STATE/EPA REGION IV AGREEMENT ON THE DEVELOPMENT OF WASTELOAD ALLOCATIONS AND WASTEWATER PERMIT LIMITATIONS

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I. General

A. Purpose, Scope, and Authority

The purpose of this document is to set forth basic understandings between the States and Region IV of EPA as to how water permit limitations are to be established. The permit limitations will be incorporated into NPDES permits directly by States with the delegated authority, and indirectly through the 401 certification process for States which do not have the delegated NPDES authority. The procedures for developing and issuing permits are set forth in the Consolidated Permit Regulations and associated agreements with the States. This document is consistent with and intended to compliment those requirements. This document is intended to relate to all portions of water permits; however, most technical portions better relate to dissolved oxygen analyses.

Both the States and EPA have defined responsibilities for the development of appropriate effluent limitations. All States have statutes relating to water pollution control with the general scheme of controlling pollutant discharges through both technology based and water quality standards based effluent limitations. In addition, States are charged with the responsibility under Section 303(d) of the federal Clean Water Act (CWA) to develop allowable wasteloads which will ensure the attainment of water quality standards. The term wasteload allocation has evolved as the description of effluent limitations which are needed to assure attainment of water quality standards. Specifically, 303(d) requires each State to establish and submit to EPA allowable wasteloads "at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality". Section 303(d) also requires EPA to "either approve or disapprove such identification not later than thirty days after the date of submission". Historically, the procedures for implementing those requirements have been the Water Quality Planning Regulations. This link has proven to be unnecessarily time consuming and incompatible with the desire for a fast-paced permit program. For this reason, Region IV commits to seeking regulation changes so that EPA reviews of wasteload allocations can be handled to the extent possible directly with the NPDES process, however the opportunity for public input to the wasteload allocation process must be provided.

B. Statement of Policy

EPA Region IV and the States are committed to the development of wasteload allocations which are consistent with the requirements of the Clean Water Act and applicable State statutes. In this regard, permit limitations shall be established at a level which will assure attainment of the applicable water quality standards and minimum treatment requirements. It is also recognized that some of the existing water quality standards for specific sites are not attainable. In these cases, appropriate water quality standards revisions should be made and effluent limitations based upon the revised standards. Revisions to water quality standards will be consistent with the requirements of the Clean Water Act and associated regulations.

II. Water Quality Standards Considerations

A. <u>General</u>

The purpose of a wasteload allocation is to maintain water quality standards. Water quality standards consist of both designated uses and criteria to protect the uses. The criteria, normally expressed in specific numerical terms, serve as the target values in wasteload allocation analyses. In the past, water quality standards for many streams have been established with minimal to no site-specific information. For this reason, the designated uses and associated criteria are often found to be inappropriate when site visits and studies are conducted. In addition, wasteload allocations can result in adverse economic impacts upon the affected municipal and industrial dischargers. For either of these cases, water quality standards revisions should be considered prior to or concurrently with the development of wasteload allocations. This requires close coordination of activities in water quality standards, wasteload allocations, and NPDES permit programs. Revisions can take the form of criteria modifications, or use changes. Seasonal classified uses may also be specified.

In making water quality standards revisions, the concept of attainability should be paramount. This concept refers to the Clean Water Act goal "that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved". Where these goals are not attainable, lower levels of water quality must be accepted. EPA has historically provided minimal guidance on attainability determinations, however, Region IV has been active in these analyses since the mid 70's. Perhaps the most common case involves economic hardship conditions for publicly owned treatment works. The constructive grants program guidance provides detailed economic criteria for high cost projects which can also be used as guides for economic attainability analyses. EPA will be providing in the near future specific guidance on attainability along with revised water quality standards regulations. Determinations for natural or irretrievable man-induced conditions are basically a matter of factual findings. The result of those findings should be alternative criteria or uses so that appropriate allocations can be derived.

B. <u>Types of Stream Classifications</u>

The assignment of appropriate stream classification can often avoid conflicts that occur during wasteload allocation determinations. All streams do not have the potential to support fish and aquatic life, most often due to their hydrologic characteristics. The following should be used in assigning stream classifications:

1. **Effluent Channels:** Effluent channels are constructed conveyances used to transport waste from the treatment plant to waters of the United States. An effluent channel cannot be a modified water of the U.S. and should be considered as part of the treatment system. Appropriate hazard and nuisance protection should be provided and property rights respected.

2. **Ephemeral Streams:** Ephemeral streams are natural water courses (including modified natural courses) whose stream beds are always above the groundwater table during normal hydrologic years. Ephemeral streams are generally not expected to flow continuously for 30 days during normal hydrologic years. An ephemeral stream is a water of the U.S., but should normally not be classified for fish and aquatic life protection because of its inappropriate habitat.

3. **Intermittent Streams:** Intermittent streams are natural water courses (including modified natural water courses) whose stream beds are above the groundwater table for a portion of the year. Intermittent streams are a broad class of streams which can be considered to include those that during normal hydrologic years flow continuously from 30 days to those that flow 364 days. Many intermittent streams serve as highly valuable fish and aquatic life resources, while others may not be distinguishable from ephemeral streams. For this reason, intermittent streams must be divided into at least two categories, i.e., those that support fish and aquatic life and those that do not support fish and aquatic life. Case by case fish and aquatic life resource judgments should be used to determine the appropriate classification category.

4. **Perennial Streams:** Perennial streams are natural water courses (including modified natural water courses) whose stream beds during normal hydrologic years are always below the groundwater table. Perennial streams should normally be classified for fish & aquatic life.

It should also be noted that discharges to ephemeral or dry type intermittent streams usually create an environmentally undesirable situation and can also result in public health hazards. Many of these conditions exist presently which are difficult to eliminate, however, water programs should be geared toward eliminating these situations by prohibiting, where practicable, any new discharges to these type streams. Appendix A presents water quality standards language for effluent channels and ephemeral streams.

III. Allocation Procedures and Policies

A. Basic Approach for Establishing Boundaries for Effluent Limitations Determinations

The boundaries for a water quality assessment shall be determined by examination of the watershed characteristic, the type of pollutant(s) involved, available water quality data, and information on current and future discharges. Facilities which are expected to contribute to a common water quality problem will be included in determinations for the segment or area allocations. A policy of equitable abatement should be followed in the distribution of waste loads to various discharges; however, the States use different approaches where they feel the circumstances so warrant. EPA program requirements for funding of municipal treatment facilities should also be considered by the State in the distribution of wasteloads.

B. Determination of Effluent Limitations Using Water Quality Models

There are many analytical approaches that can be used to assist in the development of wasteload allocations. The usual approach is through the use of deterministic water quality models. Both the States and EPA endorse the approach of using water quality models, where applicable, for determination of effluent limitations needed to meet water quality standards. The models used can generally be divided into three categories based upon degree of reliability:

1. **Empirical Models-**these models are generally of the same mathematical formulation as other models; however, the various reaction rates and input parameters are determined through empirical formulations based on experience from detailed studies in other areas.

2. **Calibrated Models-**the reaction rates and inputs for these models are based on actual measurements using data from surveys on the water body in question. Rarely is every reaction rate and input

parameter measured; however, models where most values are based on field measurements are referred to as calibrated.

3. **Verified Models-**these are models which are calibrated to one set of field data and confirmed by comparison to at least one additional set of field data taken under different physical circumstances.

With some exceptions, all of the above models are acceptable for effluent limitation determinations for both permit and Section 201 Construction grants funding purposes. The primary consideration which should be given in using the above models is does the model provide a reasonable scientific basis and allow a confident and defensible water quality decision. In determining the level of model to use, consideration of many factors such as the complexity of the water body, magnitude and impact of the resulting treatment levels, amount of available data and human health implications must be given. Thus, for those situations where water quality models are applicable, models should be used for determining wasteload allocations. Generally, dissolved oxygen type empirical models are acceptable for use in developing effluent limitations under the following circumstances:

1. Effluent BOD_5 = 30 mg/ℓ
  a. all cases unless actual data indicate otherwise

2. Effluent BOD_5 <30 mg/ ℓ but $\geq$ 10mg/ ℓ
  a. design size of facility $\leq$ 10 MGD
  b. consideration of treatment cost must also be given; for example, facilities which can achieve the required effluent level with only the addition of nitrification generally do not greatly exceed the cost of secondary alone.

3. Effluent BOD_5 $\leq$ 10mg/ ℓ
  a. not acceptable

Where the above constraints prohibit use of empirical models, some level of calibrated or verified model must be established for wasteload allocation purposes.

C. Determination of Effluent Limitations Using Other Analytical Tools

There are several types of water bodies for which dissolved oxygen water quality models are not generally reliable predictive tools. Swamps, wetlands and some lakes fall into this category. For these water bodies alternative methods for determining wasteload allocations should be used.

Initially, however, an on-site visit should be made before determining whether or not a model is applicable.

1. Losing Flow Streams

Many of these streams can be modeled, and should be in the allocation process. For losing flow streams, models can be adjusted by removing flow and thus are effective and applicable analytical tools for these types of streams. (Note: The Georgia DOSAG model has specific provisions for handling losing streams, and can be used as a guide.) Even with effluent flows, streams that lose their entire flow on a frequent basis can only be modeled to the point of zero flow. Such streams should be assessed to determine the appropriate water quality standards use classifications since fish and aquatic life may not be reasonably sustainable in streams of this type.

2. Lakes

Large computerized and/or ecological type models are not, except in rare circumstances, recommended for use at the present. Large data requirements and lack of consensus regarding their applicability often render then impractical for use. From the standpoint of dissolved oxygen, if there are data which show that current discharges meet water quality standards and there are no nuisance problems associated with the discharger, then current effluent limitations should be adequate. The Vollenweider, Larsen-Mercier or similar nutrient-budget models can be used to determine if nutrient reductions should be considered. Application of these models can be seen in Analyses of Southeastern Lakes as previously done by Region IV and the EPA-HQ AWT Review of Lake Toho. If these models indicate a problem, then nutrient reductions from point sources should be considered. The relative magnitude of non-point sources and their abatement possibilities should also be considered. Elimination of discharges to lake bays and coves should be evaluated. Diffuser outfalls for discharges to the main body of lakes should be required where needed to eliminate localized or nuisance problems. Standard stream models can often be used for run of the river type impoundments, and dispersion type models can sometimes be used on bays, however, photosynthetic activity should be taken into account.

3. Swamps, Wetlands

For existing dischargers to swamps, wetlands, etc. the current impact can be evaluated in terms of physical, chemical, and biological impact. For those water bodies not sufficiently defined by a channel, the upstream characteristics should be compared to the downstream characteristics. Where the discharger is having a significant detrimental impact in terms of not meeting water quality standards and/or reduced quantity and diversity of species, reduced effluent limitations should be imposed or alternative treatment such as land application should be considered and selected where possible. Swamps and wetlands may be able to receive and assimilate the wastewater with proper diffusion of the effluent.

If upstream data show contravention of standards then the standards should also be reviewed. Concurrently, the wasteload allocation should be revised so that the waters are not further degraded. In the absence of an existing discharge to the system, comparisons to similar water bodies with existing dischargers can be utilized to estimate the impact of a new discharge.

At the present time, EPA along with the States' participation is conducting a generic EIS on wetlands disposal. Information resulting from this study will be used to supplement this agreement for these types of analyses.

4. Lagoon Discharges

Recent studies have indicated that oxidation ponds or lagoon discharges are difficult to model using standard techniques. As an alternative, lagoon discharges can be handled using the basic biological type of approach used in swamps and wetlands.

D. <u>Special Case Policies</u>

There are some cases where additional factors, besides applicability of models, are an important part of wasteload allocation determinations. Water bodies with poor natural water quality, water bodies with multiple dischargers, and shellfish waters fall into this category. The following considerations are in addition to those previously discussed in this paper.

1. Dystrophic Waters

Where natural background conditions in a receiving water body do not meet water quality standards, all reasonable alternatives including land application should be considered before allowing a new discharge or continuation of an existing discharge to these waters. For existing dischargers the impact of the discharger on the receiving water body should be determined. Where downstream quality indicates a further significant degradation of natural water quality conditions, the wasteload allocation should be revised to prevent such degradation. In these cases, a review of the existing standards should also be undertaken to determine if the criteria and use classification are appropriate.

2. Equitable Wasteload Allocation

The allocation of assimilative capacity among multiple dischargers to the same receiving water body shall be determined by the States. To ensure that the distribution of assimilative capacity among dischargers is consistent, each State should develop a policy governing its procedure. It is recommended that where reduction of one significant effluent would eliminate the need for similar reductions in effluents of much lesser quantity and substantial cost savings would result, the allocation policy should allow for the savings. Where effluents of similar quantity and quality are involved, across-the-board reduction may prove to be more equitable.

3. Shellfish Waters

Public health protection is the paramount concern when dealing with shellfish waters. Waters classified as shellfish waters are generally classified to protect commercially or recreationally harvestable shellfish resources. Where attainable, no discharges within a twenty-four hours travel time of these waters should be allowed. For discharges within a 24-72 hours travel time, evaluation of impacts on the use of shellfish waters should be considered on a case-by-case basis. Impacts of dischargers at a distance greater than 72-hours travel time is not normally expected to affect the designated use of such waters. For areas with existing dischargers that impact shellfish water, other alternatives should be considered. However, if the impacted waters have no existing or potentially harvestable shellfish resources to protect, then modification of the use classification itself should be considered. In situations where removal of existing dischargers is not attainable at the present time, use of variances, buffer zones, etc. can be used to retain the shellfish classification while providing appropriate regulatory relief.

4. Seasonal Wasteload Allocations

The concept of seasonal wasteload allocations is set forth in Section 303(d)(1)(C) of the Clean Water Act. Congress directed that allowable wasteloads "be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality". In addition, many States have laws or regulations specifically relating to seasonal allocations.

Seasonal allocations provide an important tool for reducing the economic impact of complying with water quality standards. In all cases, the water quality parameter being regulated will be affected by the cyclic nature of temperature, streamflow, etc., which makes the need for effluent controls more stringent during various seasons. Several seasonal allocation procedures are now being utilized in the Region including hydrograph controlled release (HCR), monthly allocations, stream flow variable limitations, summer-winter allocations, etc. All of these should be considered where more than minimum treatment is needed.

Some margin of safety is inherent in current procedures used for wasteload allocations due to the selection of design parameters. Additional margins are not generally recommended.

IV. Approval of Wasteload Allocations

The EPA is required by 303(d) of the Clean Water Act to review and approve/disapprove the allowable wasteloads established by the States within thirty days after submission. An additional thirty days is allowed to make necessary revisions to disapproved identifications and loads. All final approval of wasteload allocations are to be incorporated by the States into their water quality management plans through the Continuing Planning Process required under 303(e) of the Act.

Although some wasteload allocations were submitted as part of the 303(e) basin plans and 208 Water Quality Management plans, these have not been formally approved by EPA. By linking the allocation approval/appeal process to the Water Quality Management Planning requirements, the wasteload allocation process has not been utilized effectively. On a case-by-case basis, EPA has been concurring with the States' allocations for NPDES permits and 201 plans; however, no formal wasteload allocation approval process has been finalized to date.

It is the intent of EPA to link the wasteload allocation review process to the NPDES permitting process where possible. Currently, all of the models discussed in Section III B have been used by Region IV states for both permits and funding purposes. Details on the development and use of models is generally contained in modeling or wasteload allocation methodology document developed by the States and submitted to EPA for approval. The States of Georgia and South Carolina have recently updated their methodology documents to include information developed in recent years. These updated documents have been reviewed and approved by EPA. Through this approval process, EPA can assure that comparable allocations are being developed for all States in the region. In addition, up-front agreement on modeling procedures helps to eliminate specific model application disagreements. Therefore, the States agree to update their modeling procedures (except for Georgia and South Carolina) during FY 83 for approval by EPA. EPA agrees to expeditiously review the procedures and exercise reasonable flexibility in that review. Approval of the methodology will then provide a basis for EPA approval of wasteload allocations developed in accordance with such methodology and will eliminate the necessity for an in-depth review of every allocation. Proposed wasteload allocations would be submitted to EPA for approval, along with the draft permits and would be specifically referenced as wasteload allocations determined pursuant to Section 303(d) of the CWA in the NPDES public notice.

EPA staff resources are not available for individual review of every wasteload allocation developed within the region. Nevertheless, EPA is still required by law to approve all such allocations. It is recommended that each state develop a computerized listing of wasteload allocations which could be coded with method and date of allocation determination and with EPA approval/disapproval date. Alternately these listings could be submitted in some other manner if direct computer communication with EPA is not available. These listings could be updated on a monthly basis, and EPA could review the revisions to the listings on a continuing basis. Likewise, EPA could then provide an approval letter on a periodic basis. Thus, EPA could exercise its review role in a more efficient manner. The States would be expected to provide the supporting documentation for specific allocations requested. For example, EPA could be expected to check an estimated 10% of the allocations to ensure the approved methodologies are being consistently applied and to offer technical assistance.

V. Incorporation of Wasteload Allocations Into Permit Limitations

A. General

The wasteload allocations developed in accordance with this procedure and subsequently approved by EPA are to be directly incorporated into permit limitations. Unless there are overriding environmental concerns, the current NPDES permit will remain in effect until its specified expiration date. At that time the approved limitation will be the basis for the permit limitations.

B. Priority Considerations

In many cases, permit issuance schedules do not coincide with development of wasteload allocations. This problem can be alleviated, for the most part, by close coordination and planning at the State level, however, there will certainly be cases where needed field studies or other information will not be completed when permits are due. In cases where empirical models are known to be applicable, the allocations should be completed prior to permit issuance. For those cases where calibrated models or biological surveys are required, but not readily available for allocation purposes and the permit is due for reissuance, several approaches can be used as interim solutions. The following are acceptable:

1. NPDES permits for municipalities on the States three (3) year construction grants priority list should be reissued at expiration with an up-to-date and technically defensible wasteload allocation using the procedures contained in this Agreement. For equity, any industrial permits within the area of influence of these municipal dischargers should be treated in a like manner. Obviously, permits for dischargers not included above but which have up-to-date and appropriate wasteload allocations would be reissued using same.

2. Dischargers and/or areas of a State not included in (1) above, but considered as high priority areas by the State and EPA would receive up-to-date wasteload allocation for permit reissuance purposes. These will be identified on a case-by-case basis.

3. Up-to-date wasteload allocation will be needed for other program purposes such as elimination of "back logged" 201 facilities planning grants. As these are identified, the State will finalize the wasteload allocations to complete the 201 plans and use the wasteload allocations in permit reissuance as appropriate.

4. Reissue all other permits with interim limits, include a statement that the facility is believed to be presently inadequate, and include a specific reopener clause stating when final limits will be developed.

APPENDIX A

Draft Language for Effluent Channels and Ephemeral Stream Water Quality Standards Classification

Effluent Channels

Definitions Section

Effluent channel shall mean a man-made discernable confined and discrete conveyance which is used for transporting treated wastewater to a receiving stream or other body of water; provided that such channels shall:

(a) be contained entirely on property owned (or controlled by easement) by the discharger (to be demonstrated by the discharger),
(b) not contain natural waters except when such waters occur in direct response to rainfall events by overland runoff,
(c) be so constructed or modified to minimize the migration of fish into said channel.

Effluent channels shall be identified by the Secretary and designed on a case-by-case basis prior to permit issuance.

Water Quality Standards Section

Effluent Channels

The standards of water quality contained in this section shall not apply to waters within effluent channels, except that said waters shall be maintained at a quality which will prevent the occurrence of offensive conditions, protect public health, and allow maintenance of the standards applicable to all downstream waters.

Ephemeral Streams

Definitions Sections

Ephemeral streams shall mean a natural watercourse, including natural watercourses that have been modified by channelization, that flow only in direct response to precipitation in the immediate locality and whose channel is at all times above the ground water table.

Water Quality Standards Section

Ephemeral Stream

Waters in this classification are not usable for fish life, human consumption, or aquatic life, however, the waters must be protective of wildlife and protective of humans which may come in contact with the waters. Waters contained in ephemeral streams must also allow maintenance of the standards applicable to all downstream waters.

a. Minimum conditions for all waters are applicable except those relating to aquatic life.

b. Dissolved Oxygen: To avoid nuisance conditions, dissolved oxygen shall be maintained at not less than 2.0 mg/ ℓ as a daily average and at no time allowed to fall to anoxic levels.

c. Bacteria: Fecal coliform shall not exceed a monthly geometric mean of 5000/100 ml. However, the Director may assign more stringent levels based upon the probability of public health hazards.

Assignment of the Ephemeral Stream classification may be made by the Secretary after appropriate demonstration of the physical and hydrological facts. The Ephemeral Stream Classification may be assigned only to situations involving wastewater discharges existing as of the effective date of this Section. The Ephemeral Stream Classification shall not be assigned where environmental circumstances are such that a nuisance condition exists or is likely to result.

APPENDIX B

EPA-Region IV
Routine Modeling Procedures

- **<u>7Q10 Low Flow</u>**

The 7Q10 is to be determined from USGS flow information, whether it be from actual gaging measurements or a 7Q10 flow coefficient (cfs/mi^2), for the given area, times the stream's drainage area.

The USGS information can be obtained directly from the State's USGS office or from appropriate USGS low flow publications. In either case, the reference and gaging station should be noted in the resultant modeling write up.

- **<u>Temperature</u>**

All available USGS long term temperature data should be analyzed to determine an average of the maximum monthly or yearly temperatures for a given area. Based on this data, the State should be divided up into various zones of input temperature. Summer/winter or monthly temperatures can also be established for use in seasonal allocations.

- **<u>Velocity</u>**

Where time-of-travel data is not available, the equation:

$$\frac{V=0.127\,(Qact)^{0.69}\,(Slope)\ 0.1}{(Qavg.)^{0.24}}$$

will be used to estimate stream velocities. In the above equation:

- V is velocity in ft/sec.,
- Qact is the actual modeled stream flow in cfs
- Slope is the average stream slope of the reach to be modeled in ft/mile, and
- Qavg is the average yearly stream flow in cfs.

If V calculated is less than 0.1 ft/sec assume V to equal 0.1 ft/sec. The above equation was developed from actual time-of-travel data taken on streams in Region IV and will continually be updated with intensive survey data.

or

$$V= 0.144\,(Qact)^{0.4\,(Slope)\,0.2}\ -0.2$$

- **Depth**

  Depth should not be used unless it has been accurately measured for the given stream.

- **Slope**

  Slope information should be taken from USGS Quad maps, unless actual changes in elevations have been measured. Flood plain and stream bottom profiles by the Army Corps can also be helpful.

- **K1 or Kd Carbonaceous Deoxygenation Rate**

  When usable field data is not available to predict K1 rates, the following K1 values will be used for various treatment levels and stream conditions.

  - Secondary treatment or instream CBOD concentration greater than 15 mg/ ℓ, Kd = 0.6/day
  - AST or instream CBOD concentration less than 15 mg/ ℓ, kd = 0.4/day
  - AWT or instream CBOD concentration less than 7 mg/ ℓ, kd = 0.3/day
  - $Kd(T) = Kd\ (20^{o}C)\ (1.047)^{T-20}$

- **Kn or K3, Nitrogenous Deoxygenation Rate**

  In the absence of measured values, Kn will be assumed a 0.3 per day for streams with less than 20 ft/mile slope and 0.5 per day for streams with greater slope.

  Kn has been found to range from 0.3 to 1.5 per day (at $20^{0}C$) in free flowing streams containing greater than 2 to 3 mg/ ℓ of dissolved oxygen. Impounded streams of streams with low D.O. levels will exhibit Kn's as low as 0.0 to 0.3 per day.

- **KA or K2, Reaeration Coefficient**

  For calculating the reaeration coefficient the most appropriate formula for Region IV is that one developed by E.C. Tsivoglou.

  - K2 =1.8 (Slope) (Vel) or 0.11 AH/Tf for Q less than 10 cfs
  - K2 =1.3 (Slope) (Vel) or 0.08 AH/Tf for Q greater than 10 cfs and less than 25 cfs
  - K2 =0.88 (Slope) (Vel) or 0.054 AH/Tf for Q greater than 25 cfs

    where

  - Slope is in ft/mile
  - Vel is velocity in ft/sec

- AH is the change in elevation in feet
- Tf is the time of flow in days

For streams where measures depth is greater than 5 feet and a slope less the 2 ft/mile, O'Connor's formulation may be used as an alternative.

$$K_2 = \frac{12.9\ V^{0.5}}{H^{1.5}}$$

where: V = Velocity in ft/sec
H = depth in feet

The minimum K_2 to be used is 0.15/day. This is the lowest K_2 value measured in this area.

$$K_2\,(T) = K_2\,(20^0C)\,(1.022)^{T-20}$$

- **<u>Other Model Inputs</u>**

Background water quality data for relatively unpolluted streams, unless shown otherwise, should be assumed to be:

D.O. = 80% - 90% of saturation depending on the background quality of the stream.

CBOD = 2 to 3 mg/ ℓ

NBOD = 0.5 to 1 mg/ ℓ

The model needs to assume these background conditions immediately above the upstream discharger.

The CBOD: BOD_5 ratio of 1.5 should be used for domestic discharges unless the data shows otherwise. Industrial discharger, especially textile mills and pulp paper mills, tend to have a higher ratio (i.e. 3). These should be determined on a case by case basis.

Routine Modeling Procedures – Estimation of K_1 Rate

The following clarification can be used in the estimation procedure for K_1, carbonaceous BOD rate.

Type of Treatment	Instream $CBOD_{ult}$	K_1

	(mg/ ℓ)	(1/day)
Secondary: ($BOD_5 = 30$)	• Greater than 15	0.6
	• Less than 15 and greater than 7	0.4
	• Less than 7	0.3
AST: ($BOD_5 < 30$) ($BOD_5 \geq 10$)	• Greater than 7	0.4
	• Less than 7	0.3
AWT: ($BOD_5 < 10$)	—	0.3

Note these values are just estimations and if actual data is available it should be used.