

SURFACE WATER QUALITY CRITERIA

PROVINCE OF ALBERTA

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Prepared by

WATER POLLUTION CONTROL SECTION

DIVISION OF ENVIRONMENTAL HEALTH

and Approved by

THE PROVINCIAL BOARD OF HEALTH

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Minister of Health

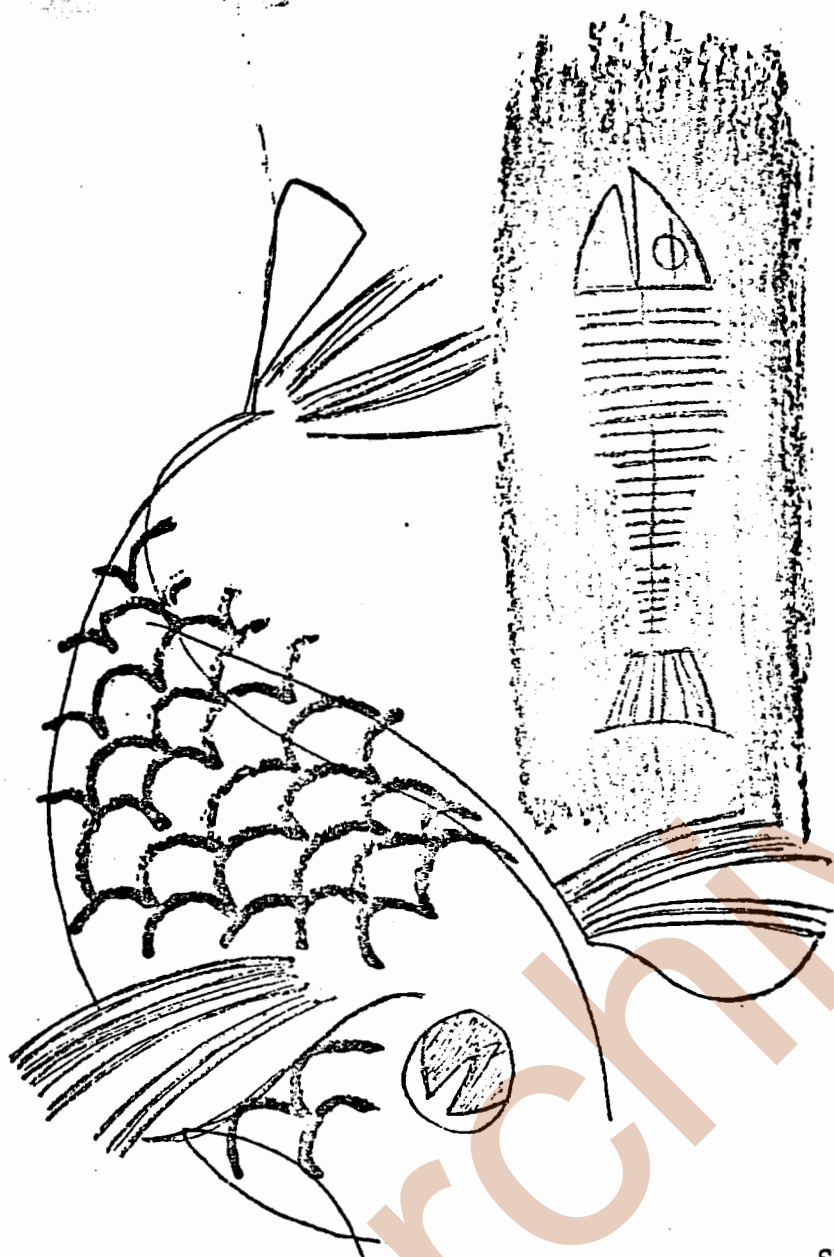
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August, 1970

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H. L. Hogg
Aug. 1970.



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SURFACE WATER QUALITY CRITERIA

PROVINCE OF ALBERTA

ENVIRONMENTAL HEALTH SERVICES DIVISION
GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HEALTH

*Superseded by
Surface water guidelines
for use in Alberta*

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SURFACE WATER QUALITY CRITERIA

PROVINCE OF ALBERTA

INTRODUCTION

The water quality criteria as set out are to provide the basis for water quality regulation in the Province of Alberta and that, if observed, will permit the maximum use of the water resources and prevent unreasonable use of the water in the Province.

The water quality criteria take into consideration the use and value of water resources for:

- 1) Recreation and Aesthetics;
- 2) Public Water Supplies;
- 3) Fish, other Aquatic Life, and Wildlife;
- 4) Agriculture; and
- 5) Industry

The water quality parameters mentioned herein are specified at the most sensitive level in order that one set of guidelines be applicable to all uses. These criteria apply to moving water only. Because of the variability of water quality in lakes, each lake or part thereof will have to be assessed on its own merits and appropriate water quality established for the purposes in question.

It is recognized that within the Province there will be certain areas of the rivers immediately downstream of waste water release points which may have water quality inferior to that outlined below and that use

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of water in these areas may be curtailed. It is also appreciated that the use made of the river and the technological knowledge available will change in the future and therefore there will be a need to review and amend these 'Water Quality Criteria' periodically.

In the application of these 'Water Quality Criteria', the quality of waste waters and the rate of release shall be controlled so that the river water quality is maintained within the criteria levels after the calculated dilution in the river. Where downstream users are affected by the waste waters not completely diluted in the river flow, a special outlet structure to achieve the effective dilution within the available river length may be required.

Prior to discharge of any waste water into the waters of any stream or lake, approval of the Provincial Board of Health must be obtained. Each Board Approval defines the maximum rate of release of each type of pollutant which may be released and the sampling and analyses to be performed to ensure that the waste water complies with the provisions of the Approval. The point in the river at which the water quality criteria shall be applied will be determined by the Province for each waste water discharge.

A. GENERAL OBJECTIVES

These 'Criteria' have been prepared in co-operation with the Provinces of Saskatchewan and Manitoba and represent water quality suitable for most uses, either through direct use or prepared for use by an economically practical degree of treatment.

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The following basic objectives shall be applicable to all waters receiving effluents in the context that municipal, industrial, agricultural or other discharges shall be:

1. free from substances that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life or waterfowl;
2. free from debris, oil, grease, scum or other materials in amounts sufficient to be noticeable in the receiving water;
3. free from colour, turbidity or odour-producing materials that would;
 - a) adversely affect aquatic life or waterfowl;
 - b) significantly alter the natural colour of the receiving water;
 - c) directly or through interaction among themselves or with chemicals used in water treatment, result in undesirable taste or odour in treated water;
4. free from substances in concentrations or combinations which are toxic or may be harmful to human, animal or aquatic life;
5. free from nutrients in concentrations that create nuisance growths of aquatic weeds or algae in the receiving water.

B. SPECIFIC OBJECTIVES

The following specific objectives are for evaluation of conditions except in areas in close proximity to outfalls as prescribed by the pollution control agency. The values are considered to be

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the basic quality objectives in surface waters, except for those cases where more stringent objectives are required because of specific uses.

Naturally occurring circumstances are not taken into account in these 'Criteria' and due consideration must be given where applicable (e.g. spring runoff effect on colour, odour, etc.)

1. Bacteriology (Coliform Group)

- a) In waters to be withdrawn for treatment and distribution as a potable supply or used for outdoor recreation other than direct contact at least 90 per cent of the samples (not less than five samples in any consecutive 30 day period) should have a total coliform density of less than 5,000 per 100 ml. and a faecal coliform density of less than 1,000 per 100 ml. The maximum permissible limit of total coliform organisms in a single sample shall be determined by the control agency based on the type and degree of pollution and other local conditions existing within the watershed.
- b) In waters used for direct contact recreation or vegetable crop irrigation the geometric mean of not less than five samples taken over not more than a 30 day period shall not exceed 1,000 per 100 ml total coliforms, nor 200 per 100 ml faecal coliforms, nor exceed these numbers in more than 20 per cent of the samples examined during any month, nor

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exceed 2,400 per 100 ml total coliforms on any day.

2. Dissolved Oxygen

A minimum of 5 mg/l at any time.

3. Biochemical Oxygen Demand

Dependent on the assimilative capacity of the receiving water. The B.O.D. must not exceed a limit which would create a dissolved oxygen of less than 5 mg/l.

4. Suspended Solids

Not to be increased by more than 10 mg/l.

5. pH

To be in the range of 6.5 to 8.5 pH units but not altered by more than 0.5 pH units from background value.

6. Temperature

Not to be increased by more than 3^oC above ambient water temperature.

7. Odour

The cold (20^oC) threshold odour number not to exceed eight.

8. Colour

Not to be increased more than 30 colour units above natural value.

9. Turbidity

Not to exceed more than 25 Jackson units over natural turbidity.

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10. Organic Chemicals

<u>Constituent</u>	<u>Maximum Concentration (mg/l)</u>
Carbon Chloroform Extract (CCE)	0.2
Methylene Blue Active Substances	0.5
Oil and Grease	substantially absent no irridescent sheen
Phenolics	0.005

Pesticides

To provide reasonably safe concentrations of these materials in receiving waters an application shall not exceed 1/100 of the 48-hour Tlm. Persistent insecticides such as DDT, Aldrin, Dieldrin, Endrin, Heptachlor should not be used on or near surface waters.

11. Inorganic Chemicals

<u>Constituent</u>	<u>Maximum Concentration (mg/l)</u>
Boron	0.5
Copper	0.02
Fluoride	1.5
Iron	0.3
Manganese	0.05
Nitrogen (Total Inorganic and Organic)	1.0*
Phosphorous as PO_4 (Total Inorganic and Organic)	0.15*
Sodium (as per cent of cations)	between 30 and 75
Zinc	0.05

Note: The predominant cations of Na, Ca and Mg and anions of SO_4 , Cl and HCO_3 are too variable in the natural water quality state to attempt to define limits.

* These criteria are presently under study and may require adjusting according to naturally occurring concentrations or conditions.

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12. Toxic Chemicals

<u>Constituent</u>	<u>Maximum Concentration (mg/l)</u>
Arsenic	0.01
Barium	1.0
Cadmium	0.01
Chromium	0.05
Cyanide	0.01
Lead	0.05
Mercury	0.0001
Selenium	0.01
Silver	0.05

13. Radioactivity

Gross Beta not to exceed 1,000 pCi/l.

Radium 226 not to exceed 3 pCi/l.

Strontium 90 not to exceed 10 pCi/l.

14. Unspecified Substances

Substances not specified herein should not exceed values which are considered to be deleterious for the most critical use as established by the control authority.

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APPENDIX

EXPLANATORY NOTES FOR PARAMETERS AND COMMENTS IN THE WATER QUALITY CRITERIA

1. Biochemical Oxygen Demand (BOD) -- usually analyzed as a five-day @ 20° test (BOD₅) this parameter is a measure of organic matter and thereby a measure of the degree of pollution.
2. Boron (B) -- is harmful to boron sensitive plants, may have a long-term effect on health if ingested in large amounts over protracted time.
3. Carbon Chloroform Extract (CCE) and Carbon Alcohol Extract (CAE) -- a measure of organic materials such as insecticides, pesticides, herbicides and synthetic industrial chemicals which are toxic in trace quantities.
4. Chloride (Cl) -- causes a salty taste, accelerates corrosion, interferes with some industrial processes and is detrimental for irrigation.
5. Coliform Bacteria -- used as an indicator of the bacteriological quality of water as related to the possible presence of disease producing organisms. Faecal coliforms are of recent origin from the intestinal tract of warm-blooded animals.
6. Colour -- causes undesirable aesthetic effect on water used for domestic supplies and is detrimental for various industrial processes.
7. Copper (Cu) -- imparts an undesirable taste in drinking water, is objectionable for canning and is toxic to fish and aquatic life.
8. Dissolved Oxygen (DO) -- the effect of organic pollution is reflected in the resulting depletion of DO; an adequate level of DO is required to maintain a proper balance of fish and aquatic life, for natural river purification and to prevent obnoxious anaerobic conditions.
9. Fluoride (F) -- optimum concentrations of fluoride in drinking water will reduce dental caries whereas excessive amounts will induce dental fluorosis.

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10. Iron (Fe) -- stains laundry and plumbing fixtures, imparts taste and interferes with ion exchange units.
11. Magnesium (Mg) -- in combination with sulphate causes a laxative effect and imparts taste.
12. Manganese (Mn) -- stains laundry and plumbing fixtures and is undesirable in many industrial processes even in low concentrations.
13. Methylene Blue Active Substances (MBAS) -- a term used to describe synthetic detergents and the method of detection. Synthetic detergents reduce the rate of re-aeration, may cause taste in water supplies, are toxic to fish in high concentrations and cause foaming.
14. Nitrogen -- a nutrient for plant growth. Ammonia nitrogen ($\text{NH}_3\text{-N}$) creates oxygen demand, indicates pollution, can be toxic to fish, interferes with water treatment and brewing. Nitrate (NO_3) levels in excess of 40 mg/l as nitrate can be harmful to infants.
15. Oils and Grease (Ether Solubles) -- objectionable from an aesthetic standpoint, reduce re-aeration, are toxic to fish, taint fish flesh, create taste and odours, interfere with water treatment and waterfowl.
16. Pesticides -- terms used synonymously with biocides but generally refers to chlorinated hydrocarbon and organophosphorous chemicals.
17. pH -- measure of chemical quality and related to taste, corrosiveness, efficiency of chlorination, coagulation and suitability of industrial application.
18. Phenolics -- minute concentrations impart a taste to water which is intensified by chlorination; small amounts taint fish flesh.

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19. Phosphorous -- a nutrient for plant growth, interferes markedly with coagulation, often measured as phosphate (PO_4).
20. Radioactivity -- is especially significant in relation to human health, first through the direct consumption of water and second through the ingestion of agricultural products, stock and aquatic life that have accumulated radioactivity.
21. Sodium (Na) -- in combination with sulphate causes a laxative effect and boiler foaming, undesirable for people on a salt free diet, detrimental to irrigation.
22. Sodium (as a per cent of cations - $\%$ Na) -- a measure of the suitability of water for irrigation.
23. Sulphate (SO_4) -- see references to sodium and magnesium
24. Suspended Solids (SS) -- a measure of material exceeding colloidal size. These solids interfere with self-purification, lead to sludge deposits, damage fisheries and create a nuisance aesthetically.
25. Temperature -- affects palatability, water treatment, industrial processes, self-purification and aquatic life.
26. Threshold Odour Number (TON) -- measure of taste and odour producing substances in water; high concentrations of odour require extensive treatment.
27. Tl_m -- median tolerance limit or the concentration that kills 50 per cent of the test organisms in a bioassay within a specified time span, usually 48 hours or less.
28. Toxic Chemicals -- often related to heavy metals. These include arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), cyanide (CN), lead (Pb),

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Toxic Chemicals
(cont)

mercury (Hg), nickel (Ni), selenium (Se), and silver (Ag). Because of the ability of organisms to concentrate these chemicals and because of their toxicity to humans in minute amounts the concentration of any toxic chemical must be kept very low.

29. Turbidity

-- a measure of the colloidal and suspended solids load; it has a bearing on aesthetics, water treatment, aquatic life and industrial use.

30. Zinc (Zn)

-- produces an undesirable taste;

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