DEPARTMENT OF ECOLOGY

June 9, 1995

TO: David Giglio, Karol Erickson, Bob Cusimano

FROM: John Tooley

THROUGH: Larry Goldstein

SUBJECT: Description of Spatial Analyses in Support of Columbia Gorge TMDL Projects

Project Objective

Use Geographic Information System spatial analysis to help explain observed variability in water-quality samples collected in Salmon Creek, Lacamas Lake, and Gibbons Creek watersheds

Approach

The approach taken was to obtain high-quality, locally maintained spatial data sets which would describe those land-use activities which could directly, or indirectly, impact water quality Next, these data were used in spatial analyses which provided information to be used to evaluate the spatial variability observed in several water quality investigations in the Columbia Gorge Water Quality Management Area

Data Source

Most data used in this analysis were obtained from Clark County Assessment and GIS office of Clark County, Washington Clark County has a long history of using spatial data in the daily operation of county and regional government As a result they have a well-established GIS operation with resulting high-quality spatial data

Clark County and Ecology have a history of working cooperatively on environmental projects Because of this tradition Clark County agreed to provide the spatial data used in this project for the minimum cost of staff time to process and copy the data Ecology will reciprocate by providing any newly developed spatial data to Clark County

Data Layer Description

There were six primary spatial data sets (referred to as data layers in the remainder of this report) used in this analysis These are shown in the table below:

Name	Description	Spatial Feature Type	Number of Features
basins	Project watersheds, and sub-basins with additions by EILS Program staff	polygon	26
parcels	Land parcels within project watersheds with a primary property type code	polygon	35658
land use	Existing land use within project watersheds, similar to parcels except polygons are lumped together and an 1990 aerial photography was used to assign land use on parcels greater than 5 acres in area	polygon	14862
septic	Centroid of parcels with reported septic system, within project watersheds	point	13066
dairy	Dairy locations located by address-matching from WA Dept. of Agriculture *raw milk producers* database (data extracted in December 1993)	point	17 within project watersheds, 1156 statewide
manapp3	Animal waste application areas	polygon	70

Data Processing - Projection Conversion

All data sets obtained from Clark County Assessment and GIS were converted from the map coordinate system used by Clark County, to the system used by Ecology. The only difference between the two was the horizontal datum. Ecology uses North American Datum 1927; while Clark County recently converted to North American Datum 1983.

A horizontal datum shift was noted when comparing the Existing Land Use data from Clark County to the 1:24000 Transportation from WDNR. The WDNR data appears to be shifted approximately 80 feet south and 40 feet east of the Clark County data. While such errors are somewhat greater than would be expected from data of this scale, these are not huge errors and should not affect the overall analysis.

Data Processing - Data Classification

Most of the data obtained from Clark County was used as received except for the projection conversion mentioned earlier. The property parcels data, however, needed to be aggregated into mapping and analysis classes to meet the requirements of the water quality analysis. The grouping used in this project is similar to the one used by Rod Swanson in his assessment of ground water contaminant loadings (Swanson, 1993). These are listed in the table below:

Land Use / Land Cover Mapping and Analysis Classes (used with 'parcel' and 'land use' layers)
Forest
Pasture
Agriculture
Commercial
Heavy Industrial
Light Industrial
Public Facilities
Parks/Schools/Recreation
Institutional
Residential
Rural Residential
Rural
Roads and Right of Way
Vacant, mixed open, etc.

The parcel layer contained a *property type code* which designated which of approximately 600 different land use / zoning categories the Clark County Assessor's Office had assigned to each parcel polygon. Parcels were assigned to the mapping and analysis classes based on this code. The exception was single-family residential parcels which were grouped into one of three classes based on the whether the parcel first had a 'single-family-residential' *property type code*, then based on the size of the parcel as listed in criteria table below:

Mapping and Analysis Class Name	Parcel Size Criteria
residential	parcel size <= 1.0 acre
rural residential	1.0 acre < parcel size <= 5.0 acres
rural	parcel size > 5.0 acres

Each polygon in the land use layer was assigned an *existing land use code* which was assigned to a land use / land cover category based on a parcel size criteria. If the parcel was greater than 5 acres in area, then a land cover category value was assigned based on 1990 aerial photo interpretation. For those equal or less than 5 acres, the parcel layer *property type code* was used to assign the land use / land cover category.

Spatial Analysis

The primary spatial analysis tool used in this project was the ARC/INFO INTERSECT command. This spatial analysis tool calculates the geometric intersection between two data layers. The output of the calculation is a new data layer which contains the information contained in the two input layers. For example, when the *septic* system layer was intersected with the *basins* layer, the output was a new layer which described which basins each of the septic systems were contained within.

The following table describes the intersect analyses which were performed:

4

input layer	intersection layer	output layer	description of primary output
parcels	basins	bas-parc2	land parcel polygons with associated land-cover code, and project watershed name
dairy	basins	bas-cow	dairy location points with dairy attributes and project watershed name
landuse	basins	bas-lulc	polygons with existing land use code and project watershed name
manapp3	basins	bas-manu	land application area polygons of described size and project watershed name
septic	basins	bas-sep	centroids of parcels with reported septic systems and project watershed names

Statistical Analysis

Simple statistical summaries were prepared from several of the output data layers. These were performed using the ARC/INFO - FREQUENCY and STATISTICS commands. The table below lists the statistics performed and the layers used.

Statistic Calculated	Input layer	Output file	Description
frequency analysis	bas-sep	bs-freq.xls	Number of septics in each of the 26 project basins
frequency analysis, area summation calculated for each project basin	bas-lulc	tmdl-bas xls	Number of existing land use polygons, and total area of each land use mapping unit within each project basin
frequency analysis, area summation calculated for each project basin	bas-parc2	bas-parc xls	Number of land parcel polygons, and total area of each parcel mapping unit within each project basin

Conclusions and Recommendations

An assessment of the value of these spatial analyses in explaining the variability of observed water quality monitoring information would be helpful for future phased TMDL projects. This would best be addressed in the TMDL reports for the project watersheds.

In the future, the development of spatial data requirements should occur with active involvement of both GIS technical experts and water quality technical experts. Both camps have much to contribute to the project success, but there is more understanding needed on both sides. This could be accomplished during project scoping.

References

Swanson, R D 1993 Method To Estimate Groundwater Contaminant Loading Potential Ratings, Clark County Water Quality Division, Clark County, Washington 42 pgs

Project Sub-basins and Major Watersheds

Sub-basin Name	Major Watershed	Area (acres)
114th Tributary	Salmon Creek	332
119th Tributary	Salmon Creek	948
China Ditch	Lacamas Creek	6433
Cougar Creek	Salmon Creek	1928
Curtin Creek	Salmon Creek	7037
Gibbons Creek	Gibbons Creek	11529
I-5 North	Salmon Creek	2443
I-5 South	Salmon Creek	860
Lacamas Lake	Lacamas Creek	7309
Lower Fifth Plain Creek	Lacamas Creek	981
Lower Lacamas Creek	Lacamas Creek	5336
Matney Creek	Lacamas Creek	4187
Middle Lacamas Creek	Lacamas Creek	1504
Morgan Creek	Salmon Creek	8229
Pleasant Valley	Salmon Creek	1419
Rock Creek	Salmon Creek	4747
Salmon Creek Main Channel	Salmon Creek	797
Shanghai Creek	Lacamas Creek	2968
South Mill Creek	Salmon Creek	11054
Suds Creek	Salmon Creek	476
Tenny Creek	Salmon Creek	989
Upper Fifth Plain Creek	Lacamas Creek	2693
Upper Lacamas Creek	Lacamas Creek	8770
Upper Salmon Creek	Salmon Creek	6933
Woodin Creek	Salmon Creek	8757

Table of Number of Parcels with Septic Systems

Number of Parcels with Septics	NAMES
1	114th Tributary
40	119th Tributary
134	China Ditch
28	Cougar Creek
214	Curtin Creek
117	Gibbons Creek
49	I-5 North
18	I-5 South
130	Lacamas Lake
18	Lower Fifth Plain Creek
70	Lower Lacamas Creek
136	Matney Creek
44	Middle Lacamas Creek
245	Morgan Creek
78	Pleasant Valley
84	Rock Creek
3	Salmon Creek Main Channel
85	Shanghai Creek
289	South Mill Creek
5	Suds Creek
25	Tenny Creek
86	Upper Fifth Plain Creek
45	Upper Lacamas Creek
128	Upper Salmon Creek
225	Woodin Creek

Watersheds with Dairies and calculated number of cows based on milk production

Watershed Name	Calculated Number of Cows*
South Mill Creek	New Dairy, Milk Production Unavailable
South Mill Creek	200
Morgan Creek	136
South Mill Creek	75
China Ditch	155
China Ditch	664
China Ditch	New Dairy, Milk Production Unavailable
China Ditch	23
China Ditch	118
China Ditch	109
Lower Fifth Plain Creek	118
Shanghai Creek	582
Shanghai Creek	145
Lower Lacamas Creek	50
Matney Creek	61
Matney Creek	177
Lacamas Lake	259

*Number of Cows based on average milk production of 55 pounds of milk/cow/day

Appendix 1 GIS Data Set Descriptions for Ecology-derived Data Sets

```
COVERAGE:            bas-parc2
SERVER:              aqua
LOCATION:            /net/aqua/ei1/clark/spsz/bas-parc2
DESCRIPTION:         ARC INTERSECT ouput coverage with Salmon Creek, Lacamas
                     Lake, and Gibbons Creek TMDL sub-basins and Clark
                     County Assessment and GIS
                     Parcel information
LAYER TYPE:          POLY
ANNOTATED:           YES
MAP PROJECTION:      WA State Plane South Zone (5626)
MAP UNITS:           feet
MAP EXTENT:          Salmon, Lacamas Lake, and Gibbons Creek Watersheds, Clark
County Wa.
INPUT SCALE:         1:24k or better
INPUT FORMAT:        unknown
DATA SOURCE:         Clark County Assessment and GIS
COMPLETION:          4/27/95
LAST UPDATED:
RELATED TABLES:      none
CLASSIFIED DATA:     NO
NOTES:

CONTACT:             John Tooley
                     jtoo461@ecy.wa.gov
```

Item Format for INFO File BAS-PARC2.PAT

ITEM NAME	DESCRIPTION	DEFINITION
AREA	Area in coverage units	4,12,F,3
PERIMETER	Polygon perimeter in coverage units	4,12,F,3
BAS-PARC2#	Program assigned spatial feature identifier	4,5,B,0
BAS-PARC2-ID	User controlled spatial feature identifier	4,5,B,0
BAS-PARC#	polygon id from parcel input in	4,5,B,0
BAS-PARC-ID		4,5,B,0
BASNPARC#		4,5,B,0
BASNPARC-ID		4,5,B,0
SERIAL.NUMBER		9,9,I,0
PARCELS-C		4,4,I,0
PT1	parcel type code	3,3,I,0
DESC	parcel type description	120,120,C,0
SYMBOL	plotting symbol and classification grouping attr	4,5,B,0
BASINS#	basins polygon coverage internal id	4,5,B,0
BASINS-ID	basins polygon coverage user id	4,5,B,0
NAMES	basins sub-basin name	40,40,C,0
AC-SEC	?	7,7,N,2
BASINS-C	basins id?	3,3,I,0
MAJOR	major basins id?	3,3,I,0
MAJNAME	major basin name	20,20,C,0
D	?	80,80,C,0

9

```
COVERAGE:            bas-lulc
SERVER:              aqua
LOCATION:            /net/aqua/ei1/clark/spsz/bas-lulc
DESCRIPTION:         ARC INTERSECT output coverage, intersection of basins and
                     existing land use
LAYER TYPE:          POLY
ANNOTATED:           NO
MAP PROJECTION:      WA State Plane South Zone (5626)
MAP UNITS:           feet
MAP EXTENT:          Salmon, Lacamas Lake, and Gibbons Creek Watersheds,
                     Clark Co.
INPUT SCALE:         1:24k or better
INPUT FORMAT:        LULC unknown, basins unknown, and digitized from 7.5 quads
DATA SOURCE:         Clark County Assessment and GIS, additional basins by EILS
COMPLETION:          4/20/95
LAST UPDATED:

RELATED TABLES:      /net/aqua/ei1/clark/spsz/info/elu2
CLASSIFIED DATA:     NO
NOTES:

CONTACT:             John Tooley
                     jtoo461@ecy.wa.gov
```

Item Format for INFO File BAS-LULC.PAT

ITEM NAME	DESCRIPTION	
DEFINITION		
AREA	Area in coverage units	4,12,F,3
PERIMETER	Polygon perimeter in coverage units	4,12,F,3
BAS-LULC#	Program assigned spatial feature identifier	4,5,B,0
BAS-LULC-ID	User controlled spatial feature identifier	4,5,B,0
BASINS#	basins coverage internal id	4,5,B,0
BASINS-ID	basins coverage user id	4,5,B,0
NAMES	sub-basin name	40,40,C,0
AC-SEC	?	7,7,N,2
BASINS-C	?	3,3,I,0
MAJOR	major basin identifier	3,3,I,0
MAJNAME	major basin name	20,20,C,0
LANDUSE#	existing land use coverage internal id	4,5,B,0
LANDUSE-ID	existing land use coverage user id	4,5,B,0
ELU	exising land use code, 0=vacant,1=Forest,2=ag,20	3,3,I,0

```
COVERAGE:          bas-cow
SERVER:            aqua
LOCATION:          /net/aqua/eil/clark/spsz/bas-cow
DESCRIPTION:       ARC INTERSECT output coverage from intersection of
                   dairy coverage
                   Salmon, Lacamas Lake and Gibbons basins.
LAYER TYPE:        POINT
ANNOTATED:         NO
MAP PROJECTION:    WA State Plane South Zone (5626)
MAP UNITS:         feet
MAP EXTENT:        Salmon, Lacamas Lake, and Gibbons Creek Watersheds
                   Clark County Wa
INPUT SCALE:       1:100000
INPUT FORMAT:      dairy: address match, basins: Clark GIS and 7.5
                   quad digitizing
DATA SOURCE:       various, address match dairy locations, Clark GIS and
                   EILS basin delineations
COMPLETION:        4/20/95
LAST UPDATED:
RELATED TABLES:    none
CLASSIFIED DATA:   NO
NOTES:
CONTACT:           John Tooley
                   jtoo461@ecy.wa.gov
```

Item Format for INFO File BAS-COW.XAT

ITEM NAME	DESCRIPTION	DEFINITION
DEFINITION		
AREA	Not used	4,12,F,3
PERIMETER	Not used	4,12,F,3
BAS-COW#	Program assigned spatial feature identifier	4,5,B,0
BAS-COW-ID	User controlled spatial feature identifier	4,5,B,0
DAIRY#	Dairy coverage internal id	4,5,B,0
DAIRY-ID	dairy coverage user id	4,5,B,0
LONG	dairy location longitude decimal degrees	8,10,F,6
LAT	dairy location latitude decimal degrees	4,9,F,6
PATRON#	Dept of AG tracking number	12,12,C,0
COUNTY	dairy location county	16,16,C,0
OWNERS	owner name	70,70,C,0
STREET	dairy street address	35,35,C,0
CITY	dairy city	17,17,C,0
STATE	dairy state	8,8,C,0
ZIP	dairy zip	4,6,B,0
ID	unknown id from dept. of AG	7,7,C,0
MILK	average lbs of milk produced per day	4,7,B,0
COWS	estimated number of cows based on lbs milk/day	4,7,B,0
DAIRYNAME	dairy name	33,33,C,0
MATCHCODE	address match code b-batch,r-reject	12,12,C,0
WORKSTATUS	q-quit, n-new farm	17,17,C,0
RAGCODE	?	10,10,C,0
FARMADDRES	?	21,21,C,0
BASINS#	basins coverage internal id	4,5,B,0
BASINS-ID	basins coverage user id	4,5,B,0
NAMES	sub-basin name	40,40,C,0
AC-SEC	?	7,7,N,2
BASINS-C	?	3,3,I,0
MAJOR	major basin code	3,3,I,0
MAJNAME	major basin name	20,20,C,0

```
COVERAGE:            bas-manu
SERVER:              aqua
LOCATION:            /net/aqua/ei1/clark/spsz/bas-manu
DESCRIPTION:         ARC INTERSECT output coverage from intersection of animal
                     waste application area and project sub-basins
LAYER TYPE:          POLY
ANNOTATED:           NO
MAP PROJECTION:      WA State Plane South Zone (5626)
MAP UNITS:           feet
MAP EXTENT:          Salmon, Cacamas Lake, and Gibbons Creek Watersheds,
                     Clark Co. Wa
INPUT SCALE:         unknown
INPUT FORMAT:        Farm operations with animal waste applicatios were assigned
                     to property parcel
DATA SOURCE:         Clark County Assessment and GIS for animal waste, Clark Co
                     and EILS for sub-basins
COMPLETION:          4/20/95
LAST UPDATED:
RELATED TABLES:      none
CLASSIFIED DATA:     NO
NOTES:
CONTACT:             John Tooley
                     jtoo461@ecy.wa.gov
```

Item Format for INFO File BAS-MANU.PAT

ITEM NAME	DESCRIPTION	DEFINITION
AREA	Area in coverage units	4,12,F,3
PERIMETER	Polygon perimeter in coverage units	4,12,F,3
BAS-MANU#	Program assigned spatial feature identifier	4,5,B,0
BAS-MANU-ID	User controlled spatial feature identifier	4,5,B,0
MANAPP3#	Animal waste coverage internal id	4,5,B,0
MANAPP3-ID	animal waste coverage user id	4,5,B,0
POOPAR	unknown	2,2,I,0
BASINS#	basins coverage internal id	4,5,B,0
BASINS-ID	basins coverage user id	4,5,B,0
NAMES	sub-basins name	40,40,C,0
AC-SEC	?	7,7,N,2
BASINS-C	?	3,3,I,0
MAJOR	major watershed code	3,3,I,0
MAJNAME	major watershed name	20,20,C,0

Appendix B -- Project Request From Watershed Assessment Section

DATE: December 8, 1994

TO: Will Kendra and John Tooley

FROM: Bob Cusimano and David Giglio

SUBJECT: Salmon Creek Basin GIS Coverage "Wish List"

We found out that Clark has GIS data available for the Salmon Creek drainage.
We would like to get the following GIS information either directly from Clark
County by contracting their GIS group or from Ecology's GIS staff by
February 1, 1995.

The GIS map must include:

*   the Salmon Creek Basin, with all permanent tributaries

*   Land Use coverage, grouped into:
            Forest
            Agriculture
            Roads
            Residential
            Rural Residential
            Commercial/Industrial
            Public/Other/Unused

*   include municipal boundaries: Vancouver, Battle Ground

The GIS map may include (if possible/affordable):

*   percentage of land use for the entire basin and each major
        tributary sub-basin   ("major" = at least Cougar, Mill, Curtin,
        Weaver/Woodin).

*   more refined land use coverage: split Agriculture into Dairy and
        Farming, perhaps distinguish by size add septic tank locations
        (stars or some symbol), if septic locations not available then
        provide houses in and out of sewered areas.

Map Size and Format:

*   two (or more) wall-size color maps for both Current and Future
        Land Use (for presentations, reference, etc.).

*   one (or more) 11" x 17" map, suitable for reproduction in the
        final report. This will be color, if within our printing budget,
        or crosshatched for black-and-white reproduction.

13

Appendix C -- Spatial Data Description from Clark County
Assessment and GIS

March 1, 1995

Clifton C. McCarley
GIS Analyst
Department of Assessment and GIS
P.O. Box 5000
Vancouver, WA 98668

John Tooley
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

John:

Here is some description of the data that was requested by DOE. If you have
any problems please contact me at 360-699-2391 X4651 anytime Monday thru
Thursday 6:00am - 4:30pm. The coverages are not exported and the tape was
written non compressed. If you're reading this then obviously you had no
problem loading the tape. Enjoy!

The data are basically a group of coverages with four INFO lookup tables for
the basnslope(slope), flood(flood area), landslides and ugabnd (urban growth
areas). The coverages include:
Let me know if you need more specific information.

AQUIFERS	MANAPP3
BASNPARC	MUNWELSP
BASNSLOPE	SCLCGC
CCWELL	SEPTIC
CPUWQ	UGABND
CRITALL	USGSWELLS
FLOOD	WETPOLY
LANDSLIDE	

****INFO Lookup Tables****

        LANDSLIDE.LANDSLIDE
        FLOOD.FLOOD
        SLOPES.SLOPES
        UGABND.UGABND

****DIRECTORIES****
        ZOCS

If I haven't dropped the ball, all these coverages SHOULD be in NAD83
projected State Plane (Washington State South Zone) Coordinates. We only
recently made the jump to NAD83 and some of these layers have been sleeping on
tape for a while. I think I've correctly converted all of them but if one (or
more) seems to be ~3,000,000 feet off, that would be the problem.

****DATA DESCRIPTION****

AQUIFERS - This polygon coverage depicts the major aquifer units in Clark County.
The critical item in the .pat is "USGSUNIT'. This is a two letter character descriptor for the aquifer units. The aqgifer media designations are:

OR = Older Rocks
TG = Troutdale Gravels
UF = Undifferentiated Fine Sediments
     (Lower Troutdale)
US = Unconsolidated Sediments

**NOTE: There are 10 polygons that lack an entry in the "USGSUNIT" item. There are the larger surfacial bodies of water (e.g. Vancouver Lake, Lake Merwin, Yale Lake, etc).

BASNPARC - This is the parcels coverage for the three watershed that you requested. The parcels PT1 (property type) code and a description ('DESC') have been joined to the basnparc.pat. There are 35,658 parcels, more or less.

BASNSLOPE - These polygons represent the slope calculations for the watersheds. An INFO lookup table is included with descriptions for the "Slopes" items in basnslope.pat. This lookup table is named SLOPES.SLOPES and is relatable to basnslope.pat via the "Slopes" item.

CCWELL - This is an appended point coverage representing both the USGS mapped wells and the Clark Public Utilities mapped wells. There is no useful data other than the spatiality.

CPUWQ - This cover represents the 4200 wells mapped by Clark Public Utilities and the now defunct Intergovernmental Resource Center. There is substantial data associated with each well but little in the way of metadata. Rod Swanson probably knows this data better than anyone.

CRITALL - These polygons represent the critical lands in Clark County that were used in the identification of Buildable Vacant lands. The important item in the PAT is "CRITICAL". The values for CRITICAL are:

0 = Non -Critical Lands
1 = Critical 1 Lands
2 = Critical 2 Lands
3 = Both Critical 1 and Critical 2 Lands

A. Critical 1 Lands are defined by an overlay of Floodways, Slopes GT 40%, and High Quality Wetlands buffered fifty(50) feet.

B. Critical 2 Lands are defined as all Critical 1 Lands, with the addition of:
a.Flood Fringe
b.Hydric Soils with a fifty(50) foot buffer
c.Slopes 25 -40%
d.USGS Streams with a fifty(50) foot buffer
e.Priority Habitats
f.Unstable Slopes (active, potential or historic landslide areas)

15

FLOOD - This polygon coverage represents the flood areas in Clark County. An
        INFO lookup table is included with descriptions for the "FLOOD"
        item in Flood.pat. This lookup table is named FLOOD.FLOOD and is
        relatable to Flood.pat via the "FLOOD" item.

LANDSLIDE - This polygon coverage represents the unstable slopes in Clark
        County. An INFO lookup table is included with descriptions for
        the "LANDSLIDE" item in landslide.pat. This lookup table is named
        LANDSLIDE.LANDSLIDE and is relatable to landslide.pat via the
        "LANDSLIDE" item.

MANAPP3 - These polygons represent the animal waste application areas in Clark
        County. There is no other important data other the the spatiality.

MUNWELSP - These 102 points represent the public supply wells currently mapped
        in Clark County. It does not represent all public supply wells.

SCLCGC - These polygons represent the Salmon Creek, Lacamas Creek and Gibbons
        Creek watersheds. MAJNAME is the item that contains the names of
        rhe watershed. MAJOR is an interger that represents each
        watershed and NAME is the subbasin name associated with each
        watershed.

SEPTICS - This point coverage represents an ATTEMPT to map as many septic
        locations as we could find DIGITAL data for. This data came from
        SW Washington Health District, City of Vancouver and Burnt Bridge
        Creek Utility. It only represents some unknown fraction of the
        septic sustems existing in reality and some very liberal awk
        massage was applied in certain cases in order to beat to fit.
        Don't bet the farm on this one! The points are parcel centroids
        identified by serial number as opposed to system location within
        the parcel and the remaining data is very dated information about
        that parcel.

UGABND - This polygon coverage represents the official Urban Growth Areas in
        Clark County. A lookup table is included with descriptions for
        the "UGABND" item in ugabnd.pat. This lookup table is named
        UGABND.UGABND and is relatable to ugabnd.pat via the "UGABND"
        item.

CPUWQ - This cover represents the 6949 wells mapped by the US Geological
        Survey. There is substantial data associated with each well but
        little in the way of metadata. Again, Rod Swanson probably knows
        this data better than anyone.

WETPOLY - These polygons represent the High Quality wetlands in Clark County
        as delineated by the county's Water Quality Division. Reselect for
        item "WETPOLY" = 1 to shade areas or perform analysis.

And Last but not least,

ZOCS - This a DIRECTORY that contains 32 coverages. Thirty-one of these covers
are the individual zones of contribution for the 31 well 'locations'
associated with the public supply wells. There are 102 wells
distributed in 31 locations. In each of the 31 zoc coverages there is
an item called "YEAR" that designates the contributory year of the
polygon and "NAME" which is used to position the official location name
associated with the zoc. There is also one coverage that is an append
of the 31 seperate coverages. This has not been converted to a REGIONS
coverage. There is massive overlap among these ZOCS and they are
difficult to use graphically. That is the reason only one polygon of
each coverage has text in the "NAME" item. It is used to place a
location name for each ZOC on an 11 x 17 graphic.

HAPPY HUNTING!
Clifton C. McCarley

PS Our Shoreline data is locally generated data that was used in some open
space analysis long ago and does not reflect Shorelines of Statewide
Significance designations. I have not included this data set.

Appendix D -- Existing Land Use Data Description from Clark County Assessment and GIS

April 4, 1995

Clifton C. McCarley
GIS Analyst
Clark County Assessment and GIS
P.O. Box 5000
Vancouver, WA 98668

John Tooley
GISist
Environmental Investigations and Lab Services
P.O. Box 47600
Olympia, Washington 98504-7600

John,

Here we have the 'existing landuse coverage' and associated landuse.elu
INFO lookup table for that coverage. The relate item in the coverage is
"ELU". These landuse classifications were created by assigning either the
pt1 code from the parcel assessment or the 1990 photo-interpreted land cover
(whichever was applicable) to one of these 25 'landuse' classifications.
The aml that creates this coverage is run quarterly or on request. When
the parcel size exceeds five(5) acres the landcover attributes are used.
Less than five(5) acres, the PT1 code from assessment is used.

Note that this coverage has no association with current zoning or
comprehensive
plan other than coincidence. It is currently our best shot at a landuse
inventory.

The charge for this is $55.00 reflecting one hour staff and processing time.
we would request that you return both of the 8mm tapes from these data
transfers, however if you wish to keep them a subsequent invoice for $50
will be sent reflecting charges for 2 tapes @ $25 per tape.

Happy Hunting!

Cliff McCarley

Appendix E -- Dairy Location Layer Data Description

Dairy Mapping Project - Procedures for creating ARC/INFO data layer

1   Received address database of <u>raw milk producers</u> in ascii format from Washington State Department of Agriculture (12/93). Reformatted file using Wordperfect software to allign columns.

2.   Imported ascii address database into Matchmaker 2000 (address matching software) by defining appropriate columns for the various fields.

3.   Batch matched all addresses with an initial success rate of 60%.

4.   Studied each address that failed for simple corrections (i.e. directional component in wrong place: nw 32 street vs. 32 street nw, small spelling errors, etc.). After these corrections, there was a 90% success rate.

5.   Divided remaining "rejected" addresses up by county. Called SCS extension agents, Department of Agriculture inspectors, Department of Ecology inspectors and commercial milk companies to help locate these farms. Used Metskers maps, Delorme maps, township-section-range, and a variety of other landmarks to help register locations.

6.   Updated address list from Department of Agriculture by checking actual files (9/94). Verified whether farm was still active, and added information on how much milk was produced. Also added new farms and eliminated duplicate entries. Verified actual farm address (original database contained mailing addresses). Repeated steps 1-5 for all addresses which were updated.

7.   Finalized all address data in Microsoft Excel Worksheet (milk.xls). Created field for estimating size of farm (number of cows) based on how much milk was produced. Used conversion factor of 55 pounds of milk per cow per day. Exported this into file format that could be imported by ARC/INFO (milk.dbf).

8.   Converted address file to ARC/INFO coverage using EPA developed AML (DBF2COVER).

9.   Received SCS dairy database (Microsoft Excel) for Puget Sound Area (600 farms). Cross referenced farms in this file with Patron-id number found in the GIS coverage to enable relates. Exported this file to format that can be imported by ARC/INFO.

10.   Imported SCS dairy database to an INFO file using EPA developed AML (DBF2INFO).

11.   Final maps showing relationship between farms and water quality produced for each region, statewide and one example watershed.

12.   All relevant files will be transferred to the EPA Region 10 GIS section. Further questions on the dairy data layer can be directed to Scott Breidenbach, Washington State Deparment of Ecology. Further questions on water quality data can be directed to Steve Butkus, Washington State Department of Ecology.

Numerical breakdown of Address Processing:

```
Addresses in orginal raw milk producer database (12/93) 1129
Additional farm addresses   (9/94)                         37
Duplicate addresses removed                                 5
Addresses in final database                              1161
```

Breakdown of addresses matched by farm status:

	Number of farms	Address matched	Percentage
Active farms	1010	1010	100
Farms no longer doing business	151	149	98.6
TOTAL	1161	1159	99.8

Breakdown of Active Farms by size

Small farms (0-200 cows)	642	
Mediem farms (200-700 cows)		305
Large farms (over 700 cows)		63

Notes on Accuracy of Address Matching

The bulk of locations of farms were determined using an address-matching software; Matchmaker 2000. This software uses Census data and some additional postal information to determine the beginning and ending numerical address for a given road segement. Thus numerical addresses are interpolated using the two endpoints as known addresses. Possible errors include:

1) Non-linear arrangement of addresses along any given road segment
2) Road names having more than one name (i.e. HWY 99, Pacific HWY, Carnation-Duvall RD, Carnation RD).
3) Inaccurate name or number data in Matchmaker database
4) Inaccurate spelling, name or number data in farm database (zip codes were often inaccurate due to lack of actual mailing address of parcel.

Accuracy of locations was checked for a handfull of farms after software matching and was found to be generally within a mile of the actual location. This does not, in any way establish an accuracy level for the entire database. Addresses which failed the software process were matched using a variety of methods with varying reliablity.

The creation of this data layer was intended to provide a general view of the number of dairy farms in different watersheds. *The Department of Ecology does not recommend using the dairy farm locations for more precise analyses.*

Notes on Water Quality Data

Preparation of the final maps for this project required using 305b and 303d water quality data prepared by Steve Butkus of the Washington State Department of Ecology. Coverages were created for streams which do not meet water quality standards as set by the State of Washington. There is a separate coverage for each distinct cause of failure (i.e. DO, fecal coliform, metals, etc.). The final maps displayed streams which did not meet standards for fecal coliform, temperature or dissolved oxygen. This data has all been previously transferred to the EPA.