	4.06
T30N R5W 13 NE	275	104		38	160	640	1.72	0.65	0.24	1.00	4.00
T30N R5W 13 NW	336	116		33	158	631	2.10	0.73	0.21	0.99	3.94
T30N R5W 13 SW	355	137		34	86	672	2.22	0.86	0.21	0.54	4.20
T30N R5W 13 SE	355	140		39	92	618	2.22	0.88	0.24	0.58	3.86
T30N R5W 14 NE	282	96		23	80	616	1.76	0.60	0.14	0.50	3.85
T30N R5W 14 NW	189	76		28	121	604	1.18	0.48	0.18	0.76	3.78
T30N R5W 14 SW	288	88		29	111	630	1.80	0.55	0.18	0.69	3.94
T30N R5W 14 SE	243	80		20	69	646	1.52	0.50	0.13	0.43	4.04
T30N R5W 23 NE	240	76		12	31	598	1.50	0.48	0.08	0.19	3.74
T30N R5W 23 NW	340	142		26	84	596	2.28	0.95	0.17	0.56	4.00
T30N R5W 23 SW	384	160		12	49	350	2.40	1.00	0.08	0.31	2.19
T30N R5W 23 SE	253	92		1	33	80	1.58	0.58	0.01	0.21	0.50
T30N R5W 24 NE	352	120		4	33	625	2.20	0.75	0.03	0.21	3.91
T30N R5W 24 NW	349	116		11	58	627	2.18	0.73	0.07	0.36	3.92
T30N R5W 24 SW	362	148		6	58	635	2.26	0.93	0.04	0.36	3.97
T30N R5W 24 SE	384	160		1	33	640	2.40	1.00	0.01	0.21	4.00
T30N R5W 25 NE	346	144		30	65	628	2.16	0.90	0.19	0.41	3.93
T30N R5W 25 NW	307	128		27	66	636	1.92	0.80	0.17	0.41	3.98
T30N R5W 25 SW	384	160		5	27	480	2.40	1.00	0.03	0.17	3.00
T30N R5W 25 SE	346	144		1	8	31	2.16	0.90	0.01	0.05	0.19
T30N R5W 26 NE	307	128		10	27	479	1.92	0.80	0.06	0.17	2.99
T30N R5W 26 NW	269	112		1	8	32	1.68	0.70	0.01	0.05	0.20
T30N R5W 26 SW	186	72		10	66	631	1.16	0.45	0.06	0.41	3.94
T30N R5W 26 SE	384	160		21	33	630	2.40	1.00	0.13	0.21	3.94
T30N R5W 35 NE	384	160		8	8	32	2.40	1.00	0.05	0.05	0.20
T30N R5W 35 NW	176	60		2	8	31	1.10	0.38	0.01	0.05	0.19
T30N R5W 35 SW	134	40		7	8	32	0.84	0.25	0.04	0.05	0.20
T30N R5W 35 SE	301	120		7	8	32	1.88	0.75	0.04	0.05	0.20
T30N R5W 36 E50	710	248		1	16	64	2.22	0.78	0.00	0.05	0.20
T30N R5W 36 NW	384	160		11	20	54	2.40	1.00	0.07	0.13	0.34
T30N R5W 36 SW	224	56		5	8	32	1.40	0.35	0.03	0.05	0.20
SUBTOTALS	12632	4710	0	758	2262	18670					
T31N R3W 30 ALL	0	0		137	132	565	0.00	0.00	0.94	0.91	3.90
T31N R3W 31 N50	0	0		235	365	992	0.00	0.00	0.90	1.40	3.82
T31N R3W 31 S50	64	16		90	101	1308	0.20	0.05	0.28	0.32	4.09
T31N R3W 32 ALL	87	22		27	20	387	0.90	0.23	0.28	0.21	3.99
SUBTOTALS	151	38	0	489	618	3252					
T31N R4W 25 NE	0	0		1	6	108	0.00	0.00	0.04	0.22	4.00
T31N R4W 25 NW	0	0		1	1	4	0.00	0.00	0.05	0.05	0.19
T31N R4W 25 SW	184	51		89	79	551	1.34	0.38	0.65	0.58	4.02
T31N R4W 25 SE	16	4		96	38	643	0.10	0.03	0.60	0.24	4.02
T31N R4W 26 NE	0	0		1	4	35	0.00	0.00	0.11	0.44	3.89
T31N R4W 26 SW	227	80		111	45	429	2.12	0.75	1.04	0.42	4.01
T31N R4W 26 SE	224	74		41	55	528	1.70	0.56	0.31	0.42	4.00
T31N R4W 27 SW	76	19		24	40	159	1.80	0.45	0.57	0.95	3.79
T31N R4W 27 SE	98	31		22	21	197	2.00	0.63	0.45	0.43	4.02

X81

T31N R4W 28 ALL	0	0		1	0	1	0.00	0.00	3.70	0.00	3.70
T31N R4W 33 E50	518	130		4	432	1728	1.20	0.30	0.01	1.00	4.00
T31N R4W 33 SW	96	24		27	87	348	1.10	0.28	0.31	1.00	4.00
T31N R4W 34 NE	333	96		167	161	643	2.08	0.60	1.04	1.01	4.02
T31N R4W 34 NW	320	80		110	160	640	2.00	0.50	0.69	1.00	4.00
T31N R4W 34 SW	256	64		52	162	648	1.60	0.40	0.33	1.01	4.05
T31N R4W 34 SE	256	64		21	161	643	1.60	0.40	0.13	1.01	4.02
T31N R4W 35 NE	250	72		40	151	604	1.56	0.45	0.25	0.94	3.78
T31N R4W 35 NW	336	100		161	168	672	2.10	0.63	1.01	1.05	4.20
T31N R4W 35 SW	352	96		67	169	674	2.20	0.60	0.42	1.06	4.21
T31N R4W 35 SE	264	72		0	103	613	1.65	0.45	0.00	0.64	3.83
T31N R4W 36 NE	64	16		48	220	620	0.40	0.10	0.30	1.38	3.88
T31N R4W 36 NW	307	96		47	162	447	1.92	0.60	0.29	1.01	2.79
T31N R4W 36 SW	400	128		23	160	667	2.50	0.80	0.14	1.00	4.17
T31N R4W 36 SE	288	83		32	92	665	1.80	0.52	0.20	0.58	4.16
SUBTOTALS	4864	1380	0	1186	2677	12267					
TOTALS	100569	33427	1620	11675	35192	171850					

Appendix N

Evaluation of a Groundwater Data Management System

Evaluation of a Ground Water Data Management System for Clallam County

Prepared for

Clallam County Department of Community Development

July 15, 1991

Prepared by

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Project W72-01.01

CONTENTS

INTRODUCTION

The purpose of this report is to present a ground water data management system available to Clallam County which will aid in the storage, retrieval, and reporting of hydrogeologic data. Currently, the county's "database" consists of hard copy files of ground water and geologic data which is often stored at different locations throughout the county. With the current system, access to existing and new data is often difficult and it may not be utilized because of the time and effort it takes to get the data. The principal goals and objectives of a data management system (DMS) for Clallam County should be to:

1. Facilitate data analysis and interpretation for technical investigations.

2. Provide an efficient data management tool for future ground water management activities.

3. Meet data reporting requirements of Department of Ecology (Ecology).

The DMS discussed in this report is available to Clallam County at little or no cost from the Seattle-King County Health Department (SKCHD). The SKCHD is the lead agency for all the ground water management programs (GWMP) in progress throughout King County, Washington. The DMS runs on an IBM-compatible computer using D-base III software. SKCHD has been using the DMS for over a year and are in the process of producing an operating manual for the system.

The following sections describe the DMS used by SKCHD. The report also includes all appropriate sections of the Ecology document *Data Reporting Manual for the Ground Water Management Program* (Water Resources Division, 1988).

Water Resources Database Management System

The computerized water resource database management system was developed as part of the South King County GWMP and has been modified by the county. The database management system includes a number of procedures that allow convenient input, editing, transfer, backup, and retrieval of data. The procedures provide a menu environment through which the water resource manager and planner can access the database. Data input procedures are designed to prompt the user for required data fields and to do limited error checking to confirm that the data was properly entered. Data editing procedures allow the user to modify or update existing information that is already contained in the database.

A data backup routine allows the user to periodically save the contents of the entire database management system to a set of floppy disks.

Data retrieval routines allow the user to prepare data reports for use in water resource planning studies. Standardized report forms (e.g., water levels, pumpage, well logs, etc.) and customized report forms created by the user are available (construction data, site file information, etc.). In general, the user is able to select from the following options for data retrieval:

- Retrieve by site ID,
- Retrieve by an owner ID (e.g., DSHS number),
- Retrieve by township-range-section, and
- Retrieve by latitude-longitude window.

In addition, the user can specify that the output be directed either to a printer or to an ASCII file.

Hardware and Software Requirements

The minimum hardware requirements for operation of the database management system will be an IBM AT or compatible configured with a 20 Mbyte hard disk, 640 Kbytes of memory, and DOS 3.1 or later. A substantial improvement in the performance of the database management system can be achieved with the newer generation 80286- and 80387-based PC computers that are configured with high speed larger capacity, hard disks, high processing speeds and/or numeric co-processors.

Computer mapping and/or geographical display of data in the DMS may occur through a variety of systems including CAD (computer aided drawing) or other plotting and mapping software. These systems may require additional hardware to support these applications. Such hardware may include: digitizing pad, plotter, color graphics, etc.

Data Management System Structure

The structure and organization of the data management system conforms to the requirements defined in Ecology's Data Reporting Manual. All database information is organized and indexed using a site identification number based on the USGS protocol. The database can include WATSTOR data currently online at the USGS.

A listing of the data management system files and their corresponding structure is presented in Part IV. The file naming conventions specified in Part IV are only for internal usage. The actual file names used for the data transfer to Ecology will conform to the conventions specified in the Data Reporting Manual. For each file, the first three letter ("xxx") are used to identify the project area database (i.e., "SEQ" for Sequim).

A listing of the STORET files and their corresponding structure is also presented in Part IV. The database file structure conforms to Part II of the Data Reporting Manual.

Geologic (well) log information is organized into five database files. The geologic log files contain the site identification number, soil descriptions for each designated interval, and the range in interval depths. A listing of the geologic log files and their corresponding structure is presented in Part IV.

Data fields are provided for water production data. Production file includes fields for nominal discharge rate and maximum developed capacity.

Report Organization

The remainder of this Data Management Report incorporates, in total, all of the Parts presented in Ecology's data reporting manual and examples of the DMS menus and file structures.

Part I	-	Water Well Construction and Water Level Information
Part II	-	Coding Instructions for Water Quality Data
Part III	-	Other Ground Water Information
Part IV	-	Description of Database Files and File Structure
Part V	-	Appendices
Part VI	-	Example Menus and File Structures

Modifications have been incorporated in Parts I, II, and III to provide data not currently covered by the WDOE-DRM (i.e., pumping test records).

Part V includes WDOE-DRM Appendices. Part VI provides example menus and file structures.

PART I
WATER WELL CONSTRUCTION AND WATER LEVEL INFORMATION

The water well and water level information part of the DMS will be identical to the October 1987 Ecology Data Reporting Manual (DRM), which requires use of the USGS WATSTORE system.

The remainder of this Part is taken directly from Ecology's DRM and includes six sections:

Section A	Introduction
Section B	Field Characteristics
Section C	Coding Instructions
Section D	Aquifer Codes
Section E	Source Agency Codes
Section F	Example Completed Form and Corresponding Computer Files

PART I

WATER WELL CONSTRUCTION AND WATER LEVEL INFORMATION

The water well and water level information part of the DMS will be identical to the October, 1987 WDOE-DRM which requires use of the USGS WATSTORE system. At present, we anticipate modifying the WDOE format to include a pumping test record. This assumes both authorization and direction (i.e., fields and codes) by WDOE. The proposed pumping test record is presented below.

The remainder of this Part is taken directly from the WDOE-DRM and includes 6 sections:

Section A Introduction
Section B Field Characteristics
Section C Coding Instructions
Section D Aquifer Codes
Section E Source Agency Codes
Section F Example Completed Form and Corresponding Computer Files

PUMPING TEST RECORD

RECORD NUMBER

FLOW RATE, GPM

DRAWDOWN, FT

TEST DURATION, HRS

TEST TYPE 8

TRANSMISSIVITY (gpd/ft)

STORAGE COEFFICIENT

SOURCE OF DATA 1

DATE MEASURED

8 B=BAILER, P=PUMP, A=AIRLIFT, F=FLOW, S=SLUG

Section A - Introduction

Data in Part I on well construction and water levels will be entered into the USGS WATSTORE system by Ecology. Therefore, the data format required by Ecology is based on the WATSTORE system. To ensure that data on individual wells are not entered twice into the system, it will be necessary to contact the USGS and request a retrieval of existing information for the project area. The corresponding USGS field numbers are shown on the Data Form in the small boxes followed by an equal sign and in brackets in the Coding Instructions (Part I, Section C). Contact Dave Sapik of the USGS (206-593-6510) for more information.

Well construction data must be transmitted to Ecology for each well identified under the Ground Water Management Program. This includes any well used for defining stratigraphy, water level contours, or other analyses. Water levels must be reported for each well measured. When well inventories are conducted (a minimal amount of data is collected for a very large number of wells), this data should be handled acording to the instructions in Part III. Data shall be error-checked and verified before being transmitted to Ecology.

Data must be submitted to Ecology in computer files on PC/MS-DOS 2.1 (or compatible) formatted 5-1/4 inch diskettes. A printout of all computer files submitted must be included with the diskettes. The computer files for Part I can be in dBASE II, dBASE III, SMART, or ASCII data-type formats. ASCII data-type files are specially formatted files in which fields are separated from each other by commas and text fields are enclosed by quotation marks. A carriage return and line feed marks the end of each record; a control Z character marks the end of the file. Blank fields must be carried; leading zeros are not needed except where noted in the coding instructions. (An example of an ASCII data file is shown in Part I, Section F.)

The well construction and water level data are divided into 14 files that are linked together through the Site ID. The file naming conventions are listed below:

1.	SITE FILE	SITE??.xxx
2.	GROUND WATER MANAGEMENT IDENTIFICATION FILE	GWMID??.xxx
3.	OWNERS FILE	OWN??.xxx
4.	CONSTRUCTION FILE	CONST??.xxx
5.	HOLE DIAMETER FILE	HOLE??.xxx
6.	CASING FILE	CASE??.xxx
7.	OPENINGS FILE	OPEN??.xxx
8.	LIFT FILE	LIFT??.xxx
9.	OTHER DATA AVAILABLE FILE	OTDA??.xxx
10.	GEOPHYSICAL LOGS FILE	GEOL??.xxx
11.	NETWORK FILE	NETW??.xxx
12.	WELL FIELD FILE	WLFD??.xxx
13.	WATER LEVEL FILE	WTLV??.xxx
14.	MEASURING POINT FILE	MPNT??.xxx

The "??" shown in each file name are to be replaced with the Ranking Number for each Ground Water Management Area from the General Schedule (listed in the Coding Instructions in Section C for Field 38). The "xxx" should be replaced with "ASC" for an ASCII file, "DB" for SMART database files, and "DB2" or "DB3" for DBASE2 or DBASE3 files respectively. There is always one sitefile record for each well, but there may be multiple records per well for the other files. The first field for each file other than the site file should always be the site ID, as shown in the example in Section F.

An example of the Data Form follows. <u>This form is for Lead Agency use only; do not transmit paper forms to Ecology.</u> Additional forms are available upon request from the Ecology Grant Project Officer. Mandatory fields are shaded in green on the form. Fields outlined in green are mandatory if the information is reasonably available, such as from a drillers report or other easily available source. Fields outlined in black are not mandatory.

A summary of field characteristics is given in Section B followed by the detailed coding instructions in section C. Sections D and E list the Aquifer and Source Agency codes, respectively. Section F gives an example of a completed form and the corresponding ASCII files.

Section B - Field Characteristics

I. SITE FILE RECORD

Number	Field Title	Type	Length
	Transaction	A	1
	Start Card No.	A	6
1	Source Agency	A	5
2	Site ID	A	15
3	Local Number	A	15
4	Latitude	A	6
5	Longitude	A	7
6	Lat-Long Accuracy	A	1
7	State	A	2
8	County	A	3
9	Location Map	A	20
10	Scale	N0	7
11	Altitude	N2	8
12	Method Measure	A	1
13	Accuracy	A	3
14	Hydrologic Unit	A	8
15	Station Type	A	1
16	Agency Use Site	A	1
17	Remarks	A	50
18	Date Site Est.	A	8
19	Data Reliabitity	A	1
20	Site Type	A	1
21	Date of Constr.	A	8
22	Use of Site	A	1
23	Second-site-use	A	1
24	Third-site-use	A	1
25	Use of Water	A	1
26	Secondary Use	A	1
27	Tertiary Use	A	1
28	Aquifer Type	A	1
29	Primary Aquifer	A	8
30	Well Depth	N2	8
31	Hole Depth	N2	8
32	Source of Depth	A	1
33	Water Level	N2	8
34	Date Measured	A	8
35	Method of Meas.	A	1
36	Site Status	A	1
37	Source of Data	A	1

II. GROUND WATER MANAGEMENT IDENTIFICATION RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
38	Identification	A	10
39	Assigner	A	15

III. OWNERS RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
40	Date Ownership	A	8
41	Name	A	42

IV. CONSTRUCTION RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Entry Number	A	3
	Record Number	A	3
42	Date of Complet.	A	8
43	Name of Driller	A	12
44	Source of Data	A	1
45	Method of Constr.	A	1
46	Finish	A	1
47	Type of Seal	A	1
48	Botton of Seal	N0	4
49	Method of Devel.	A	1
50	Hours Develop.	A	3
51	Special Treatment	A	1

Section C

Coding Instructions

Table of Contents

V. HOLE DIAMETER RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Entry Number	A	3
	Record Number	A	3
52	Top of Hole	N2	8
53	Bottom of Hole	N2	8
54	Diameter of Hole	N2	8

VI. CASING RECORD

2	Site ID	A	15
	Transaction	A	1
	Entry Number	A	3
	Record Number	A	3
55	Top of Casing	N2	8
56	Bottom of Casing	N2	8
57	Diameter Casing	N2	5
58	Casing Material	A	1
59	Thickness Casing	N3	6

VII. OPENINGS RECORD

2	Site ID	A	15
	Transaction	A	1
	Entry Number	A	3
	Record Number	A	3
60	Top of Section	N2	8
61	Bottom of Section	N2	8
62	Type of Opening	A	1
63	Material Type	A	1
64	Diameter of Open	N2	5
65	Width of Opening	N3	6
66	Length of Opening	N2	6

VIII. LIFT RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Entry Number	A	3
	Record Number	A	3
67	Type of Lift	A	1
68	Date Recorded	A	8
69	Intake Depth	N0	5
70	Type of Power	A	1
71	Horsepower Rate	N2	7

IX. OTHER DATA AVAILABLE RECORD

2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
72	Type of Data	A	10
73	Location of Data	A	1
74	Format	A	1

X. GEOPHYSICAL LOGS RECORD

2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
75	Type of Log	A	1
76	Beginning Depth	N2	8
77	Ending Depth	N2	8
78	Source of Data	A	1

Field Characteristics (Con't.)

XI. NETWORK RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
79	Type of Network	A	2
80	Beginning Year	A	4
81	Ending Year	A	4
82	Type of Analyses	A	1
83	Source Agency	A	5
84	Frquncy Collectn	A	1
85	Method Collection	A	1
86	Analyzing Agency	A	5
87	Primary Net. St.	A	1
88	Secondary Net. St.	A	1

XII. WELL FIELDS RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
89	Number of Wells	A	3
90	Depth of Deepest	N0	3
91	Depth of Shallow	N0	3
92	Method Construct	A	1
93	Size of Well Fld	N0	7

XIII. WATER LEVEL RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
94	Date Measured	A	8
95	Time Measured	A	4
96	Water Level	N2	7
97	Status	A	1
98	Method of Measur	A	1
99	Water Levl Acurcy	A	1

XIV. MEASURING POINT RECORD

Number	Field Title	Type	Length
2	Site ID	A	15
	Transaction	A	1
	Record Number	A	3
100	Beginning Date	A	8
101	Ending Date	A	8
102	M.P. Height	N2	6
103	M.P. Remarks	A	100

Key:

A - Alphanumeric field (this type is used for numbers when leading zeros must be carried)
Nx - Numeric Field; "x" indicates the number of digits to the right of the decimal point.

The decimal point and minus sign each take up one character in the field length.
N0 fields do not contain a decimal point.

Coding Instructions

I. SITE FILE

The SITEFILE record is used for recording general information including location and water use information. Information will not be stored for a site if any mandatory entry in this record is missing. There is only one SITEFILE for each SITE ID. (In case of nested piezometers or deepening of wells, contact Ecology for instructions on SITE ID's and LOCAL NUMBERS.)

TRANSACTION CODE (mandatory) [A1]

Select the correct transaction code for this file.

- A - Add (this is for sites that do not exist in WATSTORE)
- D - Delete (this will delete a sitefile and should not normally be used)
- M - Modify (this will allow changes in the existing file)

WASHINGTON STATE START CARD NUMBER [A6]

Ch. 18.104 RCW requires drillers to submit a notice of intent to begin construction, reconstruction, or abandonment procedures ("start card") in advance of commencing work, effective September, 1987. The start card has a six-digit number in the upper right corner. If a start card is submitted on any well identified in the Ground Water Management Area, the start card number must be included in the SITEFILE information transmitted to Ecology.

1. SOURCE AGENCY (mandatory) [A5; WATSTORE #4]
For the Ground Water Management Areas the SOURCE AGENCY will be the Department of Ecology (WA001).

2. SITE ID (mandatory) [A15; WATSTORE #1]
This is a 15-digit identification number assigned to the site. It contains no blanks or alphabetic characters. It is used primarily as an internal control number within the computer files. Although the site identification number is formed initially from the latitude and longitude of a point believed to represent the location of the site, the number is an identifier and not a locator.

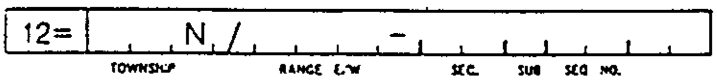
** It cannot be too strongly emphasized that the site identification number, once assigned, is a pure number and HAS NO LOCATIONAL SIGNIFICANCE.

-- The site identification number is assigned as follows:
Spot the site on the best available map (usually a USGS 7 1/2' quadrangle) as accurately as possible. Using an appropriate scaling aid, determine the latitude and longitude of the point on the map. The location of this point is always scaled to the nearest second of latitude and longitude, even if there is doubt about the exact location of the site or the accuracy of the map.

The first six digits of the identification number are the value of latitude, the seventh through thirteenth digits are the value of longitude, and the fourteenth and fifteenth digits are a sequence number used to distinguish between sites at the same location.

Use leading zeros if the value of latitude is less than 10 degrees, the value of longitude is less than 100 degrees, or the sequence number is less than 10.

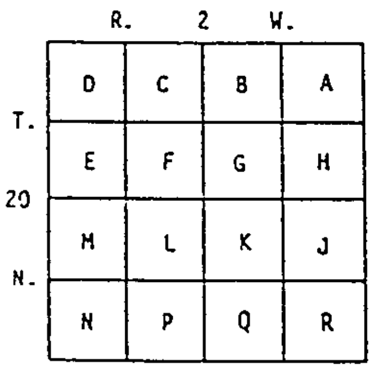
3. LOCAL NUMBER (mandatory) [A16; WATSTORE #12]
The local number for Ground Water Management sites is in the following format:



The last two digits are left blank unless the hole has been deepened since the initial local number was assigned (contact Ecology for instructions on how to handle deepened wells). The format for Township 20 North, Range 2 West, section 29, subsection (40 acres) F, and the third well entered into the data base at this location is:

29N/03E-09F03

This is a text field. The local number should be entered as it is to be printed; including leading zeros if the value of township or range is less than 10, or the sequence number is less than 10. The following diagram shows forty-acre tract letter designations.



Section 29

4. LATITUDE (mandatory) [A6; WATSTORE #9]
Enter the best available value for the latitude of the site in degrees, minutes, and seconds, right justified in the field. Use leading zeros if needed. Six digits must be coded.

5. LONGITUDE (mandatory) [A7; WATSTORE #10]
Enter the best available value for the longitude of the site, in degrees, minutes, and seconds, right justified in the field. Use leading zeros if needed. Seven digits must be coded.

The values of latitude and longitude entered in these fields are locators: they should be the best available information about the location of the site. The accuracy of the location should be indicated by a suitable entry in the next field.

* 6. LAT-LONG ACCURACY [A1; WATSTORE #11]
Enter the code for the accuracy of the latitude-longitude values.

S - the measurement is accurate to + 1 second
F - the measurement is accurate to + 5 seconds
T - the measurement is accurate to + 10 seconds
M - the measurement is accurate to + 1 minute

No value (blank field) indicates that the accuracy is unknown and is, therefore, assumed to be greater than one minute.

7. STATE (mandatory) [A2; WATSTORE #7]
The Washington State code is 53, Oregon is 41, and Idaho is 16.

8. COUNTY (mandatory) [A3; WATSTORE #8]
Enter the numeric code for the county in which the site is located. Include leading and trailing zeros if appropriate. The county codes in Washington State are:

001	Adams	027	Grays Harbor	053	Pierce
003	Asotin	029	Island	055	San Juan
005	Benton	031	Jefferson	057	Skagit
007	Chelan	033	King	059	Skamania
009	Clallam	035	Kitsap	061	Snohomish
011	Clark	037	Kittitas	063	Spokane
013	Columbia	039	Klickitas	065	Stevens
015	Cowlitz	041	Lewis	067	Thurston
017	Douglas	043	Lincoln	069	Wahkiakum
019	Ferry	045	Mason	071	Walla Walla
021	Franklin	047	Okanogan	073	Whatcom
023	Garfield	049	Pacific	075	Whitman
025	Grant	051	Pend Oreille	077	Yakima

* 9. LOCATION MAP [A20; WATSTORE #14]
Enter the name of the best available map on which the site can be located, preferably a USGS 7 1/2' topographic quadrangle. If no topographic map is available for the area, a county highway map or similar map may be used.

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

* 10. SCALE [NO,7; WATSTORE #15]
Enter the scale of the map identified in the previous entry, as follows. If the map scale is given as a ratio (1:24,000 1:62,500, and so forth) omit figure '1' and the colon, and enter the remaining number without the comma. If the scale is given in miles per inch, as on many county highway maps, convert the scale to a ratio (multiply miles per inch by 63,360) and proceed as above. A 7 1/2' quadrangle (1:24,000 scale) would be entered as 24000; a county or other map of 2 inches to the mile would be entered as 31680.

11. ALTITUDE (mandatory) [N2,8; WATSTORE #]
For ground water sites, enter the altitude of the land surface at the site, in feet NGVD (National Geodetic Vertical Datum). Precision to two decimal places can be coded if available. Altitudes below NGVD should be preceded by a minus sign (-).

* 12. METHOD OF MEASUREMENT [A1; WATSTORE #17]
Enter the appropriate code for the method used to determine the altitude.

A - altimeter
L - level or other surveying method
M - interpolated from topographic map

Failure to select one of these values (blank field) implies that the method is unknown.

* 13. ACCURACY [A3; WATSTORE #18]
Enter the accuracy of the altitude in terms of the possible error in feet. An accuracy of +/- 0.1 foot would be entered as '.1'. In general, the accuracy of altitudes interpolated from the contours on topographic maps is plus or minus one-half of the contour interval.

* 14. HYDROLOGIC UNIT [A8; WATSTORE #20]
Enter the eight-digit hydrologic unit code for the USGS cataloging unit in which the site is located.

State Hydrologic Unit maps delineating the hydrographic boundaries of these units are available from the following address:

U.S. Geological Survey
Branch of Distribution
Box 25286, Federal Center
Denver, Colorado 80225.

If the site does not lie within a currently designated hydrological unit (e.g., offshore wells), the eight-digit code 99999999 should be entered in this field.

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

15. STATION TYPE (mandatory) [A1; WATSTORE #802]
Check which site type best describes the station. Only one type can be assigned for a site. For Ground Water Management Areas the STATION TYPE will usually be "G".

S - Stream
L - Lake or reservoir
E - Estuary
C - Coastal other than estuary
P - Spring
G - Ground water other than spring
M - Meteorological

16. LEAD AGENCY USE OF SITE (mandatory) [A1; WATSTORE #803]
The allowable codes for the agency use of site are as follows:

A - Active data-collection site (the agency is actively collecting data at this site)
I - Inactive or discontinued data-collection site (data has been collected but is not actively being collected)
O - Inventory data site only (no data has been collected at this site)

17. REMARKS [A50; WATSTORE #806]
General remarks concerning the site. (up to 50 characters)

* 18. DATE SITE ESTABLISHED OR INVENTORIED by the Lead Agency [A8; WATSTORE #711]
Enter the date that site was established or inventoried in the following format - MMDDYYYY.

* 19. DATA RELIABILITY [A1; WATSTORE #3]
Enter the code indicating the overall reliability of the data available for the site.

C - the data have been field checked.
L - location not accurate.
M - minimal data.
U - the data have not been field checked but is considered to be reliable.

When in doubt, always select the code which portrays the lesser confidence. (Note: The codes are listed in order of decreasing confidence).

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

20. SITE TYPE (mandatory) [A1; WATSTORE #2]
Enter the code indicating the type of site to which these data apply. The most common site code is "W".

- C - collector or Ranney type well.
- D - drain dug to intercept the water table or potentiometric surface to either lower the ground-water level or serve as a water supply.
- E - excavation.
- H - sinkhole.
- I - interconnected wells, also called connector or drainage wells that is, a well interconnected via an underground lateral.
- M - multiple wells. Use only for well field consisting of a group of wells that are pumped through a single header and for which little or no data about the individual wells are available.
- O - outcrop.
- P - pond dug to intercept the water table or potentiometric surface and serve as a water supply.
- S - spring (used only on spring schedule).
- T - tunnel, shaft, or mine from which ground water is obtained.
- W - well, for single wells other than wells of the collector or Ranney type.
- X - test hole, not completed as a well.

* 21. DATE OF FIRST CONSTRUCTION [A8; WATSTORE #21]
Enter the earliest date for which data are available for the site or the date on which construction began, whichever is the earlier. If the month or day are not known, enter 00 in the spaces. Use leading zeros for month or day values less than 10. Enter four digits for year. Use the following format - MMDDYYYY.

22. USE OF SITE (mandatory) [A1; WATSTORE #23]
Enter the code indicating the principal use of the site or the purpose for which the site was constructed (the former always holds precedence over the latter). The most common use of site code is "W".

- A - anode
- C - standby emergency supply
- D - drain
- E - geothermal
- G - seismic
- H - heat reservoir
- M - mine
- O - observation
- P - oil or gas well
- R - recharge
- S - repressurize
- T - test
- U - unused
- W - withdrawal of water
- X - waste disposal
- Z - destroyed

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

(A) Anode is a hole used as an electrical anode. Include in this category wells used solely to ground pipe-lines or electronic relays and other installations.

(C) Standby emergency supply refers to a water supply source that is used only when the principal supplier of water is unavailable.

(D) Drainage refers to the drainage of surface water underground.

(E) Geothermal well is a hole drilled for geothermal energy development. Use this category for 'dry' geothermal wells or wells into which water is injected for heating. For 'wet' geothermal wells, through which water is withdrawn, use W -withdrawal of water for the use of site, and E - power generation for the primary use of water.

(G) Seismic (G) hole is one drilled for seismic exploration. If it has been converted to water supply, it is used to withdraw water. A seismic hole used as an observation well should be in the observation-well category.

(H) Heat reservoir refers to a well in which a fluid is circulated in a closed system. Water is neither added to, nor removed from, the aquifer.

(M) Mine includes any tunnel, shaft, or other excavation constructed for the extraction of minerals.

(O) Observation well is a cased test-hole or well drilled either for water-level or for water-quality observations. Do not use this category for an oil-test hole, or water supply well used only incidentally as an observation well.

(P) Oil or gas well is any well or hole drilled in search of, or for production of, petroleum or gas. It includes any oil or gas production well, dry hole, core hole, injection well drilled for secondary recovery of oil, etc. An oil-test hole converted to a water supply well should be classified as withdrawal (W).

(R) Recharge site is a site constructed or converted for use in replenishing the aquifer. An irrigation well used to return water to the aquifer during nonpumping periods is a well for withdrawing water, not a drainage or recharge well. Use this category for wells that are used to return water to the aquifer after use, such as those for returning air-conditioning water.

(S) Repressurize refers to pumping water into an aquifer in order to increase the pressure in the aquifer for a specific purpose, for example, water flood purposes in oil fields.

(T) Test hole is an uncased hole (or one cased only temporarily) that was drilled for water, or for geologic or hydrogeologic testing. It may be equipped temporarily with a pump in order to make a pumping test, but if the well is destroyed after testing is completed, it is still a test hole. A core hole drilled as a part of mining or quarrying exploration work, should be in this class.

(U) An unused site is an abandoned water-supply site or one for which no use is contemplated. At an abandoned farmstead, a well originally used for domestic purposes may be classed as unused, even though it is equipped with a pump. Similarly, a stock well with a pump may become unused when a pasture or corral is put into cultivation. An irrigation well that is not equipped with a pump, nor used because the yield is too low or the water is too mineralized, belongs in this class.

(W) Withdrawal of water refers to a site that supplies water for one of the purposes shown under use of water. It includes a dewatering well, if the dewatering is accomplished by pumping ground water.

(X) A waste-disposal site is one used to convey industrial waste, domestic sewage, oil-field brine, mine drainage, radioactive waste, or other waste fluid into an underground zone. An oil-test or deep-water well converted to waste disposal should be in this category.

(Z) A destroyed site is one that is no longer in existence. The casing of most destroyed wells will be pulled, but some may be plugged or filled. Do not use this category for an abandoned site that merely is not in use.

23. SECONDARY SITE USE [A1; WATSTORE #301]
If the site is used for more than one purpose, show the secondary use here. Enter a code from the above list.

24. TERTIARY SITE USE [A1; WATSTORE #302]
If needed, a third use of the site can be shown here. Enter an appropriate code from the above list.

* 25. USE OF WATER [A1; WATSTORE #24]

Enter the code indicating the principal use of water from the site. If water from the site is used for more than one purpose, enter the principal use here and enter the subordinate uses in the following two fields.

A - air conditioning	I - irrigation	R - recreation
B - bottling	J - industrial (cooling)	S - stock
C - commercial	K - mining	T - institution
D - dewater	M - medicinal	U - unused
E - power	N - industrial	Y - desalination
F - fire	P - public supply	Z - other (explain in remarks)
H - domestic	Q - aquaculture	

(A) Air conditioning refers to water supply used solely or principally for heating or cooling a building. Water used to cool industrial machinery belongs in the industrial category, not in the air conditioning category.

(B) Bottling refers to the storage of water in bottles and use of the water for potable purposes (see Medicinal).

(C) Commercial use refers to use by a business establishment that does not fabricate or produce a product. Filling stations and motels are examples of commercial establishments. If some product is manufactured, assembled, remodeled, or otherwise fabricated, use of water for that plant should be considered industrial, even though the water is not used directly in the product or in the manufacturing of the product.

(D) Dewatering means the water is pumped for dewatering a construction or mining site, or to lower the water table for agricultural purposes. In this respect, it differs from a drainage well that is used to drain surface water underground. If the main purpose for which the water is withdrawn is to provide drainage, dewatering should be indicated even though the water may be discharged into an irrigation ditch and subsequently used to irrigate land.

(E) Power generation refers to use of water for generation of any type of power.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

(F) Fire protection refers to the principal use of the water and should be indicated if the site was constructed principally for this purpose even though the water may be used at times to supplement an industrial or defense supply, to irrigate a golf course, fill a swimming pool, or for other use.

(H) Domestic use is water used to supply household needs, principally for drinking, cooking, washing, and sanitary purposes, but including watering a lawn and caring for a few pets. Most domestic wells will be at suburban or farm homes, but wells supplying small quantities of water for domestic purposes for one-classroom schools, turnpike gates, and similar installations, should be in the domestic category.

(I) Irrigation refers to the use of water to irrigate cultivated plants. Most irrigation sites will supply water for farm crops, but the category should include wells used to water the grounds of schools, industrial plants, or cemeteries, if more than a small amount of water is pumped and that is the sole use of the water.

(J) Industrial (cooling) refers to a water supply used solely for industrial cooling.

(K) Mining refers to a water supply used solely for mining purposes.

(M) Medicinal refers to water purported to have therapeutic value. Water may be used for bathing and/or drinking. If use of water is mainly because of its claimed therapeutic value, use this category even though the water is bottled.

(N) Industrial use is within a plant that manufactures or fabricates a product. The water may or may not be incorporated into the product being manufactured. Industrial water may be used to cool machinery, to provide sanitary facilities for employees, to air-condition the plant, and to irrigate the ground at the plant.

(P) Public Supply use is water that is pumped and distributed to several homes. Such supplies may be owned by a municipality or community, a water district, or a private concern. In most States, public supplies are regulated by departments of health which enforce minimum safety and sanitary requirements. If the system supplies five or more homes, it should be considered a public supply, as four or less classify use as domestic. Water supplies for trailer or summer camps with five or more living units should be in this category, but motels and hotels are classified as commercial. Most public supply systems also furnish water for a variety of other uses, such as industrial, institutional, and commercial.

(Q) Aquaculture refers to a water supply used solely for aquaculture, such as fish farms.

(R) Recreation refers to water discharged into pools, or channels which are dammed downstream to form pools, for swimming, boating, fishing, ice rinks, and other recreational uses.

(S) Stock Supply refers to the watering of livestock.

(T) Institutional refers to water used in the maintenance and operation of institutions such as large schools, universities, hospitals, rest homes, or similar installations. Owners of institutions may be individuals, corporations, churches, or governmental units.

(U) Unused means water is not being removed from the site for one of the purposes described above. A test hole, oil or gas well, recharge, drainage, observation, or waste-disposal well will be in this category.

<u>Do not use this classification for an irrigation, domestic, stock, or other well during 'off season' or temporary periods of nonuse. The use of water from a newly constructed site should be considered as the use for which it is intended even though it may not yet be in use when inventoried.</u>

(Y) Desalination refers to water used in a desalting process whereby dissolved solids are removed to make water potable or suitable for other uses. Enter the type of use of the desalinated water in the next column, "Secondary Water Use".

(Z) Other refers to miscellaneous uses not included in the listed categories.

26. SECONDARY WATER USE [A1; WATSTORE #25]
If water from the site is used for more than one purpose, show the secondary use here. Enter an appropriate code from the list above.

27. TERTIARY WATER USE [A1; WATSTORE #26]
If needed, a third use of water from the site can be shown here. Enter an appropriate code from the list above.

28. AQUIFER TYPE CODE [A1; WATSTORE #713]
Enter the appropriate code to describe the type of aquifer(s) encountered by the well.

U - Unconfined single aquifer
N - Unconfined multiple aquifers
C - Confined single aquifer
M - Confined multiple aquifers
X - Mixed (confined and unconfined) multiple aquifers

29. PRIMARY AQUIFER [A8; WATSTORE #714]
Left justify the code identifying the primary aquifer unit from which the water is obtained. Use codes given in the 'Catalog of Aquifer Names and Geologic Unit Codes used by the Water Resources Division' (Aquifer codes for Washington State are listed in Part I, Section D of this manual).

* 30. WELL DEPTH [N2,8; WATSTORE #28]
Enter the depth of the finished well, in feet below land surface datum. The depth of the well is the greatest depth to which the well can be sounded if measurement is not practicable. Enter the reported depth at which the well was finished.

* 31. HOLE DEPTH [N2,8; WATSTORE #27]
Enter the total depth to which the hole was drilled, in feet below the land surface datum, even though it may have been plugged back in completing the well. For collector or Ranney type wells, enter the depth of the central shaft. For multiple-well fields (listed as "M" in SITE TYPE field), leave the space blank.

This field should be completed for wells whenever possible. If the hole depth is given, all other depths entered on the schedule will be compared with it for validity. Precision may be carried to two decimal places.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

* 32. SOURCE OF DEPTH DATA [A1; WATSTORE #29]
Enter a code to indicate how the depth information of the well was obtained.

A - reported by another government agency. Do not use 'A' if the reporting agency is the owner of the well--use 'O'.
D - from driller's log or report.
G - from the lead agency or a private geologist or consultant.
L - depth interpreted from geophysical logs by personnel of source agency.
M - memory (owner, operator, driller).
O - reported by the owner of the well.
R - reported by person other than the owner, driller, or another government agency.
S - measured by personnel of reporting agency.
Z - other source (explain in remarks).

33. INVENTORY WATER LEVEL [N2,8; WATSTORE #30]
Enter the water level that is reported on the drillers report, in feet below land surface. Precision can be carried to two decimal places. If the water level is above land surface, enter the water level in feet above land surface preceded by a minus sign (-). If the site flows but the head is not known, the site is dry, the level cannot be measured, measurement has been discontinued, or the well destroyed, leave this space blank and see SITE STATUS.

34. DATE MEASURED (mandatory only if 'inventory water level' or 'site status' is entered) [A8; WATSTORE #31]

Enter the date on which the water level entered above was measured. Use the following format - MMDDYYYY. If the day or month are not known, code the appropriate field with 00. Use leading zeros for values of month and day that are less than 10, and provide all four digits of the year.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

35. METHOD OF WATER-LEVEL MEASUREMENT [A1; WATSTORE #34]
Enter the code indicating how the water level was measured.

- A - airline measurement
- B - analog or graphic recorder
- C - calibrated airline measurement
- E - estimated
- G - pressure-gage measurement
- H - calibrated pressure-gage measurement
- L - interpreted from geophysical logs
- M - manometer measurement
- N - nonrecording gage
- R - reported, method not known
- S - steel-tape measurement
- T - electric-tape measurement
- V - calibrated electric-tape measurement
- Z - other

36. SITE STATUS FOR WATER LEVEL [A1; WATSTORE #37]
Enter the code indicating the status of the site at the time the water-level was measured.

** If no site status is indicated, the reported water-level measurement represents a static level.

- D - the site was dry (no water level is recorded).
- E - the site was flowing recently.
- F - the site was flowing, but the head could not be measured (no water level is recorded).
- G - a nearby site that taps the same aquifer was flowing.
- H - a nearby site that taps the same aquifer had been flowing recently.
- I - injector site (recharges water being injected into the aquifer).
- J - injector site monitor (a nearby site that taps the same aquifer is injecting recharge water).
- N - measurement discontinued.
- O - an obstruction was encountered in the well above the water surface (no water level is recorded).
- P - the site was being pumped.
- R - the site had been pumped recently.
- S - a nearby site that taps the same aquifer was being pumped.
- T - a nearby site that taps the same aquifer had been pumped recently.
- V - foreign substance present on the surface of the water.
- W - well destroyed.
- X - water level affected by stage in nearby surface-water site.
- Z - other conditions that would affect the measured water level (explain in remarks).

37. SOURCE OF WATER-LEVEL DATA [A1; WATSTORE #33]
Enter the code that best indicates source of the water-level data. The codes are the same as those used for field number 32 (SOURCE OF DEPTH DATA).

II. GROUND WATER MANAGEMENT IDENTIFIERS RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The first record must contain the Ecology identifier as explained below; additional records may be used for ID numbers defined by the Lead Agency for internal tracking purposes.

* 38. IDENTIFICATION [A10; WATSTORE #190]
Enter the name or number by which the site is identified. For Ground Water Management Areas the following codes shall be used:

GWMA-86-01	Clover-Chambers Creek Basin
GWMA-86-02	Island County
GWMA-86-03	S. King County
GWMA-86-04	Vashon\Maury Island
GWMA-86-05	Gig Harbor
GWMA-86-06	Kitsap County
GWMA-86-07	Redmond
GWMA-86-08	Issaquah
GWMA-87-09	Clark County
GWMA-87-10	North Thurston County
GWMA-87-11	Deer Park Basin
GWMA-87-12	Lummi Indian Reservation
GWMA-87-13	Toppenish Creek Basin
GWMA-87-14	East King County
GWMA-87-15	Methow River Basin

Contact Ecology for any other Ground Water Management Area

* 39. ASSIGNER [A15; WATSTORE #191]
Enter 'Ecology' for the assigner.

III. OWNERS RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. If the site is used, leased, or occupied by someone other than the owner, this fact should be entered in the 'REMARKS' data record of the SITEFILE, together with the name of the user, lessee, or tenant.

* 40. DATE OF OWNERSHIP [A8; WATSTORE #159]
Enter the date (MMDDYYYY) that this owner acquired ownership of the well or the earliest date on which this owner was known to own the source. If the day or month are not known, enter 00 in these spaces. Use leading zeros for month and day values less than 10. Specify all four digits of the year.

* 41. OWNERS NAME [A42; WATSTORE #161]
Enter the last name of the owner. If known, enter the first name and middle initial. (Note: Although the form shows 23 characters for this field, up to 42 may be used.)

IV. CONSTRUCTION RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The entry number will always be 001 unless the well has been deepened or altered in some way; contact Ecology for instructions in these cases.

* 42. DATE OF COMPLETED CONSTRUCTION [A8; WATSTORE #60]

Enter the date (MMDDYYYY) on which the work was completed. If the day or month are not known, enter 00 in the spaces. Use leading zeros for values of day and month less than 10, and specify all four digits for the year. For many sites, this date will be the same as the one entered earlier (Date of Construction/Completion) however, it must be re-entered here.

* 43. NAME OF CONTRACTOR/DRILLER [A12; WATSTORE #63]
Enter the name of the individual or company that did the work. For company names, use meaningful abbreviations or acronyms if needed to fit the space.

* 44. SOURCE OF CONSTRUCTION DATA [A1; WATSTORE #64]
Enter the code that best indicates the source of construction data, that is, who furnished the data. The codes are the same as those used for field number 32 (SOURCE OF DEPTH DATA).

* 45. METHOD OF CONSTRUCTION [A1; WATSTORE #65]
Enter the code indicating the method by which the site was constructed.

A - air-rotary
B - bored or augered
C - cable-tool
D - dug
H - hydraulic rotary
J - jetted
P - air percussion
R - reverse rotary
T - trenching
V - driven
W - drive and wash
Z - other (explain in remarks)

(A) Air-rotary method uses a stream of air to cool the bit and bring the rock cuttings to the surface.

(B) A bored or augered hole cuts and removes the earth materials from the hole with an auger. The auger may be powered by hand or machinery.

(C) Cable-tool refers to a "percussion" or "churn-drill" method whereby a heavy drilling tool is raised and lowered with enough force to pulverize the rock. The rock debris is commonly removed from the hole with a bailer. The California mud-scow method is a special variation of the cabletool method.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

(D) Dug holes are excavated by hand tools or power-driven digging equipment. Caissons, Ranney-type collectors, and galleries belong here even though they may have laterals that are driven or jetted.

(H) The hydraulic-rotary well is constructed by rotating a length of pipe (drill stem) equipped with a bit that cuts or grinds the rocks. Water or drilling mud is pumped down the drilling stem. Cuttings are carried to the surface in the annular space between the drilling stem and the wall of the hole. Note that separate categories are provided for air-rotary and reverse-rotary.

(J) Jetted wells are excavated by using high velocity streams of water pumped through a pipe having a restricted opening or "jetting" nozzle. For some types of earth materials a cutting bit is attached to the end of the jetting pipe. The material cut or washed from the hole is carried to the surface in the annular space outside the pipe as by the hydraulic-rotary method. This method is most suitable for construction of small-diameter wells in unconsolidated material.

(P) An air-percussion drill is powered by compressed air. It uses a rapid percussion effect, coupled with rotary action, to drill hard rocks. Compressed air also is used to blow the cuttings from the hole. Air-percussion drills are generally used in conjunction with air-rotary drilling rigs.

(R) Reverse rotary is similar to the hydraulic rotary except that the water or drilling mud flows down the annular space between the drilling stem and the wall of the hole and the cuttings are pumped out through the drill stem.

(T) Trenching refers to the construction of a sump or open pit from which ground water may be pumped. Trenching may be done by hand but more commonly power equipment, such as a bulldozer, dragline power shovel, or a backhoe is used.

(V) Driven wells are constructed by driving a length of pipe, usually of small diameter and generally equipped with a sand point, to the desired depth. The wells may be driven by hand or with air hammer or other power equipment. An essential feature of a driven well is that no earth material is removed as the well is constructed.

(W) Drive and wash wells are constructed by driving a small diameter open-end casing a few feet into the earth, then washing out the material from inside the casing with a jet of water. The process is repeated until the well has penetrated a sufficient depth into the aquifer.

* 46. TYPE OF FINISH [A1; WATSTORE #66]
Enter the code indicating the finish or the nature of the openings that allow water to enter the well.

C - porous concrete
F - gravel pack w/perforations
G - gravel pack w/screen
H - horizontal gallery
O - open end
P - perforated or slotted
S - screen
T - sand point
W - walled
X - open hole
Z - other (explain in remarks)

(C) Porous concrete is concrete casing that is pervious enough to allow ground water to seep into the well.

(F & G) A gravel pack well is a drilled or dug well that has a gravel envelope opposite the part through which water enters. Commonly, these wells will be finished either with commercial screen or with slotted casing.

(H) A horizontal gallery or collector essentially is a horizontal type well in which the screen, slotted pipe, or gravel-filled trench is horizontal. All horizontal wells should be in this class, including Ranney collectors and infiltration galleries.

(O) An open-end well is one that is cased to the bottom of the hole so that water can enter the well only through the bottom of the hole.

(P) Perforated or slotted casing is well pipe that has had holes punched or slots cut in it to admit water. Do not use this designation if the well has a gravel pack. Use "F" instead.

(S) Screen refers to commercial well screen manufactured for the purpose of admitting water to a well. Common types of screen are wire mesh, wrapped trapezoidal wire, and shutter screen. Do not use this designation if the well also has a gravel pack. Use "G" instead.

(T) A sand point is the screen part of a drive point and usually is part of a driven well.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

(W) A walled or shored well is usually a dug well in which the walls have been shored-up with open-jointed fieldstone, brick, tile, concrete blocks, wood cribbing, or other material. A few wells of this type may have gravel walls, however, they should be placed in this category instead of F or G. A dug well that is mostly open hole but has even a few feet of cribbing, corrugated pipe, or other shoring to prevent caving, should be in this category.

(X) An open hole well is one that has a finished open hole in the aquifer. A well belongs in this class even if the casing does not actually extend to the geologic unit or zone from which the water is obtained.

* 47. TYPE OF SEAL [A1; WATSTORE #67]
Enter the code indicating the material used to seal the well against the entry of surface water.

B - bentonite
C - clay or cuttings
G - cement grout
N - none
Z - other (explain in remarks)

* 48. BOTTOM OF SEAL [N0,4; WATSTORE #68]
Enter the depth to the bottom of the seal, in feet below land surface.

* 49. METHOD OF DEVELOPMENT [A1; WATSTORE #69]
Enter the code indicating the method used to develop the well.

A - pumped with air lift
B - bailed
C - "blown" or surged w/compressed air
J - washed or jetted
N - none
P - pumped
S - surged with surge block
Z - other (explain in remarks)

* 50. HOURS OF DEVELOPMENT [A3; WATSTORE #70]
Enter the number of hours that the well was bailed, pumped, and so forth, for development.

* 51. SPECIAL TREATMENT DURING DEVELOPMENT [A1; WATSTORE #71]
Enter the code indicating any special treatment that was applied during development of the well.

C - chemical (acid, and so forth)
D - dry ice
E - explosives
F - deflocculent
H - hydrofracturing
M - mechanical abrasion
Z - other (explain in remarks)

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

V. HOLE DIAMETER RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The entry number will always be 001 unless the well has been deepened or altered in some way; contact Ecology for instructions in these cases.

* 52. DEPTH TO TOP OF HOLE SEGMENT [N2,8; WATSTORE #73]
Enter the depth to the point where this section of hole begins, in feet below land surface. The first section of hole always begins at depth 0.0

* 53. DEPTH TO BOTTOM OF HOLE SEGMENT [N2,8; WATSTORE #74]
Enter the depth to the bottom of the hole segment, in feet below land surface.

* 54. DIAMETER OF HOLE SEGMENT [N2,8; WATSTORE #75]
Enter the nominal diameter of the bit used to drill this section of the hole or the diameter to which the hole was reamed, in inches.

VI. CASING RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The entry number will always be 001 unless the well has been deepened or altered in some way; contact Ecology for instructions in these cases.

* 55. DEPTH TO TOP OF CASING SEGMENT [N2,8; WATSTORE #77]
Enter the depth to the top of this section of casing, in feet below land surface. If the casing extends above land surface, enter the height of the casing above land surface preceded by a minus sign (-).

* 56. DEPTH TO BOTTOM OF CASING SEGMENT [N2,8; WATSTORE #78]
Enter the depth to the bottom of this section of casing, in feet below land surface.

* 57. DIAMETER OF CASING SEGMENT [N2,5; WATSTORE #79]
Enter the diameter of this section of casing, in inches. Two decimal places are provided for fraction sizes (1 1/4 = 1.25).

* 58. CASING MATERIAL [A1; WATSTORE #80]
Enter the code indicating the casing material.

B - brick
C - concrete
D - copper
G - galvanized iron
I - wrought iron
M - other metal
P - PVC, fiberglass, other plastic
R - rock or stone
S - steel
T - tile
U - coated steel
W - wood
Z - other material (explain in remarks)

* 59. CASING THICKNESS [N3,6; WATSTORE #81]
Enter the thickness of the casing wall, in inches. Three decimal places are provided.

VII. OPENINGS RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The entry number will always be 001 unless the well has been deepened or altered in some way; contact Ecology for instructions in these cases.

* 60. DEPTH TO TOP OF SECTION [N2,8; WATSTORE #83]
Enter the depth to the top of the open section, in feet below land surface.

* 61. DEPTH TO BOTTOM OF SECTION [N2,8; WATSTORE #84]
Enter the depth to the bottom of the open section, in feet below land surface.

* 62. TYPE OF OPENING [A1; WATSTORE #85]
Enter the code indicating type of open section.

- F - fractured rock
- L - louvered or shutter-type screen
- M - mesh screen
- P - perforated, porous, or slotted casing
- R - wire-wound screen
- S - screen, type not known
- T - sand point
- W - walled or shored
- X - open hole
- Z - other (explain in remarks)

* 63. MATERIAL TYPE [A1; WATSTORE #86]
Enter the code indicating the type of screen material.

- B - brass or bronze
- C - concrete
- G - galvanized iron
- I - wrought iron
- M - other metal
- P - PVC, fiberglass, or other plastic
- R - stainless steel
- S - steel
- T - tile
- Z - other (explain in remarks)

* 64. DIAMETER OF OPEN SECTION [N2,5; WATSTORE #87]
Enter the diameter, in inches, of perforated or slotted pipe, the diameter of a screen, or the diameter of the hole, if the well is finished open-hole.

* 65. WIDTH OF OPENING [N3,6; WATSTORE #88]
Enter the short dimension of perforations or slots, or the mesh size of screens, in inches. (Note: The form should show three digits to the right of the decimal point.)

* 66. LENGTH OF OPENING [N2,6; WATSTORE #89]
Enter the long dimension of perforations or slots, in inches. This refers to the individual openings in the screen or slotted pipe.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

VIII. LIFT RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The entry number will always be 001 unless the well has been deepened or altered in some way; contact Ecology for instructions in these cases.

* 67. TYPE OF LIFT [A1; WATSTORE #43]
Enter the code indicating the type of pump or lift. Allowable codes are:

A - air lift	R - rotary pump
B - bucket	S - submergible pump
C - centrifugal pump	T - turbine pump
J - jet pump	U - unknown
P - piston pump	Z - other (explain in remarks)

(A) Air lift is a type of lift in which a jet of air pumped below the water table causes a stream of mixed air and water to issue from the well.

(B) Bucket include the familiar "rope and bucket", chain and bucket lifts, and the small bailer lifted by a rope or chain and pulley.

(C) Centrifugal pumps have rotating impellers in a closed chamber that draw the water into the pump. The water is then discharged from the pump, common under great pressure, by centrifugal force. Such pumps have maximum lift of about 25 feet but can force water to considerable heights above the pump.

(J) Jet pumps have two pipes extending from the pump into the well. One pipe forces water down the hole under pressure while the other pipe discharges water that has been forced to the surface by the action of the jet. Jet pumps are used principally for small water supplies, such as would be used for a suburban home, farm, or small commercial establishment.

(P) Piston pumps include the familiar lift and pitcher pumps common in many rural areas. The old "reciprocating" pumps and the "deep-well with walking-bean jacks" are of the piston type.

(R) Rotary pumps operate on the principle that direct pressure is created by squeezing the water between specially designed runners. A relatively high vacuum may be created on the intake side so the suction lift is comparable to that for centrifugal pumps.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

(S) A submergible pump is a special type of turbine in which an electric motor is connected directly to the impellers and submerged beneath the water. It can be recognized by the presence of insulated electric wire leading into the well and the absence of any pump or power unit at the surface.

(T) Turbines are of several types and may be either for a deep or shallow well. A series of impellers, placed below the surface of the water, are rotated by a vertical shaft connected to a power source at the land surface. These impellers "pick up" the water and force it to the surface through the pump column. Such pumps are commonly used to lift large amounts of water at high pressure. They are used in high capacity wells for public, industrial, or irrigation supply.

(U) Use unknown only if the site is equipped with a pump about which other data are available, but the type of pump cannot be identified.

(Z) Other. Place in this category any lifting device that does not belong in one of the other categories. Examples are: helical rotor, hydraulic ram, and siphon.

* 68. DATE RECORDED [A8; WATSTORE #38]
Enter the date (MMDDYYYY) on which the lift data were collected. If the day or month are not known, enter 00 in the spaces. Use leading zeros for month or day less than 10 and specify all four digits for the year.

* 69. INTAKE DEPTH [N0,5; WATSTORE #44]
Enter the depth to the bottom of the pump bowls or intake, in feet below land surface. The value desired for this entry is the maximum distance the water level can be drawn down before the pump breaks suction.

* 70. TYPE OF POWER [A1; WATSTORE #45]
Enter the code indicating the type of power used to power the pump. The codes and their meanings are:

D - diesel engine	L - LP gas (propane or butane engine)
E - electric motor	N - natural-gas engine
G - gasoline engine	W - windmill
H - hand	Z - other (explain in remarks)

* 71. HORSEPOWER RATING [N2,7; WATSTORE #46]
Enter the horsepower rating of the primary power source. Two decimal places are provided for small motors.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

IX. OTHER-DATA-AVAILABLE RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The 'other data' record is used to indicate the availability of additional data pertinent to the site.

* 72. OTHER DATA TYPE [A10; WATSTORE #181]
Describe the type of data that are available for the site, such as pump tests. Use meaningful abbreviations if needed.

* 73. OTHER DATA LOCATION [A1; WATSTORE #182]
Enter the code that identifies the location of the data.

- C - cooperator's office
- D - district office (USGS only)
- R - reporting agency office
- Z - other (explain in remarks)

* 74. FORMAT [A1; WATSTORE #261]
Enter the code describing the form in which the data are stored.

- F - files (raw data)
- M - machine readable
- P - published (report or basic-data release)
- Z - other (explain in remarks)

X. GEOPHYSICAL-LOGS RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats.

This record is used to enter information about types of geophysical or other logs available for the site.

* 75. TYPE OF LOG [A1; WATSTORE #199]
Enter the code that best describes the log type.

- A - drilling time
- B - casing collar
- C - caliper
- D - drillers
- E - electric
- F - fluid-conductivity
- G - geologists or sample
- H - magnetic
- I - induction
- J - gamma ray
- K - dipmeter survey
- L - lateral log
- M - microlog
- N - neutron
- O - microlateral log
- P - photographic
- Q - radioactive-tracer
- S - sonic
- T - temperature
- U - gamma-gamma
- V - fluid velocity
- X - core
- Z - other (explain in remarks)

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

* 76. BEGINNING DEPTH [N2,8; WATSTORE #200]
Enter the depth to the top of the logged interval in feet below land surface.

* 77. ENDING DEPTH [N2,8; WATSTORE #201]
Enter the depth to the bottom of the logged interval, in feet below land surface.

* 78. SOURCE OF DATA [A1; WATSTORE #202]
Enter the code that indicates who provided the information. The codes are the same as those used for field number 32 (SOURCE OF DEPTH DATA).

XI. NETWORKS RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats. The network record indicates the availability of the site as an established data collection station for water-quality, water- levels, or withdrawal data. If there are periods of signifi- cant interruption in the measurements or if the frequency of measurement changes, multiple entries may be reported to reflect the variations.

79. TYPE OF NETWORK [A2; WATSTORE #706]
Enter the code for the type of network.
- 'QW' - Water quality network station
- 'WL' - Water levels network station
- 'WD' - Pumpage or withdrawals network station

80. BEGINNING YEAR [A4; WATSTORE #115]
Enter 4 digits for the year in which the data collection began.

81. ENDING YEAR [A4; WATSTORE #116]
Enter the year in which the data collection was ended at the site. Use 4 digits. If the site is currently monitored, leave this field blank.

82. TYPE OF ANALYSES [A1; WATSTORE #120]
Enter the code that indicates the type of water-quality data generally collected at the site.

A - physical properties
B - common ions
C - trace elements
D- pesticides
E - nutrients
F - sanitary analysis (organisms)
G - pesticides and common ions
H - nutrients and common ions
I - common ions/trace elements
J - sanitary analysis and common ions
K - pesticides and nutrients
L - trace elements, pesticides, and nutrients
M - all or most of the above
N - common ions, trace elements and radioactive
P - common, trace, and physical
Z - other (explain in remarks)

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

83. SOURCE AGENCY [A5; WATSTORE #117]
Enter the code identifying the principal agency responsible for collection of data. This field is mandatory only if necessary to uniquely identify the data collection network of more than one agency. Source Agency codes are listed in Part I, Section E of this manual).

84. FREQUENCY OF COLLECTION [A1; WATSTORE #118]
Enter the code indicating frequency with which data are collected at the site. The codes and their meanings are:

A - annually
B - bimonthly (every 2 months)
C - continuously (recorder)
D - daily
F - semimonthly (twice a month)
I - intermittently
M - monthly
O - one time only
Q - quarterly
S - semiannually
W - weekly
Z - other (explain in remarks)
2 - biannually
3 - every 3 years
4 - every 4 years
5 - every 5 years
X - every 10 years

85. METHOD OF COLLECTION [A1; WATSTORE #133]
Enter the code indicating the method by which water withdrawal data are collected at the site.

C - calculated from power-consumption records
E - estimated
M - metered
U - unknown
Z - other (explain in remarks)

86. ANALYZING AGENCY [A5; WATSTORE #307]
Enter up to 5 characters to indicate which agency performed the analyses on the water-quality data collected for this site.

87. PRIMARY NETWORK SITE [A1; WATSTORE #257]
Enter the code to indicate the network designation. This field is mandatory only if required to uniquely identify more than one data collection network for a single collection agency. Following are the codes and their meanings:

1 - national
2 - district
3 - project
4 - cooperator

88. SECONDARY NETWORK SITE [A1; WATSTORE #708]
This component allows for more than one entry for network designation. Use the codes as defined under field number 87 (PRIMARY NETWORK SITE).

XII. WELL FIELDS RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats.

89. NUMBER WELLS IN GROUP [A3; WATSTORE #204]
Enter the number of wells that make up this well group.

90. DEPTH OF DEEPEST WELL [N0,3; WATSTORE #205]
Enter the depth of the deepest well in the group, in feet below land surface.

91. DEPTH OF SHALLOWEST WELL [N0,3; WATSTORE #206]
Enter the depth of the shallowest well in the group, in feet below land surface.

92. METHOD WELLS CONSTRUCTED [A1; WATSTORE #207]
Enter the code indicating the method by which the wells were constructed.

D - drilled
J - jetted
V - driven
W - drive-wash
Z - other

93. SIZE OF WELL FIELD [N0,7; WATSTORE #262]
Enter the mean diameter of the well field, in feet; that is the diameter of a circle that will enclose the well group.

XIV. WATER-LEVEL RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats.

The 'water level' record is used to enter water-level data for ground-water sites.

* 94. DATE MEASURED [A8; WATSTORE #235]
Enter the date (MMDDYYYY) on which the water level was measured. If the day or month are unknown, show them as 00. Use leading zeros for values of month and day that are less than 10, and specify all four digits for year.

<u>NOTE: Date is a control field, therefore, two entries with the same date and time will not be accepted. Furthermore, if the date is known to the year only, one entry only for that year may be specified. NOTE: The year is used as a secondary key.</u>

* 95. TIME OF MEASUREMENT [A4; WATSTORE #709]
Enter the time of day, when known, using the 24-hour clock.

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

* 96. WATER LEVEL [N2,7; WATSTORE #237]
Enter the water level at the site, in feet below land surface. Precision can be carried to two decimal places. If the water level is above land surface, precede the value with a minus sign (-). If the site flows but the head is not known, the site is dry, the level cannot be measured, measurement has been discontinued, or the well was destroyed, leave this field blank and record the appropriate code under STATUS.

* 97. STATUS [A1; WATSTORE #238]
Enter the code indicating the status of the site at the time the water-level was measured. <u>If no site status is indicated, the reported water-level measurement represents a static level.</u>

D - the site was dry (no water level is recorded).
E - the site was flowing recently.
F - the site was flowing, but the head could not be measured (no water level is recorded).
G - a nearby site that taps the same aquifer was flowing.
H - a nearby site that taps the same aquifer had been flowing recently.
I - injector site (recharges water being injected into the aquifer).
J - injector site monitor (a nearby site that taps the same aquifer is injecting recharge water).
N - measurement discontinued.
O - an obstruction was encountered in the well above the water surface (no water level is recorded).
P - the site was being pumped.
R - the site had been pumped recently.
S - a nearby site that taps the same aquifer was being pumped.
T - a nearby site that taps the same aquifer had been pumped recently.
V - foreign substance present on the surface of the water.
W - well destroyed.
X - water level affected by stage in nearby surface-water site.
Z - other conditions that would affect the measured water level (explain in remarks).

* 98. METHOD OF MEASUREMENT [A1; WATSTORE #239]
Enter the code indicating how the water level was measured.

A - airline measurement
B - analog or graphic recorder
C - calibrated airline measurement
E - estimated
G - pressure-gage measurement
H - calibrated pressure-gage measurement

* Mandatory if reasonably available, such as from a drillers report or other easily available source.

L - interpreted from geophysical logs

M - manometer measurement
N - nonrecording gage
R - reported, method not known
S - steel-tape measurement
T - electric-tape measurement
V - calibrated electric-tape measurement
Z - other

* 99. WATER LEVEL ACCURACY [A1; WATSTORE #276]
The accuracy of the water level can be coded as an aid to proper table formatting.

0 - Water level accuracy to nearest foot
1 - Water level accuracy to nearest tenth of a foot
2 - Water level accuracy to nearest hundredth of a foot

XIII. MEASURING-POINT RECORD

This record can be repeated as many times as needed and linked through the site ID to the SITEFILE. Record numbers are used to distinguish between repeats.

* 100. BEGINNING DATE [A8; WATSTORE #321]
Enter the date on which the measuring point was established using the following format - MMDDYYYY. If the day or month are unknown, show them as 00. Use leading zeros for values of month and day that are less than 10, and specify all 4 digits for year. NOTE: Date is a control field, therefore two entries with the same date will not be accepted.

* 101. ENDING DATE [A8; WATSTORE #322]
If this measuring point is no longer used, enter the date on which it was last used as a measuring point using the following format - MMDDYYYY. A new occurrence of the measuring point data should be used for the new measuring point. In this way, a history of measuring point data corresponding to each water level can be maintained.

* 102. HEIGHT OF MEASURING POINT [N2,6; WATSTORE #323]
For observation wells or other wells where repeated measurements are made, enter the height of the measuring point above or below land surface datum. Values for measuring points above land surface should be preceded by a minus sign (-).

103. MEASURING POINT REMARK [A100; WATSTORE #324]
A detailed description of the measuring point may be entered here. Up to 94 characters of remarks are allowed.

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* Mandatory if reasonably available, such as from a drillers report or other easily available source.

Section D - Aquifer Codes

note: left justify the aquifer source code in field number 29

000HKNS	HAWKINS FORMATION
000LCHR	LEECHER METAMORPHICS
000MNSR	MOUNT STUART GRANODIORITE
000MTHW	METHOW GNEISS
000NWKM	NEWAUKUM SERIES
000ORCS	ORCAS GROUP
000PSSN	PESHASTIN FORMATION
000SPCK	SHEEP CREEK CONGLOMERATE
000TLBK	TURTLEBACK COMPLEX
100GVWWO	GRAVEL OF WALLA WALLA,OLDER
110ALVM	QUATERNARY ALLUVIUM
110BSLT	BASALT
110CLVM	COLLUVIUM
110DGHD	DOGS HEAD ANDESITES
110DRML	DRUMHELLER SILTS
110DUNE	DUNE SAND
110GCPK	GLACIER PEAK VOLCANICS
110GRCK	GOAT ROCK PYROCLASTIC DEPOSITS
110MBKR	MOUNT BAKER LAVA
110MNRR	MOUNT RAINIER LAVAS
110MSHS	MOUNT ST HELENS LAVAS
111ALVM	HOLOCENE ALLUVIUM
111CLWD	COLWOOD FORMATION
111DUNE	DUNE SAND
111ELCR	ELECTRON MUDFLOW
111OSCL	OSCEOLA MUDFLOW
112ADML	ADMIRALTY DRIFT OR CLAY
112ALVM	ALLUVIUM
112ARLG	ARLINGTON GRAVEL MEMBER OF VASHON DRIFT
112BRNG	BORING LAVA
112CLVS	COLVOS SAND
112CRSN	CARSON LAVA
112CWCH	COWICHE GRAVEL
112EPRC	ESPERANCE SAND MEMBER OF VASHON DRIFT
112EVCK	EVANS CREEK DRIFT OF FRASER GLACIATION
112EVRS	EVERSON INTERSTADE OF FRASER GLACIATION
112FLVC	FLUVIOLACUSTRINE DEPOSITS
112GALE	GALE SAND
112GLCV	GLACIO-FLUVIATILE
112KTSP	KITSAP FORMATION
112LCSR	LACUSTRINE DEPOSITS
112LGHL	LOGAN HILL FORMATION
112LLCK	LILY CREEK FORMATION
112LWTN	LAWTON CLAY MEMBER OF VASHON DRIFT
112MDLD	MIDLAND SAND
112MNRR	MOUNT RAINIER VOLCANICS
112MRIN	MARINE DEPOSITS
112MRVL	MARYSVILLE SAND MEMBER OF VASHON DRIFT
112NPLM	NESPELEM SILT
112OKNG	OKANOGAN TILL
112ORNG	ORTING DRIFT OR GLACIATION

112PCCK	PILCHUCK CLAY MEMBER OF VASHON DRIFT
112PLLP	PUYALLUP FORMATION OR INTERGLACIATION
112PLUS	PALOUSE FORMATION
112QUTS	QUEETS BEDS
112RGLD	RINGOLD FORMATION
112SCBD	SCABLAND FLOOD DEPOSITS
112SKKM	SKOKOMISH GRAVEL
112SLCM	STEILACOOM GRAVEL
112SLGM	STILLAGUAMISH SAND MEMBER OF VASHON DRIFT
112SSPG	SALMON SPRINGS DRIFT
112STCK	STUCK DRIFT
112STSP	SATSOP FORMATION
112SUMS	SUMAS DRIFT OF FRASER GLACIATION
112TCHT	TOUCHET BEDS
112TFLS	TIFLIS MEMBER OF WAHLUKE FORMATION
112THLH	TAHOLAH FORMATION
112TILL	TILL
112TRHL	TROUT HILL LAVA FLOWS
112TRRC	TERRACE DEPOSITS
112TTON	TIETON ANDESITE
112VSHN	VASHON DRIFT OF FRASER GLACIATION
112WGHL	WINGATE HILL DRIFT
112WHLK	WAHLUKE FORMATION
112WLLP	WILLAPA CLAYS
120CAMS	CAMAS BASALT
120CDRL	CATHEDRAL GRANITE
120CLDP	CLOUDY PASS DIORITE
120KRGR	KRUGER ALKALINE SYENITES
120PLLK	PHALEN LAKE VOLCANICS
120PLMR	PALMER VOLCANICS
120RSLD	ROSSLAND GROUP
120SDCK	SOLEDUCK FORMATION
120SPRD	SHEPPARD GRANITE
120TIGR	TIGER FORMATION
120TSSR	TWIN SISTERS DUNITE
120UDRD	UNDERWOOD LAVA
121BVRL	BEVERLY MEMBER OF ELLENSBURG FORMATION
121ELPM	ELEPHANT MOUNTAIN FLOW
121HARO	HARO FORMATION
121HOKO	HOKO FORMATION
121HWSN	HOWSON ANDESITE
121MNSN	MONTESANO FORMATION
121QLLT	QUILLAYUTE FORMATION
121QNLT	QUINAULT FORMATION
121RFRV	RAFT RIVER FORMATION
121SELH	SELAH TUFF MEMBER OF ELLENSBURG FORMATION
121SGLF	SUGARLOAF ANDESITE
121SLBT	SELAH BUTTE FLOW
121SMMT	SUMMIT CONGLOMERATE
121SNPS	SNIPES CONGLOMERATES
121SQLM	SNOQUALMIE GRANODIORITE
121TRDL	TROUTDALE FORMATION

121UDDM	UNDERWOOD MOUNTAIN LAVA
122BRNP	BROWNS POINT FORMATION
122CBRV	COLUMBIA RIVER BASALT GROUP
122CLLM	CLALLAM FORMATION
122DGLC	DOUGLAS CANYON FORMATION
122EGCK	EAGLE CREEK FORMATION
122ELBG	ELLENSBURG FORMATION
122EMCL	ENUMCLAW VOLCANIC SERIES
122FFPK	FIFES PEAK FORMATION
122FSPG	FRENCHMAN SPRINGS MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP
122GDRD	GRAND RONDE BSLT OF YAKIMA BSLT SUBGROUP OF COLUMBIA RIVER BSLT GROUP
122HMBF	HAMMER BLUFF FORMATION
122HOH	HOH FORMATION
122HWRD	HOWARD ARKOSE
122IMNH	IMNAHA BASALT OF COLUMBIA RIVER BASALT GROUP
122LATH	LATAH FORMATION
122LCCK	LINCOLN CREEK FORMATION
122LKVG	LAKE VANTAGE LAVAS
122MBTN	MABTON MEMBER (INFORMAL USAGE) OF ELLENSBURG FORMATION
122MSHL	MASHEL FORMATION
122OCDP	ORCHARD POINT CONGLOMERATE OF BLAKELEY FORMATION
122PCGG	PICTURE GORGE BASALT OF COLUMBIA RIVER GROUP
122PDOV	PEND OREILLE VALLEY ANDESITE
122PRPD	PRIEST RAPIDS MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP
122QNCY	QUINCY DIATOMITE BED OF PRIEST RAPIDS MBR OF YAKIMA BASALT
122ROZA	ROZA MEMBER OF YAKIMA BASALT OF COLUMBIA RIVER GROUP
122RSRP	RESTORATION POINT MEMBER OF BLAKELEY FORMATION
122SDLM	SADDLE MNT BASALT OF YAKIMA, SUBGROUP OF COLUMBIA RIVER BASALT GROUP
122SELH	SELAH MEMBER (INFORMAL USAGE) OF ELLENSBURG FORMATION
122SKMN	SKAMANIA VOLCANIC SERIES
122SLVS	SILVER STAR GRANODIORITE
122SQCK	SQUAW CREEK DIATOMITE BED OF FRENCHMAN SPRINGS MBR OF YAKIMA BASALT
122SVRG	STEVES RIDGE FORMATION
122TNUM	TANEUM ANDESITE
122VNTG	VANTAGE MEMBER OF ELLENSBURG FORMATION
122WIDX	WEST INDEX ANDESITIC SERIES
122WNPM	WANAPUM BASALT OF YAKIMA BASALT SUBGROUP OF COLUMBIA RIV. BASALT GROUP
122YKIM	YAKIMA BASALT SUBGROUP OF COLUMBIA RIVER BASALT GROUP
123BLKL	BLAKELEY FORMATION
123GROM	GEROME VOLCANICS
123GRRC	GRIES RANCH FORMATION
123KDKM	KLONDIKE MOUNTAIN FORMATION
123LNCL	LINCOLN FORMATION
123MRSN	MARROWSTONE SHALE
123OPCS	OHANAPECOSH FORMATION
123PRTR	PORTER SHALE

Aquifer Codes (Con't.)

123PUGT	PUGET GROUP
123QMPR	QUIMPER SANDSTONE
123RNTN	RENTON FORMATION OF PUGET GROUP
123RSRP	RESTORATION POINT HORIZON
123SKCK	SKATE CREEK LAHARIC BRECCIA
123STTL	SEATTLE FORMATION
123TKWL	TUKWILA FORMATION OF PUGET GROUP
123TMTB	TOM THUMB TU[illegible] MEMBER OF KLONDIKE MOUNTAIN FORMATION
123TNSD	TOWNSEND SHA[illegible]
123TRVR	TWIN RIVER FORMATION
123TUTL	TOUTLE FORMATION
123WKKM	WAHKIAKUM FORMATION
124BLGM	BELLINGHAM BEDS
124BNDR	BOUNDARY SHALE
124BYNE	BAYNE SERIES
124CBRV	CARBON RIVER COAL SERIES
124CCKN	CHUCKANUT FORMATION
124CHLS	CHEHALIS SANDSTONE
124CLTZ	COWLITZ FORMATION
124CRBD	CARBONADO FORMATION OF PUGET GROUP
124CRSC	CRESCENT FORMATION
124EVCK	EVANS CREEK COAL SERIES
124FRFX	FAIRFAX COAL BEARING ROCKS
124FRKL	FRANKLIN SANDSTONE
124FRKLS	FRANKLIN SERIES
124GUYE	GUYE FORMATION
124KBHL	KNOB HILL ANDESTIE
124KCSS	KACHESS RHYOLITE
124KMMR	KUMMER SERIES
124KMMRF	KUMMER FORMATION
124LYRE	LYRE FORMATION
124MCIS	MC INTOSH FORMATION
124MCSN	METCHOSIN VOLCANIC SERIES
124MLMN	MELMONT COAL BEARING ROCKS
124MNSS	MANASTASH FORMATION
124NCHS	NACHES FORMATION
124NRCF	NORTHCRAFT FORMATION OF PUGET GROUP
124NTPC	NATAPOC FORMATION
124OBCK	OBRIEN CREEK FORMATION
124OLQU	OLEQUA FORMATION
124OQCK	OLEQUA CREEK MEMBER OF COWLITZ FORMATION
124PELL	PE ELL VOLCANICS MEMBER OF COWLITZ FORMATION
124PPNC	PIPESTONE CANYON FORMATION
124PUYR	PUYER FORMATION
124RGRV	RAGING RIVER FORMATION
124RSLN	ROSLYN FORMATION
124SCCK	SCATTER CREEK RHYODACITE OR FORMATION
124SKKK	SKOOKUMCHUCK FORMATION
124SLCK	STILLWATER CREEK MEMBER OF COWLITZ FORMATION
124SNPL	SANPOIL VOLCANICS
124SPKN	SPIKETON FORMATION OF PUGET GROUP
124SPRR	SOUTH PRAIRIE FORMATION

124SUMS	SUMAS SHALE IN CHUCKANUT FORMATION
124SWUK	SWAUK FORMATION
124TGRM	TIGER MOUNTAIN FORMATION OF PUGET GROUP
124TNWY	TEANAWAY BASALT
124WLKS	WILKESON COAL SERIES
125EGLE	EAGLE GREENSCHIST
125ESTN	EASTON SCHIST
200JUMB	JUMBO VOLCANICS
200KRGM	KRUGER MOUNTAIN MALIGNITE
200OSYS	OSOYOOS GRANODIORITE
200WSKM	WHISKEY MOUNTAIN GRANODIORITE
210BGCL	BOGACHIEL FORMATION
210CLEM	CLE ELUM FORMATION
210LCRV	LEECH RIVER GROUP
210LNLK	LOON LAKE GRANITE
210VGRG	VIRGINIAN RIDGE FORMATION
211MGPK	MIDNIGHT PEAK FORMATION
211WNRP	WINTHROP SANDSTONE
217PSTN	PASAYTEN FORMATION
217SPDN	SPIEDEN FORMATION
220EGCF	EAGLE CLIFF PORPHYRITE
220INDX	INDEX GRANODIORITE
220NWBY	NEWBY FORMATION
220RMML	REMMEL GRANODIORITE
220TYE	TYE GRANITE
221CHLN	CHELAN GRANODIORITE
221MTOR	METEOR GRANODIORITE
221SKSN	SHUKSAN FORMATION
230COVD	COVADA GROUP
230FDLG	FIDALGO FORMATION
230VNTR	VENTURA FORMATION
230VNTR	VENTURA FORMATION
300CLGS	CLUGSTON LIMESTONE
300DRLK	DEER LAKE ARGILLITE
300EGLM	EAGLE MOUNTAIN QUARTZITE
300FCRK	FISH CREEK ARGILLITE
300LDPN	LEAD POINT ARGILLITE
300SNJN	SAN JUAN SERIES
310GRFL	GRANITE FALLS LIMESTONE
320CHPKB	CHOPAKA BASIC INTRUSIVES
320CHPKS	CHOPAKA SCHIST
320GNPK	GUNN PEAK FORMATION
320HZMN	HOZOMEEN SERIES
320KRGR	KRUGER SCHIST
330CLVL	COLVILLE QUARTZITE
331CHLH	CHEWELAH ARGILLITE
350SVNS	STEVENS SERIES
360LDBR	LEDBETTER SLATE
360MLNY	MALONEY METAMORPHIC SERIES
370BCKK	BUCKSKIN SCHIST
370BNDR	BOUNDARY ARGILLITE
370CDCK	CEDAR CREEK ARGILLITE

370CHKM	CHIWAUKUM SCHIST
370DPLK	DEEP LAKE ARGILLITE
370FRNW	FERNOW GNEISS
370GYPS	GYPSY QUARTZITE
370REVS	REEVES LIMESTONE MEMBER OF MAITLEN PHYLLITE
370SWKN	SWAKANE BIOTITE GNEISS
370TONG	TONGA FORMATION
374MSSN	MISSION ARGILLITE
374MTLN	METALINE LIMESTONE OR FORMATION
374NRPR	NORTHPORT LIMESTONE
374RBCK	REPUBLICAN CREEK LIMESTONE
374RDTP	RED TOP LIMESTONE
377ADDY	ADDY QUARTZITE
377MTLN	MAITLEN PHYLLITE
377ODDM	OLD DOMINION LIMESTONE
400BDLK	BEAD LAKE FORMATION
400BFHP	BUFFALO HUMP FORMATION OF DEER TRAIL GROUP
400DRTL	DEER TRAIL GROUP
400EDNA	EDNA DOLOMITE OF DEER TRAIL GROUP
400HCKB	HUCKLEBERRY FORMATION
400LEOL	LEOLA VOLCANICS
400MCHL	MC HALE SLATE OF DEER TRAIL GROUP
400MNHL	MOON HILL QUARTZITE MEMBER OF SKOOKUM FORMATION
400MRDG	MARTIN RIDGE SCHIST
400MRSL	MARSHALL DIORITE
400NONM	NO NAME ARGILLITE
400NPRT	NEWPORT GROUP
400ORNT	ORIENT GNEISS
400RBBN	RIBBON GNEISS
400SDRF	SHEDROOF CONGLOMERATE
400SKKM	SKOOKUM FORMATION
400SSGR	STENSGAR DOLOMITE OF DEER TRAIL GROUP
400TOGO	TOGO FORMATION OF DEER TRAIL GROUP

Section E - Source Agency Codes

USGS	GEOLOGICAL SURVEY
WA001	WASH DEPARTMENT OF ECOLOGY, WA
WA002	PUBLIC UTILITY DIST NO.1, SKAGIT COUNTY, WA
WA003	CHELAN COUNTY PUBLIC UTILITY DISTRICT NO.1 WA
WA004	WASHINGTON UNIV-FISHERIES RES INST, WA
WA005	ENVIRONMENTAL ENG, WASHINGTON STATE UNIV, WA
WA006	DEPARTMENT OF ZOOLOGY, UNIV OF WASHINGTON, WA
WA007	CITY OF BREMERTON WATER DEPARTMENT, WA
WA008	CITY OF EVERETT DEPARTMENT OF WATER, WA
WA009	WATER QUALITY DIV, SEATTLE WATER DEPARTMENT, WA
WA010	DEPT OF PUBLIC UTILITIES, CITY OF TACOMA, WA
WA011	MUNICIPALITY OF METROPOLITAN SEATTLE, WA
WA012	DEPARTMENT OF PUBLIC WORKS, KING COUNTY, WA
WA013	WASHINGTON WATER POWER COMPANY, WA
WA014	DOUGLAS COUNTY PUBLIC UTILITIES DISTRICT, WA
WA015	PUBLIC UTILITIES DISTRICT OF GRANT COUNTY, WA
WA016	PUGET SOUND POWER & LIGHT COMPANY, WA
WA017	DEPARTMENT OF LIGHTING, CITY OF SEATTLE, WA
WA018	WASHINGTON STATE DEPARTMENT OF FISHERIES, WA
WA019	WASHINGTON STATE DEPT OF NAT RES. AERIAL PHOTOG, WA
WA020	WATER RESEARCH CENTER, WASH STATE UNIV, WA
WA021	ALBROOK LABORATORY, WASHINGTON STATE UNIV, WA
WA022	GEOHYDROLOGY SECTION, WASHINGTON STATE UNIV, WA
WA024	WEYERHAEUSER COMPANY, WA
WA025	WALKER & ASSOCIATES, INC, WA
WA026	WASH STATE DEPT OF TRANS-PHOTOGRAMMETRY BR, WA
WA027	BURLINGTON NORTHERN, WA
WA028	CLARK COUNTY MAP SERVICE, WA
WA029	SNOHOMISH COUNTY, WA
WA030	CITY OF BELLEVUE, SURVEY DEPT, WA
WA031	HANFORD ENGINEERING DEVELOPMENT LABORATORY, WA
WA032	BATTELLE PACIFIC NORTHWEST LAB, WA
WA033	EVERGREEN STATE COLLEGE, WA
WA034	WASH STATE UNIV. DEPT OF CIVIL ENG, WA
WA035	S.J. GROVES & SONS COMPANY, WA
WA036	NORTHWEST AIR PHOTOS, WA
USAF	AIR FORCE
USAHS	ARMY HEALTH SERVICES
USAPA	ALASKA POWER ADMINISTRATION
USARS	AGRICULTURAL RESEARCH SERVICE
USBIA	BUREAU OF INDIAN AFFAIRS
USBLM	BUREAU OF LAND MANAGEMENT
USBM	BUREAU OF MINES
USBPA	BONNEVILLE POWER ADMINISTRATION
USBR	WATER AND POWER RESOURCES SERVICES
USCE	CORPS OF ENGINEERS
USCEQ	COUNCIL ON ENVIRONMENTAL QUALITY

Section E - Source Agency Codes (Con't.)

USDA	FRUIT PROT AND PRODUCTION RESE LAB
USDOE	DEPARTMENT OF ENERGY
USEDS	ENVIRONMENTAL DATA AND INFORMATION SERVICE
USEPA	ENVIRONMENTAL PROTECTION AGENCY
USERL	ENVIRONMENTAL RESEARCH LABORATORIES
USESS	NATIONAL ENVIRONMENTAL SATELLITE SERVICE
USFEC	FEDERAL ENERGY REGULATORY COMMISSION
USFEM	FEDERAL EMERGENCY MANAGEMENT
USFHA	FEDERAL HIGHWAY ADMINISTRATION
USFS	FOREST SERVICE
USFWS	FISH AND WILDLIFE SERVICE
USGPO	GOVERNMENT PRINTING OFFICE
USHEW	DEPT OF HEALTH, EDUCATION AND WELFARE
USHUD	DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
USIBW	INTERNATIONAL BOUNDARY AND WATER COMMISSION
USMA	ARMY MILITARY ACADEMY, SCIENCES RESE LAB, NY
USMC	MARINE CORPS
USMFS	NATIONAL MARINE FISHERIES SERVICE
USN	NAVY DEPARTMENT
USNFE	NAVAL FACILITIES ENGINEERING COMMAND
USNOA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
USNOS	NATIONAL OCEAN SURVEY
USNPS	NATIONAL PARK SERVICE
USNRC	NUCLEAR REGULATORY COMMISSION
USNTS	NATIONAL TECHNICAL INFORMATION SERVICE
USNWS	NATIONAL WEATHER SERVICE
USOSM	OFFICE OF SURFACE MINING RECLAM & ENFORCEMENT
USPCC	PANAMA CANAL COMMISSION
USRDC	RENO FEDERAL DISTRICT COURT (NV)
USSCS	SOIL CONSERVATION SERVICE
USSPA	SOUTHEASTERN POWER ADMINISTRATION
USSWP	SOUTHWESTERN POWER ADMINISTRATION
USTVA	TENNESSEE VALLEY AUTHORITY
USWRC	WATER RESOURCE COUNCIL

Section F - Example Completed Form and Corresponding Computer Files

There are three SITEFILEs shown in this example. The completed form on the following pages corresponds to the third SITEFILE, Site ID number 460333122243801.

SITE00.ASC

```
"A","","WA001","464532123454301","12N/34E-05F01","464532","1234543","S","53","067","GRAND MOUND",24000,200.00,"M",5.00,"17100103","G","A","","07141987","C","W","02181983","W","","","N","S","","U","",73.00,73.00,"D",23.40,"02171983","R","","D"
"A","","WA001","464337122434801","12N/33E-09H01","464337","1224348","S","53","067","GRAND MOUND",24000,205.00,"M",5.00,"17100103","G","A","","07141987","C","W","05121978","W","","","N","","","U","",92.00,92.00,"D",25.83,"05121978","R","","D"
"A","","WA001","460333122243801","13N/33E-34B01","460333","1222438","S","53","067","GRAND MOUND",24000,225.00,"M",5.00,"17100103","G","A","","07151987","C","W","09101975","W","","","Q","","","U","",123.00,123.00,"D",19.37,"09101975","R","","D"
```

GWMI00.ASC

```
"464532123454301","A","001","GWMA-87-10","ECOLOGY"
"464337122434801","A","001","GWMA-87-10","ECOLOGY"
"460333122243801","A","001","GWMA-87-10","ECOLOGY"
```

OWN00.ASC

```
"464532123454301","A","001","02181983","SMITH,TIM D."
"464337122434801","A","001","05121978","JONES,K. A."
"460333122243801","A","001","09101975","CLEARWATER FISH FARM"
```

CONST00.ASC

```
"464532123454301","A","001","001","02181983","KING BRTHS.","D","C","O","B",18,"S","6",""
"464337122434801","A","001","001","05121978","KING BRTHS.","D","C","O","B",18,"S","8",""
"460333122243801","A","001","001","09101975","HENRY DIGS","D","A","S","B",18,"P","24",""
```

HOLE00.ASC

```
"464532123454301","A","001","001",0.00,73.00,8.00
"464337122434801","A","001","001",0.00,92.00,8.00
"460333122243801","A","001","001",0.00,123.00,12.00
```

CASE00.ASC

```
"464532123454301","A","001","001",0.00,73.00,8.00,"",0
"464337122434801","A","001","001",0.00,92.00,8.00,"",0
"460333122243801","A","001","001",0.00,123.00,12.00,"",0
```

OPEN00.ASC

```
"460333122243801","A","001","001",73.00,81.00,"S","S",12.00,0.18,1.00
"460333122243801","A","001","002",113.00,123.00,"S","S",12.00,0.18,1.00
```

LIFT00.ASC

```
"464337122434801","A","001","001","S","05301978",50,"E",0
"460333122243801","A","001","001","T","09301975",95,"E",0
```

OTDA00.ASC

```
"460333122243801","A","001","WEATHER","C","F"
```

GEOL00.ASC

```
"460333122243801","A","001","G",0.00,123.00,"D"
```

NETW00.ASC

```
"460333122243801","A","001","WL","1979","1984","G","WA001","S","C","WA001","4",""
```

WLF000.ASC

```
"460333122243801","A","001","4",136,68,"D",700
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WTLV00.ASC

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"464532123454301","A","06201983","1200",22.64,"","T","2"
"464532123454301","A","09101987","1200",21.50,"","T","1"
"464337122434801","A","09121987","1200",23.23,"","T","2"
"464337122434801","A","08101987","1200",23.89,"","T","2"
"460333122243801","A","06101977","1200",20.37,"","T","2"
"460333122243801","A","09101987","1200",19.43,"R","T","2"
"460333122243801","A","08101987","1200",18.96,"R","T","2"
"460333122243801","A","07201987","1200",18.22,"R","T","2"
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MPNT00.ASC

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"464532123454301","A","001","02181983","",0.50,"TOP OF SANITARY SEAL"
"464337122434801","A","001","05121978","",0.80,"TOP OF SANITARY SEAL"
"460333122243801","A","001","09101975","",1.00,"ACCESS PORT"
```

WASHINGTON STATE DEPARTMENT OF ECOLOGY

GROUND WATER MANAGEMENT DATA FORM

SITE FILE

TRANSACTION T= A D M (ADD, DELETE, MODIFY) — A

WASHINGTON STATE START CARD NUMBER

1. SOURCE AGENCY 4= WA001
2. SITE ID. 460333 1222438 01 (LATITUDE, LONGITUDE, WELL NO)
3. LOCAL NO 12= 13N/33E-34B01 (TOWNSHIP, RANGE E/W, SEC, SUB, SEQ NO)
4. LATITUDE 9= 460333 (DEG, MIN, SEC)
5. LONGITUDE 10= 1222438 (DEG, MIN, SEC)
6. LAT/LONG ACCURACY 11= S F T M — S
7. STATE 7= 53
8. COUNTY 8= 067
9. LOCATION MAP 14= GRAND MOUND
10. SCALE 15= 24000
11. ALTITUDE 16= 225.00
12. METHOD OF MEASUREMENT 17= A L M (ALTIMETER, LEVEL, MAP) — M
13. ACCURACY 18= 5
14. HYDROLOGIC UNIT 20= 17100103
15. STATION TYPE 802= S L E C P G M (STREAM, LAKE OR RESERVOIR, ESTUARY, COASTAL (NOT ESTUARY), SPRING, GROUND WATER (NOT SPRING), METEOROLOGICAL) — G
16. AGENCY USE 803= A I O (ACTIVE, INACTIVE, INVENTORY ONLY) — A
17. REMARKS 806=
18. DATE SITE ESTABLISHED 711= 07/15/1987 (MONTH, DAY, YEAR)
19. DATA RELIABILITY 3= C L M U (CHECKED, LOCAL, MINIMAL, UNCHECKED) — C
20. SITE TYPE 2= C D E H I M O P S T W X (COLLECTOR, DRAIN, EXCAVATION, DUG HOLE, CONNECTOR WELL, MULTIPLE, OUTCROP, POND, SPRING, TUNNEL OR SHAFT, WELL, TEST HOLE) — W
21. DATE OF FIRST CONSTRUCTION 21= 09/10/1975 (MONTH, DAY, YEAR)
22. USE OF SITE 23= A C D E G H M O P R S T U W X Z (ANODE, STANDBY EMER SUPPLY, DRAIN, GEOTHERMAL, SEISMIC, HEAT RESERV, MINE, OBSERVATION, OIL OR GAS, RECHARGE, REPRESS, TEST, UNUSED, WITHDRAWAL, WASTE, DESTROYED) — W
23. SECONDARY SITE USE 301=
24. TERTIARY SITE USE 302=
25. USE OF WATER 24= A B C D E F H I J K M N P Q R S T U Y Z (AIR COND, BOTTLING, COMMERCIAL, DE-WATER, POWER, FIRE, DOMESTIC, IRRIGATION, INDUSTRIAL (COOLING), ..., MEDICINAL, INDUSTRIAL, PUBLIC SUPPLY, AQUACULTURE, RECREATION, STOCK, INSTITUTION, UNUSED, DESAL, OTHER) — Q
26. SECONDARY WATER USE 25=
27. TERTIARY WATER USE 26=
28. AQUIFER TYPE CODE 713= U N C M X (UNCONFINED SINGLE, UNCONFINED MULTIPLE, CONFINED SINGLE, CONFINED MULTIPLE, MIXED) — U
29. PRIMARY AQUIFER 714=
30. WELL DEPTH 28= 123.00
31. HOLE DEPTH 27= 123.00
32. SOURCE OF DEPTH DATA ① 29= D
33. INVENTORY WATER LEVEL 30= 19.37
34. DATE MEASURED 31= 09/10/1975 (MONTH, DAY, YEAR)
35. METHOD OF MEASUREMENT 34= A B C E G H L M N R S T V Z (AIRLINE, ANALOG, CALIBRATED AIRLINE, ESTIMATED, PRESSURE GAGE, CALIBRATED PRESSURE GAGE, GEOPHYSICAL LOGS, MANOMETER, NON-REC GAGE, REPORTED, STEEL TAPE, ELECTRIC TAPE, CALIBRATED ELECTRIC TAPE, OTHER) — R
36. SITE STATUS 37= D E F G H I J N O P R S T V W X Z (DRY, RECENTLY FLOWING, FLOWING, NEARBY FLOWING, NEARBY RECENTLY FLOWING, INJECTOR SITE, INJECTOR SITE MONITOR, MEASUREMENT DISCONTINUED, OBSTRUCTION, PUMPING, RECENTLY PUMPED, NEARBY PUMPING, NEARBY RECENTLY PUMPED, FOREIGN SUBSTANCE, WELL DESTROYED, SURFACE WATER EFFECTS, OTHER)
37. SOURCE OF WATER LEVEL ① 33= D

FOOT NOTES

① SOURCE OF DATA CODES: A D G L M O R S Z (OTHER GOVT, DRILLER, GEOLOGIST, LOGS, MEMORY, OWNER, OTHER REPORTED, REPORTING AGENCY, OTHER)

Recorded by A. Walters

Date 9-17-87

ECY 050-29 (6/87)

GROUND WATER MANAGEMENT IDENTIFICATION RECORD

R=129 | T= A D M

RECORD NUMBER 736= 0 0 1 | 38. IDENT. 190= G W M A - 8 7 - 1 0 | 39. ASSIGNER 191= E C O L O G Y

RECORD NUMBER 736= 0 0 2 | 38. IDENT. 190= | 39. ASSIGNER 191=

OWNER IDENTIFICATION RECORD

R=158 | T= A D M

40. DATE OF OWNERSHIP | 41. NAME

RECORD NUMBER 718= 0 0 1 | 159= 0 9 / 1 0 / 1 9 7 5 (MONTH DAY YEAR) | 161= CLEARWATER FISH FARM (LAST, FIRST, MIDDLE INITIAL)

RECORD NUMBER 718= 0 0 2 | 159= / / | 161=

CONSTRUCTION RECORD

R=58 | T= A D M | ENTRY NUMBER 59= 0 0 1 | RECORD NUMBER 723= 0 0 1

42. DATE OF COMPLETION 60= 0 9 / 1 0 / 1 9 7 5 (MONTH DAY YEAR) | 43. CONTRACTOR/DRILLER 63= HENRY DIGS | 44. SOURCE OF CONST. DATA ① 64= D

45. METHOD OF CONSTRUCTION 55= A B C D H J P R T V W Z

46. FINISH 66= C F G H O P S T W X Z | 47. TYPE OF SEAL 67= B C G N Z

48. BOTTOM OF SEAL 68= 18 | 49. METHOD OF DEVELOPMENT 69= A B C J N P S Z | 50. NUMBER OF HOURS IN DEVELOPMENT 70= 24

51. SPECIAL TREATMENT DURING DEVELOPMENT 71= C D E F H M Z

HOLE DIAMETER RECORD

R=72 | T= A D M | CONSTRUCTION ENTRY NO. 59= 0 0 1

RECORD NUMBER	724= 0 0 1	724= 0 0 2	724= 0 0 3
52. DEPTH TO TOP OF HOLE SEGMENT	73= 0.00	73=	73=
53. DEPTH TO BOTTOM OF HOLE SEGMENT	74= 123.00	74=	74=
54. DIAMETER OF HOLE SEGMENT	75= 12.00	75=	75=

CASING RECORD

R=76 | T= A D M | CONSTRUCTION ENTRY NO. 59= 0 0 1

RECORD NUMBER	725= 0 0 1	725= 0 0 2	725= 0 0 3
55. DEPTH TO TOP OF CASING SEGMENT	77= 0.00	77=	77=
56. DEPTH TO BOTTOM OF CASING SEGMENT	78= 123.00	78=	78=
57. DIAMETER OF CASING SEGMENT	79= 12.00	79=	79=
58. CASING MATERIAL ③	80=	80=	80=
59. THICKNESS OF CASING	81=	81=	81=

FOOT NOTES:

① SOURCE OF DATA CODES: A D G L M O R S Z

③ CASING MATERIAL CODES: B C D G I M P R S T U W Z

ECY 4 47 (1/1/8)

OPENING RECORD

R=82 | T= A D M (ADD, DELETE, MODIFY) | CONSTRUCTION ENTRY NO. 59# 0 0 1

RECORD NUMBER	726# 0 0 1	726# 0 0 2	726# 0 0 3
60. DEPTH TO TOP OF SECTION	83# 73.00	83# 113.00	83# .
61. DEPTH TO BOTTOM OF SECTION	84= 81.00	84= 123.00	84= .
62. TYPE OF OPENINGS ⑥	85= S	85= S	85=
63. TYPE OF MATERIAL ⑦	86= S	86= S	86=
64. DIAMETER OF OPEN SECTION	87= 12.00	87= 12.00	87= .
65. WIDTH OF OPENING	88= 0.18	88= 0.18	88= .
66. LENGTH OF OPENING	89= 1.00	89= 1.00	89= .

LIFT RECORD

R=42 | T= A D M (ADD, DELETE, MODIFY) | ENTRY NO. 254# 0 0 1 | RECORD NUMBER 254# 0 0 1

67. TYPE OF LIFT 43# A (AIR) B (BUCKET) C (CENTRIFUGAL) J (JET) P (PISTON) R (ROTARY) S (SUBMERSIBLE) T (TURBINE) U (UNKNOWN) Z (OTHER) — circled: T

68. DATE RECORDED 38= 09/30/1975 (MONTH DAY YEAR)

69. INTAKE DEPTH 44= 95

70. TYPE OF POWER 45= D (DIESEL) E (ELECTRIC) G (GASOLINE) H (HAND) L (LP GAS) N (NATURAL GAS) W (WINDMILL) Z (OTHER) — circled: E

71. HORSE-POWER 46= .

OTHER DATA AVAILABLE

R=180 | T= A D M (ADD, DELETE, MODIFY)

RECORD NUMBER	72. TYPE OF DATA	73. LOCATION OF DATA	74. FORMAT
312# 0 0 1	181= WEATHER	182= C D R Z (circled: C)	261= F M P Z (circled: F)
312# 0 0 2	181=	182= C D R Z	261= F M P Z

Location codes: C (GEOL. SURVEY/CENTRAL), D (DISTRICT), R (REPORTING AGENCY), Z (OTHER). Format codes: F (FILES), M (MACHINE READABLE), P (PUBLISHED), Z (OTHER).

GEOPHYSICAL-LOG RECORD

R=198 | T= A D M (ADD, DELETE, MODIFY)

RECORD NUMBER	75. TYPE OF LOG ②	76. BEGINNING DEPTH	77. ENDING DEPTH	78. SOURCE OF DATA ①
739# 0 0 1	199= G	200= 0.00	201= 123.00	202= D
739# 0 0 2	199=	200= .	201= .	202=

FOOT NOTES:

① SOURCE OF DATA CODES

A	D	G	L	M	O	R	S	Z
OTHER GOVT.	DRILLER	GEOLOGIST	LOGS	MEMORY	OWNER	OTHER REPORTED	REPORTING AGENCY	OTHER

② TYPE OF LOG CODES

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
TIME	COLLAR	CALIPER	DRILLER'S	ELECTRIC	FLUID CONDUCT.	GEOLOGIST	MAGNETIC	INDUCTION	GAMMA RAY	DIPMETER	LATERAL	MICROLOG	NEUTRON	[illegible]	PHOTO	RADIO ACTIVE

S	T	U	V	X	Z
SONIC	TEMP	GAMMA GAMMA	FLUID VELOCITY	CORE	OTHER

⑥ TYPE OF OPENINGS CODES

F	L	M	P	R	S	T	W	X	Z
FRACTURE	LOUVERED SHUTTERED	MESH	PERFORATED OR SLOTTED	WIRE WOUND	SCREEN	SAND POINT	WALLED	OPEN HOLE	OTHER

⑦ TYPE OF MATERIAL CODES FOR OPEN SECTIONS

B	C	G	I	M	P	R	S	T	Z
BRASS OR BRONZE	CONCRETE	GALV. IRON	WROUGHT IRON	OTHER METAL	PVC OR PLASTIC	STAINLESS STEEL	STEEL	TILE	OTHER

ECL 8/87 1310 C

NETWORK RECORD

R=114 | T= A D M | RECORD NUMBER 730=0 0 1

79. TYPE OF NETWORK 706= QW WL WD (WATER QUALITY, WATER LEVELS, PURPOSE)

80. BEGIN YEAR 1'5= 1 9 7 9

81. END YEAR 1'6= 1 9 8 4

82. TYPE OF ANALYSES 120= A B C D E F G H I J K L M N P Z

83. SOURCE AGENCY 117= W.A. 0 0 1

84. FREQUENCY OF COLLECTION 118= A S C D F I M O Q S W Z 2 3 4 5 X

85. METHOD OF COLLECTION 133= C E M U Z (CALCULATED, ESTIMATED, METERED, UNKNOWN, OTHER)

86. ANALYZING AGENCY 307= W.A. 0 0 1

87. PRIMARY NETWORK SITE 257= 1 2 3 4 (NATIONAL, DISTRICT, PROJECT, COOPERATOR)

88. SECONDARY NETWORK SITE 708=

WELL FIELDS

R=203 | T= A D M | RECORD NUMBER 729=0 0 1

89. NO WELLS IN GROUP 204= 4

90. DEEPEST DEPTH 205= 1 3 6

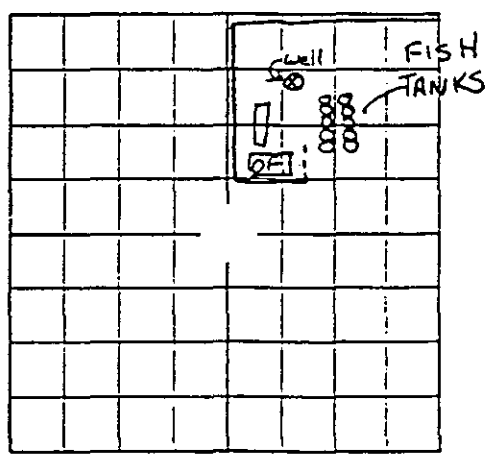
91. SHALLOWEST DEPTH 206= 6 8

92. CONSTRUCTION METHOD 207= D J V W Z (DRILLED, JETTED, DRIVEN, DRIVE, WASH, OTHER)

93. SIZE OF WELL FIELD 262= . 7 0 0

NOTE: Locate the well site accurately on the section below.

T13N/R33E-34B01



COLOR KEY:

GREEN SHADED—Mandatory for new WATSTORE sites.

GREEN—Mandatory if the information is reasonably available, such as from driller's reports or other easily available sou

BLACK—Not mandatory.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

WATER LEVEL DATA

LOCAL NO. 13N/33E-34B01

MP HEIGHT 1.0

SITE IDENT NO. 460333 1222438 01 (LATITUDE / LONGITUDE / WELL NO) R=234 T= A

94. DATE	95. TIME (24 hour)	96. WATER LEVEL (below LSD)	97. STATUS (see below)	98. METHOD (see below)	99. ACCURACY (see below)	HOLD	CUT	DEPTH BELOW MP	REMARKS
235# 06/10/1977	709# 12:00	237# 20.37	238#	239# T	276# 2	24.09	2.72	21.37	BC
235# 07/20/1987	709# 12:00	237# 18.22	238# R	239# T	276# 2	23.22	4.00	19.22	AW
235# 08/10/1987	709# 12:00	237# 18.96	238# R	239# T	276# 2	23.96	4.00	19.96	AW
235# 09/10/1987	709# 12:00	237# 19.43	238# R	239# T	276# 2	24.43	4.00	20.43	AW

CODES FOR SITE STATUS 238= D E F G H I J N O P R S T V W X Z

CODES FOR METHOD OF MEASUREMENT 239= A B C E G H L M N R S T V Z

276= 0 1 2

MEASURING POINT RECORD T= A D M RECORD NUMBER 728# 001

100 MP BEGIN DATE 321# 09/01/1975

101 MP END DATE 322= / /

102 MP HEIGHT 323= 1.00

103 MP REMARK 324= ACCESS PORT

ECY 050-1-31 E

NOTE: Reverse side may be used to sketch well site and measuring point location.

PART II
CODING INSTRUCTIONS FOR WATER QUALITY DATA

PART II

CODING INSTRUCTIONS FOR WATER QUALITY DATA

Water quality data collected for the Ground Water Management Programs will be entered into the DMS according to PC-STORET system format defined by WDOE.

The remainder of PART II presents the current WDOE-DRM for STORET (primarily water quality station indexing information). Where appropriate, the existing SKCHD/dms will be modified to PART II coding instructions.

In order to prevent duplicate well entries in the STORET system, each grantee or its contractor will review a data retrieval of all wells in the national STORET data base that are in that Ground Water Management Area (GWMA). If a well to be used in the GWMA study already exists in the STORET system, the existing primary and secondary station codes should be used. See the STORET ground water manual for instructions and definitions of primary and secondary station codes. (Ground Water Data Management with STORET, 1986, EPA/600/M-86/007). New primary station codes should not be assigned for wells already in the STORET system.

A. Introduction

The following instructions outline procedures for reporting water quality and associated data in STORET format. STORET is the data base used by Ecology and EPA for water quality and associated information. Data must be submitted in ASCII text-type files. Boundaries between lines are marked by carriage return and line feed. The end of the file is marked by Control Z.

An example of the STORET WATER QUALITY FILE - STATION LOCATION STORAGE form follows. Since this form is used for several different functions, parts of the form do not pertain to this program. Mandatory fields are shaded in green on the form. Fields outlined in green are mandatory if the information is reasonably available, such as from a driller's report or other easily available source. Fields outlined in black do not pertain to this program and should not be filled in.

GROUND WATER QUALITY DATA STORAGE FORMATS

This part contains an introduction to the formatting and retrieval strategies used in STORET. An explanation of data needed for storage is presented in the next several sections.

Data Needs Identified for Ground Water/STORET Users

A station must be thoroughly and correctly described so that data associated with it can be stored and later retrieved. It should be emphasized that the more information available about a station, the more flexibility there will be in retrieving the data stored with that station.

Three broad categories of descriptors have been identified as needed by Ground Water/STORET users to completely document information available for a particular station. These categories are:

- o Station descriptors.
- o Sample descriptors.
- o Analytical findings.

There are several elements under each category that will enable the user to describe the station thoroughly. These elements are perhaps more information than would be needed to store surface water data. Elements making up each category of descriptors are described below. A graphic representation of where these descriptors should be entered into the data record are given in Appendix A.

Station Descriptors

Factors which are descriptive of the sampling location and would not change over time are called "station descriptors." There are three types of station descriptors needed by ground-water data managers to support their ground-water monitoring data. They are as follows:

Facility Descriptors

Facility descriptors are descriptors of the operation being monitored, such as type of waste management area (e.g., landfill), facility location (not the corporate headquarters), (e.g., zip code), and type of business (e.g., disposer of hazardous waste). Facility descriptors except ownership, will always be stored in either a station header or a descriptive paragraph.

Physical Setting Descriptors

Physical setting descriptors are descriptors of the setting in which the facility is located and from which samples were taken, such as aquifer name or geologic formation name. For the most part, these descriptors are stored in the parametric data field. Two of these descriptors are stored in the descriptive paragraph and one descriptor in the station header.

Well Descriptors

Well descriptors are descriptors of those characteristics of a well that may be an important factor in data analysis and that would not be expected to change over time, such as type of well, well depth, and casing material. All but one of these descriptors will be stored in the parametric data "fixed date" field. Note that the term "fixed date" under the parameter field means elements that will not change with time.

Sample Descriptors

Factors that describe a sample at the time it was taken and that are expected to change with each sampling event are called "sample descriptors." Three types of sample descriptors needed by ground-water data managers to support their ground-water monitoring data are:

Sampling Purpose Descriptors

Sampling purpose descriptors are descriptors of why and by whom a sample was taken. These descriptors are stored in the parametric "variable date field."

Sampling Condition Descriptors

Sampling condition descriptors are descriptors of the conditions during the sampling event, such as the depth to the top of the water table or the temperature. These descriptors are stored in the parametric "variable date field."

Sampling/Analysis Descriptors

Sampling/analysis descriptors are descriptors to document how a sample was taken and/or analyzed, such as how the sample was drawn and whether or not it was replicated.

Analytical Findings

The findings that were determined from each sample at a station are called "analytical findings" (e.g., the concentration of arsenic in the sample). Analytical findings will be stored in the STORET parametric data field by using "parameter codes." A printed list of all current STORET parameters and their codes may be obtained by users of the STORET system with the command %Batch with one of the following: PARMALFA, PARNUMER, and PARCAS. Descriptions of these lists are contained in Section 4.6.5 of this report, and instructions on storing findings can be found in Chapter WQ-DE of the STORET User's Handbook (February 1982). A list of the parametric codes especially pertinent to RCRA and likely useful to others can be found in Appendices G and H of this manual.

There are specific formats that must be used when inputting station and parametric data into STORET. Station header data are always stored and modified with the ?01 format which is a fixed form method. Exhibit 4-1 is the EPA form used for storing station location data in the STORET Water Quality File. Parametric data can be stored with five different formats: ?ØØ, ?Ø1, ?Ø2, ?Ø3, and ?Ø4. Whereas any of these formats are acceptable, the ?ØØ format is the most versatile and contains special features to be discussed in a later section that make it the only recommended format for ground-water users.

Chapter WQ-DE of the STORET User's Handbook (February 1982) describes the technical procedures for storing data in STORET. Specifically, it describes the various storage formats, how each one can be used, how to invoke each format, and how to enter data. This chapter is mean to be a supplement to Chapter WQ-DE of the STORET User's Handbook (February 1982). Rather than describing the technical procedures for entering any data into STORET, this chapter assists ground-water users in understanding what information is needed for data storage, and describes what has been determined to be the most useful organization and format for ground-water monitoring data in STORET. Extensive capabilities have been provided for storing station and sampling data. Users should determine which of these capabilities are appropriate to them.

Station Header

Before any ground-water monitoring data can be entered in STORET, an identification of each station from which the samples were taken must be "established" in the data base. In other words, a station header must be created for each ground-water monitoring well to which data are attributed.

B. Entering Header Data in STORET Format

Figure 1 is a station location storage format form to be used for station headers. The information described in these instructions for entering header data is to be submitted one time only for each well unless the information for that sampling location (e.g., well) changes. Figure 2, an example station location storage form, with information filled in, illustrates the following instructions.

To store a new station, you have to use the following "cards." Lines in a data set are the equivalent of a deck of cards, and the terms are used interchangeably in this documentation.

Name	Use	Card Type (in space 80)	Required
Agency	FOR ECOLOGY USE ONLY.	A	No
Station Type Card	Supplies the attributes or the characteristics of the site.	T	Yes
Station Card	Supplies station identifier, state and county codes.	S	Yes
Lat/Long Card	Supplies latitude/longitude, precision code, and depth of water at site. Also supplies surface elevation of station, and up to 5 aquifer codes.	Ø	Yes
Basin Card	Supplies EPA basin names, basin codes, and EPA eco-region code.	3	Yes
Location Card	Supplies narrative station description, hydrologic unit code, and river reach information.	4	Yes
Descriptive Paragraph Card	Further descriptive information about the station. This can be anything the user wishes.	5	No

Figure 1.

DEPARTMENT OF ECOLOGY — STORET WATER QUALITY FILE — STATION LOCATION STORAGE

1 2 3 4 5 6 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 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

AGENCY CARD (A CARD)

AGENCY CODE (Left Justify)		UNLOCK AFTER (date)		UNLOCKING KEY (Left Justify)	INDIVIDUAL STORING DATA NAME, LOCATION, AGENCY TELEPHONE (Optional Comments – will not be stored)		LOCK AFTER YR MO	CONTROL CODE	A

STATION TYPE CARD (T CARD)

A STRING OF VALID COMBINATIONS OF STATION TYPE CODES SEPARATED BY SLASHES (Left Justify) — T

STATION CARD (S CARD)

SORT NO	PRIMARY STATION CODE (Left Justify)		STATION ALIASES (1) SECONDARY STATION CODE (Left Justify)	(2) SECONDARY STATION CODE (Left Justify)	(3) SECONDARY STATION CODE (Left Justify)	FIPS CODES STATE	COUNTY		CONTROL CODE	S
						53	0			

LATITUDE/LONGITUDE CARD (HEADER CARD 0)

SORT NO		LATITUDE (Zero Fill) dd mm sss	LONGITUDE (Zero Fill) ddd mm sss		P C	D	TOTAL STATION DEPTH	Stn. Elev.	Aquifer Codes	0
								3238	22	

RMI CARD (HEADER CARD 1)

SORT NO		TERM BASIN	TERM STREAM NO	LEVEL 1 MILES	LEVEL 2 INDEX	LEVEL 2 MILES	LEVEL 3 INDEX	LEVEL 3 MILES	LEVEL 4 INDEX	LEVEL 4 MILES	LEVEL 5 INDEX	LEVEL 5 MILES	LEVEL 6 INDEX	LEVEL 6 MILES	LEVEL 7 INDEX	LEVEL 7 MILES	LAST LEVEL USED	1

RMI CARD (HEADER CARD 2)

SORT NO		TERM BASIN	TERM STREAM NO	LEVEL 8 INDEX	LEVEL 8 MILES	LEVEL 9 INDEX	LEVEL 9 MILES	LEVEL 10 INDEX	LEVEL 10 MILES	LEVEL 11 INDEX	LEVEL 11 MILES	LEVEL 12 INDEX	LEVEL 12 MILES		2

MAJOR/MINOR BASIN CARD (HEADER CARD 3)

SORT NO	STATION LOCATION MAJOR BASIN NAME	STATION LOCATION MINOR BASIN NAME	LOCATION BASIN CODES Major / Minor / Sub		3
	PACIFIC NORTHWEST		1 7		

LOCATION DESCRIPTION CARD (HEADER CARD 4)

SORT NO	LOCATION OF SITE, LANDMARK NAMES, ETC	REACH CODING: Hydrologic Unit Code	ON OFF	MILES ON REACH	C R	4

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Figure 1 - continued.

DESCRIPTIVE PARAGRAPH CARDS (HEADER CARD 5)

SORT NO (1–3)	Blank (4–6)	DESCRIPTION (7–78)	79	80
			0	5
			1	5
			2	5
			3	5
			4	5
			5	5
			6	5
			7	5
			8	5
			9	5
			J	5
			K	5
			L	5
			M	5
			N	5

EPA Form 7500-24 (Rev. 6-83) Previous edition is obsolete

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Figure 2.

DEPARTMENT OF ECOLOGY — STORET WATER QUALITY FILE – STATION LOCATION STORAGE

AGENCY CARD (A CARD)

AGENCY CODE (Left Justify)		UNLOCK AFTER (days)		UNLOCKING KEY (Left Justify)	INDIVIDUAL STORING DATA NAME, LOCATION, AGENCY TELEPHONE (Optional Comments – will not be stored)		LOCK AFTER YR / MO	CONTROL CODE
								A

STATION TYPE CARD (T CARD)

A STRING OF VALID COMBINATIONS OF STATION TYPE CODES SEPARATED BY SLASHES (Left Justify)

/WELL/AMBNT/MUN — T

STATION CARD (S CARD)

SORT NO	PRIMARY STATION CODE (Left Justify)		(1) SECONDARY STATION CODE (Left Justify)	(2) SECONDARY STATION CODE (Left Justify)	(3) SECONDARY STATION CODE (Left Justify)	FIPS CODES STATE	FIPS CODES COUNTY	CONTROL CODE
	482242122274701		86010007	33N42W02R01	L76158-05	53	053	S

LATITUDE/LONGITUDE CARD (HEADER CARD 5)

SORT NO		LATITUDE (Zero Fill) dd mm ss	LONGITUDE (Zero Fill) ddd mm ss		P C	O	TOTAL STATION DEPTH	Sta. Elev.	Aquifer Codes	
		4822420	12227470		2	F	000	3232	72	5

RMI CARD (HEADER CARD 1)

SORT NO		TERM RMI	TERM STREAM NO	LEVEL 1 MILES	LEVEL 2 INDEX	LEVEL 2 MILES	LEVEL 3 INDEX	LEVEL 3 MILES	LEVEL 4 INDEX	LEVEL 4 MILES	LEVEL 5 INDEX	LEVEL 5 MILES	LEVEL 6 INDEX	LEVEL 6 MILES	LEVEL 7 INDEX	LEVEL 7 MILES	LAST LEVEL USED	
																		1

RMI CARD (HEADER CARD 2)

SORT NO		TERM RMI	TERM STREAM NO	LEVEL 8 INDEX	LEVEL 8 MILES	LEVEL 9 INDEX	LEVEL 9 MILES	LEVEL 10 INDEX	LEVEL 10 MILES	LEVEL 11 INDEX	LEVEL 11 MILES	LEVEL 12 INDEX	LEVEL 12 MILES		
															2

MAJOR/MINOR BASIN CARD (HEADER CARD 3)

SORT NO	STATION LOCATION MAJOR BASIN NAME	STATION LOCATION MINOR BASIN NAME	LOCATION BASIN CODES Major / Minor / Sub		
	PACIFIC NORTHWEST	PUGET SOUND	13 / 11 / 12		3

LOCATION DESCRIPTION CARD (HEADER CARD 4)

SORT NO	LOCATION OF SITE, LANDMARK NAMES, ETC	REACH CODING: Hydrologic Unit Code	ON/OFF	MILES ON REACH	CK	
	CAREFREE ACRES MOBILE HOME PARK	17110019				4

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Figure 2 - continued.

DESCRIPTIVE PARAGRAPH CARDS (HEADER CARD 5)

DESCRIPTION

Card	Description
0 5	CLASS 4 WELL AT 37, PINEAPPLE DRIVE, MILTON 98404. WELL INSIDE PUMPHOUSE
1 5	IN BACKYARD. SPIGOT BEFORE HOLDING TANK. ELEVATION OF TOP OF CASING IN
2 5	FEET: 201.30. ECOLOGY SOUTHWEST REGION. USGS BLACK BUTTE 7.5 MIN. QUAD
3 5	MAP.
4 5	
5 5	
6 5	
7 5	
8 5	
9 5	
J 5	
K 5	
L 5	
M 5	
N 5	

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AGENCY CARD (A CARD)

AGENCY CODE - FOR ECOLOGY USE ONLY.

STATION TYPE CARD (T CARD)

Space	Contents	Required
1-78	Must begin with a slash (/) which is pre-printed on the form for users' convenience. A valid station type which describes the type of water body being sampled and other characteristics of the sampling site. Each level is separated by a "/", and no embedded blanks are allowed. This is a required item. For a list of all the valid station types, see the STORET Help File "STORET.HELP. STATION.TYPE". The Help File also contains examples of their format and use.	Yes
79	Blank	No
80	The letter "T" is entered. This is the card identifier.	Yes

A list of valid station types is in the back of this document (Exhibit 4-1 in Appendix A). It includes a short definition of the types. Users are required to specify one one-level and one two-level code for each station.

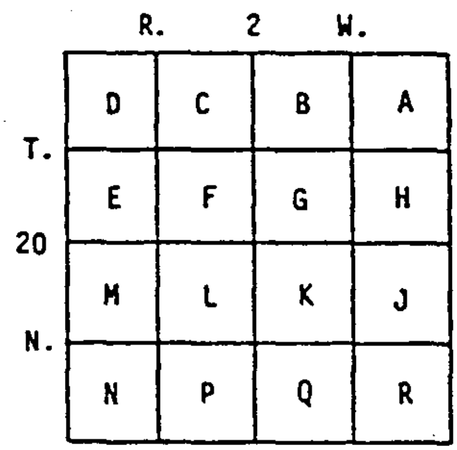
STATION CARD (S CARD)

NOTE: No two wells can have the same Primary or Secondary Station Code.

Space	Contents	Required
1-3	Blank	No
4-18	The latitude/longitude followed by the sequential number will represent the Primary Station Code for each sampling location. This code must be the same as the USGS latitude/longitude Site ID number if the site exists in the USGS data base. If the site is not in the USGS data base, the latitude/longitude location should be determined to the nearest second using a map of no larger scale than a 7.5 minute quadrangle map, and a sequential number assigned (01 if no site with the same latitude/longitude already in the USGS system; the next highest sequential number if others with the same latitude/longitude already exist).	Yes
19-33	Blank	No
34-41	The first Secondary Station Code is the Ecology I.D. number consisting of the following: First 4 characters = the Ground-Water Management Area Identifier Code: Clover-Chambers Creek Basin - 8601 Island County - 8602 South King County - 8603 Vashon/Maury Island - 8604 Gig Harbor - 8605 Kitsap County - 8606 Redmond-Bear Creek - 8607 Issaquah Valley - 8608 North Clark County - 8709 Thurston County - 8710 Deer Park Basin - 8711 Lummi Indian Reservation - 8712 Toppenish Creek Basin - 8713 East King County - 8714 Methow River Basin - 8715 Last 4 characters = assigned a unique number (grantee's choice). Leading zeros are mandatory.	No

STATION CARD (S CARD) - continued

Space	Contents	Required
42-45	Blank	No
46-56	If the sampling site is in the USGS data base, the second Secondary Station Code should be the USGS local identifier which is the township, range, section, quarter-quarter letter (Figure 3), sequential number (leaving out slashes and dashes). See Part I, LOCAL NUMBER, pg. C-3. Leading zeroes required; e.g., 20N02W29R01.	No



Section 29

Figure 3. Forty-acre tract letter (quarter-quarter diagram).

If the sampling site is not in the USGS data base, the local identifier (township, range, section, quarter-quarter letter, sequential number) should be determined using a map of no larger scale than a 7.5 minute quadrangle map. The sequential number should be the next consecutive integer (01, 02, . . .) higher than the highest existing one for that township, range, section, quarter-quarter letter.

57	Blank	No

STATION CARD (S CARD) - continued

Space	Contents	Required
58-67	If the sampling site is a public water supply well, the Secondary Station Code should be the 6-digit DSHS Station I.D. Number followed by a dash and the 3-digit source code. (Source codes have been stored as 2 digits in the past, but DSHS is planning to change them to 3 digits soon.)	No
68-69	The two-character FIPS state code which is required. It is always "53" for Washington. It is pre-printed on the form for users' convenience.	Yes
70-72	The three-character FIPS county code which is required. A leading zero is required. The zero is pre-printed on the form for users' convenience. (See Table 1 for a list of county codes.)	Yes
73-77	Blank	No
78-79	For new stations, "NS" is entered. If it is an existing STORET station, you do not have to enter this line.	Yes
80	The character "S" is entered. This is the card identifier.	Yes

Table 1. County codes for Washington State.

County	Code	County	Code
Adams	001	Lewis	041
Asotin	003	Lincoln	043
Benton	005	Mason	045
Chelan	007	Okanogan	047
Clallam	009	Pacific	049
Clark	011	Pend Oreille	051
Columbia	013	Pierce	053
Cowlitz	015	San Juan	055
Douglas	017	Skagit	057
Ferry	019	Skamania	059
Franklin	021	Snohomish	061
Garfield	023	Spokane	063
Grant	025	Stevens	065
Grays harbor	027	Thurston	067
Island	029	Wahkiakum	069
Jefferson	031	Walla Walla	071
King	033	Whatcom	073
Kitsap	035	Whitman	075
Kittitas	037	Yakima	077
Klickitat	039		

LATITUDE/LONGITUDE CARD (HEADER CARD Ø)

Space	Contents	Required
1-6	Blank	No
7-13	The degrees, minutes, seconds, and tenths of seconds of latitude. No decimal point is entered. The latitude of the station is checked along with the longitude to ensure that the specified lat/long is within the county entered on the "S" card.	Yes
	For Clarity:	
7-8	= degrees	
9-10	= minutes	
11-12	= seconds	
13	= 1/10ths of seconds	
14-21	The degrees, minutes, seconds, and tenths of seconds of longitude. No decimal point is entered. The longitude of the station is checked along with the latitude to ensure that the specified lat/long is within the county entered on the "S" card.	Yes
	For Clarity:	
14-16	= degrees	
17-18	= minutes	
19-20	= seconds	
21	= 1/10ths of seconds	
22-27	Blank	No
28	The precision code which indicates the preciseness with which the lat/long was measured. If nothing is coded, a "4" is assumed.	No

Code	Precision
1	Tenth of a second
2	One second
3	Ten seconds
4	Thirty seconds
5	One minute
6	Ten minutes
7	Thirty minutes
8	One degree

LATITUDE/LONGITUDE CARD (HEADER CARD Ø) - continued

Space	Contents	Required
29	The units used when entering the aquifer thickness at the sampling site (F for feet or M for meters). If nothing is entered, feet are assumed.	No
30-32	Refers to aquifer thickness. If nothing is entered, "000" is assumed.	No
33-37	The surface elevation of the station in feet as a five-digit, whole number.	No
38-77	Aquifer code of sampling site. Five sets of aquifer codes, each 8 characters long, can be entered. The first three characters must be numeric; the remaining five are alphanumeric. Used predominantly with ground-water wells. See Part I, Section D, Aquifer Codes, page D-1 through D-6.	No
78-79	Blank	No
80	The character zero "0" is entered. This is the card identifier.	Yes

MAJOR/MINOR BASIN CARD (HEADER CARD 3)

Space	Contents	Required
1-3	Blank	No
4-27	The EPA major basin name in which the station is located. It is a required field. The name is always "Pacific Northwest." It is pre-printed on the form for users' convenience.	Yes
28-67	Minor Basin name starting with space no. 28 (e.g., Puget Sound, Coastal, Yakima). May be up to 29 characters. See Table 2 for list of Minor Basin names. For added clarity, the subbasins are also listed.	Yes
68-69	The EPA major basin code where the station is located. This is a required field. It is always "13" in the Pacific Northwest. It is pre-printed on the form for users' convenience.	Yes
70-71	The EPA minor basin code where the station is located. This is a required field. Minor and Subbasin codes are shown in Table 2.	Yes
72-73	This is an optional field which is used to enter the subbasin code if one is available. EPA has not defined subbasins, and if nothing is entered, two zeros are assumed. See Table 2 and Figures 4a-e.	No
74-79	Blank	No
80	The character "3" is entered. This is the card identifier.	Yes

Table 2. Minor and subbasin names and codes in Washington State.

11 - Puget Sound (Minor basin)

01	Nooksack (Subbasin)	10	Puyallup-White
02	San Juan	11	Nisqually
03	Lower Skagit	12	Chambers-Clover
04	Upper Skagit	13	Deschutes
05	Stillaguamish	14	Kennedy-Goldsboro
06	Island	15	Kitsap
07	Snohomish	16	Skokomish-Dosewallips
08	Cedar	17	Quilcene-Snow
09	Duwamish-Green	18	Elwha-Dungeness

12 - Coastal (Minor basin)

19	Lyre-Hoko (Subbasin)	22	Lower Chehalis
20	Soleduck-Hoh	23	Upper Chehalis
21	Queets-Quinault	24	Willapa

10 - Lower Columbia (Minor basin)

25	Grays-Elochoman (Subbasin)	29	Wind-White Salmon
26	Cowlitz	30	Klickitat
27	Lewis	31	Rock-Glade
28	Salmon-Washougal	32	Walla Walla

08 - Lower Snake (Minor basin)

33	Lower Snake (Subbasin)	35	Middle Snake
34	Palouse		

04 - Yakima (Minor basin)

37	Lower Yakima (Subbasin)	39	Upper Yakima
38	Naches		

05 - Upper Columbia (Minor Basin)

36	Esquatzel Coulee (Subbasin)	49	Okanogan
40	Alkali-Squilchuck	50	Foster
41	Lower Crab	51	Nespelem
42	Grand Coulee	52	Sanpoil
43	Upper Crab-Wilson	53	Lower Lake Roosevelt
44	Moses Coulee	58	Middle Lake Roosevelt
45	Wenatchee	59	Colville
46	Entiat	60	Kettle
47	Chelan	61	Upper Lake Roosevelt
48	Methow		

03 - Spokane (Minor basin)

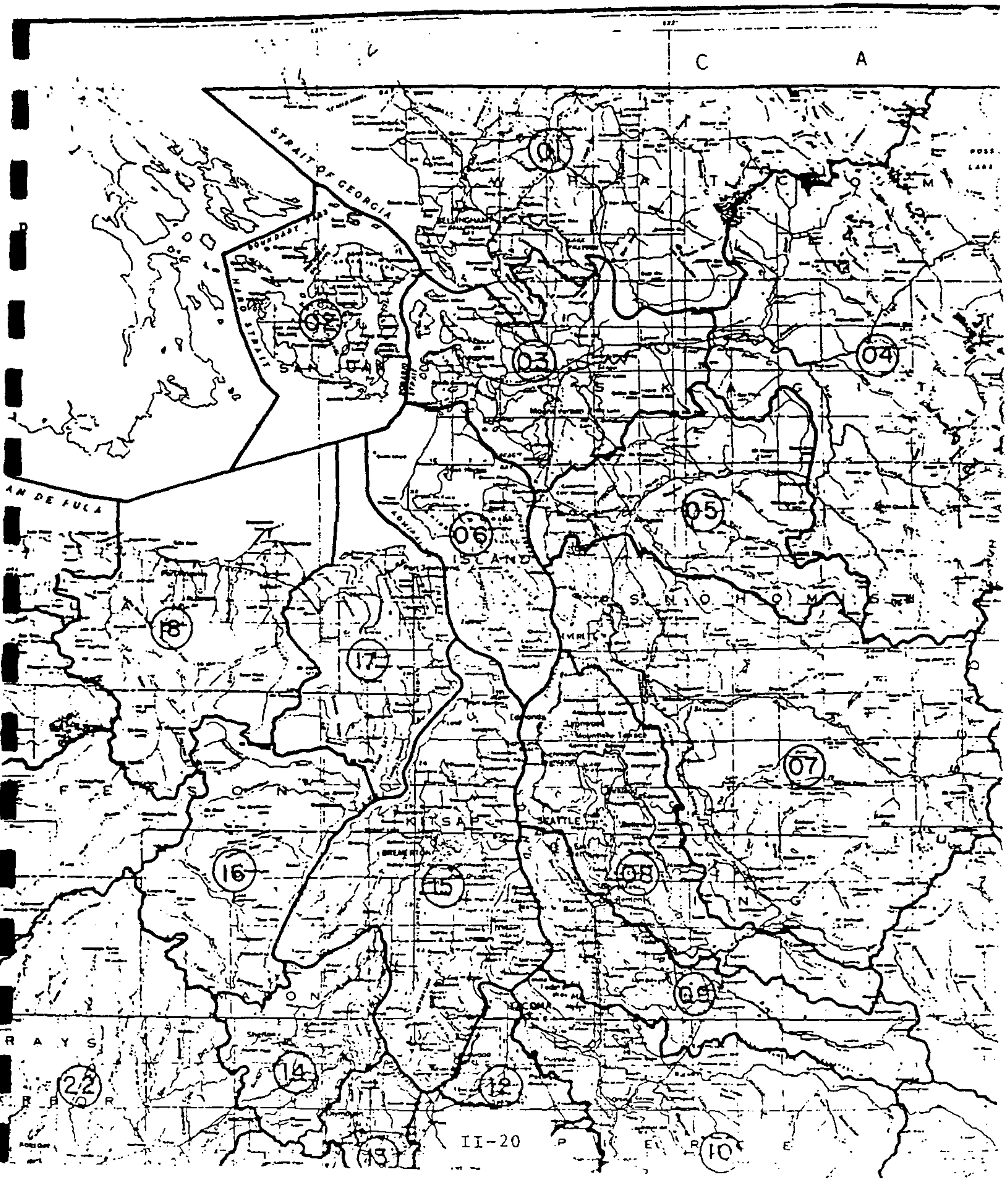
54	Lower Spokane (Subbasin)	56	Hangman
55	Little Spokane	57	Middle spokane

02 - Clark Fork, Pend Oreille (Minor basin)

62	Pend Oreille (Subbasin)

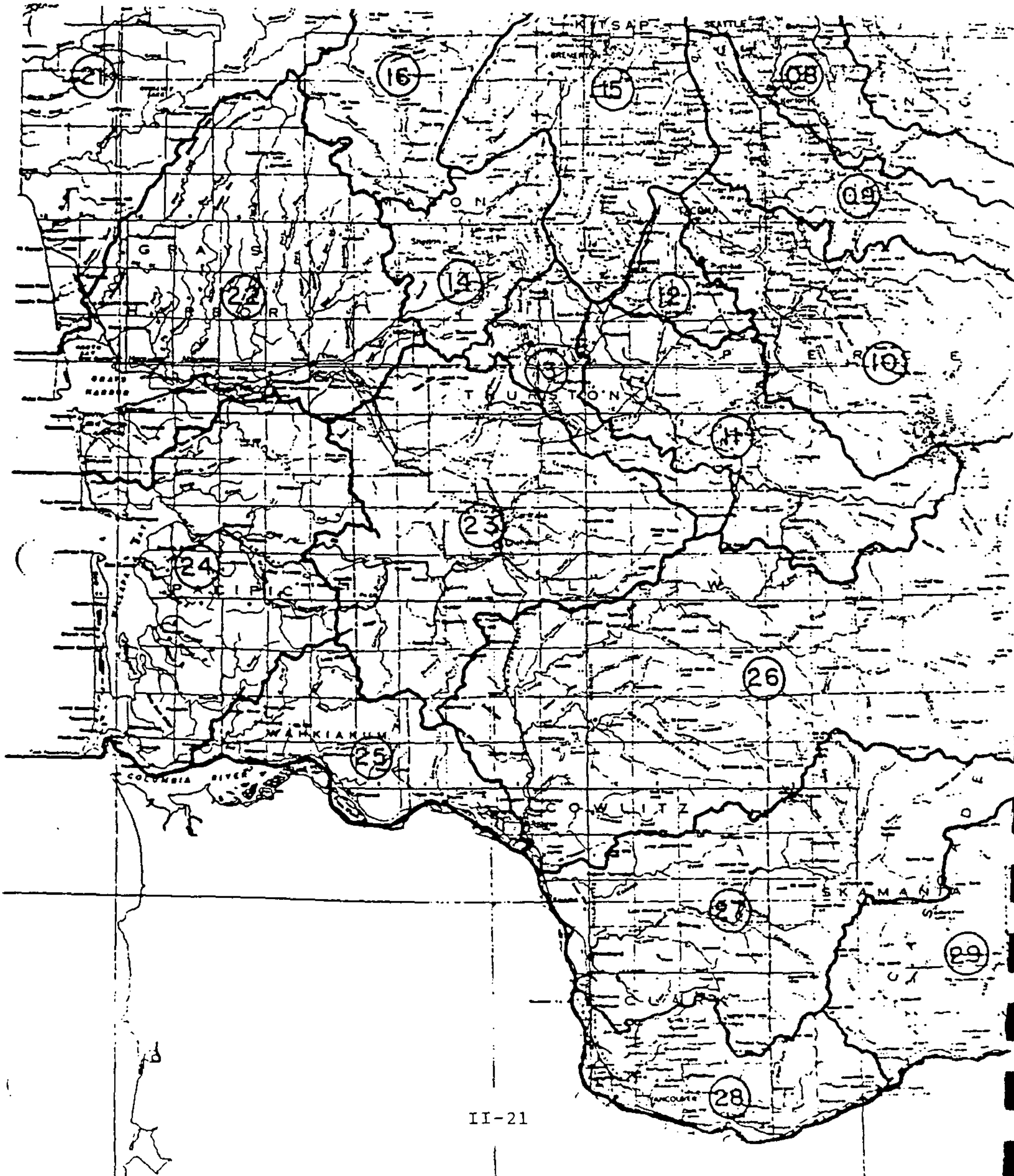
Ecology

Figure 4a. Subbasin boundaries (Water Resource Inventory Areas) for the Puget Sound Basin.



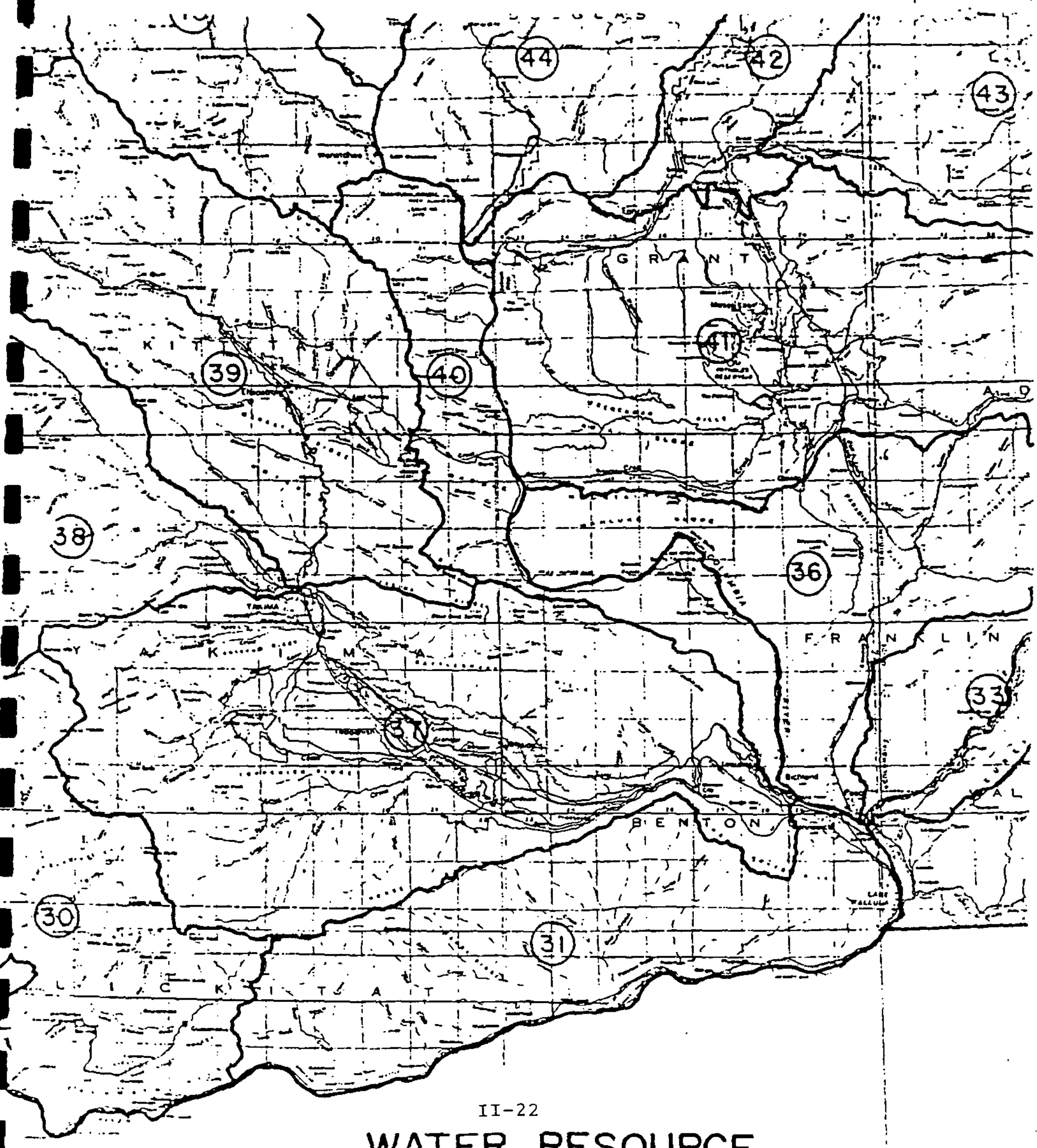
Ecology

Figure 4b. Subbasin boundaries (Water Resource Inventory Areas) for southwest Washington.



Ecology

Figure 4c. Subbasin boundaries (Water Resource Inventory Areas) for south-central Washington.



WATER RESOURCE

Ecology

Figure 4d. Subbasin boundaries (Water Resource Inventory Areas) for east-central Washington.

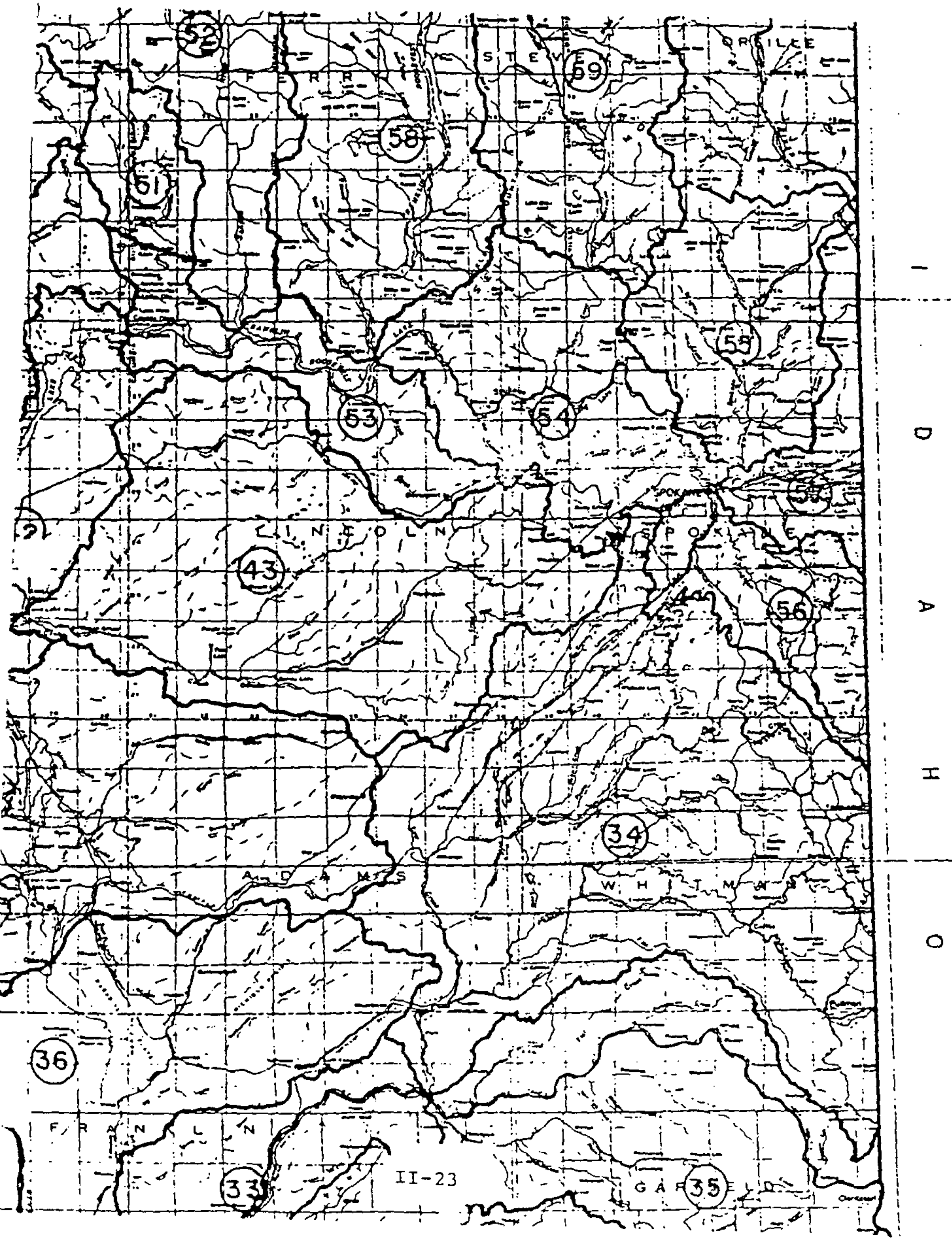
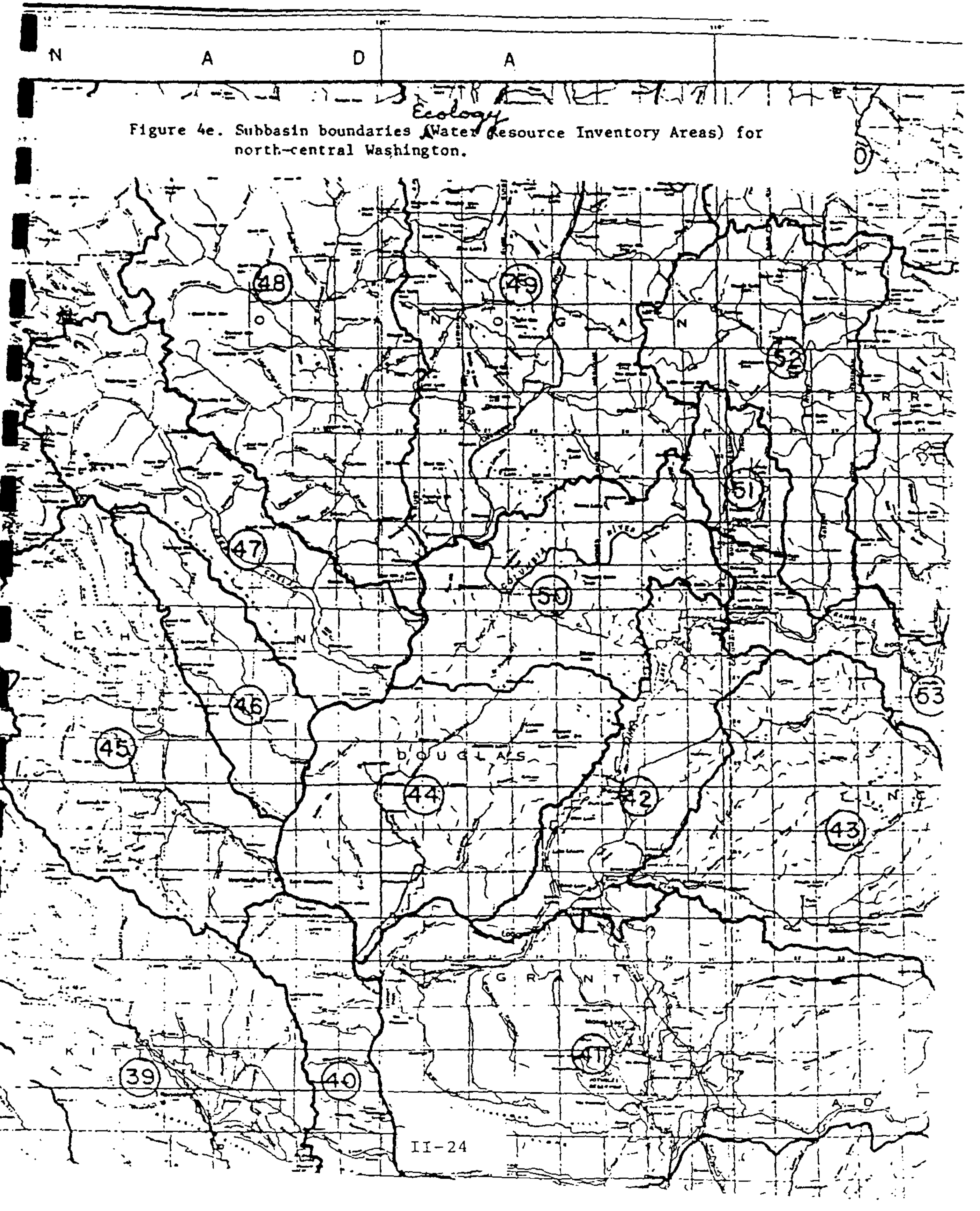


Figure 4e. Subbasin boundaries (Ecology Water Resource Inventory Areas) for north-central Washington.



LOCATION DESCRIPTION CARD (HEADER CARD 4)

Space	Contents	Required
1-3	Blank	No
4-51	Brief description of station's location. May be up to 48 characters. Leave 1 character space between words. This is a required field and should be as informative as possible.	Yes
52-59	The USGS cataloging unit number in which the station is located is entered. Codes can be found on US Hydrologic Unit Map-1974, State of Washington, which may be obtained from USGS Purchasing (Spokane), phone (509) 456-2524.	Yes
60-62	The EPA reach number on which the station is located or the reach that receives the drainage from the stream where the station is located is entered. If a cataloging unit code is entered and a reach number is not supplied, this field is left blank.	No
63-65	If a reach number is entered, this field must be completed. "ON" indicates that a station is located on the reach, and "OFF" is used if the station is on a stream whose water enters the indicated reach directly or through one or more tributaries. When "ON' is utilized, it is entered left-justified.	No
66-73	The miles from the downstream end of the reach to the point where the station is located or where the water enters the reach if the station is noted on the reach. The mileage is entered left-justified, and decimal fractions of miles may be utilized with the unused spaces left blank.	No
74	A check digit is entered which is used by an algorithm to verify that the 11-digit reach data are correct. The check digit is shown in the river reach file directory.	No
75-79	Blank	No

LOCATION DESCRIPTION CARD (HEADER CARD 4) - continued

Space	Contents	Required
80	The character "4" is entered. This is the card identifier.	Yes

Columns 60-74 make up the reach coding for the station and presently its use is optional. However, it is recommended that these fields be used to further identify the station's location and to enhance station retrieval capabilities.

DESCRIPTIVE PARAGRAPH CARDS (HEADER CARD 5)

Space	Contents	Required
1-6	Blank	No
7-78	To be used for additional information on the sampling site location, directions for finding the site, elevation of the top of the casing, USGS quadrangle map name and scale, Ecology region. Up to 15 "5" cards may be used, allowing the user to store up to 1,080 characters of additional information about the station. (Leave 1 character space between words.)	No
79-80	"05" through "N5" is entered, which identifies the card and which of the "5" cards is to be used. Must be entered in sequence beginning with "05" and incrementing by 1. After the "95" card is used, the next card is "J5" and then it is incremented by 1 letter of the alphabet until "N5" is reached.	Yes

Figure 5 shows how the header data looks when printed in the STORET format.

Figure 5. Example station location printout in STORET format.

```
/WELL/AMBNT/MUN                                                        T
   482242122274701           12A007     33N42W02R01 676158-05153053  NSS
     482242012227470     2F000                                         0
   PACIFIC NORTHWEST     PUGET SOUND                33N42WC2R131112    3
   CAREFREE ACRES MOBILE HOME PARK     17110019                        4

     CLASS 4 WELL AT 372 PINEAPPLE DRIVE, MILTON 98404. WELL INSIDE PUMPHOUSE05
     IN BACKYARD. SPIGOT BEFORE HOLDING TANK. ELEVATION OF TOP OF CASING IN  15
     FEET: 201.30. ECOLOGY SOUTHWEST REGION. USGS BLACK BUTTE 7.5 MINUTE     25
     QUADRANGLE MAP.                                                         35
```

C. Entering Parametric Data in STORET "SC" Format (water quality, sampling parameters)

Table 3 is a sample data reporting form. Figure 6 demonstrates how data from this form look in STORET SC format.

Figure 6. Example of STORET SC format for parametric data in Table 3.

```
SC,86010007,8709240945,MEDIA=GRWTR,SMK=000000,UMK=00000000,P72019,52.3,
P82546,55.3,P72004,15,P73655,230,P84124,SBPMP,P84125,CELTP,P84077,SBPMP,
P84129, 11 ,P10,11.2,P400,6.8,P95,138,P70304,150;P630,.264,P940,12.4,P1045,5.6,
P945,26,P31616,1K,P1002,1U,P1027,1U,P1034,2.8,P1051,10.5,P71900,.200U,
SC,86010007,8709241000,MEDIA=GRWTR,SMK=310000,UMK=033601,P82546,55.2,P72004,15,
P73675,230,P84124,SBPMP,P94077,BAIL,P84129, 11 ,P10,11.2,P400,6.9,P95,140,
P34506,3U,P32102,8J,P34423,10B,
SC,86010007,8709241005,MEDIA=GRWTR,SMK=320000,UMK=033601,P82546,55.2,P72004,15,
P73675,230,P72004,15,P73675,230,P84124,SBPMP,P84077,BAIL,P84129, 11 ,P23406,3U,
P344232,5N,P34423,5J,
```

Each set of samples taken at a particular time and place with the same System Multipurpose Key (SMK) and Users Multipurpose Key (UMK) code values is a separate data entry. Each data entry begins with "SC,". See the sample form (Table 3), Appendix B pages 43 through 46, and Appendix E for an explanation of SMK and UMK codes.

Lines for entering parametric data are up to 80 characters long.

The <u>Station Code</u> comes after "SC," followed by a comma. This may be either the primary station code or a secondary station code. Next comes the Date (YRMMDD) and Time, followed by a comma (no comma between Date and Time). "MEDIA=GRWTR," is entered next for all ground-water samples; then "SMK =" followed by the 6-digit code and a comma; then "UMK =" followed by the 8-digit code and a comma.

Parametric data immediately follows the above sample descriptor information. Parametric data is always in the format: parameter code, value, parameter code, value.

Parameter codes and the corresponding values must always be on the same line. There should be no spaces in the line except at the end. For instance, if the parameter code ends on the 77th character and the value and comma go beyond the 80th character, both the parameter code and the corresponding value would drop down to the next line. Space must be left at the end of a line in such a case. If all the data does not fit on one line, the second line (and third, etc.) begin with parameter code, value, rather than "SC,".

Table 3. Sample Data Reporting Form.

Chambers Creek/Clover Creek Ground Water Management Area

Primary Station Code	Date YRMMDD	Time	Media	SMK	IMK	Depth to water surface from land surface (feet) P72019	Depth to measuring point from land surface (feet) P82546	Pumping period (minutes) P72006	Volume of water evacuated from well (gallons) P73675	Method of evacuation P84126	Method of water level measurement P84125	Monitoring well sampling method P84077	Data quality assessment P84129	Temperature (°C) P10	pH P400
[illegible]	[illegible]	0945	GRWTR	000000	000000	52.1	55.3	15	230	Submersible Pump (SBMPMP)	Calibrated Elec. Tape (CELTP)	Submersible Pump (SRPMT)	-11--	11.2	6.8
[illegible]	87-09-24	1000	GRWTR	310000	033601		55.2	15	230	SBPMP		Bailer (BAIL)	-11--	11.7	6.8
[illegible]	87-09-24	1005	GRWTR	320000	033601		55.2	15	230	SBPMP		Bailer (BAIL)	-11--	11.1	6.8

Specific conductance (umhos/cm) P95	Total dissolved solids (mg/L) P70300	Total nitrate + nitrite (mg/L) P630	Total chloride (mg/L) P940	Total iron (mg/L) P1045	Total sulfate (mg/L) P945	Fecal coliform (colonies/ 100mL)* P31616	Total 1,1,1-trichloroethane (ug/L) P34506	Total carbon tetrachloride (ug/L) P32102	Total methylene chloride (ug/L) P34423	Total arsenic (ug/L) P1002	Total cadmium (ug/L) P1027	Total chromium (ug/L) P1034	Total lead (ug/L) P1051	Total mercury (ug/L) P71900
138	150	.265	12.4	5.6	26	<1	-	-	-	Not detected (DL = 1.0)	Not detected (DL = 1.0)	2.9	10.5	Not detected (DL = 0.2)
140		-	-	-	-	-	ND (DL = 1.0)	8 (estimated)	[illegible] (found in blank)					
139	-	-	-	-	-	-	ND (DL = 1.0)	ND (DL = 1.0)						

AV/WQ1/87/03700

ND = Not detected
DL = Detection limit

* Membrane - filter method

The Data Quality Assessment parameter code, P 84129, is an exception to the rule of no spaces in a line. Values for this code may be blank spaces. See Appendix C for instructions for using the "Quality Assurance/Quality Control" parameter code.

In addition to water quality information, the following parameters should be included in data entries:

- Depth to water surface from land surface (feet) (P72019)
- Depth to measuring point (sampling point) from land surface (feet) (P82546)
- Pumping period (minutes) (P72004)
- Volume of water evacuated from well (gallons) (P73675)
- Method of evacuation (P84124)
- Monitoring well sampling method (P84077)
- Data quality assessment (P84129)

Appendix D lists additional sample descriptor parameter codes that may be used.

Water quality parameter codes and values should follow those above. See Appendix F for a listing of commonly used parameter codes. Parameter codes for some organics are listed in U.S. EPA's Ground-Water Data Management with STORET, 1986.

Leading and following zeroes in parameter values are optional (e.g., 0.3 or .3).

Remark codes should be used to explain numerical values as needed, particularly with metals and organics results. See Table 4 for a list of remark codes. The remark code is entered as the character directly following the value. See the last four lines of Figure 6 and corresponding data in Table 3 for examples.

A separate entry should be made to specify collection and quality control techniques (SMK and UMK codes) for each duplicate, replicate, or special treatment. Organics should always be entered separately from other data results. The examples (Figure 6 and corresponding Table 3) show that conventional parameters were sampled with a submersible pump at the well on Sept. 24, 1987, after the well was purged with the submersible pump. A few minutes later, two duplicate samples were collected for volatile organics using a teflon bailer.

The time and SMK and UMK codes for the organics samples are different from those for the conventionals. Duplicates were collected using a teflon bailer which changes the SMK code and the time tells someone looking at the data the order in which samples were collected.

Table 4. Remark codes to use with STORET data.

Code	Definition
Blank	Values greater than the detection limit
J	Estimated value
K	Actual value is known to be less than the value shown
L	Actual value is known to be greater than the value shown
M	Presence of material verified but not quantified
N	Presumptive evidence of presence of material
U	Material specifically analyzed for but not detected
B	Analyte found in blank as well as in the sample
C	Pesticide parameters identified and confirmed by GC/MS
S	Value determined by Method of Standard Addition
R	Spike sample recovery not within control limits
*	Duplicate analysis not within control limits
+	Correlation coefficient for Method of Standard Addition less than 0.995

It is helpful to include water level information (P82546), pumping period (P72004), volume of water evacuated (P73675), method of evacuation (P84124), monitoring well sampling method (P84077), and data quality assessment (P84129) in addition to the concentration of the specific organics or other constituents, as well as SMK, UMK, and media information on shorter data entries.

PART III
OTHER GROUND WATER INFORMATION

PART III

OTHER GROUND WATER INFORMATION

Part III covers ground water data that is not covered in Parts I and II. Many types of data may be entered into various computer programs for Ground Water Management Programs. These data may include but not be limited to well inventories (a minimal amount of information for a very large number of wells), lithology, ground water models, water rights, water use, precipitation, runoff, and various types of maps and plots. As these data are not suitable for WATSTORE or STORET, Ecology needs the following where applicable:

Hard and digital copy of the data;
Manufacture, model, amount of memory, CPU, and modification (if any) to the computer;
What peripherals, if any, are required to run the program;
The name and source of the program used to process the data (including the version if applicable);

If digital data is on a floppy disk, include:

Disk operating system (DOS),
Number of tracks,
Number of sectors per track,
Density tracks per inch,
Hard or soft sectored,
Number of bytes per sector,
For sequential files the data separators,
For random access files the number of fields per record and field length,
Data file format, ASCII, binary, etc.

If digital data is on reel of tape include:

Number of tracks,
Density,
Is it labeled or unlabeled,
Record length
Track length,
For sequential files the data separators,
For random access files the number of fields per record and field length,
Data file format, ASCII, binary, etc.

In addition, Ecology requires a written description of what the software does and what is contained in the data set. Each site must have a unique site number which is consistent with the Site ID described in Part I, field number 2 (see Page C-2) or consistent with the Local Number (Part I, field number 3, Page C-3). In addition, the type of site (i.e. well, spring, etc.) must be identified and the source of the data stated.

For the case of computer generated maps Ecology requires the latitude and longitude of the reference or register points and the projection and scale of the source map used. The data files must be compatible with ARC/INFO. The software Auto LISP can be used to convert Auto CAD files (version 2.5 or more recent) into export files that Ecology will then convert to ARC/INFO.

PART IV
DESCRIPTION OF DATABASE FILES AND FILE STRUCTURE

PART IV

DESCRIPTIONS OF DATABASE FILES AND FILE STRUCTURE

DATABASE FILE NAME	FILE DESCRIPTION
xxxCASG.DBF	WELL CASING DATA (i.e. depth, diameter, interval, etc.)
xxxCONS.DBF	WELL CONSTRUCTION DATA (i.e. driller, seal information, date of construction, etc.)
xxxGEOP.DBF	BOREHOLE GEOPHYSICS DATA (i.e. type of log, depth, etc.)
xxxGWNA.DBF	GROUND WATER MANAGEMENT IDENTIFICATION DATA (i.e. identification number, assigner)
xxxHOLE.DBF	HOLE DIAMETER RECORD (i.e. depth and diameter of hole intervals)
xxxLIFT.DBF	LIFT RECORD (i.e. pump information)
xxxLOG1.DBF	WELL LOG DATA (i.e. descriptive soil logs)
xxxLOG2.DBF	WELL LOG DATA (i.e. descriptive soil logs)
xxxLOG3.DBF	WELL LOG DATA (i.e. descriptive soil logs)
xxxLOG4.DBF	WELL LOG DATA (i.e. descriptive soil logs)
xxxLOB5.DBF	WELL LOG DATA (i.e. descriptive soil logs)
xxxMPNT.DBF	MEASURING POING DATA (i.e. height of measuring point for water level measurements)
xxxNETW.DBF	WELL NETWORK DATA (i.e. identification of observed well network parameters)
xxxOPEN.DBF	WELL OPENINGS DATA (i.e. depth and diameter of openings, type of openings, etc.)
xxxOTDA.DBF	OTHER DATA AVAILABLE (i.e. types and location of other data)
xxxOWNR.DBF	WELL OWNER DATA (i.e. owner name, address, contact person, DSHS No., etc.)
xxxPROD.DBF	WELL PRODUCTION DATA (i.e. well discharge, drawdown, specific capacity, etc.)
xxxRGHT.DBF	WATER RIGHTS DATA (i.e. water rights number, withdrawal quanitiy, etc.)
xxxSITE.DBF	WELL SITE DATA (i.e. Location of site, altitude, site use, water use, etc.)
xxxWFLD.DBF	WELL FIELDS DATA (i.e. well field parameters, no. of wells, etc.)
xxxWLVL.DBF	WATER LEVEL DATA (i.e. water level depths, tim eand date of measurement, etc.)
xxxWQSF.DBF	WATER QUALITY SITE DATA (i.e. location of site, STORET station codes, etc.
xxxSDAF.DBF	WATER QUALITY QA/QC DATA (i.e. SMK and UMK codes, sample collection information, etc.
xxxWQI1.DBF	WATER QUALITY DATA (i.e. water quality results)
xxxWQI2.DBF	WATER QUALITY DATA (i.e. water quality results)
xxxWQI3.DBF	WATER QUALITY DATA (i.e. water quality results)
xxxWQI4.DBF	WATER QUALITY DATA (i.e. water quality results)
xxxWQI5.DBF	WATER QUALITY DATA (i.e. water quality results)

DATABASE FILE STRUCTURES

Structure for database: C:xxxcasg.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	CONST_ENTR	Character	3	
5	TOP_CASING	Numeric	8	2
6	BOT_CASING	Numeric	8	2
7	DIA_CASING	Numeric	5	2
8	CASING_MAT	Character	1	
9	THICK_CASE	Numeric	6	3
10	TRANS_DATE	Date	8	
** Total **			59	

Structure dor database: C:xxxcons.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	CONST_ENTR	Character	3	
4	RECORD_NO	Character	3	
5	DATE_CONST	Character	8	
6	DRILLER	Character	12	
7	SRCE_CONST	Character	1	
8	METH_CONST	Character	1	
9	FINISH	Character	1	
10	TYPE_SEAL	Character	1	
11	BOT_SEAL	Numeric	4	
12	METH_DEV	Character	1	
13	HRS_DEV	Character	3	
14	SPEC_TRT	Character	1	
15	TRANS_DATE	Date	8	
** Total **			64	

Structure for database: C:xxxgeop.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	TYPE_LOG	Character	1	
5	BEG_DEPTH	Numeric	8	2
6	END_DEPTH	Numeric	8	2
7	SOURCE	Character	1	

8	TRANS_DATE	Date	8	
** Total **			46	

Structure for database: C:xxxgwma.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	IDENT	Character	10	
5	ASSIGNER	Character	15	
6	TRANS_DATE	Date	8	
** Total **			53	

Structure for database: C:xxxhole.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	CONST_ENTR	Character	3	
5	TOP_HOLE	Numeric	8	2
6	BOT_HOLE	Numeric	8	2
7	DIA_HOLE	Numeric	8	2
8	TRANS_DATE	Date	8	
** Total **			55	

Structure for database: C:xxxlift.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
**** 3	CONS_ENTR	Character	3	
4	RECORD_NO	Character	3	
5	TYPE_LIFT	Character	1	
6	DATE	Character	8	
7	PUMP_INTAK	Numeric	5	
8	TYP_POWER	Character	1	
9	HORSEPOWER	Numeric	7	2
10	ADD_LIFT	Character	3	
11	RAT_CAP	Character	5	
12	TRANS_DATE	Date	8	
** Total **			61	

Structure for database: C:xxxlog1.dbf

Field	Field Name	Type	Width	Dec
1	SYSTEMID	Character	6	
2	SITEID	Character	15	
3	NOINTERVAL	Numeric	2	
4	DATE	Date	8	
5	INTERVAL1	Character	7	
6	DESCRPTN1	Character	35	
7	INTERVAL2	Character	7	
8	DESCRPTN2	Character	35	
9	INTERVAL3	Character	7	
10	DESCRPTN3	Character	35	
11	INTERVAL4	Character	7	
12	DESCRPTN4	Character	35	
13	INTERVAL5	Character	7	
14	DESCRPTN5	Character	35	
15	INTERVAL6	Character	7	
16	DESCRPTN6	Character	35	
17	INTERVAL7	Character	7	
18	DESCRPTN7	Character	35	
** Total **			326	

Structure for database: C:xxxlog2.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	INTERVAL8	Character	7	
3	DESCRPTN8	Character	35	
4	INTERVAL9	Character	7	
5	DESCRPTN9	Character	35	
6	INTRVAL10	Character	7	
7	DESCPTN10	Character	35	
8	INTRVAL11	Character	7	
9	DESCPTN11	Character	35	
10	INTRVAL12	Character	7	
11	DESCPTN12	Character	35	
12	INTRVAL13	Character	7	
13	DESCPTN13	Character	35	
14	INTRVAL14	Character	7	
15	DESCPTN14	Character	35	
** Total **			310	

Structure for database: C:xxxlog3.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	INTRVAL15	Character	7	
3	DESCPTN15	Character	35	
4	INTRVAL16	Character	7	
5	DESCPTN16	Character	35	
6	INTRVAL17	Character	7	
7	DESCPTN17	Character	35	
8	INTRVAL18	Character	7	
9	DESCPTN18	Character	35	
10	INTRVAL19	Character	7	
11	DESCPTN19	Character	35	
12	INTRVAL20	Character	7	
13	DESCPTN20	Character	35	
14	INTRVAL21	Character	7	
15	DESCPTN21	Character	35	
** Total **			310	

Structure for database: C:xxxlog4.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	INTRVAL22	Character	7	
3	DESCPTN22	Character	35	
4	INTRVAL23	Character	7	
5	DESCPTN23	Character	35	
6	INTRVAL24	Character	7	
7	DESCPTN24	Character	35	
8	INTRVAL25	Character	7	
9	DESCPTN25	Character	35	
10	INTRVAL26	Character	7	
11	DESCPTN26	Character	35	
12	INTRVAL27	Character	7	
13	DESCPTN27	Character	35	
14	INTRVAL28	Character	7	
15	DESCPTN28	Character	35	
16	INTRVAL29	Character	7	
17	DESCPTN29	Character	35	
18	INTRVAL30	Character	7	
19	DESCPTN30	Character	35	
20	INTRVAL31	Character	7	
21	DESCPTN31	Character	35	
22	INTRVAL32	Character	7	

23	DESCPTN32	Character	35
24	INTRVAL33	Character	7
25	DESCPTN33	Character	35
26	INTRVAL34	Character	7
27	DESCPTN34	Character	35
28	INTRVAL35	Character	7
29	DESCPTN35	Character	35
** Total **			604

Structure for database: C:xxxlog5.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	INTRVAL36	Character	7	
3	DESCPTN36	Character	35	
4	INTRVAL37	Character	7	
5	DESCPTN37	Character	35	
6	INTRVAL38	Character	7	
7	DESCPTN38	Character	35	
8	INTRVAL39	Character	7	
9	DESCPTN39	Character	35	
10	INTRVAL40	Character	7	
11	DESCPTN40	Character	35	
12	INTRVAL41	Character	7	
13	DESCPTN41	Character	35	
14	INTRVAL42	Character	7	
15	DESCPTN42	Character	35	
16	INTRVAL43	Character	7	
17	DESCPTN43	Character	35	
18	INTRVAL44	Character	7	
19	DESCPTN44	Character	35	
20	INTRVAL45	Character	7	
21	DESCPTN45	Character	35	
22	INTRVAL46	Character	7	
23	DESCPTN46	Character	35	
24	INTRVAL47	Character	7	
25	DESCPTN47	Character	35	
26	INTRVAL48	Character	7	
27	DESCPTN48	Character	35	
28	INTRVAL49	Character	7	
29	DESCPTN49	Character	35	
** Total **			604	

Structure for database: C:xxxmpnt.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	BEG_DATE	Character	8	
5	END_DATE	Character	8	

Field	Field Name	Type	Width	Dec
6	MP_HEIGHT	Numeric	6	2
7	MP_REMARKS	Character	50	
8	MP_REMARK2	Character	50	
9	TRANS_DATE	Date	8	
** Total **			150	

Structure for database: C:xxxnetw.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	NETWK_TYP	Character	2	
5	BEG_YR	Character	4	
6	END_YR	Character	4	
7	TYP_ANALYS	Character	1	
8	AGENCY	Character	5	
9	FREQ_COL	Character	1	
10	METH_COL	Character	1	
11	ANAL_AGNCY	Character	5	
12	NETWORK_ST	Character	1	
13	SECNETW_ST	Character	1	
14	TRANS_DATE	Date	8	
** Total **			53	

Structure for database: C:xxxopen.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	CONST_ENTR	Character	3	
5	TOP_SECT	Numeric	8	2
6	BOT_SECT	Numeric	8	2
7	DIA_OPENG	Numeric	5	2
8	TYP_MATL	Character	1	
9	TYP_OPNGS	Character	1	
10	LEN_OPENG	Numeric	6	2
11	WID_OPENG	Numeric	6	3
12	TOP_SCREEN	Numeric	8	2
13	BOT_SCREEN	Numeric	8	2
14	TRANS_DATE	Date	8	
** Total **			82	

Structure for database: C:xxxotda.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	CONST_ENTR	Character	3	
5	TYPE_DATA	Character	38	
6	LOC	Character	1	
7	FORMAT	Character	1	
8	TRANS_DATE	Date	8	
** Total **			71	

Structure for database: C:xxxownr.dbf

Field	Field Name	Type	Width	Dec
1	OWNER_ID	Character	6	
2	SITEID	Character	15	
3	SYSNAME	Character	35	
4	CLASS	Character	2	
5	STORE	Character	20	
6	ADDRESS	Character	30	
7	CITY	Character	20	
8	COUNTY	Character	12	
9	STATE	Character	2	
10	ZIP_CODE	Character	5	
11	PHONE_NO	Character	8	
12	CONTACT_NM	Character	20	
13	CONNECTS	Numeric	6	
14	POPULATION	Numeric	6	
15	DATE_CON	Date	8	
16	DATE_POP	Date	8	
17	CLS_RES	Numeric	3	
18	CLS_COM	Numeric	3	
19	CLS_IRR	Numeric	3	
20	CLS_IND	Numeric	3	
21	TRANS_CODE	Character	1	
22	RECORD_NO	Character	3	
23	DATE_OWN	Character	8	
24	OWNERNM	Character	42	
25	TRANS_DATE	Date	8	
** Total **			278	

Structure for database: C:xxxprod.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	RECORD_NO	Character	3	
3	ENTRY_NO	Character	3	
4	DATE	Character	8	
5	DISCHARGE	Numeric	10	2

6	SOURCE_DAT	Character	1	
7	METH_MEAS	Character	1	
8	PROD_LEVEL	Numeric	8	2
9	STAT_LEVEL	Numeric	8	2
10	SOURC_DATA	Character	1	
11	METH_MEAS2	Character	1	
12	PUMP_PER	Numeric	6	1
13	SPEC_CAP	Numeric	8	2
14	DRAWDOWN	Numeric	8	2
15	TRANSIVITY	Numeric	8	
16	STOR_COEFF	Numeric	9	7
17	TEST_TYPE	Character	1	
18	TRANS_DATE	Date	8	
** Total **			108	

Structure for database: C:xxxrght.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	WR_NO	Character	12	
3	TYP_USE	Character	3	
4	ANN_AFY	Numeric	6	
5	INST_GPM	Numeric	6	
6	SUPP_USE	Character	8	
7	SUPP_AFY	Numeric	6	
8	SUPP_GPM	Numeric	6	
9	WR_DATE	Date	8	
10	TRANS_DATE	Date	8	
** Total **			79	

Structure for database: C:xxxwfld.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	TRANS_CODE	Character	1	
3	RECORD_NO	Character	3	
4	NO_WELLS	Character	3	
5	DEPTH_DEEP	Numeric	3	
6	DEPTH_SHAL	Numeric	3	
7	METH_CONS	Character	1	
8	SIZE_WFLD	Numeric	7	
9	TRANS_DATE	Date	8	
** Total **			45	

Structure for database: C:xxxsite.dbf

Field	Field Name	Type	Width	Dec
1	TRANS_CODE	Character	1	
2	STRT_CARD	Character	6	
3	SITEID	Character	15	
4	RPTG_AGNCY	Character	5	
5	PROJ_NO	Character	6	
6	LOCAL_NO	Character	15	
7	LATITUDE	Numeric	7	
8	LONGITUDE	Numeric	7	
9	LATLONG_AC	Character	1	
10	LAMBERT_N	Numeric	10	
11	LAMBERT_E	Numeric	10	
12	OWNER_ID	Character	6	
13	STATE	Character	2	
14	COUNTY	Character	3	
15	LOC_MAP	Character	20	
16	SCALE	Numeric	7	
17	ALTITUDE	Numeric	8	2
18	METH_MEASR	Character	1	
19	ACCURACY	Character	3	
20	HYDRO_UNIT	Character	8	
21	STAT_TYPE	Character	1	
22	AGNCY_USE	Character	1	
23	REMARKS	Character	50	
24	DATE_EST	Character	8	
25	DATA_RELY	Character	1	
26	SITE_TYPE	Character	1	
27	DATE_CONST	Character	8	
28	USE_SITE	Character	1	
29	SEC_SUSE	Character	1	
30	TERT_SUSE	Character	1	
31	USE_WATER	Character	1	
32	SEC_WUSE	Character	1	
33	TERT_WUSE	Character	1	

34	AQUIF_TYPE	Character	1	
35	PRIM_AQUIF	Character	8	
36	DEPTH_WELL	Numeric	8	2
37	DEPTH_HOLE	Numeric	8	2
38	SRCE_DATA	Character	1	
39	WATER_LVL	Numeric	8	2
40	DATE_MEAS	Character	8	
41	METH_MEAS	Character	1	
42	SITE_STAT	Character	1	
43	SOURCE_COD	Character	1	
44	GEOLOG	Logical	1	
45	TRANS_DATE	Date	8	
** Total **			272	

Structure for database: C:xxxwqsf.dbf

Field	Field Name	Type	Width	Dec
1	STA_TYP1	Character	6	
2	STA_TYP2	Character	6	
3	STA_TYP3	Character	6	
4	STA_TYP4	Character	6	
5	STA_TYP5	Character	6	
6	STA_TYP6	Character	6	
7	STA_TYP7	Character	6	
8	SITEID	Character	15	
9	SS_CODE1	Character	8	
10	SS_CODE2	Character	11	
11	SS_CODE3	Character	10	
12	STATE	Character	2	
13	COUNTY	Character	3	
14	STA_STAT	Character	2	
15	LATITUDE	Character	7	
16	LONGITUDE	Character	8	
17	LATLONG_AC	Character	1	
18	UNITS	Character	1	
19	AQ_THICK	Numeric	3	
20	ALTITUDE	Numeric	5	
21	PRIM_AQUIF	Character	40	
22	MAJ_BASIN	Character	24	
23	MIN_BASIN	Character	40	
24	MAJ_B_CODE	Character	2	
25	MIN_B_CODE	Character	2	
26	SUB_B_CODE	Character	2	
27	LOCATION	Character	48	
28	CAT_NO	Character	8	
29	REACH_NO	Character	3	
30	ON_OFF	Character	3	
31	REACH_MI	Character	8	

32	REMARK1	Character	72
33	REMARK2	Character	72
34	REMARK3	Character	72
35	REMARK4	Character	72
36	REMARK5	Character	72
37	REMARK6	Character	72
38	REMARK7	Character	72
39	REMARK8	Character	72
40	REMARK9	Character	72
41	REMARK10	Character	72
42	REMARK11	Character	72
43	REMARK12	Character	72
44	REMARK13	Character	72
45	REMARK14	Character	72
46	REMARK15	Character	72
47	TRANS_DATE	Date	8
** Total **			1387

Structure for database: C:xxxsdaf.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	DATE_TIME	Character	10	
3	MEDIA	Character	6	
4	SMK_1	Character	1	
5	SMK_2	Character	1	
6	SMK_3	Character	1	
7	SMK_4	Character	1	
8	SMK_5	Character	2	
9	UMK_1	Character	2	
10	UMK_2	Character	3	
11	UMK_3	Character	1	
12	UMK_4	Character	2	
13	P72019	Character	10	
14	P82546	Character	10	
15	P72004	Character	10	
16	P73675	Character	10	
17	P84124	Character	10	
18	P84077	Character	10	
19	P84129	Character	10	
20	TRANS_DATE	Date	8	
** Total **			124	

Structure for database: C:xxxwqil.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	RECORD_NO	Character	3	
3	PARM_001	Character	10	
4	CONC_001	Character	10	
5	PARM_002	Character	10	
6	CONC_002	Character	10	
7	PARM_003	Character	10	
8	CONC_003	Character	10	
9	PARM_004	Character	10	
10	CONC_004	Character	10	
11	PARM_005	Character	10	
12	CONC_005	Character	10	
13	PARM_006	Character	10	
14	CONC_006	Character	10	
15	PARM_007	Character	10	
16	CONC_007	Character	10	
17	PARM_008	Character	10	
18	CONC_008	Character	10	
19	PARM_009	Character	10	
20	CONC_009	Character	10	
21	PARM_010	Character	10	
22	CONC_010	Character	10	
23	PARM_011	Character	10	
24	CONC_011	Character	10	
25	PARM_012	Character	10	
26	CONC_012	Character	10	
27	PARM_013	Character	10	

28	CONC_013	Character	10	
29	PARM_014	Character	10	
30	CONC_014	Character	10	
31	PARM_015	Character	10	
32	CONC_015	Character	10	
33	PARM_016	Character	10	
34	CONC_016	Character	10	
35	PARM_017	Character	10	
36	CONC_017	Character	10	
37	PARM_018	Character	10	
38	CONC_018	Character	10	
39	PARM_019	Character	10	
40	CONC_019	Character	10	
41	PARM_020	Character	10	
42	CONC_020	Character	10	
** Total **			419	

Structure for database: C:xxxwqi2.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	RECORD_NO	Character	3	
3	PARM_021	Character	10	
4	CONC_021	Character	10	
5	PARM_022	Character	10	
6	CONC_022	Character	10	
7	PARM_023	Character	10	
8	CONC_023	Character	10	
9	PARM_024	Character	10	
10	CONC_024	Character	10	
11	PARM_025	Character	10	
12	CONC_025	Character	10	
13	PARM_026	Character	10	
14	CONC_026	Character	10	
15	PARM_027	Character	10	
16	CONC_027	Character	10	
17	PARM_028	Character	10	
18	CONC_028	Character	10	
19	PARM_029	Character	10	
20	CONC_029	Character	10	
21	PARM_030	Character	10	
22	CONC_030	Character	10	
23	PARM_031	Character	10	
24	CONC_031	Character	10	
25	PARM_032	Character	10	

26	CONC_032	Character	10
27	PARM_033	Character	10
28	CONC_033	Character	10
29	PARM_034	Character	10
30	CONC_034	Character	10
31	PARM_035	Character	10
32	CONC_035	Character	10
33	PARM_036	Character	10
34	CONC_036	Character	10
35	PARM_037	Character	10
36	CONC_037	Character	10
37	PARM_038	Character	10
38	CONC_038	Character	10
39	PARM_039	Character	10
40	CONC_039	Character	10
41	PARM_040	Character	10
42	CONC_040	Character	10
** Total **			419

Structure for database: C:xxxwqi3.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	RECORD_NO	Character	3	
3	PARM_041	Character	10	
4	CONC_041	Character	10	
5	PARM_042	Character	10	
6	CONC_042	Character	10	
7	PARM_043	Character	10	
8	CONC_043	Character	10	
9	PARM_044	Character	10	
10	CONC_044	Character	10	
11	PARM_045	Character	10	
12	CONC_045	Character	10	
13	PARM_046	Character	10	
14	CONC_046	Character	10	
15	PARM_047	Character	10	
16	CONC_047	Character	10	
17	PARM_048	Character	10	
18	CONC_048	Character	10	
19	PARM_049	Character	10	
20	CONC_049	Character	10	
21	PARM_050	Character	10	
22	CONC_050	Character	10	
23	PARM_051	Character	10	

24	CONC_051	Character	10
25	PARM_052	Character	10
26	CONC_052	Character	10
27	PARM_053	Character	10
28	CONC_053	Character	10
29	PARM_054	Character	10
30	CONC_054	Character	10
31	PARM_055	Character	10
32	CONC_055	Character	10
33	PARM_056	Character	10
34	CONC_056	Character	10
35	PARM_057	Character	10
36	CONC_057	Character	10
37	PARM_058	Character	10
38	CONC_058	Character	10
39	PARM_059	Character	10
40	CONC_059	Character	10
41	PARM_060	Character	10
42	CONC_060	Character	10
** Total **			419

Structure for database: C:xxxwqi4.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	RECORD_NO	Character	3	
3	PARM_061	Character	10	
4	CONC_061	Character	10	
5	PARM_062	Character	10	
6	CONC_062	Character	10	
7	PARM_063	Character	10	
8	CONC_063	Character	10	
9	PARM_064	Character	10	
10	CONC_064	Character	10	
11	PARM_065	Character	10	
12	CONC_065	Character	10	
13	PARM_066	Character	10	
14	CONC_066	Character	10	
15	PARM_067	Character	10	
16	CONC_067	Character	10	
17	PARM_068	Character	10	
18	CONC_068	Character	10	
19	PARM_069	Character	10	
20	CONC_069	Character	10	
21	PARM_070	Character	10	

22	CONC_070	Character	10
23	PARM_071	Character	10
24	CONC_071	Character	10
25	PARM_072	Character	10
26	CONC_072	Character	10
27	PARM_073	Character	10
28	CONC_073	Character	10
29	PARM_074	Character	10
30	CONC_074	Character	10
31	PARM_075	Character	10
32	CONC_075	Character	10
33	PARM_076	Character	10
34	CONC_076	Character	10
35	PARM_077	Character	10
36	CONC_077	Character	10
37	PARM_078	Character	10
38	CONC_078	Character	10
39	PARM_079	Character	10
40	CONC_079	Character	10
41	PARM_080	Character	10
42	CONC_080	Character	10
** Total **			419

Structure for database: C:xxxwqi5.dbf

Field	Field Name	Type	Width	Dec
1	SITEID	Character	15	
2	RECORD_NO	Character	3	
3	PARM_081	Character	10	
4	CONC_081	Character	10	
5	PARM_082	Character	10	
6	CONC_082	Character	10	
7	PARM_083	Character	10	
8	CONC_083	Character	10	
9	PARM_084	Character	10	
10	CONC_084	Character	10	
11	PARM_085	Character	10	
12	CONC_085	Character	10	
13	PARM_086	Character	10	
14	CONC_086	Character	10	
15	PARM_087	Character	10	
16	CONC_087	Character	10	
17	PARM_088	Character	10	
18	CONC_088	Character	10	
19	PARM_089	Character	10	

20	CONC_089	Character	10
21	PARM_090	Character	10
22	CONC_090	Character	10
23	PARM_091	Character	10
24	CONC_091	Character	10
25	PARM_092	Character	10
26	CONC_092	Character	10
27	PARM_093	Character	10
28	CONC_093	Character	10
29	PARM_094	Character	10
30	CONC_094	Character	10
31	PARM_095	Character	10
32	CONC_095	Character	10
33	PARM_096	Character	10
34	CONC_096	Character	10
35	PARM_097	Character	10
36	CONC_097	Character	10
37	PARM_098	Character	10
38	CONC_098	Character	10
39	PARM_099	Character	10
40	CONC_099	Character	10
41	PARM_100	Character	10
42	CONC_100	Character	10
** Total **			419

APPENDIX A. Instructions for entering STORET Station Type Codes.

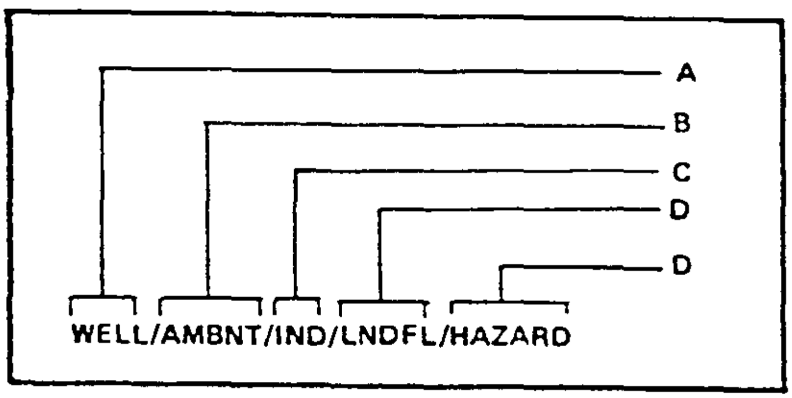
4.3.5 Station Type Codes

Station type codes are those station header data elements that describe the type and purpose of the monitoring station. STORET currently has several categories of station type codes. In STORET terminology, each category is called a level. Different levels are required depending on the type of data entered (Ground-Water, Surface-Water POTW, sediment, or biological).

Existing and planned station type codes of particular importance to Ground-Water/STORET users are highlighted in Exhibit 4-1. Many of the station type codes that are recommended for the station headers of ground-water monitoring wells are not of the "required" type for STORET. However, in order to completely distinguish ground-water monitoring stations from others in STORET, they should be used.

Users are required to specify one level-one and one level-two code for each station entered into STORET. The station codes in levels three through five are optional and may be used in any combination to further describe the sampling site. For example, with ground-water data, level-four codes are not pertinent. However, using two level-five codes may make station identification easier.

Users must string together station type codes relevant to their station. For example, a station monitoring a hazardous waste landfill located in an industrial facility might have a station type code of:



Key

A Level 1 Code

B Level 2 Code

C Level 3 Code

D Level 5 Code

EXHIBIT 4-1

Recommended STORET station-type codes for ground water monitoring stations

Category	Code	Definition
1 - Station Location; one required.		
	WELL	Station samples from a well.
	SPRING	Station samples from a spring. A natural flow of ground water fro the earth, which feeds into a stream or body of water on the surface.
	PIPE	Station samples at or within a man-made facility. Includes water supply, waste-water treatment and industrial facilities.
2 - Monitoring Class; one required.		
	AMBNT	Monitoring ambient conditions of the environment. Includes facility intakes pulling directly from an ambient source (EX-STREAM/AMBNT/MUN/INTAKE).
	NONAMB	Monitoring at or within a man-made facility. Compliance monitoring falls into this category. Includes sites where facility discharge has directly influenced or impacted the environment (Ex-PIPE/NONAMB/IND/OUTFL/NTRTMT). Only valid for station locations "PIPE" or "WELL". NONAMB is assumed for "PIPE" sites.
3 - Operation; required for "PIPE", otherwise optional.		
	MUN	Public drinking water intake sites or wastewater treatment facilities. Public facilities munici-pal/state/federal).
	IND	Industrial private facility.
	CMBMI	Combined "MUN" and IND".

EXHIBIT 4-1 - continued

Category	Code	Definition
3 - Operation; required for "PIPE", otherwise optional - continued.		
	AGRI	Agricultural site. Includes raw crops, feedlots, grazing, and silviculture (forestry).
	MINE	Mine or site of mining activities.
	COMNTY	Community (unincorporated). Includes water supplies and septic systems.
	DEVLMT	Development site. Includes construction.
	DOMEST	Domestic (residential) grey water discharge facility. Includes water supplies and on-lot septic systems.
	ABANDN	The site from which samples are gathered is abandoned.
	DISPOS	Waste disposal site (solid/liquid).
4 - Treatment Status; required for "PIPE", otherwise optional.		
	NTRTNT	No pollution abatement has been performed.
	PTRTMT	Some, but not all, of the intended pollution abatement has been performed. Pretreatment.
	TREATED	All of the intended pollution abatement has been performed.
	CMBTRT	Combined treatment, where treatment status does not clearly fall into. Includes unknown treatment status.
5 - Source Type; required for "PIPE", otherwise optional.		
	INTAKE	Intake or influent.
	OUTFL	Outfall, discharge or effluent.
	CMBSRC	Combined source ("INTAKE and "OUTFL").

EXHIBIT 4-1 - continued

Category	Code	Definition
6 - Waste Source; one or more optional.		
	IMPDMT	Impoundment. Includes waste pits, treatment lagoons, and settling and evaporation ponds.
	LNDFL	Landfill.
	INJECT	Site where liquid waste has been injected underground as a means of disposal.
	SEPTIC	Septic system.
	LNDTRT	Land treatment area.
	NONPNT	Nonpoint source pollution. Includes eutrophication, acidification, thermal change, organic nutrients, sedimentation, and hydromodification.
7 - Miscellaneous Descriptors; optional.		
	SPRAY	Site where water has been sprayed on the surface of the land for purposes of irrigation.
	SBSOIL	Subsoil - a drain tile system or other points just below the surface of the land.
	HRZTL	Horizontal well.
	TUNNEL	Tunnel - an underground corridor.
	GALERY	Gallery - an artificial, underground structure implanted to collect ground water.
	RUNOFF	Stormwater runoff.
	STMSWR	Stormwater sewer.
	SANSWR	Sanitary sewer.
	CMBSWR	Combined stormwater and sanitary sewer. "STMSWR" and "SANSWR".

EXHIBIT 4-1 - continued

Category	Code	Definition
7 - Miscellaneous Descriptors; optional - continued.		
	SUPPLY	Water supply storage or treatment facility.
	NET	Fixed site network station.
	MONITR	Source monitoring site, which monitors a known problem or detects a specific problem.
	HAZARD	Site of hazardous or toxic waste or substances.
	BACK	Monitoring for background (baseline) water quality. Opposite of "DOWN".
	DOWN	Down (i.e., within a potentially polluted area) from a facility which has a potential to pollute. See also "DOWNGR" and "UPGR".
	MET	Site where sampling is performed to describe scientific phenomena related to the meteorological conditions, such as temperature, solar radiation, winds, and the quantity and quality of atmospheric deposition.
	UPGR	Upgradient of a well or spring. Only valid for use with "WELL" or "SPRING" (ground water sites).
	DOWNGR	Downgradient of a well or spring. Only valid for use with "WELL" or "SPRING" (ground water sites).
	RCRA	RCRA monitoring site.
	CERCLA	Cercla ("Superfund") monitoring site.

The complete list of valid STORET station type codes may be retrieved in the on-line data set called "STORET.HELP. STATION.TYPE".

4.3.6 Station Depth

The station depth field in the STORET station header is used for surface-water stations, to store the total depth (i.e., from surface to bottom) of the point where the sample was taken. Ground-Water/STORET users may score the aquifer thickness, at the point where the well is located, in the station depth field.

4.3.7 Hydrologic Unit Code

The hydrologic unit code of the STORET station header is an eight-digit code representing the USGS hydrologic unit in which the station is located. The components of the codes represent hydrologic region, sub-region, accounting unit, and cataloging unit. This coding scheme represents different basin designations than the major/minor/sub-basin required by STORET. Codes can be found on US Hydrologic Unit Map-1974, State of Washington, which may be obtained from USGS Purchasing (Spokane), phone (509) 456-2524.

APPENDIX B. Instructions for entering STORET SMK and UMK Codes.

4.5.4.1.1 Media Key

The media key identifies the medium in which sampling was done (e.g., water, sediment, etc.). For ground-water, there are currently two media keys: "GRWTR" and "RCRAGW." "GRWTR" is to be used by all programs except RCRA. The RCRA Program has designated its own media key "RCRAGW" which is to be used for inputting RCRA ground-water monitoring data. Any program that wishes its own media key can develop it own code. This option is currently being investigated at the Agency.

4.5.4.1.2 System Multipurpose Key (SMK)

When doing ground-water monitoring, it is common to extract more than one sample per monitoring station. There are several ways to obtain multiple samples, and for quality assurance purposes, it will be beneficial for STORET/Ground-Water users to be able to distinguish the manner in which multiple samples were obtained. The system multipurpose key enables users to make this distinction. A brief review of sampling is included here which will help explain the coding used with the system multipurpose key.

There are three common methods for obtaining multiple samples from ground-water monitoring stations.

- Several samples may be taken from the same sample point and placed into separate sample bottles. For the purpose of this manual, each individual sample of the total set will carry its own unique number.

- One sample may be taken from the sample point, immediately divided in the field, and placed into different sample bottles. Each portion of the original sample now residing in separate sample bottles will be called a "Field replicate" in this manual.

- One sample may be taken from a well and not divided into separate sample bottles until it arrives at the laboratory. Each portion of the original sample now residing in sample bottles will be called a "laboratory replicate" in this manual.

It should be understood that when multiple samples are indicated on a data sheet, it may mean that any one of the above methods was used to obtain the multiple sample or that a combination of the above methods was used to obtain the multiple sample. The SMK code will enable a STORET/Ground-Water user to determine whether the ground-water data is a multiple sample, what method(s) was(were) used to obtain the multiple sample, how many multiple samples were taken, and which one of the multiple samples the data examined came from.

This information is obtained via the six-digit SMK code. Each of the first four digit positions of the code signifies a specific piece of information. At this time, the last two digits of the code will appear as zeros because no specific pieces of sampling information have yet been defined for these positions. One SMK will be entered fore each sampling event (each set of multiple samples will be considered a sampling event).

The information conveyed in the first four digit positions of the SMK is summarized in the following:

Digit Position	Component Definition
1	Identifies whether the sample is an individual sample or one of a multiple sample set. For example, the sample in question could be: one of a set of samples taken from a station (well) and nor further divided; one of a set of multiple samples divided in the field; one of a set of multiple samples divided in the laboratory; or a combination of the above. The actual number placed in the first digit position will be a value ranging from 0-7. The meaning attached to the first digit position number can be determined from the table on page 4-29.
2	Identifies which sample in the set of multiple samples the data received comes from. For example, if a sampling event from a single sample point has resulted in four undivided samples, the data values reported for the first sample would have an SMK code with "1" in the second digit position; the data values reported for the second sample would have an SMK with "2" in the second digit position, etc.
3	Identifies which one of the field replicates the data received comes from. For example, if one sample was collected at the sample point and divided in to several sample bottles for analysis in the field, the data values reported for the first "field replicate" would have a "1" in the third digit position of the SMK code; the second field replicate would have "2" in the third digit position of the SMK code, etc.
4	Identifies which of the lab replicates the data received comes from. For example, if one sample was collected at the sample point and divided into several sample bottles for analysis in the lab, the

data values reported for the first "lab replicate" would have a "1" in the fourth digit position of the SMK code; the second "lab replicate" would have a "2" in the fourth digit position of the SMK code, etc.

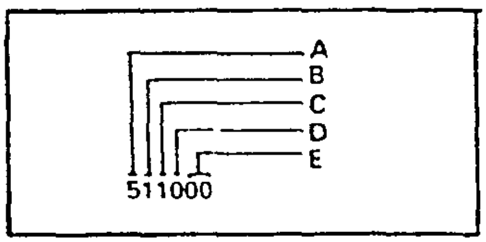
The following table will enable the user to determine the significance of the value appearing in the first digit position of the SMK.

Sample Media Key "SMK" Notation for Ground-Water/STORET User

First Digit Code	Multiple Sample	Field Replicate	Lab Replicate
0	No	No	No
1	No	No	Yes
2	No	Yes	No
3	Yes	No	No
4	No	Yes	Yes
5	Yes	Yes	No
6	Yes	No	Yes
7	Yes	Yes	Yes

For example, should the first value of an SMK code be 3, the user knows that several separate samples were taken at the sample point. None of these were further divided in either the field or the lab. If the first value of the SMK code were a 5, the user would know that several samples were taken at the station and further, that one or all of the samples were subsequently divided in the field so that the data retrieved is from a field replicate. Finally, should the first value of the SMK code be a 1, the user would know that only one sample was obtained from the sample point, but this was divided into several portions in the lab and the data retrieved is from one of the lab replicates.

The example of an SMK code illustrated below indicates that the data observed is one sample from a set of samples, that this particular sample was the first in the lot, the sample was divided in the field, and that this is the first of the field replicates. There was no division in the lab.



Key

A 5 indicates that this one set of multiple samples which was subsequently divided into field replicates

B 1 indicates that this is the first replicate of the set of samples for this particular station

C 1 indicates that this is the first field replicate

D 0 indicates that the original samples were not divided in the lab.

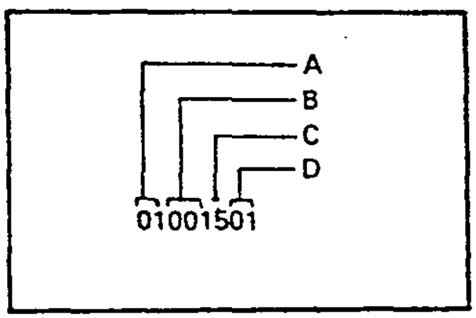
E These fields are currently undefined

4.5.4.1.3 Users Multipurpose Key (UMK)

The UMK is an eight-digit number which will be used to describe the method in which a ground-water sample was collected and analyzed. There will be one "UMK" per sampling event (each multiple sample may be considered a sampling event). There are four components of a UMK code, defined below.

Digit	Component Definition
1-2	Coded value for sampler type (see Appendix E)
3-5	Identifies up to three different materials making up the sampling equipment; one digit each (see Appendix E)
6	Flag for indicating whether the reported values were determined in the lab or the field (see Appendix E)
7-8	Coded value to identify analytical method used to determine reported values (see Appendix E)

A sample UMK is illustrated below:



Key

A Sampler type; 01 = Bottom Valve Bailer

B Sampling equipment material; 001 = stainless steel

C Lab or field determination flag; 5 = contract, field

D Analytical method used to determine reported values; 01 = Gas chromatography/mass spectrometry (GC/MS)

APPENDIX C. Instructions for entering STORET Data Quality Assessment information.

Remark codes may be entered with each data point. They need not always be used. Complete instruction on how to store data with remark codes may be found in Chapter WQ-DE of the <u>STORET Users' Handbook</u> (February 1982).

It should be noted that some data (Superfund especially) may have remark codes identical to STORET's but with different definitions. These are usually indicated on the lab data forms. For example, remark code "B" in STORET refers to bacterial counts out of range, while Superfund uses "B" to indicate a compound found in a travel or lab blank sample. Another example is that Region IX's office policy is to substitute "U" for "B" if data value is below the detection level. If the value is above detection level, no data is entered at all. These inconsistencies are mentioned to ensure that users "pre-edit" suspect data so that they maintain consistency with STORET remark codes.

4.7 Quality Assurance/Quality Control

Information of QA/QC for ground-water monitoring such as well construction, sampling methods, and laboratory analysis techniques is extremely important because of the numerous factors which may affect the accuracy of the parameter values input into STORET. For example, knowledge of the well construction may help the user determine the reliability of the data, and knowing the sampling method used might help the users determine the possibility of sample aeration and a subsequent volatilization of organics. Accessibility to this type of information will assist users in determining the usefulness of STORET data for their particular needs.

A parameter QA/QC code named Data Quality (84129) has been added to STORET. As with all parameter codes in STORET, four characters of coded values are available for use with the Data Quality parameter code. The presence of this code will enable users to store fairly detailed QA/QC information for each sample.

QA/QC is a complex element of a data management system and involves many activities in well location, construction, sampling, and laboratory analysis. A decision on how all or some of these activities should be included in the data base has not been made at this time. However, because of the importance of this issue, a preliminary approach has been added to STORET by the Office of Solid Waste. The approach will provide a mechanism for starting to address this topic. This approach is expected to be refined by EPA over the next year.

The four-digit code contains the following for the specified digit positions:

- o The first-position (left) character will contain a one-digit code for the evaluation of well construction. The values in the first digit position will range from 0-2 or be blank. The meaning of each of the possible values is summarized below:

  2 -- Well has been EPA/State inspected in the last five years and determined to be of high quality.

  1 -- Well has been properly drilled, constructed of inert materials, properly developed, properly located, and has controls to prevent tampering. Well constructed in accordance to guidance produced by EPA/State.

  0 -- Well is known to be inadequate in some manner.

  Blank -- Well information unknown or not stored.

- o The second-position character will contain a one-digit code for the evaluation of sampling QA/QC. The values of digits in the second position can range from 0-3 or be blank. The meaning for each value is given below:

  3 -- EPA/State has performed a QA/QC evaluation within the last two years, with a positive result.

  2 -- A detailed QA/QC plan with standard procedures and internal checks exists; the objectives of the plan have been verified as being met for at least one year (e.g., RCRA guidance for waste analysis, September 1984).

  1 -- A detailed QA/QC plan with standard procedures and internal checks exists (e.g., RCRA guidance for waste analysis, September 1984).

  0 -- No detailed QA/QC plan exists.

  Blank -- Information unknown or not stored.

- o The third-position character will contain a one-digit code for the evaluation of laboratory QA/QC and will have values ranging from 0-3 or be blank. The meaning for these values is identical to the second-position character described above.

- The fourth-position character will contain a one-digit code for the evaluation of overall QA/QC during the entire sequence of the sampling event. The fourth-position character can have values ranging from 0-3 or be blank. The meaning for these values is identical to the second-position character described above.

Appendix D

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sample purpose descriptors			
84053	Sample type and frequency	WQM	Water quality, monthly
		WQQ	Water quality, quarterly
		WQS	Water quality, semi-annually
		WQA	Water quality, annually
		WLC	Water level, continuous
		WLM	Water level, monthly
		WLQ	Water level, quarterly
		WLS	Water level, semi-annually
		WLA	Water level, annually
84067	Nature of monitoring	SELF	Facility collected and analyzed sample
		COMP	Regulating agency collected and analyzed sample for compliance monitoring

Appendix D (continued, p.2)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sample purpose descriptors (continued)			
84121	Regulating agency	STATE	State is regulating facility
		FEDL	Federal agency is regulating facility
		OTHER	Other agency is regulating facility
84122	Sample purpose	BKGRD	Sampled to determine background levels
		GWQAL	Sampled to determine ground-water quality
		DWQAL	Sampled to determine ground-water suitability as drinking water source
		CNTMN	Sampled to determine ground-water contamination
		ASMNT	Sampled as part of facility's assessment plan
		PRMIT	Sampled as part of facility's permit requirements
Sampling condition descriptors			
73674	Production level	-----	Water level, in feet below LSD, while well was discharging
72000	Elevation of land surface datum	-----	Elevation of land surface, in feet above mean sea level

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling condition descriptors (continued)			
71993	Elevation of ground water	-----	Elevation of top of water table at sampling point, in feet above mean sea level
72019	Depth to water level	-----	Depth, in feet, from land surface to top of water table at sampling point
82545	Water level relative to mean sea level	-----	Difference between top of water table and mean sea level at sampling point
82514	Measuring point elevation	-----	Elevation of measuring point, in feet above mean sea level
82546	Depth from level to measuring point	-----	Depth, in feet, from land surface to measuring point, in feet
Sampling/Analytical Methods Descriptors			
73675	Volume of water evacuated from well prior to sample collection	-----	In gallons

Appendix D (continued, p.4)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling/analytical methods descriptors (continued)***			
84119	Source of evacuation data	EPA	EPA
		OWNOP	Owner/operator
		CL	Contract labs
		ESDL	ESD labs
		STATE	State
		OTHER	Other
84124	Method of evacuation	APUM	Air lift pump
		BAIL	Bailed
		COMPA	Compressed air
		JETD	Jetted
		PERP	Peristaltic pump
		CENP	Centrifugal pump
		PITP	Pitcher pump
		SMPL	Sampler
		BUCKT	Bucket
		RTPMP	Rotary pump
		SBPMP	Submersible pump
		TRPMP	Turbine pump
		PSPMP	Piston pump
		BOTVB	Bottom valve bailer
		SRNGB	Syringe bailer
		DULVB	Dual valve bailer
		BLDRP	Bladder pump

Appendix D (continued, p.5)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling/analytical methods descriptors (continued)			
84124	Method of evacuation (continued)	NLFTP	Nitrogen lift pump
		COMPN	Compressed nitrogen
		UNKN	Unknown
		OTHER	Other
84125	Method of Water-Level Measurement	ARLMS	Airline measurement
		ANGRP	Analog or graphic recorded
		CARLM	Calibrated airline measurement
		EST	Estimated
		PRSG	Pressure-gage measurement
		CPRSG	Calibrated pressure gage
		GPHYS	Interpreted from geophysical logs
		MNMTR	Manometer
		NRECG	Non-recording gage
		UNKN	Reported, method unknown
		STLTP	Steel tape
		ECTP	Electric tape
		CHLIN	Chalk line
		SOUND	Sounder
		CELTP	Calibrated electric tape
		OTHER	Other
		UNKN	Unknown

Appendix D (continued, p.6)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling/analytical methods descriptors (continued)			
84126	Source of depth data	DRLLG	Driller's log or report
		GLGST	Private geologist/consultant
		GPHYS	Depth interpreted from geophysical logs by some source agency
		MEMRY	Memory
		OWNOP	Reported by well owner/operator
		OTHER	Reported by other
		RAGNC	Measured by reporting agency
		EPA	EPA
		STATE	State
		CL	Contract labs
		ESDLB	ESD labs
84127	Method of depth measurement	STLTP	Steel tape
		EST	Estimated
		CHLIN	Chalk line
		SOUND	Sounder
		GPHYS	Interpreted from geophysical logs
		UNKN	Unknown
		OTHER	Other

Appendix D (continued, p.7)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling/analytical methods descriptors (continued)			
84128	Source of water level data	DRLLG	Driller's log or report
		GLGST	Private geologist/consultant
		GPHYS	Depth interpreted from geophysical logs by some source agency
		MEMRY	Memory
		OWNOP	Reported by well owner/operator
		OTHER	Reported by other
		RAGNC	Measured by reporting agency
		EPA	EPA
		STATE	State
		CL	Contract labs
		ESDLB	ESD labs
84077	Monitoring well sampling method	APUM	Air lift pump
		BAIL	Bailed
		COMPA	Compressed air
		JETD	Jetted
		PERP	Peristaltic pump
		CENP	Centrifugal pump
		PITP	Pitcher pump

Appendix D (continued, p.8)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling/analytical methods descriptors (continued)			
84077	Monitoring well sampling method (continued)	SMPL	Sampler
		BUCKT	Bucket
		RTPMP	Rotary pump
		SBPMP	Submersible pump
		TBPMP	Turbine pump
		PSPMP	Piston pump
		BOTVB	Bottom valve bailer
		SRNGB	Syringe bailer
		DULVB	Dual valve bailer
		BLDRP	Bladder pump
		NLFTP	Nitrogen lift pump
		COMPN	Compressed nitrogen
		UNKN	Unknown
		OTHER	Other
00008	Lab identification number	-----	Coded identification number for laboratory where sample was analyzed
72004	Pumping period	-----	Pumping or flow period prior to sampling, in minutes

Appendix D (continued, p.9)

Sample Descriptor Parameter Codes, Values, and Definition

Parameter Code	Name	Values	Value Definitions
Sampling/analytical methods descriptors (continued)*			
84062	Sampling point description	LNDSR	Land surface
		TPCAS	Top of casing
		PMPBS	Pump base
		RECRD	Continuous recorded
84129	Data quality assessment		(See Section 4.7 of this manual for code identification)

APPENDIX E

User Multipurpose Key (UMK)
Sampler-Type Values for Digits 1 and 2 of the UMK

Codes for Digits 1 and 2	Definition
00	Entry not needed/not applicable
01	Bottom valve bailer
02	Syringe bailer
03	Dual valve bailer
04	Rotary pump
05	Centrifugal pump
06	Peristaltic pump
07	Bladder pump
08	Turbine pump
09	Piston pump
10	Air lift pump
11	Nitrogen lift pump
12	Compressed air
13	Compressed nitrogen
14	Unknown
15	Other

APPENDIX E (continued, p.2)

User Multipurpose Key ("UMK")

Sampler Material Codes for Digits 3,4, and 5 of the UMK

- One code per digit, up to three may be stored per sample

Code for Digit 3 and/or 4 and/or 5	Definition
0	Not applicable
1	Stainless steel
2	Polyvinyl chloride (PVC)
3	Teflon
4	Polyalkene (polyethylene, polypropylene, etc)
5	Nylon
6	Rubber
7	Other

APPENDIX E (continued, p.3)

User Multipurpose Key ("UMK")

Lab or Field Determination Flag as Sixth Digit of the UMK

Code	Definition
0	Not applicable
1	EPA Lab (in-house and contractors)
2	EPA Field (in-house and contractors)
3	Owner/operator, field
4	Owner/operator, lab
5	Contract, field
6	Contract, lab
7	Unknown
8	Other

APPENDIX E (continued, p.4)

User Multipurpose Key ("UMK")

Analytical Method Codes for the 7-8 Digits of the UMK

Code for 7th and 8th digits	Definition
00	Not applicable
01	Gas chromatography/mass spectrometry (GC/MS)
02	Gas chromatography/flame ionization detector (GC/FID)
03	Gas chromatography/electron capture detector (GC/ECD)
04	Gas chromatography/thermal conductivity detector (GC/TD)
05	Gas chromatography/other
06	Liquid chromatography
07	Other chromatography
08	Atomic absorption spectrophotometry, flame (AA/flame)
09	Atomic absorption spectrophotometry, furnace (AA/furnace)
10	Atomic absorption spectrophotometry, other
11	Inductively coupled plasma (ICP)
12	Specific ion electrode (includes pH)
13	Resistivity or conductivity
14	Other electrochemical
15	Colorimetric
16	Infra-red spectrometry (IR)
17	Other spectrophotometric
18	Titration
19	Unknown
20	Other

APPENDIX F

STORET Parameter Codes for Some Classic Ground-Water Monitoring Parameters

Substance	STORET PARAMETER CODES					
	Total or Whole Water Sample	Units	Dissolved Fraction of Water	Units	Suspended Fraction of Water	Units
Drinking Water Suitability Parameters-						
Arsenic	01002	ug/l	01000	ug/l	01001	ug/l
Barium	01007	ug/l	01005	ug/l	01006	ug/l
Cadmium	01027	ug/l	01025	ug/l	01026	ug/l
Chromium	01034	ug/l	01030	ug/l	01031	ug/l
Fluoride	00951	mg/l	00950	mg/l	82299	mg/l
Lead	01051	ug/l	01049	ug/l	01050	ug/l
Mercury	71900	ug/l	71890	ug/l	71895	ug/l
Nitrate (as N)	00620	mg/l	n/a		n/a	
Selenium	01147	ug/l	01145	ug/l	01146	ug/l
Silver	01077	ug/l	01075	ug/l	01076	ug/l
Endrin	39390	ug/l	39391	ug/l	39392	ug/l
Lindane	39782	ug/l	38341	ug/l	n/a	
Methoxychlor	39480	ug/l	38478	ug/l	39479	ug/l
Toxaphene	39400	ug/l	39401	ug/l	n/a	
2,4-D	39730	ug/l	n/a		39733	ug/l
2,4,5-TP Silvex	39045	ug/l	n/a		n/a	
Radium (226 & 228)	11503	pCi/l	n/a		n/a	
. Radium (226)	09501	pCi/l	09503	pCi/l	09505	pCi/l
. Radium (228)	11501	pCi/l	81366	pCi/l	81368	pCi/l
Gross Alpha	01501	pCi/l	01503	pCi/l	01505	pCi/l
Gross Beta	03501	pCi/l	p3503	pCi/l	03505	pCi/l

APPENDIX F (continued)

STORET Parameter Codes for Some Classic Ground-Water Monitoring Parameters

Substance	STORET PARAMETER CODES					
	Total or Whole Water Sample	Units	Dissolved Fraction of Water	Units	Suspended Fraction of Water	Units
Drinking Water Suitability Parameters (continued)						
Turbidity	00076	hach ftu	n/a		n/a	
Coliform Bacteria (Mem Fil)	31501	c/100ml	n/a		n/a	
Coliform Bacteria (Ferm Tube)	31505	mpn/100ml	n/a		n/a	
Ground-Water Quality Parameters						
Chloride	00940	mg/l	82295	ug/l	n/a	
Iron	01045	ug/l	01046	ug/l	01044	ug/l
Phenols	32730	ug/l	32732	ug/l	32733	ug/l
Sodium	00929	mg/l	00930	mg/l	00928	mg/l
Sulfate	00945	mg/l	00946	mg/l	n/a	
Ground-Water Contamination Indicator Parameters						
pH	00400	s.u.	n/a		n/a	
Specific conductance	00095	umhos/cm	n/a		n/a	
Total Organic Carbon	00680	mg/l	00681	mg/l	00689	mg/l
Total Organic Halogen						
. Purgeable organic halogen DX20	70354	ug/l	n/a		n/a	
. Total organic halogen DX20	70353	ug/l	n/a		n/a	
. Total organic halogen	81375	ug/l	n/a		n/a	
. Total organic halogen	78115	ug/l	n/a		n/a	

APPENDIX F (continued)

STORET Parameter Codes for Some Classic Ground-Water Monitoring Parameters

Substance	STORET PARAMETER CODES					
	Total or Whole Water Sample	Units	Dissolved Fraction of Water	Units	Suspended Fraction of Water	Units
Drinking Water Suitability Parameters (continued)						
Turbidity	00076	hach ftu	n/a		n/a	
Coliform Bacteria (Mem Fil)	31501	c/100ml	n/a		n/a	
Coliform Bacteria (Ferm Tube)	31505	mpn/100ml	n/a		n/a	
Ground-Water Quality Parameters						
Chloride	00940	mg/l	82295	ug/l	n/a	
Iron	01045	ug/l	01046	ug/l	01044	ug/l
Phenols	32730	ug/l	32732	ug/l	32733	ug/l
Sodium	00929	mg/l	00930	mg/l	00928	mg/l
Sulfate	00945	mg/l	00946	mg/l	n/a	
Ground-Water Contamination Indicator Parameters						
pH	00400	s.u.	n/a		n/a	
Specific conductance	00095	umhos/cm	n/a		n/a	
Total Organic Carbon	00680	mg/l	00681	mg/l	00689	mg/l
Total Organic Halogen						
. Purgeable organic halogen DX20	70354	ug/l	n/a		n/a	
. Total organic halogen DX20	70353	ug/l	n/a		n/a	
. Total organic halogen	81375	ug/l	n/a		n/a	
. Total organic halogen	78115	ug/l	n/a		n/a	

APPENDIX F

STORET Parameter Codes for Some Classic Ground-Water Monitoring Parameters

Substance	STORET PARAMETER CODES					
	Total or Whole Water Sample	Units	Dissolved Fraction of Water	Units	Suspended Fraction of Water	Units
Drinking Water Suitability Parameters-						
Arsenic	01002	ug/l	01000	ug/l	01001	ug/l
Barium	01007	ug/l	01005	ug/l	01006	ug/l
Cadmium	01027	ug/l	01025	ug/l	01026	ug/l
Chromium	01034	ug/l	01030	ug/l	01031	ug/l
Fluoride	00951	mg/l	00950	mg/l	82299	mg/l
Lead	01051	ug/l	01049	ug/l	01050	ug/l
Mercury	71900	ug/l	71890	ug/l	71895	ug/l
Nitrate (as N)	00620	mg/l	n/a		n/a	
Selenium	01147	ug/l	01145	ug/l	01146	ug/l
Silver	01077	ug/l	01075	ug/l	01076	ug/l
Endrin	39390	ug/l	39391	ug/l	39392	ug/l
Lindane	39782	ug/l	38341	ug/l	n/a	
Methoxychlor	39480	ug/l	38478	ug/l	39479	ug/l
Toxaphene	39400	ug/l	39401	ug/l	n/a	
2,4-D	39730	ug/l	n/a		39733	ug/l
2,4,5-TP Silvex	39045	ug/l	n/a		n/a	
Radium (226 & 228)	11503	pCi/l	n/a		n/a	
. Radium (226)	09501	pCi/l	09503	pCi/l	09505	pCi/l
. Radium (228)	11501	pCi/l	81366	pCi/l	81368	pCi/l
Gross Alpha	01501	pCi/l	01503	pCi/l	01505	pCi/l
Gross Beta	03501	pCi/l	03503	pCi/l	03505	pCi/l

Appendix F (continued)

STORET Parameter Codes for some classic ground-water monitoring parameters.

PARAMETER NAME	UNIT OF MEASURE	NUMBER DISS.	NUMBER TOTAL	COMMENTS
ALKALINITY	mg/l		410	CACO3
AMMONIA	mg/l	608	610	NH3+NH4 AS N
BICARBONATE	mg/l		440	ION AS HCO3
CALCIUM	mg/l	915	916	
	ug/l	82036	82032	
CARBONATE	mg/l		445	ION AS CO3
COD	mg/l	341	340	HIGH LEVEL
COPPER	ug/l	1040	1042	
DO	mg/l	300		
FECAL COLIFORM			31616	DEPENDS ON METHOD USED - USGS USES 31625 THERE ARE APPROXIMATELY 20 CODES FOR FECALS
HARDNESS	mg/l		900	901-CARBONATE 902-NONCARBONATE
IRON	ug/l	1046	1045	
MAGNESIUM	mg/l	925	927	
MANGANESE	ug/l	1056	1055	
NITRATE + NITRITE	mg/l	631	630	
NITRITE	mg/l	613	615	
PHOSPHATE	mg/l		650	AS PO4
	mg/l		70505	COLORIMETRIC METHOD AS P
PHOSPHORUS	mg/l	671	665	DISSOLVED ORTHOPHOSPHATE
POTASSIUM	mg/l	935	937	
SODIUM	mg/l	930	929	
SULFATE	mg/l	946	945	
SULFITE	mg/l		740	
SUSPENDED SOLIDS	mg/l		530	
DISSOLVED SOLIDS	mg/l		70304	
TEMPERATURE	DEGREES		10	CELCIUS 11 FAHRENHEIT
ZINC	ug/l	1090	1092	

Appendix F (continued)

STORET Parameter Codes for microbiological parameters.

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CODE	COMPUTER PRINTOUT ABBREVIATION	DECIMAL POINT LOCATION	PARAMETER DESCRIPTION / MAJOR GROUP	ANALYSIS	TISSUE AQC REF.	PARAMETER CHANGES ENTERED / REQUESTER	PARAMETER CHANGES REVISED / ACTION	NUMBER STORET OBSERV	%1970-1975 / %1965 1969 / %BEFORE 65	CAS NO.
31622	FEC COLI A-1M TIS MPN	XXXXXX.X	FECAL COLIFORM A-1 MOD,TISSUE,44.5C,24HR MPN/100ML (02)BACTERIOLOGICAL			81/10 S-WJ				
31646	FEC COLI INTERFAC #/100ML	XXXXXXXX	FECAL COLIFORM AT SURF WAT-BOT INTERFACE #/100ML (02)BACTERIOLOGICAL			83/04 S-IX				
48201	FEC COL MPN&MBR FILTER	XXXXXXXX	FECAL COLIFORM MPN & MEMBRANE FILTER, 44.5C (02)BACTERIOLOGICAL			78/05 S-SD				
74055	FEC COLI PERMIT GENERAL	XXXXXXXX	FECAL COLIFORM, GENERAL (PERMIT) (02)BACTERIOLOGICAL			71/05 F-CCE		631	99	

00027	COLLECT	XXXXXXXX	CODE NO FOR AGENCY COLLECTING SAMPLE-SEE APPEND.		206936	49
	AGENCY			71/09		22
	CODE		(01)ADMINISTRATIVE	E-R04		27
64027	COLLECT	XXXXX	CODE NUMBER FOR AGENCY COLLECTING SAMPLE			
	AGENCY			83/12		
	CODE		(01)ADMINISTRATIVE	E-R10		
64002	CODE	XXXXX	CODE, GENERAL INFORMATION - ALPHA, NUMERIC CODE		472	86
	GENERAL			76/01		13
	REMARKS		(01)ADMINISTRATIVE	E-R09		
71326	COELAST-	XXXXXXXX	COELASTRUM SP. (NO/LITER)		95	77
	RUM SP.			70/02		18
	NO/LITER		(03)BIOLOGICAL	I-DRBC		3
71435	COELOS-	XXXXXXXX	COELOSPHAERIUM NAEGELIANUM UNGER (NO/LITER)		2	
	PHR NAEG			70/02		50
	NO/LITER		(03)BIOLOGICAL	I-DRBC		50
31612	COLIFORM	XXXXXX.X	COLIFORM, FECAL 10/ML			
	, FECAL			81/09		
	10/ML		(02)BACTERIOLOGICAL	E-HQ PCS		
31502	COLIFORM	XXXXXX.X	COLIFORM, TOTAL 10/ML			
	, TOTAL			81/09		
	10/ML		(02)BACTERIOLOGICAL	E-HQ PCS		
74056	TOT COLI	XXXXXXXX	COLIFORM, TOTAL, GENERAL (PERMIT)		277	25
	PERMIT			71/05		
	GENERAL		(01)ADMINISTRATIVE	F-COE		74
71205	COLIFORM	XXXXXXXX	COLIFORM, UNCONFIRMED RESULTS, UNACCEPTABLE		13582	
	MPN PRES			68/11		9
	/100ML		(02)BACTERIOLOGICAL	S-MI		89
31503	TOT COLI	XXXXXXXX	COLIFORM,TOT,MEMBR FILTER,DELAYED,M-ENDO MED,35 C		72495	18
	MFDLENDO			65/07		24
	/100ML		(02)BACTERIOLOGICAL	E-STORET		56
31504	TOT COLI	XXXXXXXX	COLIFORM,TOT,MEMBR FILTER,IMMED,LES ENDO AGAR,35C		58098	29
	MFIM LES			68/07		58
	/100ML		(02)BACTERIOLOGICAL	S-MI		11
31501	TOT COLI	XXXXXXXX	COLIFORM,TOT,MEMBRANE FILTER,IMMED.M-ENDO MED,35C		499495	27
	MFIMENDO			65/07		35
	/100ML		(02)BACTERIOLOGICAL	E-STORET		37
31506	TOT COLI	XXXXXXXX	COLIFORM,TOT,MPN, CONFIRMED TEST, TUBE CONFIG.		50773	21
	MPN CONF			65/07		36
	TUBECODE		(02)BACTERIOLOGICAL	E-STORET		42

CODE	COMPUTER PRINTOUT ABBREVIATION	DECIMAL POINT LOCATION	PARAMETER DESCRIPTION MAJOR GROUP	ANALYSIS	TISSUE AND REF.	PARAMETER CHANGES ENTERED REQUESTER	REVISED ACTION	NUMBER STORET OBSERV	%1970-1975 %1965-1969 %BEFORE 65	CAS NO.
31625	FEC COLI M-FCAGAD /100 ML	XXXXXXXX	FECAL COLIFORM, MF,M-FC, 0.7 UM (02)BACTERIOLOGICAL			76/09 F-CS		24457	99	
31621	FEC COLI A-1M H20 MPN	XXXXXX.X	FECAL COLIFORM,A-1 MOD,WATER,44.5C,24HR MPN/100ML (02)BACTERIOLOGICAL			81/10 S-NJ				
31613	FEC COLI M-FCAGAR /100ML	XXXXXXXX	FECAL COLIFORM,MEMBR FILTER,M-FC AGAR,44.5C,24HR (02)BACTERIOLOGICAL			73/07 E-R02		23313	98 1	
31616	FEC COLI MFM-FCBR /100ML	XXXXXXXX	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C (02)BACTERIOLOGICAL			65/07 E-STORET		715753	59 33 7	
31645	FEC COLI MF VERI #/G	XXXXXXXX	FECAL COLIFORM,MF,MFC MEDIUM,VERIFIED #/G (02)BACTERIOLOGICAL			82/04 E-R10				
31623	FEC COLI MF VERI #/100ML	XXXXXXXX	FECAL COLIFORM,MF,MFC MEDIUM,VERIFIED #/100ML (02)BACTERIOLOGICAL			82/04 E-R10				
31641	FEC COLI BOT SED MPN/100G	XXXXXXXX	FECAL COLIFORM,MPN IN BOT DEPOS,EC MED (MPN/100G) (02)BACTERIOLOGICAL			73/05 E-R02		394	92 7	
31620	FEC COLI BALB 43C TUBECODE	XXXXXXXX	FECAL COLIFORM,MPN,BORIC ACID LAC. BR,TUBE CONFIG (02)BACTERIOLOGICAL			65/07 E-STORET				
31619	FEC COLI MPN BALB /100ML	XXXXXXXX	FECAL COLIFORM,MPN,BORIC ACID LACTOSE BR,43C,48HR (02)BACTERIOLOGICAL			65/07 E-STORET		542	9 88 1	
31615	FEC COLI MPNECMED /100ML	XXXXXXXX	FECAL COLIFORM,MPN,EC MED,44.5C (TUBE 31614) (02)BACTERIOLOGICAL			65/07 E-STORET		216669	36 33 30	
31618	FEC COLI EKM 45C TUBECODE	XXXXXXXX	FECAL COLIFORM,MPN,EIJKMAN TEST, TUBE CONFIG. (02)BACTERIOLOGICAL			65/07 E-STORET		1	100	
31617	FEC COLI MPN EIJK /100ML	XXXXXXXX	FECAL COLIFORM,MPN,EIJKMAN TEST,44.5C(TUBE 31618) (02)BACTERIOLOGICAL			65/07 E-STORET		2201	9 34 56	
31640	FEC COLI SHELFISH MPN/100G	XXXXXXXX	FECAL COLIFORM,MPN,IN SHELLFISH,EC MED,44.5C (02)BACTERIOLOGICAL			72/01 E-R02		86	44 55	

CODE	COMPUTER PRINTOUT ABBREVIATION	DECIMAL POINT LOCATION	PARAMETER DESCRIPTION MAJOR GROUP	ANALYSIS	TISSUE AND REF.	PARAMETER CHANGES ENTERED REVISED REQUESTER ACTION	NUMBER STORET OBSERV	%1970-1975 %1965-1969 %BEFORE 65	CAS NO.
31614	FEC COLI MPN TUBECODE	XXXXXXXX	FECAL COLIFORM,MPN,TUBE CONFIGURATION (02)BACTERIOLOGICAL			66/06 E-STORET	55121	42 41 15	
31624	FEC COLI 7 HR MF #/100ML	XXXXXXXX	FECAL COLIFORM,7 HR,M-7HR FC MED MF,41.5C,#/100ML (02)BACTERIOLOGICAL			8./04 E-R10			
31676	FECSTREP MPNADPS E #/100M	XXXXXXXX	FECAL STREP, 5 TUBE MPN AD PSE #/100 ML (02)BACTERIOLOGICAL			82/04 E-R10			
31642	FECSTREP MPNADPSE MPN/100G	XXXXXXXX	FECAL STREP,5 TUBE,MPN,ADPSE MPN/100G (02)BACTERIOLOGICAL			82/04 E-R10			
31680	FECSTREP MF-KFBR PERIOCAL	XXXXXXXX	FECAL STREPTCOCCI,MF-KF BROTH,35C,48H #/100 ML (02)BACTERIOLOGICAL			83/09 S-SC			
48200	FEC STRP MFILTER FILTER	XXXXXXXX	FECAL STREPTOCCI,MPN & MEMBRANE FILTER, 35C,48HR (02)BACTERIOLOGICAL			70/05 S-SD			
74054	FEC STRP PERMIT GENERAL	XXXXXXXX	FECAL STREPTOCOCCI, GENERAL (PERMIT) (02)BACTERIOLOGICAL			71/05 F-COE			
31673	FECSTREP MFKFAGAR /100ML	XXXXXXXX	FECAL STREPTOCOCCI, MBR FILT,KF AGAR,35C,48HR (02)BACTERIOLOGICAL			65/07 E-STORET	77156	41 19 38	
31679	FECSTREP MF M-ENT /100ML	XXXXXXXX	FECAL STREPTOCOCCI,MF M-ENTEROCOCCUS AGAR,35C,48H (02)BACTERIOLOGICAL			65/07 E-STORET	98357	59 27 13	
31690	FECSTREP BOT SED MPN/100G	XXXXXXXX	FECAL STREPTOCOCCI,MPN IN BOT DEPOS,AD-EVA BROTH (02)BACTERIOLOGICAL			73/05 E-R02			
31677	FECSTREP MPNADEVA /100ML	XXXXXXXX	FECAL STREPTOCOCCI,MPN,AD-EVA, 35C (TUBE 31678) (02)BACTERIOLOGICAL			65/07 E-STORET	16892	36 16 46	
31678	FECSTREP MPN TUBECODE	XXXXXXXX	FECAL STREPTOCOCCI,MPN,AD-EVA,TUBE CONFIGURATION (02)BACTERIOLOGICAL			65/07 E-STORET	4247	25 4 70	
31676	FEC STRP MPN-KFBR TUBE CO	XXXXXXXX	FECAL STREPTOCOCCI,MPN,KF BROTH,TUBE CONFIG. (02)BACTERIOLOGICAL				245	2 4 92	

Department of Ecology

STORET WATER QUALITY FILE—STATION LOCATION STORAGE

AGENCY CARD (A CARD)

A

STATION TYPE CARD (T CARD)

A STRING OF VALID COMBINATIONS OF STATION TYPE CODES SEPARATED BY SLASHES

T

STATION CARD (S CARD)

PRIMARY STATION CODE (Left Justify)

STATION ALIASES

FIPS CODES — STATE, COUNTY

5 3 0

S

LATITUDE/LONGITUDE CARD (HEADER CARD Ø)

LATITUDE — LONGITUDE — TOTAL STATION DEPTH — STATION ELEVATION — AGENCY CODES

Ø

RMI CARD (HEADER CARD 1)

1

RMI CARD (HEADER CARD 2)

2

MAJOR/MINOR BASIN CARD (HEADER CARD 3)

STATION LOCATION MAJOR BASIN NAME — STATION LOCATION MINOR BASIN NAME — LOCATION BASIN CODES

P A C I F I C   N O R T H W E S T

1 3

3

LOCATION DESCRIPTION CARD (HEADER CARD 4)

LOCATION OF SITE: LANDMARK NAMES, ETC. — REACH CODING — HYDROLOGIC UNIT CODE — MILES ON REACH

4

DESCRIPTIVE PARAGRAPH CARDS (HEADER CARD 6)

SORT NO. (1–3)	(Blank) (4–6)	DESCRIPTION (7–78)	79	80
			0	6
			1	6
			2	6
			3	6
			4	6
			5	6
			6	6
			7	6
			8	6
			9	6
			J	6
			K	6
			L	6
			M	6
			N	6

PART V
EXAMPLE MENUS AND FILE STRUCTURES

WATER RESOURCE DATA BASE MENU

A) Enter new data

B) Edit existing data

C) Print reports or create files

D) Create files for transfer to Dept of Ecology

E) Backup data to floppy disks

F) Rebuild index files

RTN) Exit

ENTER YOUR SELECTION:

DATA ENTRY MENU

A) Well/Site information

B) Geologic logs

C) Water levels

D) Water quality data

E) Owner information

F) Water rights information

RTN) Exit

ENTER YOUR SELECTION:

DATA EDITING MENU

A) Well/Site information

B) Geologic logs

C) Water levels

D) Water quality data

E) Owner information

F) Water rights data

RTN) Exit

ENTER YOUR SELECTION:

PRINT MENU

A) Print owner information

B) Print well information
(based on geographic window or a site id)

C) Look at previously created file

RTN) Exit

ENTER YOUR SELECTION:

èëëë£
¤GROUND WATER MANAGEMENT IDENTIFICATION RECORD¤
àëëë¥

SITE ID. 188888888888888

IDENTIFICATION GWMA- ASSIGNER

OPENING FILE

SITE ID 188888888888888

DEPTH TO TOP OF SECTION (ft)

DEPTH TO BOTTOM OF SECTION (ft)

TYPE OF OPENINGS

TYPE OF MATERIAL

DIAMETER OF OPEN SECTION (inches)

WIDTH OF OPENING (inches)

LENGTH OF OPENING (inches)

SCREEN POSITION SUMMARY:

TOP OF UPPER SCREEN (ft)

BOTTOM OF LOWER SCREEN (ft)

èëëëëëëëëëëëë£
¤ LIFT FILE ¤
àëëëëëëëëëëëë¥

TE ID 188888888888888

TYPE OF LIFT | DATE RECORDED / /

INTAKE DEPTH OF PUMP (ft) | TYPE OF POWER

HORSEPOWER

ADDITIONAL LIFT | RATING CAPACITY

èëëëëëëëëëëëëëëëëëëëë£
¤ *** SITE FILE *** ¤
àëëëëëëëëëëëëëëëëëëëë¥

WA. STATE
START CARD NO.

Öáááááááááááááááááááááá¢
°SOURCE AGENCY WA001°
âááááááááááááááááááááááì

Öááááááááááááááááááááááááá¢
°SITE ID °
âááááááááááááááááááááááááì

Öááááááááááááááááááááááááááááááá¢
°LOCAL NO. N/ E- °
âááááááááááááááááááááááááááááááááì

Öááááááááááááááááááááááááá¢
°LATITUDE D M S . °
âáááááááááááááááááááááááááì

Öááááááááááááááááááááááááááá¢
°LONGITUDE D M S . °
âááááááááááááááááááááááááááááì

LAT/LONG ACCURACY
(S,F,T,M)

(OR ENTER LOCATION IN STATE PLANE COORDINATES:
X: . Y: .

Öáááááááá¢
°STATE 53°
âáááááááááì

Öáááááááááá¢
°COUNTY 033°
âááááááááááì

LOCATION MAP SCALE

Öáááááááááááááááááá¢
°ALTITUDE °
âáááááááááááááááááááì

METHOD OF MEASUREMENT ACCURACY

HYDROLOGIC UNIT

Öáááááááááááááááááááááááááááááááá¢ Öááááááááááááááááááááááá¢
°STATION TYPE (S,L,E,C,P,G,M) ° °AGENCY USE (A,I,O) °
âááááááááááááááááááááááááááááááááì âááááááááááááááááááááááì

REMARKS

DATE SITE ESTABLISHED / / DATA RELIABILITY (C,L,M,U)

Öáá¢
°SITE TYPE (C,D,E,H,I,M,O,P,S,T,W,X) °
âááì

DATE OF FIRST CONSTRUCTION / /

Öááááááááááááááááá¢
°USE OF SITE ° SECONDARY SITE USE TERTIARY SITE USE
âááááááááááááááááì

USE OF WATER SECONDARY WATER USE TERTIARY WATER USE

AQUIFER TYPE CODE (U,N,C,M,X) PRIMARY AQUIFER

WELL DEPTH HOLE DEPTH SOURCE OF DEPTH DATA

INVENTORY WATER LEVEL DATE MEASURED / /

METHOD OF MEASUREMENT SITE STATUS

SOURCE OF WATER LEVEL

DITIONAL PARAMETERS FOR SITE FILE, NOT ON ECOLOGY GREEN SHEET:

PROJECT NUMBER LOCATION FIELD CHECK CODE

GEOLOGIC LOG FILE EXISTS T/F: F

OWNER IDENTIFICATION 999999

Structure for database: E:\DBMS\RED\REDWLVL.DBF
Number of data records: 1281
Date of last update : 05/13/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	RECORD_NO	Character	3		N
4	AGENCY	Character	5		N
5	DATE_MSRD	Character	8		N
6	TIME_MSRD	Character	4		N
7	WAT_LEVEL	Character	7		N
8	STATUS	Character	1		N
9	METHOD	Character	1		N
10	ACC_CODE	Character	1		N
11	TRANS_DATE	Date	8		N
** Total **			55		

```
Structure for database: E:\DBMS\RED\REDSITE.DBF
Number of data records:      668
Date of last update   : 05/30/1991
Field  Field Name  Type       Width    Dec    Index
    1  TRANS_CODE  Character      1               N
    2  STRT_CARD   Character      6               N
    3  RPTG_AGNCY  Character      5               N
    4  SITEID      Character     15               N
    5  LOCAL_NAME  Character     26               N
    6  PARCEL_NO   Character     10               N
    7  PROJECT_NO  Character     12               N
    8  LOCAL_NO    Character     15               N
    9  LATITUDE    Character     10               N
   10  LONGITUDE   Character     11               N
   11  LATLONG_AC  Character      1               N
   12  LAMBERT_N   Character      9               N
   13  LAMBERT_E   Character     10               N
   14  FIELD_CHEK  Character      6               N
   15  OWNER_ID    Character      6               N
   16  PROJ_NO     Character     12               N
   17  STATE       Character      2               N
Press any key to continue...
   18  COUNTY      Character      3               N
   19  LOC_MAP     Character     20               N
   20  SCALE       Character      7               N
   21  ALTITUDE    Character      8               N
   22  METH_MEASR  Character      1               N
   23  ACCURACY    Character      3               N
   24  HYDRO_UNIT  Character      8               N
   25  STAT_TYPE   Character      1               N
   26  AGNCY_USE   Character      1               N
   27  REMARKS     Character     50               N
   28  DATE_EST    Character      8               N
   29  DATA_RELY   Character      1               N
   30  SITE_TYPE   Character      1               N
   31  DATE_CONST  Character      8               N
   32  USE_SITE    Character      1               N
   33  SEC_SUSE    Character      1               N
   34  TERT_SUSE   Character      1               N
   35  USE_WATER   Character      1               N
   36  SEC_WUSE    Character      1               N
   37  TERT_WUSE   Character      1               N
   38  AQUIF_TYPE  Character      1               N
Press any key to continue...
   39  PRIM_AQUIF  Character      8               N
   40  DEPTH_WELL  Character      8               N
   41  DEPTH_HOLE  Character      8               N
   42  SRCE_DATA   Character      1               N
   43  WATER_LVL   Character      8               N
   44  DATE_MEAS   Character      8               N
   45  METH_MEAS   Character      1               N
   46  SITE_STAT   Character      1               N
   47  SOURCE_COD  Character      1               N
   48  GEOLOG      Logical        1               N
   49  TRANS_DATE  Date           8               N
** Total **                     338
```

Structure for database: E:\DBMS\RED\REDOWNR.DBF
Number of data records: 668
Date of last update : 05/14/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	RECORD_NO	Character	3		N
4	DATE_OWN	Character	8		N
5	OWNERNM	Character	42		N
6	TRANS_DATE	Date	8		N
** Total **			78		

Structure for database: E:\DBMS\RED\REDCONS.DBF
Number of data records: 644
Date of last update : 04/18/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	CONST_ENTR	Character	3		N
4	RECORD_NO	Character	3		N
5	DATE_CONST	Character	8		N
6	DRILLER	Character	12		N
7	SRCE_CONST	Character	1		N
8	METH_CONST	Character	1		N
9	FINISH	Character	1		N
10	TYPE_SEAL	Character	1		N
11	BOT_SEAL	Character	4		N
12	METH_DEV	Character	1		N
13	HRS_DEV	Character	4		N
14	SPEC_TRT	Character	1		N
15	TRANS_DATE	Date	8		N
** Total **			65		

Structure for database: E:\DBMS\RED\REDHOLE.DBF
Number of data records: 685
Date of last update : 02/25/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	CONST_ENTR	Character	3		N
4	RECORD_NO	Character	3		N
5	TOP_HOLE	Character	8		N
6	BOT_HOLE	Character	8		N
7	DIA_HOLE	Character	8		N
8	TRANS_DATE	Date	8		N
** Total **			55		

Structure for database: E:\DBMS\RED\REDCASG.DBF
Number of data records: 696
Date of last update : 05/21/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	CONST_ENTR	Character	3		N
4	RECORD_NO	Character	3		N
5	TOP_CASING	Character	8		N
6	BOT_CASING	Character	8		N
7	DIA_CASING	Character	5		N
8	CASING_MAT	Character	1		N
9	THICK_CASE	Character	6		N
10	TRANS_DATE	Date	8		N
** Total **			59		

Structure for database: E:\DBMS\RED\REDOPEN.DBF
Number of data records: 673
Date of last update : 02/25/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	CONST_ENTR	Character	3		N
4	RECORD_NO	Character	3		N
5	TOP_SECT	Character	8		N
6	BOT_SECT	Character	8		N
7	TYP_OPNGS	Character	1		N
8	TYP_MATL	Character	1		N
9	DIA_OPENG	Character	5		N
10	WID_OPENG	Character	6		N
11	LEN_OPENG	Character	6		N
12	TOP_SCREEN	Character	8		N
13	BOT_SCREEN	Character	8		N
14	TRANS_DATE	Date	8		N
** Total **			82		

Structure for database: E:\DBMS\RED\REDLIFT.DBF
Number of data records: 543
Date of last update : 02/25/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	CONST_ENTR	Character	3		N
4	RECORD_NO	Character	3		N
5	TYPE_LIFT	Character	1		N
6	DATE	Character	8		N
7	PUMP_INTAK	Character	5		N
8	TYP_POWER	Character	1		N
9	HORSEPOWER	Character	7		N
10	TRANS_DATE	Date	8		N
** Total **			53		

Structure for database: E:\DBMS\RED\REDGEOP.DBF
Number of data records: 631
Date of last update : 02/25/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	RECORD_NO	Character	3		N
4	TYPE_LOG	Character	1		N
5	BEG_DEPTH	Character	8		N
6	END_DEPTH	Character	8		N
7	SOURCE	Character	1		N
8	TRANS_DATE	Date	8		N
** Total **			46		

Structure for database: E:\DBMS\RED\REDPROD.DBF
Number of data records: 622
Date of last update : 02/27/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	RECORD_NO	Character	3		N
3	ENTRY_NO	Character	3		N
4	DATE	Character	8		N
5	DISCHARGE	Character	10		N
6	SOURCE_DAT	Character	1		N
7	DRAWDOWN	Character	8		N
8	METH_MEAS	Character	1		N
9	PROD_LEVEL	Character	8		N
10	STAT_LEVEL	Character	8		N
11	SOURC_DATA	Character	1		N
12	SPEC_CAP	Character	8		N
13	METH_MEAS2	Character	1		N
14	DURATION	Character	6		N
15	TRANSIVITY	Character	8		N
16	STOR_COEFF	Character	9		N
17	TEST_TYPE	Character	1		N
Press any key to continue...					
18	TRANS_DATE	Date	8		N
** Total **			108		

```
tructure for database: E:\DBMS\RED\REDNETW.DBF
mber of data records:      119
ate of last update   : 05/16/1991
ield  Field Name  Type       Width    Dec    Index
    1  SITEID      Character     15               N
    2  TRANS_CODE  Character      1               N
    3  RECORD_NO   Character      3               N
    4  NETWK_TYP   Character      2               N
    5  BEG_YR      Character      4               N
    6  END_YR      Character      4               N
    7  TYP_ANALYS  Character      1               N
    8  AGENCY      Character      5               N
    9  FREQ_COL    Character      1               N
   10  METH_COL    Character      1               N
   11  ANAL_AGNCY  Character      5               N
   12  NETWORK_ST  Character      1               N
   13  SECNETW_ST  Character      1               N
   14  TRANS_DATE  Date           8               N
  Total **                       53

tructure for database: E:\DBMS\RED\REDLOG1.DBF
umber of data records:      391
ate of last update   : 11/13/1990
ield  Field Name  Type       Width    Dec    Index
    1  SYSTEMID    Character      6               N
    2  SITEID      Character     15               N
    3  NOINTERVAL  Numeric        2               N
    4  DATE        Date           8               N
    5  INTERVAL1   Character      9               N
    6  DESCRPTN1   Character     35               N
    7  INTERVAL2   Character      9               N
    8  DESCRPTN2   Character     35               N
    9  INTERVAL3   Character      9               N
   10  DESCRPTN3   Character     35               N
   11  INTERVAL4   Character      9               N
   12  DESCRPTN4   Character     35               N
   13  INTERVAL5   Character      9               N
   14  DESCRPTN5   Character     35               N
   15  INTERVAL6   Character      9               N
   16  DESCRPTN6   Character     35               N
   17  INTERVAL7   Character      9               N
ress any key to continue...
   18  DESCRPTN7   Character     35               N
** Total **                     340
```

```
Structure for database: E:\DBMS\RED\REDGWMA.DBF
Number of data records:      668
Date of last update   : 05/22/1991
Field  Field Name  Type        Width    Dec    Index
    1  SITEID      Character      15               N
    2  TRANS_CODE  Character       1               N
    3  RECORD_NO   Character       3               N
    4  IDENT       Character      10               N
    5  ASSIGNER    Character      15               N
    6  TRANS_DATE  Date            8               N
** Total **                       53

Structure for database: E:\DBMS\RED\REDOWNER.DBF
Number of data records:       85
Date of last update   : 05/22/1991
Field  Field Name  Type        Width    Dec    Index
    1  SITEID      Character      15               N
    2  OWNER_ID    Character       6               N
    3  SYSNAME     Character      35               N
    4  CLASS       Character       2               N
    5  STORE       Character      20               N
    6  ADDRESS     Character      30               N
    7  CITY        Character      20               N
    8  COUNTY      Character      12               N
    9  STATE       Character       2               N
   10  ZIP_CODE    Character       5               N
   11  PHONE_NO    Character       8               N
   12  CONTACT_NM  Character      20               N
   13  MAIL_ADDRS  Character      30               N
   14  MAIL_CITY   Character      20               N
   15  MAIL_ZIP    Character       5               N
   16  CONNECTS    Character       6               N
   17  POPULATION  Character       6               N
Press any key to continue...
   18  DATE_CON    Character       8               N
   19  DATE_POP    Character       8               N
   20  CLS_RES     Character       3               N
   21  CLS_COM     Character       3               N
   22  CLS_IRR     Character       3               N
   23  CLS_IND     Character       3               N
   24  TRANS_DATE  Date            8               N
** Total **                      279
```

Structure for database: E:\DBMS\RED\REDLOG2.DBF
Number of data records: 157
Date of last update : 11/13/1990

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	INTERVAL8	Character	9		N
3	DESCRPTN8	Character	35		N
4	INTERVAL9	Character	9		N
5	DESCRPTN9	Character	35		N
6	INTRVAL10	Character	9		N
7	DESCPTN10	Character	35		N
8	INTRVAL11	Character	9		N
9	DESCPTN11	Character	35		N
10	INTRVAL12	Character	9		N
11	DESCPTN12	Character	35		N
12	INTRVAL13	Character	9		N
13	DESCPTN13	Character	35		N
14	INTRVAL14	Character	9		N
15	DESCPTN14	Character	35		N
** Total **			324		

```
tructure for database: E:\DBMS\RED\REDWFLD.DBF
umber of data records:       0
ate of last update   : 02/25/1991
ield  Field Name  Type       Width    Dec    Index
   1  SITEID      Character     15               N
   2  TRANS_CODE  Character      1               N
   3  RECORD_NO   Character      3               N
   4  NO_WELLS    Character      3               N
   5  DEPTH_DEEP  Character      3               N
   6  DEPTH_SHAL  Character      3               N
   7  METH_CONS   Character      1               N
   8  SIZE_WFLD   Character      7               N
   9  TRANS_DATE  Date           8               N
* Total **                      45

tructure for database: E:\DBMS\RED\REDMSID.DBF
umber of data records:      49
ate of last update   : 02/25/1991
ield  Field Name  Type       Width    Dec    Index
   1  OWNERNM     Character     42               N
   2  SITEID      Character     15               N
   3  LOCAL_NO    Character     15               N
   4  OWNER_ID    Character      6               N
   5  ALTITUDE    Character      8               N
   6  DEPTH_WELL  Character      8               N
   7  DEPTH_HOLE  Character      8               N
   8  DIA_CASING  Character      5               N
   9  AGNCY_USE   Character      1               N
  10  SITE_TYPE   Character      1               N
  11  SRCE_DATA   Character      1               N
  12  GEOLOG      Logical        1               N
  13  BEG_DEPTH   Character      8               N
  14  END_DEPTH   Character      8               N
* Total **                     128

tructure for database: E:\DBMS\RED\REDWQIF.DBF
umber of data records:       1
ate of last update   : 05/14/1991
ield  Field Name  Type       Width    Dec    Index
   1  SITEID      Character     15               N
   2  DATE_TIME   Character     10               N
   3  PARA_CODE   Character     10               N
   4  PARA_VALUE  Character     16               N
* Total **                      52
```

Structure for database: E:\DBMS\RED\REDRGHT.DBF
Number of data records: 0
Date of last update : 02/25/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	WR_NO	Character	12		N
3	TYP_USE	Character	3		N
4	ANN_AFY	Character	6		N
5	INST_GPM	Character	6		N
6	SUPP_USE	Character	8		N
7	SUPP_AFY	Character	6		N
8	SUPP_GPM	Character	6		N
9	WR_DATE	Character	8		N
10	TRANS_DATE	Date	8		N
** Total **			79		

```
Structure for database: E:\DBMS\RED\REDWQSF.DBF
Number of data records:       1
Date of last update   : 05/14/1991
Field  Field Name  Type       Width    Dec    Index
    1  STA_TYP1    Character      6               N
    2  STA_TYP2    Character      6               N
    3  STA_TYP3    Character      6               N
    4  STA_TYP4    Character      6               N
    5  STA_TYP5    Character      6               N
    6  STA_TYP6    Character      6               N
    7  STA_TYP7    Character      6               N
    8  SITEID      Character     15               N
    9  SS_CODE1    Character      8               N
   10  SS_CODE2    Character     11               N
   11  SS_CODE3    Character     10               N
   12  STATE       Character      2               N
   13  COUNTY      Character      3               N
   14  STA_STAT    Character      2               N
   15  LATITUDE    Character      7               N
   16  LONGITUDE   Character      8               N
   17  LATLONG_AC  Character      1               N
Press any key to continue...
   18  UNITS       Character      1               N
   19  AQ_THICK    Character      3               N
   20  ALTITUDE    Character      5               N
   21  PRIM_AQUIF  Character     40               N
   22  MAJ_BASIN   Character     24               N
   23  MIN_BASIN   Character     40               N
   24  MAJ_B_CODE  Character      2               N
   25  MIN_B_CODE  Character      2               N
   26  SUB_B_CODE  Character      2               N
   27  LOCATION    Character     48               N
   28  CAT_NO      Character      8               N
   29  REACH_NO    Character      3               N
   30  ON_OFF      Character      3               N
   31  REACH_MI    Character      8               N
   32  REMARK1     Character     72               N
   33  REMARK2     Character     72               N
   34  REMARK3     Character     72               N
   35  REMARK4     Character     72               N
   36  REMARK5     Character     72               N
   37  REMARK6     Character     72               N
   38  REMARK7     Character     72               N
Press any key to continue...
   39  REMARK8     Character     72               N
   40  REMARK9     Character     72               N
   41  REMARK10    Character     72               N
   42  REMARK11    Character     72               N
   43  REMARK12    Character     72               N
   44  REMARK13    Character     72               N
   45  REMARK14    Character     72               N
   46  REMARK15    Character     72               N
   47  TRANS_DATE  Date           8               N
** Total **                1387
```

Structure for database: E:\DBMS\RED\REDMSLST.DBF
Number of data records: 100
Date of last update : 05/14/1991

Field	Field Name	Type	Width	Dec	Index
1	OWNERNM	Character	42		N
2	SITEID	Character	15		N
3	LOCAL_NO	Character	15		N
4	NETWK_TYP	Character	2		N
5	REMARKS	Character	50		N
6	OWNER_ID	Character	6		N
7	DEPTH_WELL	Numeric	8	2	N
8	DEPTH_HOLE	Numeric	8	2	N
9	DIA_CASING	Numeric	5	2	N
10	AGNCY_USE	Character	1		N
11	GEOLOG	Logical	1		N
12	BEG_DEPTH	Numeric	8	2	N
13	END_DEPTH	Numeric	8	2	N
** Total **			170		

Structure for database: E:\DBMS\RED\REDMNTR.DBF
Number of data records: 85
Date of last update : 05/22/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	SAMPLE_NO	Character	5		N
3	SYSNAME	Character	35		N
4	WL_REMARKS	Character	26		N
5	WL_MONITOR	Character	10		N
6	PARAM_A	Character	3		N
7	PARAM_B	Character	3		N
8	WQ_TEAM	Character	25		N
9	WQ_REMARKS	Character	26		N
** Total **			149		

Structure for database: E:\DBMS\RED\REDGWMA.DBF
Number of data records: 668
Date of last update : 05/22/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	RECORD_NO	Character	3		N
4	IDENT	Character	10		N
5	ASSIGNER	Character	15		N
6	TRANS_DATE	Date	8		N
** Total **			53		

Structure for database: E:\DBMS\RED\REDMPNT.DBF
Number of data records: 155
Date of last update : 05/07/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	RECORD_NO	Character	3		N
4	BEG_DATE	Character	8		N
5	END_DATE	Character	8		N
6	MP_HEIGHT	Character	6		N
7	MP_REMARKS	Character	50		N
8	MP_REMARK2	Character	50		N
9	TRANS_DATE	Date	8		N

```
* Total **                          150

tructure for database: E:\DBMS\RED\REDWQLST.DBF
umber of data records:       15
ate of last update    : 05/22/1991
ield  Field Name  Type       Width    Dec    Index
    1  SITEID      Character     15              N
    2  LOCAL_NO    Character     15              N
    3  OWNER_ID    Character      6              N
    4  SAMPLE_NO   Character      5              N
    5  SYSNAME     Character     35              N
    6  ADDRESS     Character     30              N
    7  CONTACT_NM  Character     20              N
    8  PHONE_NO    Character      8              N
    9  DEPTH_WELL  Character      8              N
   10  WATER_LVL   Character      8              N
   11  DATE_MEAS   Character      8              N
   12  DIA_CASING  Character      2              N
   13  PURGE_VOL   Numeric        6              N
   14  PARAM_A     Character      1              N
   15  PARAM_B     Character      1              N
* Total **                          169

tructure for database: E:\DBMS\RED\REDSDAF.DBF
umber of data records:        1
ate of last update    : 04/24/1990
ield  Field Name  Type       Width    Dec    Index
    1  SITEID      Character     15              N
    2  DATE_TIME   Character     10              N
    3  MEDIA       Character      6              N
    4  SMK_1       Character      1              N
    5  SMK_2       Character      1              N
    6  SMK_3       Character      1              N
    7  SMK_4       Character      1              N
    8  SMK_5       Character      2              N
    9  UMK_1       Character      2              N
   10  UMK_2       Character      3              N
   11  UMK_3       Character      1              N
   12  UMK_4       Character      2              N
   13  P72019      Character     10              N
   14  P82546      Character     10              N
   15  P72004      Character     10              N
   16  P73675      Character     10              N
   17  P84124      Character     10              N
ress any key to continue...
   18  P84077      Character     10              N
   19  P84129      Character     10              N
   20  TRANS_DATE  Date           8              N
* Total **                          124
```

Structure for database: E:\DBMS\RED\REDWLVL.DBF
Number of data records: 1281
Date of last update : 05/13/1991

Field	Field Name	Type	Width	Dec	Index
1	SITEID	Character	15		N
2	TRANS_CODE	Character	1		N
3	RECORD_NO	Character	3		N
4	AGENCY	Character	5		N
5	DATE_MSRD	Character	8		N
6	TIME_MSRD	Character	4		N
7	WAT_LEVEL	Character	7		N
8	STATUS	Character	1		N
9	METHOD	Character	1		N
10	ACC_CODE	Character	1		N
11	TRANS_DATE	Date	8		N
** Total **			55		

Appendix O

Stormwater Infiltration System Recommendations

ADOLFSON ASSOCIATES, INC.
MEMORANDUM

TO: Jim Bailey, Sweet-Edwards/EMCON

FROM: Derek Sandison

DATE: June 11, 1990

SUBJECT: Sequim/Dungeness Stormwater Infiltration System Recommendations.

Enclosed please find our recommendations concerning stormwater infiltration system. While it appears that such systems are not likely to be contributing to the nitrate problem, they are, nevertheless, a potential source of other forms of contamination and our recommendations have been prepared accordingly. If you have any questions please call me at your convenience.

RECOMMENDATIONS CONCERNING STORMWATER INFILTRATION SYSTEMS

No comprehensive evaluation of the potential for ground water contamination associated with the operation of stormwater infiltration systems has been conducted within the Sequim/Dungeness study area. Because the risk of ground water contamination from such systems can be quite great, stormwater infiltration practices will likely be the object of future studies, ultimately, leading to the development of formal contaminant management strategies. Until those strategies are developed, some general recommendations can be offered concerning interim measures that could be undertaken to lessen the potential for ground water contamination.

Ground water quality concerns over the operation of stormwater infiltration systems are focused on two types of contaminant loading:

1) Acute incidents involving spills or releases of hazardous materials, and

2) Chronic loading from heavy metals transported in stormwater runoff.

HAZARDOUS MATERIALS INCIDENTS:

In terms of hazardous material incidents, the highest level of ground water contamination risk likely stems from commercial truck traffic on Highway 101. As a major state thoroughfare, Highway 101 is utilized by a significant number of commercial trucks that carry hazardous materials capable of causing adverse ground water quality impacts if released during a traffic accident. Such adverse impacts can result from infiltration of the hazardous materials through soils underlying the unlined roadside ditches or through discharges to stormwater infiltration facilities constructed to receive runoff from the highway. Factors that influence the extent to which a spill will impact ground water include the quantity and type of hazardous materials released, location of the spill, soil conditions, weather conditions, and the effectiveness of remedial response measures.

Remedial Response Program. Remedial response to hazardous material incidents on Highway 101 is managed by the Washington State Patrol. Depending on the nature and apparent severity of the incident, the State Patrol may request assistance from Department of Ecology spill response personnel and/or from appropriate fire departments or districts.

The State Patrol, Department of Ecology, and local fire departments or districts should be consulted regarding their existing spill response protocols. Those protocols should be evaluated to determine whether spill response procedures and notification systems are adequate to protect the vulnerable Sequim/Dungeness aquifer system. In addition, information concerning the portions of the highway corridor which are most susceptible to ground water contamination associated with transportation spills should be provided to the response agencies.

Spill Containment Facilities. Spill response efforts can either be greatly hindered or aided by the nature of stormwater disposal facilities designed to receive runoff from a highway. Subsurface stormwater infiltration systems and unlined roadside ditches will facilitate the entry of spilled contaminants into ground water. Conversely, stormwater disposal systems incorporating properly designed spill containment features can help immobilize contaminants and prevent their reaching ground water. Thus, spill containment may be the most effective protection system for mitigating the effects of highway hazardous material incidents.

A containment system typically consists of a closed drainage facility which collects the spill, separates the hazardous material from stormwater runoff, and stores the hazardous materials for recovery by the spill response agencies. Several sources of information are available concerning the design of highway spill containment facilities. Among those sources is Protective Systems for Spills of Hazardous Materials, Volume II, which contains spill containment design guidelines that were prepared for the Federal Highway Administration by Kansas State University in 1989. In addition, for protection of the City of Portland's wellfield along the south shore of the Columbia River, the city's Bureau of Environmental Services has developed a design manual for construction of highway stormwater disposal facilities incorporating spill containment features. These sources should be consulted regarding potential spill containment design schemes that may be suitable for use along Highway 101.

Once potentially suitable design schemes have been identified, the Washington State Department of Transportation should be contacted for purposes of comparing those schemes with the design of existing runoff disposal facilities along Highway 101. Should the spill containment capability of existing runoff disposal facilities prove inadequate, options for future modification of those facilities to incorporate enhanced spill containment design features should be explored with the Department of Transportation

CHRONIC CONTAMINANT LOADING

Chronic contaminant loading to ground water associated with subsurface disposal of stormwater runoff is a problem of area-wide significance. Chronic contaminant loading results not only from runoff originating from highways and roadways but from the multitude of residential and commercial developments within the Sequim/Dungeness Area as well.

Although a number of contaminants can be carried to ground water with runoff entering stormwater infiltration systems, heavy metals, particularly lead, represent the most significant contaminant from the standpoint of chronic loading. While nitrate contamination problems are of greatest concern in the Sequim/Dungeness area, stormwater infiltration systems in residential and commercial areas probably do not contribute meaningfully to those problems. Nitrate levels in runoff from residential and commercial areas is typically less than 1 mg/l.

The majority of the heavy metals present in stormwater runoff are in a suspended particulate form (as opposed to dissolved form). Thus, in a properly designed stormwater infiltration system, it should be possible to trap many of the heavy metal particulates as sediments.

In an effort to identify design methodologies to maximize the particulate removal capability of subsurface stormwater infiltration systems, Adolfson Associates and Sweet/Edwards-EMCON are currently participating in a pilot stormwater infiltration system study within the Clover/Chambers Creek Basin of central Pierce County, Washington. The results and findings of the pilot study are to be incorporated by the Pierce County Public Works Department into the design standards for new stormwater infiltration systems and into standards for upgrading existing infiltration systems.

Selection of alternative infiltration system designs for the pilot study was based on the following criteria:

- o Infiltration system designs must be relatively simple and require a low level of maintenance,

- o Infiltration system designs must provide satisfactory performance in both residential and commercial settings,

- o Infiltration system designs must achieve a balance between the desire for high particulate removal capability and the need to promote relatively rapid infiltration of stormwater runoff during precipitation events, and o Although particulate removal capability is the principal design consideration, small volume spill containment capacity should also be provided.

Three designs have been selected and tested during the pilot project, two of which have demonstrated satisfactory particulate removal capability. One of those designs involves a dual chambered facility intended to drain an approximately one acre commercially developed area. The first chamber is a water tight, four feet wide by approximately six feet deep concrete cylinder which serves as a oil/grease separator, small volume spill containment vessel, and sediment trap. The second chamber is a perforated, four feet wide by approximately ten feet deep concrete cylinder. The annular space around the exterior of the second cylinder is filled with gravel and the interior walls of the cylinder are lined with filter fabric.

The second design, intended to drain an approximately two acre area, consists of a three phase system including a sedimentation chamber, grass lined swale, and infiltration trench. The sedimentation chamber is virtually identical to the first chamber of the system described above. The sedimentation chamber discharges to a 120 feet long and six feet wide grass lined swale. After travel along the entire length of the swale, stormwater enters an subsurface infiltration trench and is discharged to the underlying soils.

Preliminary results of the pilot study indicate that the infiltration system designs described above may be effective in removing up to 80% of the particulate bound heavy metals from stormwater runoff. However, additional data must be collected to determine whether such removal efficiencies can be maintained on a long term basis.

The pilot study results indicate that particulate bound heavy metal removal efficiency increases as sediment accumulation increases. However, the accumulation of sediments also results in a significant decrease hydraulic capacity of the stormwater infiltration systems. In order to restore hydraulic capacity, sediments must be periodically extracted from the infiltration systems resulting in a corresponding decrease in removal efficiency of particulate bound heavy metals.

Based upon the findings of the pilot study and other available data concerning stormwater infiltration system technology, interim standards for design of stormwater infiltration systems, intended to reduce the potential for chronic heavy metal contaminant loading, should be developed and implemented within the Sequim/Dungeness area. Development of design criteria involving use of grass lined swales should be carefully considered. Due to the relatively dry climate of the Sequim/Dungeness area, the establishment of grass in swales may require supplemental irrigation, particularly during the first year of operation. Grass varieties will need to be judiciously selected as well. Grass varieties used in the swale will need to be capable of tolerating periods of inundation as well as extended periods of drought.