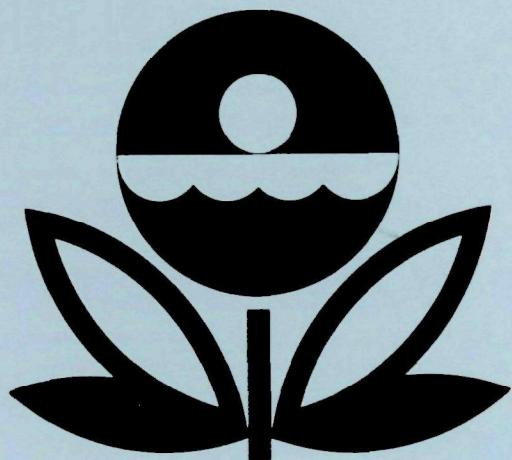


**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY
WORKING PAPER SERIES**



REPORT
ON
HILLS CREEK RESERVOIR
LANE COUNTY
OREGON
EPA REGION X
WORKING PAPER No. 830

**CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA**

REPORT

ON

HILLS CREEK RESERVOIR

LANE COUNTY

OREGON

EPA REGION X

WORKING PAPER No. 830

WITH THE COOPERATION OF THE

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

AND THE

OREGON NATIONAL GUARD

JANUARY, 1978

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

- a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.
- b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.
- c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Oregon Department of Environmental Quality for the professional involvement and to the Oregon National Guard for conducting the tributary sampling phase of the Survey.

William H. Young, Department Director, and Harold L. Sawyer, Administrator, and the staff of the Water Quality Control Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

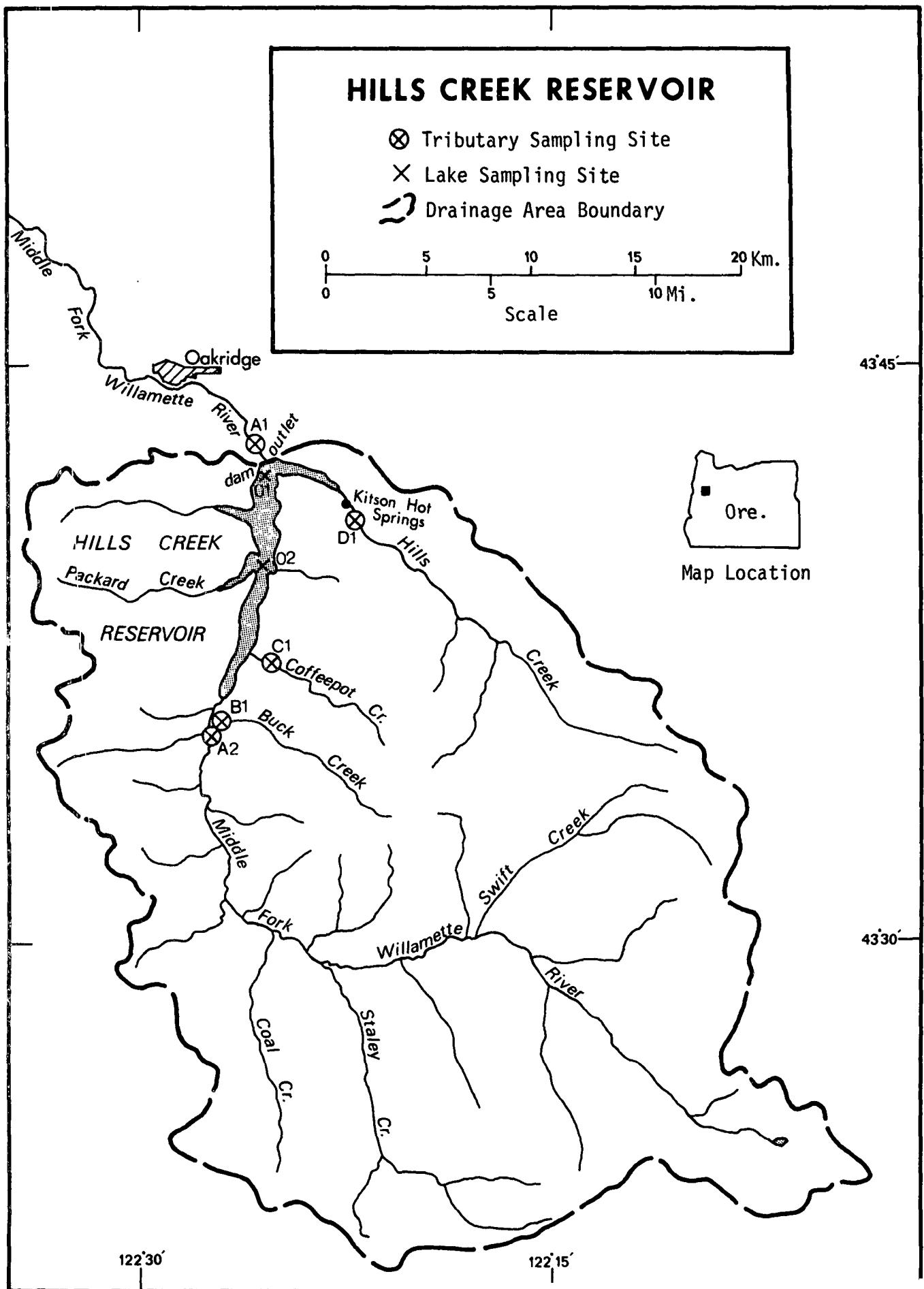
Brigadier General Richard A. Miller, the Adjutant General of Oregon, and Project Officer Lt. Colonel John Mewha, who directed the volunteer efforts of the Oregon National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES and RESERVOIRS

STATE OF OREGON

| <u>NAME</u> | <u>COUNTY</u> |
|--------------|---|
| Brownlee | Baker, OR; Washington, ID |
| Diamond | Douglas |
| Hells Canyon | Baker, Wallowa, OR; Adams, Idaho, ID |
| Hills Creek | Lane |
| Owyhee | Malheur |
| Oxbow | Baker, OR; Adams, ID |
| Suttle | Jefferson |
| Waldo | Lane |



HILLS CREEK RESERVOIR

STORET NO. 4104

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Hills Creek Reservoir is eutrophic. It ranked fourth in overall trophic quality when the eight Oregon lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Three of the water bodies had less median total phosphorus, dissolved orthophosphorus, and inorganic nitrogen; one had less mean chlorophyll a, and all but one of the other water bodies had greater mean Secchi disc transparency.

Survey limnologists did not observe surface concentrations of algae, but summer blooms of blue-green algae (Anabaena sp.) have been reported (Larson, 1974).

B. Rate-Limiting Nutrient:

Because of significant changes in nutrients in the sample between the time of collection and the beginning of the algal assay, the results are not considered representative of conditions in the reservoir at the time the sample was collected (10/30/75).

The reservoir data indicate nitrogen limitation all three sampling times. However, because of turbidity (Klingeman et al., 1971), primary productivity probably is light-limited.

C. Nutrient Controllability:

1. Point sources--No known municipal or industrial point sources impacted the reservoir during the sampling year. Septic

* See Appendix A.

tanks serving lakeshore dwellings were estimated to have contributed less than 0.1% of the total phosphorus load, but a shoreline survey is needed to determine the significance of those sources.

The present phosphorus loading of $3.66 \text{ g/m}^2/\text{yr}$ is more than twice that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11). Though the high turbidity of the reservoir may be suppressing primary production, every effort should be made to minimize phosphorus inputs to slow the aging of the reservoir.

2. Non-point sources--Non-point sources, including direct precipitation, added over 99.9% of the total phosphorus load during the sampling year. The Middle Fork Willamette River added 70.9% of the total load; Hills Creek, 10.9%; and the un-gaged tributaries contributed an estimated 17.7%.

The phosphorus export rate of Middle Fork Willamette River and Hills Creek were 43 and $32 \text{ kg/km}^2/\text{yr}$ (see page 10). These export rates are considerably higher than those of unimpacted forested watersheds in the eastern United States (Omernik, 1976). The higher rates may be due to unstable soil materials in the watersheds (Klingeman et al., op. cit.).

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS[†]

A. Morphometry^{††}:

1. Surface area: 11.07 kilometers².
2. Mean depth: 39.2 meters.
3. Maximum depth: 90.5 meters.
4. Volume: 433.571×10^6 m³.
5. Mean hydraulic retention time: 152 days.

B. Tributary and Outlet:

(See Appendix C for flow data)

1. Tributaries -

| <u>Name</u> | <u>Drainage area (km²)*</u> | <u>Mean flow (m³/sec)*</u> |
|--|--|---------------------------------------|
| Middle Fork Willamette River | 668.2 | 22.37 |
| Hills Creek | 136.5 | 4.31 |
| Minor tributaries & immediate drainage - | <u>191.7</u> | <u>6.36</u> |
| Totals | 996.4 | 33.04** |

2. Outlet -

| | | |
|------------------------------|------------|-------|
| Middle Fork Willamette River | 1,007.5*** | 33.04 |
|------------------------------|------------|-------|

C. Precipitation****:

1. Year of sampling: 123.4 centimeters.
2. Mean annual: 117.0 centimeters.

[†] Table of metric conversions--Appendix B.

^{††} Anonymous, 1972; Martin and Hanson, 1966.

^{*} For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".

^{**} Sum of inflows adjusted to equal outflow.

^{***} Includes area of reservoir.

^{****} See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Hills Creek Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 67.1 meters at station 1 and 54.9 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR HILLS CREEK RESERVOIR
STORET CODE 4104

| PARAMETER | 1ST SAMPLING (3/28/75) | | | | 2ND SAMPLING (7/16/75) | | | | 3RD SAMPLING (10/30/75) | | | |
|--------------------|-------------------------|-------|--------|---------------|-------------------------|--------|---------------|-------|-------------------------|-------|------|--------|
| | 2 SITES | | | | 2 SITES | | | | 2 SITES | | | |
| | RANGE | MEAN | MEDIAN | RANGE | MEAN | MEDIAN | RANGE | MEAN | MEDIAN | RANGE | MEAN | MEDIAN |
| TEMP (C) | 4.5 - 6.2 | 5.6 | 5.8 | 3.0 - 19.5 | 12.0 | 13.1 | 5.7 - 14.0 | 10.9 | 12.3 | | | |
| DISS OXY (MG/L) | 10.4 - 11.6 | 11.3 | 11.5 | 8.2 - 15.4 | 10.0 | 9.3 | 7.6 - 9.8 | 8.8 | 9.0 | | | |
| CONDCTVY (MICROMO) | 32. - 48. | 40. | 40. | 15. - 41. | 28. | 28. | 23. - 50. | 41. | 40. | | | |
| pH (STAND UNITS) | 7.2 - 7.8 | 7.5 | 7.4 | 6.9 - 9.3 | 8.2 | 8.3 | 6.9 - 7.9 | 7.2 | 7.2 | | | |
| TOT ALK (MG/L) | 20. - 23. | 22. | 22. | 19. - 30. | 25. | 25. | 28. - 33. | 31. | 31. | | | |
| TOT P (MG/L) | 0.038 - 0.059 | 0.044 | 0.043 | 0.017 - 0.045 | 0.029 | 0.026 | 0.022 - 0.061 | 0.034 | 0.031 | | | |
| ORTHO P (MG/L) | 0.030 - 0.041 | 0.035 | 0.034 | 0.012 - 0.038 | 0.025 | 0.026 | 0.007 - 0.028 | 0.017 | 0.014 | | | |
| NO2+NO3 (MG/L) | 0.020 - 0.040 | 0.023 | 0.026 | 0.020 - 0.080 | 0.034 | 0.030 | 0.020 - 0.080 | 0.038 | 0.030 | | | |
| AMMONIA (MG/L) | 0.020 - 0.040 | 0.024 | 0.020 | 0.030 - 0.090 | 0.049 | 0.045 | 0.020 - 0.020 | 0.020 | 0.020 | | | |
| CHLOR N (MG/L) | 0.200 - 0.400 | 0.217 | 0.200 | 0.200 - 1.200 | 0.321 | 0.250 | 0.200 - 0.200 | 0.200 | 0.200 | | | |
| INORG N (MG/L) | 0.040 - 0.070 | 0.047 | 0.040 | 0.050 - 0.170 | 0.082 | 0.075 | 0.040 - 0.100 | 0.058 | 0.050 | | | |
| TOTAL N (MG/L) | 0.220 - 0.430 | 0.240 | 0.220 | 0.220 - 1.280 | 0.355 | 0.285 | 0.220 - 0.280 | 0.238 | 0.230 | | | |
| CHLRPYL A (UG/L) | 0.6 - 1.0 | 0.8 | 0.8 | 3.8 - 4.2 | 4.0 | 4.0 | 1.7 - 2.7 | 2.2 | 2.2 | | | |
| SECCHI (METERS) | 1.4 - 1.5 | 1.4 | 1.4 | 1.8 - 2.0 | 1.9 | 1.9 | 1.5 - 1.5 | 1.5 | 1.5 | | | |

B. Biological characteristics:

1. Phytoplankton -

| <u>Sampling Date</u> | <u>Dominant Genera</u> | <u>Algal Units per ml</u> |
|----------------------|---|---|
| 03/28/75 | 1. <u>Chroomonas (?) sp.</u> 2. <u>Cryptomonas sp.</u> | 219 <u>17</u> |
| | Total | 236 |
| 07/16/75 | 1. <u>Fragilaria sp.</u> 2. <u>Cryptomonas sp.</u> 3. <u>Asterionella sp.</u> 4. <u>Chroomonas (?) sp.</u> | 1,569 297 212 <u>42</u> |
| | Total | 2,120 |
| 10/30/75 | 1. <u>Melosira sp.</u> 2. <u>Asterionella sp.</u> 3. <u>Fragilaria sp.</u> 4. <u>Chlamydomonas sp.</u> 5. Centric diatoms Other genera | 4,118 223 148 111 <u>111</u> <u>75</u> |
| | Total | 4,786 |

2. Chlorophyll a -

| <u>Sampling Date</u> | <u>Station Number</u> | <u>Chlorophyll a (µg/l)</u> |
|----------------------|-----------------------|-----------------------------|
| 03/28/75 | 1 | 0.6 |
| | 2 | 1.0 |
| 07/16/75 | 1 | 3.8 |
| | 2 | 4.2 |
| 10/30/75 | 1 | 2.7 |
| | 2 | 1.7 |

C. Limiting Nutrient Study:

Due to significant changes in the nutrients in the sample from the time of collection to the beginning of the assay, the results are not considered representative of conditions in the reservoir when the sample was taken (10/30/75).

The reservoir data indicate nitrogen limitation all three sampling times. The mean inorganic nitrogen to orthophosphorus ratios were 1 to 1 in April, 3 to 1 in July, and 3 to 1 in October; and nitrogen limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Oregon National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of January and February when two samples were collected. Sampling was begun in October, 1974, and was completed in September, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Oregon District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in kg/km²/year, at stations A-2 and D-1 and multiplying the means by the ZZ area in km².

No known wastewater treatment plants impacted Hills Creek Reservoir during the sampling year.

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

| <u>Source</u> | <u>kg P/ yr</u> | <u>% of total</u> |
|--|---------------------|-----------------------|
| a. Tributaries (non-point load) - | | |
| Middle Fk. Willamette River | 28,760 | 70.9 |
| Hills Creek | 4,395 | 10.9 |
| b. Minor tributaries & immediate drainage (non-point load) - | 7,190 | 17.7 |
| c. Known municipal STP's - None | - | - |
| d. Septic tanks | <5 | <0.1 |
| e. Known industrial - None | - | - |
| f. Direct precipitation** - | <u>195</u> | <u>0.5</u> |
| Total | 40,540 | 100.0 |

2. Outputs -

Reservoir outlet - Middle Fk
Willamette R. 36,130

3. Net annual P accumulation - 4,410 kg.

* Estimate based on three shoreline dwellings; see Working Paper No. 175.

** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

| <u>Source</u> | <u>kg N/ yr</u> | <u>% of total</u> |
|--|---------------------|-----------------------|
| a. Tributaries (non-point load) - | | |
| Middle Fk Willamette River | 119,655 | 59.4 |
| Hills Creek | 30,910 | 15.4 |
| b. Minor tributaries & immediate drainage (non-point load) - | | |
| | 38,820 | 19.3 |
| c. Known municipal STP's - None | - | - |
| d. Septic tanks* - | 30 | <0.1 |
| e. Known industrial - None | - | - |
| f. Direct precipitation** - | <u>11,950</u> | <u>5.9</u> |
| Total | 201,365 | 100.0 |

2. Outputs -

Reservoir outlet - Middle Fk
Willamette R. 256,375

3. Net annual N loss ~ 55,010 kg.

D. Non-point Nutrient Export by Subdrainage Area:

| <u>Tributary</u> | <u>kg P/km²/yr</u> | <u>kg N/km²/yr</u> |
|--------------------------|-------------------------------|-------------------------------|
| Middle Fk. Willamette R. | 43 | 179 |
| Hills Creek | 32 | 226 |

E. Mean Nutrient Concentrations in Ungaged Streams:

| <u>Tributary</u> | <u>Mean Total P Conc. (mg/l)</u> | <u>Mean Total N Conc. (mg/l)</u> |
|------------------|--------------------------------------|--------------------------------------|
| Buck Creek | 0.041 | 0.230 |
| Coffeepot Creek | 0.050 | 0.274 |

* Estimate based on three shoreline dwellings; see Working Paper No. 175.

** See Working Paper No. 175.

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

| | Total Phosphorus Total | Total Phosphorus Accumulated | Total Nitrogen Total | Total Nitrogen Accumulated |
|--------------------------|---------------------------|---------------------------------|-------------------------|-------------------------------|
| grams/m ² /yr | 3.66 | 0.40 | 18.2 | loss* |

Vollenweider phosphorus loadings
(g/m²/yr) based on mean depth and mean
hydraulic retention time of Hills Creek Reservoir:

| | |
|--------------------------------------|------|
| "Dangerous" (eutrophic loading) | 1.80 |
| "Permissible" (oligotrophic loading) | 0.90 |

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the reservoir, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, or unsampled point sources discharging directly to the reservoir. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's former National Eutrophication and Lake Restoration Branch (Malueg et al., 1975).

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500- MEAN SEC | MEAN CHLORA | 15- MIN DO | MEDIAN DISS ORTHO P |
|--------------|------------------------|-------------------|-------------------|------------------|----------------|---------------|------------------------|
| 4101 | BROWNLEE RESERVOIR | 0.079 | 0.560 | 428.133 | 16.207 | 14.500 | 0.043 |
| 4102 | DIAMOND LAKE | 0.028 | 0.040 | 294.500 | 7.300 | 6.800 | 0.011 |
| 4103 | HELLS CANYON RESERVOIR | 0.068 | 0.640 | 429.111 | 18.722 | 12.400 | 0.045 |
| 4104 | HILLS CREEK RESERVOIR | 0.038 | 0.060 | 435.200 | 2.333 | 7.400 | 0.027 |
| 4105 | OWYHEE | 0.095 | 0.425 | 480.417 | 3.350 | 13.200 | 0.064 |
| 4106 | OXBOW RESERVOIR | 0.071 | 0.690 | 425.555 | 10.311 | 12.200 | 0.040 |
| 4107 | SUTTLE LAKE | 0.031 | 0.040 | 95.000 | 9.167 | 6.800 | 0.020 |
| 4108 | WALDO LAKE | 0.005 | 0.040 | -100.000 | 0.350 | 6.800 | 0.006 |

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500- MEAN SEC | MEAN CHLORA | 15- MIN DO | MEDIAN DISS ORTHO P | INC NO |
|--------------|------------------------|-------------------|-------------------|------------------|----------------|---------------|------------------------|-----------|
| 4101 | BROWNLEE RESERVOIR | 14 (1) | 29 (2) | 43 (3) | 14 (1) | 0 (0) | 29 (2) | 12 |
| 4102 | DIAMOND LAKE | 86 (6) | 93 (6) | 71 (5) | 57 (4) | 86 (5) | 86 (6) | 47 |
| 4103 | HELLS CANYON RESERVOIR | 43 (3) | 14 (1) | 29 (2) | 0 (0) | 29 (2) | 14 (1) | 12 |
| 4104 | HILLS CREEK RESERVOIR | 57 (4) | 57 (4) | 14 (1) | 86 (6) | 57 (4) | 57 (4) | 32 |
| 4105 | OWYHEE | 0 (0) | 43 (3) | 0 (0) | 71 (5) | 14 (1) | 0 (0) | 12 |
| 4106 | OXBOW RESERVOIR | 29 (2) | 0 (0) | 57 (4) | 29 (2) | 43 (3) | 43 (3) | 20 |
| 4107 | SUTTLE LAKE | 71 (5) | 71 (5) | 86 (6) | 43 (3) | 86 (5) | 71 (5) | 42 |
| 4108 | WALDO LAKE | 100 (7) | 93 (6) | 100 (7) | 100 (7) | 86 (5) | 100 (7) | 57 |

LAKES RANKED BY INDEX NOS.

| RANK | LAKE CODE | LAKE NAME | INDEX NO |
|------|-----------|------------------------|----------|
| 1 | 4108 | WALDO LAKE | 579 |
| 2 | 4102 | DIAMOND LAKE | 479 |
| 3 | 4107 | SUTTLE LAKE | 428 |
| 4 | 4104 | HILLS CREEK RESERVOIR | 328 |
| 5 | 4106 | OXBOW RESERVOIR | 201 |
| 6 | 4101 | BROWNLEE RESERVOIR | 129 |
| 7 | 4103 | HELLS CANYON RESERVOIR | 129 |
| 8 | 4105 | OWYHEE | 128 |

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

~~Hectares x 2.471 = acres~~

~~Kilometers x 0.6214 = miles~~

~~Meters x 3.281 = feet~~

~~Cubic meters x 8.107×10^{-4} = acre/feet~~

~~Square kilometers x 0.3861 = square miles~~

~~Cubic meters/sec x 35.315 = cubic feet/sec~~

~~Centimeters x 0.3937 = inches~~

~~Kilograms x 2.205 = pounds~~

~~Kilograms/square kilometer x 5.711 = lbs/square mile~~

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR OREGON

08/11/76

LAKE CODE 4104 HILLS CREEK RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1007.5

| TRIBUTARY | SUB-DRAINAGE AREA(SQ KM) | NORMALIZED FLOWS(CMS) | | | | | | | | | | | | |
|-----------|-----------------------------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | MEAN |
| 4104A1 | 1007.5 | 53.80 | 33.98 | 15.35 | 20.44 | 28.88 | 24.52 | 16.03 | 20.95 | 33.41 | 37.10 | 54.09 | 58.05 | 33.04 |
| 4104A2 | 668.2 | 36.81 | 30.87 | 30.30 | 29.45 | 32.85 | 20.67 | 11.38 | 8.27 | 7.33 | 9.49 | 22.34 | 29.17 | 22.37 |
| 4104D1 | 136.5 | 7.79 | 6.06 | 6.03 | 5.89 | 6.77 | 4.05 | 1.43 | 0.85 | 0.81 | 1.26 | 4.30 | 6.60 | 4.31 |
| 4104ZZ | 203.6 | 9.63 | 7.36 | 7.36 | 7.08 | 8.21 | 4.81 | 1.70 | 0.99 | 0.99 | 1.56 | 5.38 | 8.21 | 5.26 |
| 4104F | 14.2 | 0.340 | 0.425 | 0.142 | 0.057 | 0.028 | 0.014 | 0.006 | 0.003 | 0.006 | 0.006 | 0.028 | 0.283 | 0.110 |
| 4104G | 47.9 | 0.708 | 0.850 | 0.283 | 0.142 | 0.057 | 0.028 | 0.014 | 0.006 | 0.008 | 0.014 | 0.057 | 0.566 | 0.224 |

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1007.5 TOTAL FLOW IN = 388.11
 SUM OF SUB-DRAINAGE AREAS = 1070.4 TOTAL FLOW OUT = 396.61

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|-----------|-------|------|-----------|-----|--------|-----|--------|-----|------|
| | | | | | | | | | |
| 4104A1 | 10 | 74 | 36.812 | 19 | 37.095 | | | | |
| | 11 | 74 | 36.812 | 15 | 35.113 | | | | |
| | 12 | 74 | 49.271 | 16 | 53.802 | | | | |
| | 1 | 75 | 58.333 | 6 | 49.838 | 17 | 75.323 | | |
| | 2 | 75 | 12.205 | 7 | 10.421 | 24 | 10.307 | | |
| | 3 | 75 | 39.644 | 7 | 45.024 | | | | |
| | 4 | 75 | 34.547 | 22 | 33.697 | | | | |
| | 5 | 75 | 30.299 | 21 | 41.626 | 28 | 41.343 | | |
| | 6 | 75 | 44.174 | 10 | 45.873 | | | | |
| | 7 | 75 | 21.209 | 28 | 14.215 | | | | |
| | 8 | 75 | 27.609 | 29 | 36.812 | | | | |
| | 9 | 75 | 37.095 | 16 | 37.661 | | | | |
| 4104A2 | 10 | 74 | 8.212 | 19 | 7.759 | | | | |
| | 11 | 74 | 10.675 | 15 | 7.929 | | | | |
| | 12 | 74 | 26.108 | 16 | 41.909 | | | | |
| | 1 | 75 | 37.095 | 6 | 50.687 | 17 | 37.095 | | |
| | 2 | 75 | 34.263 | 7 | 21.606 | 24 | 28.883 | | |
| | 3 | 75 | 33.414 | 7 | 29.450 | | | | |
| | 4 | 75 | 23.305 | 22 | 23.078 | | | | |
| | 5 | 75 | 42.475 | 21 | 34.547 | 28 | 40.210 | | |
| | 6 | 75 | 37.095 | 10 | 39.077 | | | | |
| | 7 | 75 | 18.094 | 28 | 12.997 | | | | |
| | 8 | 75 | 11.242 | 29 | 10.959 | | | | |
| | 9 | 75 | 9.543 | 16 | 9.543 | | | | |

TRIBUTARY FLOW INFORMATION FOR OREGON

08/11/76

LAKE CODE 4104 HILLS CREEK RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|-----------|-------|------|-----------|-----|--------|-----|--------|-----|------|
| 410401 | 10 | 74 | 0.703 | 19 | 0.566 | | | | |
| | 11 | 74 | 1.501 | 15 | 0.566 | | | | |
| | 12 | 74 | 5.975 | 16 | 13.847 | | | | |
| | 1 | 75 | 9.458 | 6 | 13.762 | 17 | 12.205 | | |
| | 2 | 75 | 8.778 | 7 | 3.823 | 24 | 7.362 | | |
| | 3 | 75 | 5.097 | 7 | 4.531 | | | | |
| | 4 | 75 | 3.285 | 22 | 3.002 | | | | |
| | 5 | 75 | 9.061 | 21 | 5.862 | 28 | 7.900 | | |
| | 6 | 75 | 6.654 | 10 | 7.447 | | | | |
| | 7 | 75 | 1.982 | 28 | 0.793 | | | | |
| | 8 | 75 | 0.623 | 29 | 0.595 | | | | |
| | 9 | 75 | 0.340 | 16 | 0.340 | | | | |
| 41041F | 10 | 74 | 0.0 | 19 | 0.0 | | | | |
| | 11 | 74 | 0.014 | 15 | 0.0 | | | | |
| | 12 | 74 | 0.042 | 16 | 0.028 | | | | |
| | 1 | 75 | 0.142 | 6 | 1.133 | 17 | 0.014 | | |
| | 2 | 75 | 0.850 | 7 | 0.566 | 21 | 2.265 | | |
| | 3 | 75 | 0.057 | 7 | 0.014 | | | | |
| | 4 | 75 | 0.014 | 18 | 0.006 | | | | |
| | 5 | 75 | 0.008 | 27 | 0.003 | | | | |
| | 6 | 75 | 0.006 | 10 | 0.006 | | | | |
| | 7 | 75 | 0.014 | 24 | 0.006 | | | | |
| | 8 | 75 | 0.0 | 22 | 0.0 | | | | |
| | 9 | 75 | 0.0 | 12 | 0.0 | | | | |
| 41041G | 10 | 74 | 0.0 | 19 | 0.0 | | | | |
| | 11 | 74 | 0.028 | 15 | 0.008 | | | | |
| | 12 | 74 | 0.085 | 16 | 0.057 | | | | |
| | 1 | 75 | 0.340 | 6 | 2.265 | 17 | 0.051 | | |
| | 2 | 75 | 1.982 | 7 | 1.557 | 21 | 5.663 | | |
| | 3 | 75 | 0.142 | 7 | 0.037 | | | | |
| | 4 | 75 | 0.029 | 18 | 0.017 | | | | |
| | 5 | 75 | 0.020 | 21 | 0.008 | 27 | 0.008 | | |
| | 6 | 75 | 0.011 | 10 | 0.014 | | | | |
| | 7 | 75 | 0.028 | 24 | 0.011 | 28 | 0.006 | | |
| | 8 | 75 | 0.0 | 22 | 0.0 | | | | |
| | 9 | 75 | 0.0 | 12 | 0.0 | | | | |

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/03/12

410401
 43 42 23.0 122 25 20.0 3
 HILLS CREEK RESERVOIR
 41039 OREGON

130991

11EPALES 2111202
 0159 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO ₃ MG/L | 00610 NH ₃ -N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO ₂ &NO ₃ N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|--------------------|-------------------|---------------|--------------------------------|---------------------|-------------------------------------|--|-------------------|---|--|--------------------------------|--|--------------------------------------|
| 75/03/28 | 09 40 | 0000 | 6.2 | 11.6 | 54 | 47 | 7.80 | 22 | 0.030 | 0.200K | 0.020 | 0.040 |
| | 09 40 | 0005 | 6.1 | 11.6 | | 46 | 7.70 | 22 | 0.020 | 0.200K | 0.020K | 0.032 |
| | 09 40 | 0015 | 6.1 | 11.6 | | 46 | 7.60 | 23 | 0.020 | 0.200K | 0.020 | 0.032 |
| | 09 40 | 0050 | 5.7 | 11.4 | | 46 | 7.50 | 22 | 0.020 | 0.200K | 0.020 | 0.032 |
| | 09 40 | 0100 | 5.1 | 11.4 | | 47 | 7.50 | 22 | 0.020 | 0.200K | 0.020 | 0.040 |
| | 09 40 | 0140 | 5.1 | 10.8 | | 48 | 7.40 | 23 | 0.020 | 0.200K | 0.030 | 0.040 |
| 75/07/16 | 14 50 | 0000 | 18.5 | 9.0 | 78 | 41 | 8.40 | 25 | 0.050 | 0.400 | 0.030 | 0.012J |
| | 14 50 | 0005 | 18.9 | 9.0 | | 36 | 9.20 | 22 | 0.040 | 0.300 | 0.020K | 0.013J |
| | 14 50 | 0015 | 18.2 | 8.2 | | 34 | 8.25 | 24 | 0.060 | 0.300 | 0.020K | 0.015J |
| | 14 50 | 0040 | 13.2 | 10.6 | | 27 | 8.70 | 25 | 0.050 | 0.300 | 0.020K | 0.026 |
| | 14 50 | 0100 | 6.8 | 10.0 | | 24 | 8.90 | 26 | 0.030 | 0.200K | 0.020K | 0.030K |
| | 14 50 | 0150 | 3.8 | 15.4 | | 24 | 8.60 | 30 | 0.030 | 0.200 | 0.040 | 0.035J |
| | 14 50 | 0220 | 3.0 | 9.0 | | 28 | 7.90 | 28 | 0.030 | 0.200 | 0.050 | 0.029J |
| 75/10/30 | 13 40 | 0000 | 13.9 | 9.6 | 60 | 38 | 7.90 | 30 | 0.020K | 0.200K | 0.020 | 0.007 |
| | 13 40 | 0005 | 14.0 | 9.0 | | 48 | 7.70 | 33 | 0.020K | 0.200K | 0.020K | 0.008 |
| | 13 40 | 0018 | 13.9 | 9.0 | | 49 | 7.50 | 30 | 0.020K | 0.200K | 0.020K | 0.012 |
| | 13 40 | 0050 | 11.3 | 8.2 | | 23 | 7.35 | 28 | 0.020K | 0.200K | 0.040 | 0.022 |
| | 13 40 | 0080 | 7.9 | 8.2 | | 38 | 7.20 | 29 | 0.020K | 0.200K | 0.060 | 0.027 |
| | 13 40 | 0125 | 6.0 | 9.0 | | 35 | 7.10 | 30 | 0.020K | 0.200K | 0.060 | 0.028 |
| | 13 40 | 0170 | 5.7 | 8.4 | | 34 | 7.05 | 33 | 0.020K | 0.200K | 0.080 | 0.027 |

K* VALUE KNOWN TO BE LESS
THAN INDICATED

J* VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 76/08/12

410401
43 42 23.0 122 25 20.0 3
HILLS CREEK RESERVOIR
41039 OREGON

130991

11EPALES 2111202
0159 FEET DEPTH CLASS 00

| DATE | TIME | DEPTH | PHOS-TUT | CHLRPHYL | INCOT LT |
|----------|-------|-------|----------|----------|----------|
| FROM | OF | | | A | REMNING |
| TO | DAY | FEET | MG/L P | UG/L | PERCENT |
| 75/03/28 | 09 40 | 0000 | 0.044 | 0.6 | |
| | 09 40 | 0005 | 0.039 | | |
| | 09 40 | 0015 | 0.038 | | |
| | 09 40 | 0050 | 0.038 | | |
| | 09 40 | 0100 | 0.040 | | |
| | 09 40 | 0140 | 0.059 | | |
| 75/07/16 | 14 50 | 0000 | 0.017 | 3.8 | |
| | 14 50 | 0005 | 0.018 | | |
| | 14 50 | 0015 | 0.020 | | |
| | 14 50 | 0040 | 0.023 | | |
| | 14 50 | 0100 | 0.029 | | |
| | 14 50 | 0150 | 0.040 | | |
| | 14 50 | 0220 | 0.041 | | |
| 75/10/30 | 13 40 | 0000 | 0.022 | 2.7 | |
| | 13 40 | 0005 | 0.022 | | |
| | 13 40 | 0018 | 0.029 | | |
| | 13 40 | 0050 | 0.034 | | |
| | 13 40 | 0080 | 0.041 | | |
| | 13 40 | 0125 | 0.041 | | |
| | 13 40 | 0170 | 0.043 | | |

STOREY RETRIEVAL DATE 76/08/12

410402
 43 39 52.0 122 25 26.0 3
 HILLS CREEK RESERVOIR
 41039 OREGON

130991

11EPALES 2111202
 0160 FEET DEPTH CLASS 00

| DATE | TIME | DEPTH | WATER OF TO | 00010 DO | 00300 TRANSP | 00077 SECCHI | 00094 CNDUCTVY FIELD | 00400 PH | 00410 TALK CACO3 | 00610 NH3-N TOTAL | 00625 TOT KJEL N | 00630 NO2&NO3 N-TOTAL | 00671 PHOS-DIS ORTHO MG/L P |
|----------|-------|-------|-------------------|-------------|-----------------|-----------------|----------------------------|-------------|------------------------|-------------------------|------------------------|-----------------------------|--------------------------------------|
| | | | DAY FEET | MG/L | MG/L | INCHES | MICROMHO | SU | MG/L | MG/L | MG/L | MG/L | MG/L |
| 75/03/28 | 10 00 | 0000 | 6.0 | 11.4 | 60 | | 33 | 7.50 | 21 | 0.040 | 0.400 | 0.030 | 0.039 |
| | 10 00 | 0005 | 6.0 | 11.6 | | | 33 | 7.40 | 20 | 0.020 | 0.200 | 0.020K | 0.033 |
| | 10 00 | 0015 | 6.0 | 11.6 | | | 32 | 7.40 | 20 | 0.020K | 0.200K | 0.020K | 0.041 |
| | 10 00 | 0050 | 5.1 | 11.6 | | | 32 | 7.40 | 21 | 0.030 | 0.200K | 0.020K | 0.035 |
| | 10 00 | 0100 | 4.8 | 11.2 | | | 33 | 7.30 | 21 | 0.020 | 0.200K | 0.020K | 0.030 |
| | 10 00 | 0156 | 4.5 | 10.4 | | | 34 | 7.20 | 22 | 0.030 | 0.200 | 0.040 | 0.031 |
| 75/07/16 | 14 15 | 0000 | 19.2 | 9.0 | 72 | | 16 | 9.30 | 29 | 0.090 | 1.200 | 0.080 | 0.025J |
| | 14 15 | 0005 | 19.5 | 9.6 | | | 41 | 8.90 | 19 | 0.050 | 0.300 | 0.020 | 0.015J |
| | 14 15 | 0015 | 19.1 | 9.0 | | | 33 | 7.90 | 21 | 0.070 | 0.200 | 0.020K | 0.020J |
| | 14 15 | 0040 | 13.1 | 8.8 | | | 29 | 7.50 | 22 | 0.080 | 0.300 | 0.030 | 0.026K |
| | 14 15 | 0090 | 8.6 | 9.6 | | | 20 | 7.20 | 25 | 0.040 | 0.200K | 0.040 | 0.036J |
| | 14 15 | 0140 | 3.7 | 9.6 | | | 28 | 7.00 | 25 | 0.030 | 0.200K | 0.040 | 0.038J |
| | 14 15 | 0180 | 3.0 | 13.4 | | | 15 | 6.95 | 27 | 0.030 | 0.200K | 0.040 | 0.029J |
| 75/10/30 | 14 20 | 0000 | 13.9 | 9.8 | | | 49 | 7.00 | 32 | 0.020K | 0.200K | 0.030 | 0.010 |
| | 14 20 | 0005 | 13.9 | 9.2 | | | 50 | 7.25 | 32 | 0.020K | 0.200 | 0.020K | 0.013 |
| | 14 20 | 0018 | 13.9 | 9.0 | | | 50 | 7.20 | 31 | 0.020K | 0.200K | 0.020K | 0.014 |
| | 14 20 | 0050 | 12.3 | 9.4 | | | 47 | 7.20 | 31 | 0.020K | 0.200 | 0.020K | 0.016 |
| | 14 20 | 0080 | 8.2 | 7.6 | | | 40 | 6.90 | 33 | 0.020K | 0.200 | 0.080 | 0.027 |
| | 14 20 | 0122 | 6.3 | 7.8 | | | 38 | 6.90 | 33 | 0.020K | 0.200 | 0.030 | 0.014 |

K* VALUE KNOWN TO BE LESS
THAN INDICATED

J* VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 76/08/12

410402
43 39 52.0 122 25 28.0 3
HILLS CREEK RESERVOIR
41039 OREGON

130991

11 EPALES 2111202
0160 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | PHOS-TOT MG/L P | 00665 CHLRPHYL UG/L | 32217 INCDT LT A REMNING PERCENT | 00031 |
|--------------------|-------------------|---------------|--------------------|---------------------------|--|-------|
| 75/03/28 | 10 00 | 0000 | v.053 | | 1.0 | |
| | 10 00 | 0005 | | 0.043 | | |
| | 10 00 | 0015 | | 0.042 | | |
| | 10 00 | 0050 | | 0.044 | | |
| | 10 00 | 0100 | | 0.047 | | |
| | 10 00 | 0156 | | 0.046 | | |
| 75/07/16 | 14 15 | 0000 | 0.030 | | 4.2 | |
| | 14 15 | 0005 | | 0.020 | | |
| | 14 15 | 0015 | | 0.020 | | |
| | 14 15 | 0040 | | 0.022 | | |
| | 14 15 | 0090 | | 0.038 | | |
| | 14 15 | 0140 | | 0.039 | | |
| | 14 15 | 0180 | | 0.045 | | |
| 75/10/30 | 14 20 | 0000 | 0.023 | | 1.7 | |
| | 14 20 | 0005 | | 0.025 | | |
| | 14 20 | 0018 | | 0.026 | | |
| | 14 20 | 0050 | | 0.031 | | |
| | 14 20 | 0080 | | 0.045 | | |
| | 14 20 | 0122 | | 0.061 | | |

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/08/12

6104A1
 43 42 40.0 122 25 35.0 4
 MID FORK WILLAMETTE RIV
 41 15 OAKRIDGE
 0/HILLS CREEK RESERVOIR 130991
 BELO HILL CRK DAM 2.8 MI SE OF OAKRIDGE
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | NO2&N03 N-TOTAL MG/L | 00630 TOT KJEL MG/L | 00625 N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|--------------------|-------------------|---------------|----------------------------|---------------------------|--------------------|---------------------------------|--------------------------------------|-----------------------------|
| 74/10/19 | 10 30 | | 0.040 | 0.100K | 0.010 | 0.010 | 0.010 | 0.015 |
| 74/11/15 | 10 18 | | 0.016 | 0.700 | 0.025 | 0.005 | 0.015 | 0.020 |
| 74/12/16 | 11 35 | | 0.024 | 0.200 | 0.025 | 0.005 | 0.025 | 0.030 |
| 75/01/06 | 14 10 | | 0.048 | 0.100K | 0.005 | 0.005 | 0.032 | 0.050 |
| 75/01/17 | 13 22 | | 0.056 | 0.100K | 0.008 | 0.008 | 0.040 | 0.040 |
| 75/02/07 | 10 32 | | 0.045 | 0.150 | 0.020 | 0.020 | 0.032 | 0.040 |
| 75/03/07 | 12 20 | | 0.015 | 0.050K | 0.008 | 0.008 | 0.030 | 0.030 |
| 75/04/22 | 10 55 | | 0.005 | 0.400 | 0.020 | 0.020 | | |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STOREY RETRIEVAL DATE 76/08/12

4106A2
 43 35 25.0 122 26 35.0 4
 MID FORK WILLAMETTE RIV
 41 15 OAKRIDGE
 T/HILLS CREEK RESERVOIR 130991
 BNK NEAR RIGDON RD 8.4 MI S HILL CRK DAM
 TIEPALES 2111204
 0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 N026N03 | 00625 TOT KJEL | 00610 NH3-N | 00671 PHOS-DIS | 00665 PHOS-TOT |
|--------------------|-------------------|---------------|------------------|-------------------|----------------|-------------------|-------------------|
| | | | N-TOTAL MG/L | MG/L | MG/L | MG/L P | MG/L P |
| 74/10/19 | 12 45 | | 0.016 | 0.100K | 0.010 | 0.040 | 0.040 |
| 74/12/16 | 13 30 | | 0.024 | 0.200 | 0.025 | 0.030 | 0.050 |
| 75/01/06 | 11 41 | | 0.008 | 0.200 | 0.020 | 0.050 | 0.060 |
| 75/01/17 | 12 50 | | 0.008 | 0.300 | 0.016 | 0.032 | 0.040 |
| 75/02/07 | 11 15 | | 0.008 | 0.100K | 0.024 | 0.040 | 0.040 |
| 75/02/24 | 11 03 | | 0.008 | 0.100 | 0.008 | 0.032 | 0.040 |
| 75/03/07 | 10 48 | | 0.006 | 0.100K | 0.008 | 0.024 | 0.030 |
| 75/04/22 | 10 25 | | 0.015 | 0.450 | 0.020 | 0.030 | 0.030 |
| 75/05/21 | 10 35 | | 0.005 | 0.050K | 0.010 | 0.020 | 0.030 |
| 75/06/10 | 12 30 | | 0.005 | 0.050K | 0.005 | 0.015 | 0.015 |
| 75/07/28 | 11 00 | | 0.005 | 0.100 | 0.010 | 0.035 | 0.050 |
| 75/09/16 | 15 15 | | 0.010 | 0.200 | 0.005K | 0.025 | 0.060 |

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

410481
43 35 40.0 122 26 30.0 4
BUCK CREEK
41 15 OAKRIDGE
T/HILLS CREEK RESERVOIR 130991
RIGDON RD BRDG 10.4 MI S OF OAKRIDGE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&N03 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|--------------------|-------------------|---------------|-------------------------------------|--------------------------------|---------------------------------|--------------------------------------|-----------------------------|
| 74/10/19 | 12 | 35 | 0.024 | 0.100K | 0.005 | 0.035 | 0.035 |
| 74/11/15 | 11 | 14 | 0.008 | 0.600 | 0.020 | 0.030 | 0.040 |
| 75/01/06 | 14 | 35 | 0.008 | 0.100K | 0.030 | 0.055 | 0.090 |
| 75/01/17 | 12 | 43 | 0.008 | 0.200 | 0.008K | 0.032 | 0.050 |
| 75/02/07 | 11 | 30 | 0.008 | 0.100K | 0.016 | 0.032 | 0.035 |
| 75/02/24 | 10 | 56 | 0.008 | 0.100K | 0.008 | 0.032 | 0.040 |
| 75/03/07 | 10 | 43 | 0.008 | 0.100K | 0.012 | 0.021 | 0.030 |
| 75/04/22 | 10 | 20 | 0.005 | 0.300 | 0.020 | 0.025 | 0.030 |
| 75/05/21 | 10 | 45 | 0.040 | 0.200 | 0.015 | 0.020 | 0.030 |
| 75/06/10 | 12 | 40 | 0.010 | | 0.015 | 0.015 | 0.015 |
| 75/07/28 | 11 | 20 | 0.005 | 0.200 | 0.010 | 0.030 | 0.050 |
| 75/09/16 | 15 | 20 | 0.010 | 0.400 | 0.005K | 0.035 | 0.050 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET REYRIEVAL DATE 76/08/12

4104C1
43 37 15.0 122 25 03.0 4
COFFEEPOY CREEK
41 15 OAKRIDGE
T/MILLS CREEK RESERVOIR 130991
UNPVD RD BRDG 8.5 MI S OF OAKRIDGE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 N02&N03 N-TOTAL MG/L | 00625 TOT KJEL MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|--------------------|-------------------|---------------|-------------------------------------|---------------------------|---------------------------------|--------------------------------------|-----------------------------|
| 74/10/13 | 12 10 | | 0.056 | 0.300 | 0.015 | 0.040 | 0.045 |
| 74/11/15 | 10 47 | | 0.016 | 1.050 | 0.020 | 0.045 | 0.050 |
| 74/12/16 | 14 00 | | 0.032 | 0.100 | 0.015 | 0.045 | 0.060 |
| 75/01/05 | 14 55 | | 0.016 | 0.100 | 0.010 | 0.050 | 0.080 |
| 75/01/17 | 12 55 | | 0.016 | 0.200 | 0.008K | 0.048 | 0.050 |
| 75/02/07 | 11 00 | | 0.008 | 0.100 | 0.024 | 0.048 | 0.050 |
| 75/02/24 | 10 43 | | 0.008 | 0.500 | 0.010 | 0.048 | 0.070 |
| 75/03/07 | 11 33 | | 0.008 | 0.100K | 0.016 | 0.040 | 0.040 |
| 75/04/22 | 10 00 | | 0.005 | 0.050K | 0.010 | | 0.040 |
| 75/05/21 | 10 20 | | 0.040 | 0.400 | 0.065 | 0.050 | 0.040 |
| 75/06/10 | 13 00 | | 0.015 | 0.050 | 0.010 | 0.005 | 0.010 |
| 75/07/28 | 10 45 | | 0.020 | 0.250 | 0.015 | 0.045 | 0.050 |
| 75/09/16 | 15 05 | | 0.025 | 0.100 | 0.015 | 0.040 | 0.060 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

410401
43 41 00.0 122 22 15.0 4
HILLS CREEK
41 15 OAKRIDGE
T/HILLS CREEK RESERVOIR 130991
BNK .2 MI SE OF KITSON HOT SPRINGS
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO26N03 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|--------------------|-------------------|---------------|-------------------------------------|--------------------------------|---------------------------------|--------------------------------------|-----------------------------|
| 74/10/19 | 11 | 10 | 0.016 | 0.100 | 0.010 | 0.030 | 0.030 |
| 74/11/15 | 09 | 55 | 0.008 | 0.300 | 0.015 | 0.025 | 0.030 |
| 74/12/16 | 11 | 15 | 0.048 | 0.200 | 0.030 | 0.035 | 0.040 |
| 75/01/06 | 13 | 50 | 0.016 | 0.400 | 0.050 | 0.040 | 0.060 |
| 75/01/17 | 12 | 00 | 0.016 | 0.100K | 0.096 | 0.032 | 0.035 |
| 75/02/07 | 09 | 55 | 0.008 | 0.200 | 0.024 | 0.010 | 0.020 |
| 75/02/24 | 10 | 07 | 0.008 | 0.125 | 0.008K | 0.028 | 0.035 |
| 75/03/07 | 10 | 55 | 0.008 | 0.150 | 0.008 | 0.028 | 0.028 |
| 75/04/22 | 09 | 25 | 0.005 | 0.200 | 0.015 | | 0.020 |
| 75/05/21 | 09 | 45 | 0.040 | 0.350 | 0.025 | 0.012 | 0.031 |
| 75/06/10 | 13 | 00 | 0.020 | 0.050K | 0.010 | 0.030 | 0.030 |
| 75/07/28 | 10 | 15 | 0.005 | 0.100 | 0.007 | 0.025 | 0.030 |
| 75/09/16 | | | 0.010 | 0.400 | 0.005 | 0.015 | 0.040 |

K VALUE KNOWN TO BE
LESS THAN INDICATED