

1. Considered 3-26 1980
2. Name of Applicant S.D. DEPT. OF GAME, FISH AND PARKS
3. Post Office Address PIERRE, S.D.
4. Amount of Water Claimed 3.57 (NON-CONSUMPTIVE)
5. Source of Water Supply BLUE DOG LAKE (450 AC. F. ANN)
6. Water to be used for FISH HATCHERY
7. Acres to be Irrigated -- maximum acre feet STORAGE FOUNDS OF 450 A/F ANN.
8. Water to be diverted and used in DAY County
about 1 1/2 W EDGE OF BLUE DOG LAKE of.
9. PROOF OF PUBLICATION Received ~~File~~ 3-13-80
Not Received _____
- APPLICATION Approved 3-26-80
Subject to _____
Not Approved _____
Action deferred _____

Priority Date
2-27-80 Received 2-27-80 Application Complete (yes) no --- FEE N/A

Remarks Engr. report to be sent over from Bob Hunter, GF&P.
Adding diversion on Permit No. 4385-3

Date information and/or
fee or corrected Application received _____
Period of Annual use CONTINUOUSLY

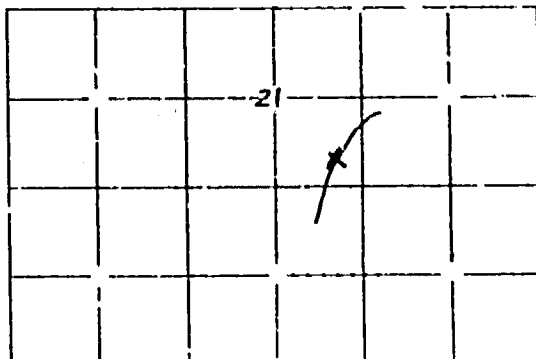
~~WATER
QUALITY~~

Received yes _____ no _____ APPROVED/CONDITIONAL (Circle one)

W-1 Description same as application yes _____ no _____ Remarks _____

Disapproved _____

Returned _____



Diversion Point _____

S 1/2 SE 4, SEC. 21-T122N-
R54W

Lands to be irrigated _____

~~WELL
LOG~~

Remarks _____

Driller _____ Licensed yes _____ no _____

Depth _____

MAP Map No. 3695-3 Map located in Water Right X Map file _____

Type of Map Drawn Prepared by Engl. UMA Eng. Inc.

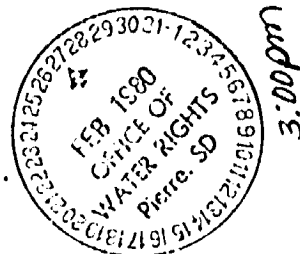
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REVIEWED This Application was reviewed within 30 days of date received, accepted as complete, Number assigned and written up for advertisement before the Board on 3-26-88.
D. W. Westlund
(Signed)

+++++

PROTESTS Letters/Petitions in File - yes _____ no _____ Remarks _____

REMARKS Date
F.F. & C Final Decision, including F.F. & C of Law were adopted _____
OF LAW, Date
FINAL Final Decision mailed to parties and/or parties notified that Final Decision
DECISIONS was adopted _____
ETC. Remarks _____



No. 4470-3
 Map No. 3695-3 Water Division No. 3 BIG S. JAMES RIVER District
 Above for Office Use

APPLICATION FOR PERMIT

To Appropriate Water within the State of South Dakota

Check one of the following:

New ☐ Vested Right ☐ Future Use ☐

Change in Diversion ☐ Additional Diversion ☒ 4385-3

Change in Acreage ☐ Additional Acreage ☐

1. Name of Applicant SD Dept. of Game, Fish & Parks Phone No. 773-4191
 Post Office Address Anderson Bldg. Pierre State South Dakota 57501
 (Street, RR, or Box) (Town) (Zip Code)

If a corporation show date and place of incorporation _____

2. Method of accomplishing work (contract, employment of others, or by direct labor) Contract

3. Name of diversion work Blue Dog Lake State Fish Hatchery

4. Amount of water claimed (cubic feet per second) 3.57 non-consumptive

5. Source of water supply Blue Dog Lake, intake structure & pumps with storage ponds of 450 ac. ft. annually.

6. Location of point of diversion S $\frac{1}{2}$ SE $\frac{1}{4}$ Sec. 21, Twp. 122, R 54

County Day

7. Annual period or periods during which water is to be used continuously

8. Use to be made of water, (irrigation, industrial, municipal, commercial, recreation, etc.) Fish Hatchery

9. For irrigation use, Total number of acres to be irrigated _____

List below each forty acre subdivision, or lot, or fraction thereof and show number of acres to be irrigated in each.

Land Description	No. Acres Irr.

Land Description	No. Acres Irr.

Attach sheet if more space is needed

10. Time required to complete construction of water supply system 4 years. Additional time required to complete application of water to the proposed beneficial use 3 years.

11. Choice of county newspaper for publication of Notice of Intent to Appropriate Water Reporter & Farmer

12. Principal Features of the Proposed Water Supply System.

A. Works proposed to divert water from its natural source.

Pump

B. Works proposed to transport water to place of use.

Pipeline

C. Works proposed to apply water to beneficial use.

Hatchery & rearing ponds

Estimated Total Cost \$ _____

Attachments: Attach Form 2A if diversion from a well or dugout, or if storage of water, is proposed. Attach map (see instructions concerning preparation.)

STATE OF SOUTH DAKOTA)
 County of Hughes) ss.

SD Dept. of Game, Fish & Parks

I, Robert L. Hunter, the applicant, certify that I have read the foregoing application and have examined the attached map and that the matters therein stated are true and that I intend, and am able to complete the necessary construction.

Signed Robert L. Hunter
 Robert L. Hunter
 Subscribed and sworn to before me this 25th day of February, 1980

Notary Public (or other qualified officer)

WATER RIGHT APPLICATION APPROVAL

The Water Management Board hereby approves Water Right Application No. 4470-3

S.D. DEPT. GAME, FISH & PARKS ANDERSON BLDG., PIERRE
(Applicant) (Post Office Address)

So. DAK. 57501 With the following qualifications
(State)

Date of first receipt of application FEBRUARY 27, 1980

Date of return to applicant for correction, amendments or changes required _____, 19____

Date of receipt of corrected application _____, 19____

Approved MARCH 26, 1980, Recorded in Book 21 Page 146

WATER RIGHT PERMIT NO. 4470-3

The Water Management Board hereby grants and issues this Water Right Permit No. 4470-3 authorizing the construction of the water use system and the putting of water to beneficial use as stated in the Application and as qualified in the Water Right Application approval, subject, however, to the following limitations and conditions:

1. The date from which applicant may claim right is FEBRUARY 27, 1980

2. The equivalent of at least one-fifth of the work above specified is to be completed on or before MARCH 26, 1982

3. The whole of said work is to be completed on or before MARCH 26, 1984

4. The limit of time from proof of beneficial use of water appropriated in accordance herewith is MARCH 26, 1987

5. The water appropriated shall be used for the purpose of A FISH HATCHERY -
NON-CONSUMPTIVE USE

6. The prior right of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of water must not be injuriously affected by this appropriation.

7. The amount of the appropriation herein granted shall not exceed 3.57 cubic feet per second, neither shall it exceed the capacity of the above described water supply system, nor shall it exceed the amount of water needed for ~~beneficial uses served, and if for irrigation purposes said appropriation must be limited to not more than 2 acre feet per acre per year and be limited to not more than one-seventieth (1/70) of one cubic foot of water per second of time for each acre of land to which water is actually and beneficially applied~~
USED FOR FISH CULTURE

~~for irrigation~~ on or before MARCH 26, 1987; said water to be used during the following described

annual period: CONTINUOUSLY

Witness my hand this 1st day of APRIL, 1980

THE WATER MANAGEMENT BOARD

By: John H. Ketch
Ch. Engineer, Water Rights

Certificate of Construction Issued _____, 19____

Water License Issued _____, 19____

No. 4470-3

Publish first publication, on or before March 12, 1980

NOTICE OF HEARING ON
APPLICATION TO APPROPRIATE WATER

Pierre, South Dakota 57501

February 28, 1980

Notice is hereby given that the SD Dept. of Game, Fish & Parks whose post office address is Pierre, South Dakota, has made an application in accordance with the provisions of SDCL 46-1-1 thru 46-1-9, 46-1-14; 46-2-9 thru 46-2-11, 46-2-13; 46-5-1 thru 46-5-8, 46-5-10 thru 46-5-22, 46-5-41, and Board Rules ARSD 52:01:01:01 thru 52:01:01:13, for a permit to appropriate for beneficial use 3.97 cubic feet of (non-consumptive) water per second of time from the Blud Dog Lake through the Blud Dog Lake State Fish Hatchery to add an additional point of diversion on an existing permit which is to be located in the S4 SW4 of Section 31, Twp. 122N, Range 54W. Said water to be used for the purpose of providing water for a fish hatchery

This Application No. 4470-3 will be considered by the Water Management Board at SDRA Auditorium, 411 E Capitol, Pierre SD upon the 26th day of March, 1980 at 10 A.M. The Board is authorized to make a determination on this application at the hearing. All interested persons may appear and be heard. Any person who may be affected by a Board decision who desires to present evidence or cross-examine witnesses according to SDCL 1-26 may notify the Board in writing prior to the hearing or orally at the hearing.

This hearing is an adversary proceeding. Any person has the right to be present or to be represented by a lawyer. These and other due process rights will be forfeited if they are not exercised at the hearing. Decisions of the Board may be appealed to the Courts as provided by law. Any handicapped person wishing to attend this hearing can contact the Water Rights Division, DMH, Fors Bldg, Pierre SD, prior to the hearing date for assistance to assure access to the hearing.

WATER MANAGEMENT BOARD

PETER WESTHOLM

Water Rights Specialist

cc: SD Dept. of Game Fish & Parks
Anderson Bldg.
Pierre SD 57501

FORM 6 - Notice of Intent to Appropriate Water
SURFACE WATER

No. 4470-3

**G, F & P, applies
for water use**

(First March 5)
**NOTICE OF HEARING
ON APPLICATION
TO APPROPRIATE WATER**

Pierre, South Dakota 57501
February 28, 1980

Notice is hereby given that the South Dakota Department of Game, Fish and Parks, whose post office address is Pierre, South Dakota, has made an application in accordance with the provisions of SDCL 46-1-1 through 46-1-9, 46-1-14, 46-2-9 through 46-2-11, 46-2-13, 46-5-1 through 46-5-8, 46-5-10 through 46-5-22, 46-5-41, and Board Rules ARSD 52:01:01:01 through 52:01:01:13; for a permit to appropriate for beneficial use 3.57 cubic feet of water per second of time (non consumptive) from Blue Dog Lake through the Blue Dog Lake State Fish Hatchery to add an additional point of diversion on an existing permit which is to be located in the S½ SE¼ of Section 21, Township 122N, Range 54W. Said water to be used for the purpose of providing water for a fish hatchery.

This Application No. 4470-3 will be considered by the Water Management Board at SDEA Auditorium, 411 S. Capitol, Pierre, S.D. upon the 28th day of March, 1980, at 10 A.M. The Board is authorized to make a determination on this application at the hearing. All interested persons may appear and be heard. Any person who may be affected by a Board decision who desires to present evidence or cross-examine witnesses according to SDCL 1-26 may notify the Board in writing prior to the hearing or orally at the hearing. This hearing is an adversary proceeding. Any person has the right to be present or to be represented by a lawyer. These and other due process rights will be forfeited if they are not exercised at the hearing. Decisions of the Board may be appealed to the Courts as provided by law. Any handicapped person wishing to attend this hearing can contact the Water Rights Division, DWRN, Foss Bldg., Pierre, S.D., prior to the hearing date for assistance to assure access to the hearing.

Water Management Board
Betty Westlund,
Water Rights Specialist
cc: S.D. Dept. of Game, Fish
& Parks,
Anderson Bldg.,
Pierre, S.D. 57501
(Last March 12)

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
County Day) ss.

Larry Ingalls

I, _____ hereby

certify that the annexed printed copy of Notice of Intent to Appropriate

Water was taken from the Reporter and Farmer

A newspaper which during the whole time of publication of said notice herein after stated, has been and is printed and published in the _____

City Webster of _____

County of Day and State of South Dakota;
that the said notice was published in said newspaper on the following
two dates:

March 5, 1980

March 12, 1980

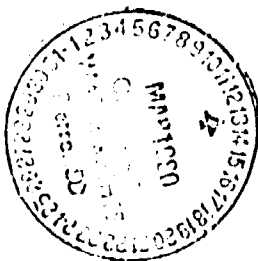
Larry Ingalls

(Signature)

(Title)

March 12, 1980

(Date Signed)



PRELIMINARY ENGINEERING REPORT
for
BLUE DOG LAKE FISH HATCHERY



Prepared for
SOUTH DAKOTA
DEPARTMENT OF GAME, FISH AND WILDLIFE

By
UMA ENGINEERS, INC.

INTRODUCTION

In order to describe this project accurately, outline specifications have been prepared that describe the functional requirements of the various structures involved in the fish rearing process. Reference to the flow diagram, Figure 1, will prove valuable when water supply and drain systems are discussed.

The hatchery building is described by a more conventional type of preliminary specification. That is, a list of products to be used for specific applications.

INCUBATION

Fertilized eggs will be placed in hatching jars at the rate of 300,000 eggs per jar and each jar will be supplied with one gallon per minute of water. Temperature of the incubation water will be adjustable from 45° - 60°F.

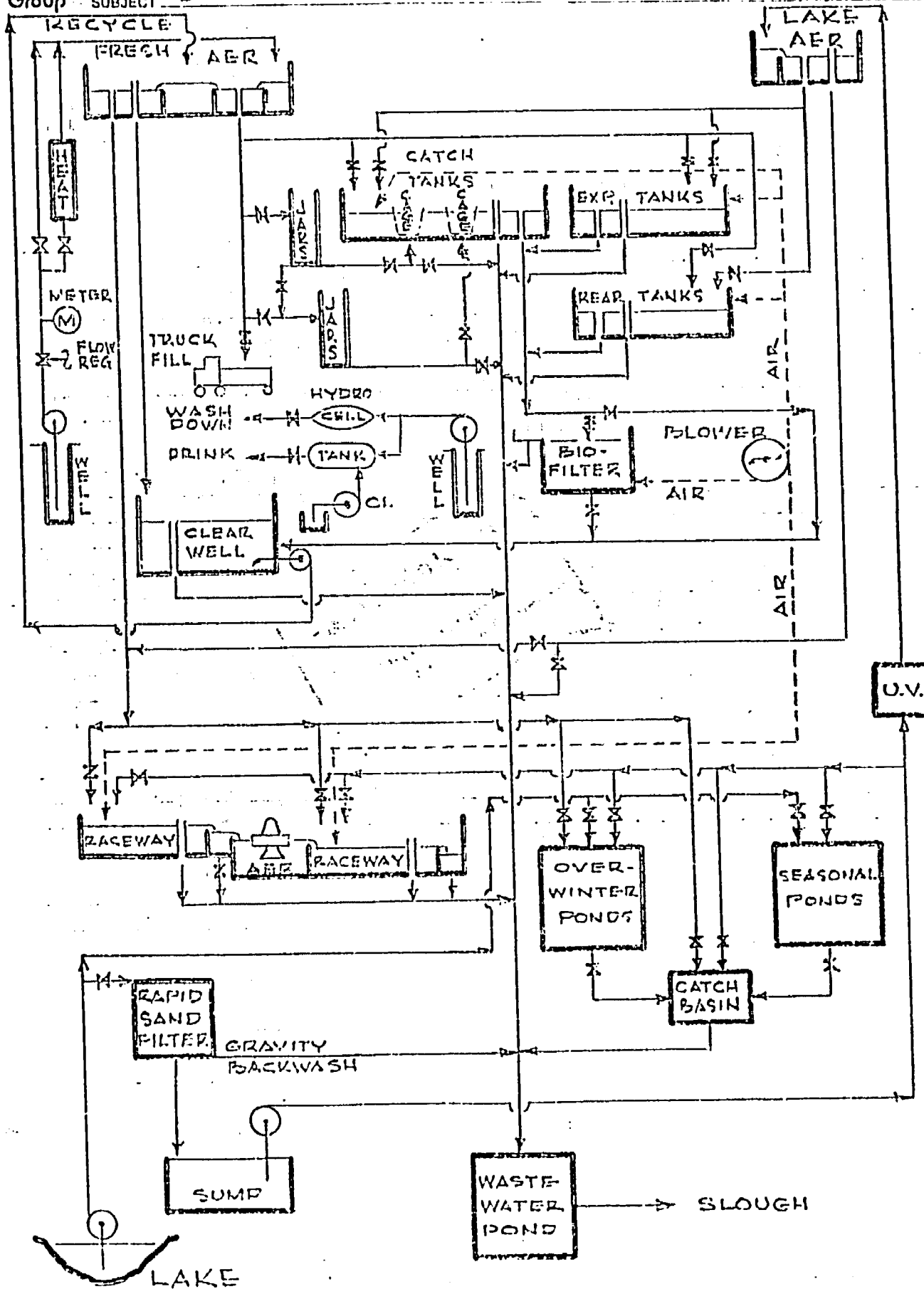
One thousand hatching jars will be included in the design. Hatching jars to be placed on racks with 100 jars per rack. Fifty jars will be on an upper level and 50 jars will be on a lower level. Overflow from the jars will be collected in troughs. From the troughs the water will flow either to waste or to the (catch-rearing) tanks. As the eggs hatch they will be carried to the catch tanks.

Water supply for the hatching jars will be well water and recycle water. The temperature of the water will be adjusted by water heaters to the most cost effective hatching temperature. A 50% recycle system is currently being designed. This will conserve energy by reusing heated water.

INB
VMA
Group

BY JDC DATE 1/11/80 PROJECT NUMBER 3341-001-00-01 SHEET 1 OF 1

SUBJECT S. DAKOTA HATCHERY FLOW DIAGRAM #7



REARING TANKS AND CATCH TANKS

As the fish hatch they will flow with the water to the catch tanks. Inside each catch tank will be four cages. Discharge from each group of 25 jars will upwell into one cage. There will be 10 catch tanks to accomodate 1000 hatching jars. Catch tanks of concrete construction will be six feet wide by 24 feet long with a water depth of 3'4". The cages will be sized to allow four per catch tank. Individual cages will be fabricated from stainless steel. If the cages are removed from the catch tanks, the catch tanks will function as rearing tanks. In addition to the 10 catch tanks, there will be 22 rearing tanks. Water discharged from the rearing tanks can be routed to the wastewater pond, the biofilter, or directly to the clearwell.

There will be a dual water supply to the catch tanks and rearing tanks. First the catch tanks and rearing tanks can be supplied by a combination of fresh well water and recycled water. Secondly, the catch and rearing tanks can be supplied by lake water that has been filtered and sterilized with UV light. Water supplies are most clearly shown in the flow diagram.

OUTSIDE RACEWAYS

Outside the hatchery building will be four 5'x50' concrete raceways with a water depth of 3'. Each of the raceways will have two spearate water supplies, filtered lake water and recycled water that can be blended if desired. Under normal operation, the first pair of raceways will drain to the second pair with reaeration of the water. All the water from the second pair of raceways then goes to waste. Either or both of the first two raceways can be drained to waste. The second pair of raceways will be equipped with water supplies identical to the first pair, as well as the ability to reuse water from the first pair.

PONDS

Four different sizes of earthen ponds will be included in the facility design. Four 1/4-acre ponds, four 1/2-acre ponds, ten 1-acre ponds, and twenty 2-acre ponds are shown on the site plans. Ponds will be formed entirely from native material. Cut and fill will be balanced as closely as possible. No pond liners will be necessary. Each pond will be equipped with one drainage structure called a monk. The structure will be concrete, precast or cast-in-place, with an 18" sluice gate. A concrete apron will be poured near the monk to prevent erosion. Access to the handwheel for the sluice gate must be provided from the bank of the pond. Twelve-inch PVC pipe will serve as the pond drain after the sluice gate, and drop into an 18" PVC main drain to the catch basins. Ponds will be supplied with water from two opposing sides. If the construction budget gets too strained, each pond could be supplied from only one point instead of two.

OUTSIDE CATCH BASINS

Rearing ponds will drain to catch basins. Water supply to the catch basins will be well water, recycled water, well water and recycled water, or filtered lake water. Dimensions of the catch basin are 12' x 15' with a 30" water depth. The catch basins will be fitted with screens for self sorting of fish by size. Each catch basin will be equipped with a 20 amp electrical service outlet. There will be one catch basin for each main drain manifold. From the catch basin, water will flow to the slough.

LAKE WATER INTAKE

At this time, we feel that the lake water intake structure should be located close to the lake with a channel dredged out into the lake. The structure itself, would consist of a wet well with four vertical turbine pumps mounted directly above in the pump room. We will endeavor to design this building with a low profile since it will be located in the area set aside for environmental interpretation. Three of the vertical turbine

pumps will be capable of suppling the maximum hatchery demand. The fourth pump is for standby.

WELLS

Two wells currently existing on site have been tested for both quantity and quality of water. The quality is suitable for this project, but at least one additional well will have to be drilled to provide the maximum amount of well water required. It would also be advisable to drill a fourth well for standby purposes should a malfunction occur at one well.

FILTRATION

Lake water to be used in the raceways or rearing tanks should be filtered. For this installation we have chosen an automatic valveless gravity filter. Operation is fully automatic, the filter backwashes itself when the filter bed is loaded, then rinses itself and returns itself to operation. The filtration system will consist of three units to minimize interruption in flow while one is backwashing.

UV STERILIZATION

Water to be sterilized must first be filtered. UV sterilization will kill almost all bacteria and algae. Two units will be capable of treating the entire flow, but the design will call for three units, one for standby purposes or to be used while one is being serviced. Gravity units are more economical to purchase than pressure units and will be included in the design if possible.

BIOFILTRATION AND RECYCLE MODULE

Water draining from rearing tanks will be collected and distributed in a pipe gallery to the five biofilter modules. Under hydrostatic pressure, the water moves upward through the media where biological activity nitrifies the ammonia and where some mechanical straining is effected. Water then flows by gravity to a clearwell, a large concrete sump. Water is then pumped up to a constant head tank and aerated by aspirator nozzels. Water in the constant head tank is available for use as required in the hatchery.

Construction of biofilter walls and floors, clearwell, and constant head tank to be of concrete. Biofilter media to be expanded shale. Pumping to constant head tank to be provided with standby. Each pump will supply its own aspirator manifold. Piping for these areas to be welded steel or steel with victaulic couplings.

WATER HEATERS

It will be necessary to heat well water for incubation. Heating will be provided by four propane fired boilers with stainless steel heat exchangers. These boilers will be capable of heating 500 GPM 15°F. An 18,000 gallon propane storage tank has also been included in the preliminary designs.

STANDBY GENERATION

In case of a power failure, a standby generator will provide power for critical hatchery requirements. Further work must be done to determine which systems will be provided with power. Should a power failure occur, the generator will start automatically and an automatic transfer switch will disconnect the hatchery from the REA power grid before engaging the generator.

WASTE WATER TREATMENT

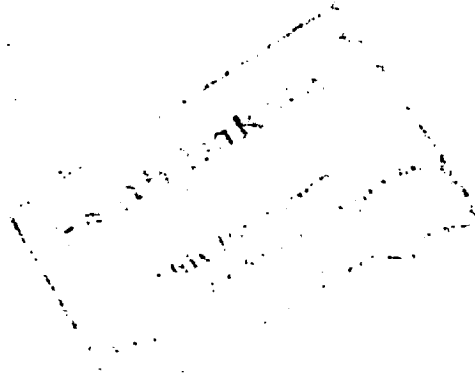
The latest EPA guidelines for discharge from fish hatcheries would exempt this hatchery from filing a National Pollution Discharge Elimination System Permit. This means that there are no Federal Discharge requirements for this hatchery. Based upon the above information, the waste water treatment system should only treat cleaning wastes from the rearing tanks, raceways, biofilters and the backwash from the rapid sand filters. A wastewater treatment pond approximately the size of the 1/4-acre rearing ponds would provide sufficient capacity. A small floating aerator would prevent the wastewater pond from becoming anearobic. No sewage wastes will be discharged into this pond. A septic system will be designed to treat sanitary wastes according to state or county guidelines.



BUILDINGS

1. Exterior Walls: Masonry cavity walls; CMU on exterior portion of cavity. 8" X 8" face at visitors' center and residence, 8" X 16" face at all other walls.
2. Floors: Reinforced concrete slab on compacted gravel or coarse sand sub-base. Carpet over wood base on wood joists at upper level of residence.
3. Structural Roof System: Plywood decking supported by steel joist and steel truss girder system. Columns - square reinforced, fair-faced concrete. Standard wood framing at residence roof.
4. Windows and Doors: "Hope series 1000" or equal, heavy intermediate fixed and casement windows and casement doors with "Ultracoat" acrylic enamel finish.
5. Glass and Glazing: Windows and transom lights, and doors - 1" insulating clear glass; two 1/4" panes with 1/2" air space. Sidelights and doors to be tempered and insulated, where required by code. Interior windows - 3/16" float glass, clear.
6. Roofing and Sheet Metal: Built-up class "A" roof with reflective surface cap sheet. Copings, leader heads and downspouts - 20 gauge galvanized sheet metal. Scuppers, gutters, counter flashing, and other miscellaneous sheet metal - 24 gauge galvanized sheet metal. Asphalt shingles at residence.
7. Roof Insulation: Rigid fiberglass in hatchery section; 4-1/2" with minimum R value = 18. 5-1/2" batt insulation at other locations; R = 19.
8. Exterior Wall Insulation: 3-1/2" batt insulation in wood frame interior cavity at visitors' center and residence; R minimum = 11. 2-1/2" minimum rigid fiberglass, where interior wall is masonry.
9. Interior Partitions: 2-1/2" - 25 gauge steel studs 24" spacing - faced with 5/8" X-rated gypsum board. Gypsum board in toilet rooms to be moisture resistant type.
10. Interior Doors and Frames: Visitors' center - solid core wood, 1-3/4" thick. Frames - hollow metal, knock down drywall type - 18 gauge pre-finished baked enamel with snap-on casings. Hatchery - "Hope" or equal, steel doors and frames.

11. Hardware: Lock and latch sets cylindrical; master-keyed. Hardware for steel doors provided by door manufacturer.
12. Interior Finishes:
 - Floors - Visitors' center and kitchen in residence - quarry tile. Carpet in other residence areas.
 - Hatchery and other areas - sealed, hardened concrete, with 4" rubber base.
 - Toilet rooms - ceramic tile with base.
 - Walls - Gypsum board with two coats paint at visitors' center and residence.
 - "Spectra-Glaze II" glazed masonry units by Burns & Russell or equal, in hatchery area; sealed CMU finish in other areas.
13. Specialties: Toilet partitions - ceiling-hung, flush type metal, baked enamel finish.



Anderson Building - Division of Wildlife
(605) 773-3331



April 25, 1980

Mr. James Delaney, Attorney
HOLLAND, DELANEY & VANDERLINDEN
P. O. Box 615
Webster, SD 57274

Dear Mr. Delaney:

Thank you for writing to us on behalf of Mr. Richard Zubke regarding our notice of discharge water from the proposed Bluedog Lake Hatchery to Hemenway Slough. Mr. Zubke's objection to the proposed discharge will be entered into our public record concerning the hatchery.

We would like to take this opportunity to assure Mr. Zubke that our discharge of water from the hatchery will not raise the water level on the property he owns to any extent that it will cause damage and harm to its use for agriculture. The normal use of lake water in the hatchery during the summer will be at a rate of approximately 2,500 gpm. Water coming from the lake will be returned to the lake via Hemenway Slough which is directly connected to the lake. Therefore lake water used in the hatchery will not affect the lake level and its connecting wetlands at all. The normal use of well water in the hatchery during winter and early spring will be at a rate of approximately 1,500 gpm. The discharge of well water would be the only new surface water added to the lake and its connecting wetlands. The well water discharge would not raise the lake during normal or wet years because the lake level is governed by the outlet structure elevation located at hwy 12. During dry years when Hemenway Slough and the lake water level are below the outlet elevation, the well water could add slightly (less than 1%) to the lake level.

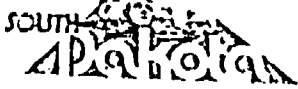
In summary, the outlet structure elevation located at hwy 12 governs the lake level and its connecting waters. Consequently, the hatchery will have no effect on the lake level except during dry years when the well water discharged might slightly help maintain the water level in Bluedog Lake. The Water and Natural Resources Department sets the lake elevations.

You are welcome to contact Mr. John Hatch concerning the elevation of the new proposed hwy 12 outlet structure for Bluedog Lake. I believe an elevation of 1800.34 ft. above sea level has been recommended for the new hwy 12 proposed outlet structure. This is the level the lake has normally been kept at in recent years. Mr. Hatch can be contacted through the Water and Natural Resources Department, Water Rights Section, Foss Building, Pierre, SD.

Sincerely yours,

Art Talsma
Hatchery Project Coordinator

bjh



Department of Game, Fish and Parks
Pierre, South Dakota 57501 • Phone 224-3387

Anderson Building = Wildlife Division
(605) 773-3381

Division of Game and Fish

April 25, 1980

Mr. James Delaney, Attorney
HOLLAND, DELANEY & VANDER LINDEN
P. O. Box 615
Webster, SD 57274

Dear Mr. Delaney:

Thank you for writing to us on behalf of Mr. and Mrs. Frank Brooks of Waubay regarding our notice of discharge water from the proposed Bluedog Lake Hatchery to Hemenway Slough. Mr. and Mrs. Brooks' objection to the proposed discharge will be entered into our public record concerning the hatchery.

We would like to take this opportunity to assure the Brooks' that our discharge of water from the hatchery will not raise the water level on the property they own to any extent that it will cause damage and harm to its use for agriculture. The normal use of lake water in the hatchery during the summer will be at a rate of approximately 2,500 gpm. Water coming from the lake will be returned to the lake via Hemenway Slough which is directly connected to the lake. Therefore lake water used in the hatchery will not affect the lake level and its connecting wetlands at all. The normal use of well water in the hatchery during winter and early spring will be at a rate of approximately 1,500 gpm. The discharge of well water would be the only new surface water added to the lake and its connecting wetlands. The well water discharge would not raise the lake during normal or wet years because the lake level is governed by the outlet structure elevation located at hwy 12. During dry years when Hemenway Slough and the lake water level are below the outlet elevation, the well water could add slightly (less than 1%) to the lake level.

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Sincerely yours,

Art Talsma
Hatchery Project Coordinator

bjh



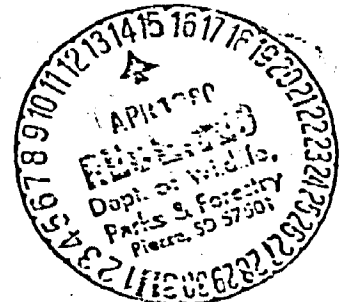
WM. J. HOLLAND
JAMES R. DELANEY
LEON J. VANDER LINDEN

TELEPHONE
(605) 345-3321

HOLLAND, DELANEY & VANDER LINDEN
ATTORNEYS
WEBSTER, S. DAK. 57274
P.O. BOX 615

April 11, 1980

Mr. Lloyd Thompson
Deputy Secretary
Department of Game, Fish & Parks
Pierre, SD 57501



Dear Mr. Thompson:

On behalf of Richard Zubke of Waubay, South Dakota, I am writing you in regard to the water discharge notice which is currently appearing in the Reporter and Farmer in Webster, South Dakota. Mr. Zubke is the owner of real estate in the Southeast Quarter of Section 29, Township 122, Range 54. This property is adjacent and to the west of the Hemenway Slough in which you will be discharging water which is described in your Notice.

Mr. Zubke is of the opinion that the discharge of water which you propose will have an effect on his real estate. He further believes that this discharge of water will raise the water level on the property which he owns to such an extent that it will cause damage and harm to the property in its use for agricultural purposes.

He, therefore, objects to the proposed discharge of water as outlined in your Notice.

Sincerely,

James R. Delaney
OF HOLLAND, DELANEY & VANDER LINDEN

JRD:ijb

PRELIMINARY ENGINEERING REPORT

FISH CULTURE FACILITIES
NORTHEAST LAKES REGION

SOUTH DAKOTA DEPARTMENT
OF GAME, FISH AND PARKS

JULY 1974

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July 29, 1974

Game, Fish & Parks Commission
S. D. Department of Game, Fish & Parks
Pierre, South Dakota

Gentlemen:

Transmitted herewith is our report "Preliminary Engineering Report - Northeast Lakes Fish Culture Facility". The report outlines the findings of investigations conducted in the Northeast Lakes Region to locate a site where soil and groundwater conditions are suitable for the construction of a fish hatchery and fish rearing ponds. The most suitable location was determined to be on the northwest edge of Blue Dog Lake.

A preliminary draft of the report was submitted on January 11, 1974. Subsequent to the preliminary report, the design of a 20 unit rearing pond installation on land owned by the Department of Game, Fish and Parks was authorized. The design has been completed and bids are to be accepted on August 16, 1974.

This report was completed concurrently with the plans and specifications and includes updated information and cost estimates for the total fish culture facilities. The total development has been separated into four projects for phase construction. The phase projects can be constructed individually or in any combination. The cost estimates include itemized costs of the project components to permit detailed evaluation when considering future projects.

We appreciated the opportunity of working on this study and report. Our office is available at your convenience to review any information contained herein, and we look forward to further work on the project.

Yours very truly,

SCHMITZ, WALDA & ASSOCIATES

Daniel J. Naughton
Daniel J. Naughton, P.E.

DJN/ht

PRELIMINARY ENGINEERING REPORT
NORTHEAST LAKES FISH CULTURE FACILITY
SOUTH DAKOTA DEPARTMENT OF GAME, FISH AND PARKS

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PRELIMINARY ENGINEERING REPORT
NORTHEAST LAKES FISH CULTURE FACILITY
SOUTH DAKOTA DEPARTMENT OF GAME, FISH & PARKS

I. INTRODUCTION.

A. Authorization.

This study was authorized by the State of South Dakota, acting through the Department of Game, Fish and Parks Commission, on September 6, 1972, in an agreement with Schmitz, Kaldia and Associates, Engineers and Land Surveyors.

B. Purpose.

The purpose of this report is to summarize the studies and investigations conducted to locate an acceptable site, develop a schematic design, and prepare a cost estimate for a fish culture facility to be located in the Northeast Lakes Region of South Dakota.

C. Scope of Project.

The ultimate aim of this project is the construction of a modern, flexible fish culture facility that will be adaptable to the Department of Game, Fish and Park's proposed fish production program. Northern pike and walleye production will be the prime goal of these facilities. Some bass and bluegills will also be produced.

Major fish culture components proposed are a 500 jar hatchery, a 100 foot pair of raceways and 40 one acre fish rearing ponds. Appurtenant facilities include a brood pond, wells, pipelines, pollution control facilities, roadways, parking and a residence.

II. SITE EVALUATIONS.

A. General.

A suitable site is of paramount importance to the success of a fish culture facility. Therefore, top priority was given to locating a site that satisfied the following criteria:

1. An adequate quantity of groundwater that has a quality acceptable for fish rearing.
2. Soil conditions that will permit the construction of impervious earthen ponds.
3. A location near the Northeastern Lakes from which brood stock are taken.

Investigations by personnel from the Department of Game, Fish and Parks, prior to the authorization of this study, produced three potential sites which warranted further study. These sites are as follows:

1. Along Owens Creek east of Blue Dog Lake.
2. North of Clear Lake in Marshall County.
3. Blue Dog Lake on the northwest bank.

This study was not limited to these three areas. Attempts were made to locate other areas which satisfied the criteria for potential sites. In all cases, other areas that had high potential for groundwater production, were located on land that either was not purchaseable, or did not have sufficiently impervious soil for the rearing ponds. Areas where land was available and soil conditions were acceptable, were outside of areas considered by the South Dakota Geological Survey to have a high probability of an adequate aquifer for water supply.

B. Geologic Considerations.

The Northeast Lakes Region in South Dakota is in the geologic area formed by the Late Wisconsin Stagnation Moraine. The top layers of earth and the physical features of this area were formed by the in place melting of stagnant ice. Differences in the thickness and variations in the amount and type of soil and debris in the glacier, caused the melting of the ice to be non-uniform. This produced a wide variation in the materials being deposited. As a result of this geologic phenomenon, there are few uniform deposits of sand and gravel or thick uniform layers of clay soil in this entire region.

The South Dakota Geological Survey has conducted investigations to locate major aquifers in Marshall and Day Counties. The results of their studies are published in informational pamphlets entitled "Major Aquifers and Sand and Gravel Resources in Marshall (Day) County". Both of these pamphlets contain a map outlining the areas of probable sand and gravel occurrence. These maps and discussions with Geological Survey personnel proved valuable in locating potential water sources. This information was followed by field investigations of these areas.

C. Sites Investigated.

1. Owens Creek.

In August, 1969, a production well was drilled along Owens Creek on land owned by the Department of Game, Fish and Parks in Section 13, Township 122 North, Range 53 West. This well produced water at 325 gallons per minute. Data on drawdown and recovery indicated that sufficient water was available at this site. Soil borings indicated that the soil was not sufficiently impervious to construct earthen ponds capable of holding water. A high groundwater table was another drawback to the construction of the proposed fish culture facilities at this site.

A more recent field investigation was made of this site to determine if more extensive clay soils existed on land owned by the Department on higher ground north of the area of previous investigation. This survey did not locate any more favorable conditions; therefore, this area was eliminated as a possible site.

2. Clear Lake.

Another potential site on Department owned land north of Clear Lake was investigated. Conditions at this site were the converse of those at the Owens Creek site. An abundance of highly impervious soils existed for the construction of the rearing ponds; however, there were no water bearing formations on the proposed site that could produce the quantity of water required for the proposed facilities.

On the basis of the extensive nature of clay soils and the large tract of Department owned land at the Clear Lake site, an expanded groundwater investigation was made. A series of three test holes were drilled near the creek that connects North Red Iron Lake with Clear Lake. These holes were drilled to an average depth of 67 feet. The thickest layer of sand was 13 feet. The sand was fine and capable of producing only a fraction of the water required. Since no other sites within a reasonable distance of Clear Lake were more likely to yield the quantity of water required, no other test holes were drilled in this area.

3. Blue Dog Lake.

The Department of Game, Fish and Parks owns approximately 80 acres of land on the northwest edge of Blue Dog Lake. Although this is not large enough to support the proposed facilities without purchasing additional land, available information on water and soil conditions near the site indicated that further investigation was warranted.

a. Soil Investigations.

Soil borings were made by the Division of Highways of the Department of Transportation. Such borings were made at the proposed site for the rearing ponds west of Blue Dog Lake and the proposed site for the retention ponds north of Little Rush Lake. Location of the borings is shown on Exhibit 1 and data on the borings are included in Appendix A.

Ten borings were made at the proposed rearing pond site on February 26-27, 1973. Sand was encountered above a depth of 7 feet in only one of the holes. The coefficient of permeability of the soil was determined to be 4.0×10^{-8} cm/sec or 0.0014 inches/day at 95% standard proctor density and optimum moisture. This is approximately 100 times less than the value above which construction of earthen ponds is normally considered impractical. Laboratory data are shown in Appendix A.

Ten borings were made at the retention pond site north of Little Rush Lake on April 16, 1974. The borings typically showed topsoil to a depth of 1 to 2.5 feet underlain with brown and yellow clay with some sand lenses. The soil structure is considered acceptable for construction of the retention ponds. The proposed bottom elevation is generally above the sand formation and selective use of the clay soils will result in a satisfactorily impervious pond. The bottom of the ponds will be above the water surface in the lake.

Five borings were made on the west access area to Blue Dog Lake on the site owned by the Department of Game, Fish and Parks. A proposal was evaluated

to locate the lift station and retention pond at this site. The borings showed a thin layer of topsoil underlain with heavy wet clays and sand. The water table is at a depth of approximately 4 feet in the areas of lower ground elevation. The water table is at about lake level elevation. The area is generally low and not considered suitable for construction of a deep retention pond. The area also serves as an attractive access to Blue Dog Lake, therefore, the proposal to construct facilities on this site was abandoned.

b. Groundwater Investigations.

Groundwater investigation test holes were drilled on the land owned by the Department of Game, Fish and Parks and at sites to the northeast. The location of the test holes is shown on Exhibit 1 and the test hole drilling logs are shown in Appendix B. The test holes indicated that an adequate quantity of groundwater could be developed at the site. Preliminary analyses of samples from the test holes indicated the water to be of good chemical quality.

On the basis of the test hole results, two permanent production wells and one additional pilot hole were completed. The location of the wells and the pilot hole are shown on Exhibit 1. Detailed data on the well logs, sand analyses, well construction and pumping tests are included in Appendix C.

Table 1 summarizes the construction of the wells, results of 24-hour pumping tests, and the recommended permanent pumping capacity.

TABLE 1. DATA ON PRODUCTION WELLS

Well No.	Depth (Ft.)	Diameter (In.)	Screen Length (Ft.)	Static Water Level (Ft.)	Test Pumping			Recommended Pump. Rate (GPM)
					Rate (GPM)	Drawdown (Ft.)	Yield (GPM/Ft.)	
1.	54.5	12	20	10.0	725	16	45.3	700
2.	56	12	20	8.3	725	25.3	28.9	500

The recommended permanent pumping capacity of Wells No. 1 and 2 is approximately 1200 gallons per minute. A pilot hole has been completed for a third well approximately 650 feet west of Well No. 2. Information from the completed wells and the pilot hole shows that the aquifer decreases in thickness to the west. The thickness of the aquifer in the test hole for Well No. 3 was 14 feet as compared to 30 feet in Well No. 2 and 34.5 feet in Well No. 1. The yield from a third well at the location of the pilot hole would necessarily be less than that from Wells No. 1 and 2, and would probably be in the range of 300 to 400 gallons per minute.

Table 2 shows data on the chemical quality of the water from the permanent wells and the recommended limits of chemical constituents of water for hatchery and rearing pond operations.

The quality of the well water is unusually good for the area. All the chemical constituents for which laboratory determinations were completed were

within the recommended limits for both hatchery and rearing pond operations. The concentration of iron is particularly significant for hatchery operations and the indicated level of 0.26 ppm is not expected to cause problems. The manganese concentration of 0.4 to 0.5 ppm will reportedly not affect hatching operations but prolonged contact may cause discoloration of equipment.

The water supply is, therefore, acceptable for use in both the hatchery and rearing ponds without treatment. Provisions to increase dissolved oxygen to the required level to support biological life will be necessary. This may be accomplished by natural aeration in the rearing ponds and by mechanical means for the hatchery water.

D. Site Recommendation.

Considering the geologic structure of the Northeast Lakes Region and the required soil and groundwater conditions, the site at Blue Dog Lake is definitely the most desirable location for the construction of the proposed fish culture facilities. Production wells were drilled and tested to determine the capacity of the well field and the quality of the water. The results of these tests indicate that both the quantity and quality of the water is satisfactory. The site on the west side of Blue Dog Lake is recommended for construction of the fish culture facilities.

The 80 acres of land owned by the Department is not adequate for the complete development of the proposed facilities. Acquisition of additional land is therefore recommended.

TABLE 2. DATA ON CHEMICAL QUALITY

Chemical Constituents	Recommended Limits		Water Analyses	
	Hatchery	Ponds	Well No. 1	Well No. 2
Temperature (°F)	50-60	45-70	50	50
pH	7.0-8.0	7.0-8.5	7.8	7.8
Dissolved Oxygen (% Sat.)	100	50-100		
CO ₂ (ppm)	0.0-10	0.0-10		
N ₂ (ppm)	Sat.	Sat.		
NH ₃ as N (ppm)	0.0-0.2	0.0-0.2		
H ₂ S (ppm)	0.0-0.3	0.0-0.3		
Organic N (ppm as N)	0.0-1.0	0.0-1.0		
NH ₄ (ppm as N)	0.0-2.0	0.0-2.0		
NO ₃ (ppm)	< 10.0	< 10.0	0.03	0.04
NO ₂ (ppm as N)	< 10.0	< 10.0		
Alkalinity: P (ppm as CaCO ₃)			0	0
T (ppm as CaCO ₃)			339	357
Na (ppm)			7.2	7.7
K (ppm)			4.9	5.3
Ca (ppm)			93.6	95.6
Mg (ppm)			37.4	39.1
Mn (ppm)			0.45	0.52
Fe (ppm)	< 0.5		0.09	0.11
F (ppm)			0.21	0.21
Cl (ppm)	10-100	10-100	5.0	6.00
SO ₄ (ppm)	100-300	100-600	53.3	65.8
HCO ₃ (ppm)			414	435
Hardness (ppm as CaCO ₃)	100-500	100-500	389	401
Total Solids (ppm)			459	488
Trace Elements (ppm)	< 0.05	< 0.05		
Chlorinated Hydrocarbons (ppm)	None	None		
Suspended Solids (ppm)	0.0-10.0	20	3	2
Turbidity (J.T.U.)	0.0-10.0	20	< 1	< 1

III. PROPOSED FACILITIES.

A. General.

The proposed facilities described in this section are designed to provide the South Dakota Department of Game, Fish and Parks with a modern, flexible fish culture facility. The ultimate development at the Blue Dog Lake site will consist of a 500 jar hatchery, a 100 foot pair of raceways, 40 one-acre fish rearing ponds. Phase construction is currently proposed for development of the total facility. During course of this study and subsequent to the First Draft of the Preliminary Engineering Report dated January 1974, plans and specifications have been prepared for the first phase of the development. The first phase constitutes the basic facilities for a fish rearing pond installation of 20 ponds. The basic initial phase facilities are designed for future expansion to 40 rearing ponds, brood ponds, hatchery, residence, access roads and related facilities.

A layout plan of the proposed facilities is shown in Exhibit 2. The present site limits the initial development to 20 rearing ponds with associated pollution control facilities and space for the fish hatchery, residence, and parking. Expansion to 40 rearing ponds will require acquisition of additional land.

The topography of the site is such that a pumping station is required to lift the drainage from the rearing ponds into the detention ponds and brood ponds. Storm water drainage from the rearing pond area can be routed to Blue Dog Lake by gravity; therefore, the lift station will need to operate only during the time the rearing ponds are being drawn down for harvesting of fish. The proposed site for the hatchery will permit gravity flow of water from the hatchery operations to the retention pond adjacent to the rearing ponds or to the lower rearing ponds for reuse if desired.

B. Proposed Phase Development.

The development of the total project for the purpose of this report and cost estimates is separated into phases or projects as follows:

1. Project 1 - Basic Facilities. The project includes the basic facilities for operation of a 20 pond rearing pond installation on the present site and includes the following components:

- a. Two wells,
- b. Twenty rearing ponds,
- c. Drain water lift station, and
- d. Detention pond for pollution control.

2. Project 2 - Expansion to 40 Rearing Ponds & Brood Pond. The additional facilities proposed for expansion to 40 rearing ponds include the following:

- a. One well,
- b. Twenty rearing ponds,
- c. One 10-acre brood pond adjacent to rearing ponds,

- d. Intake from detention pond to lift station,
- e. Force main to brood pond, and
- f. Outlet control structure for brood pond.

3. Project 3 - Hatchery & Residence. The facilities included in this phase include the following:

- a. Hatchery building and equipment,
- b. Residence,
- c. Two raceways,
- d. One hatchery well,
- e. Potable water supply system,
- f. Domestic waste disposal system,
- g. Bituminous surfacing of access roads, and
- h. Parking lots and landscaping.

4. Project 4 - Additional Brood or Detention Ponds. The facilities required for additional brood or detention ponds located north of Little Rush Lake include the following:

- a. Two 10-acre brood or detention ponds,
- b. Force main to ponds, and
- c. Outlet to Little Rush Lake.

The projects as outlined can be constructed individually or in any combination. Projects 1 and 3 are located on land presently owned by the Department of Game, Fish and Parks, and Project 2 is located on adjacent land. The need for the additional brood or detention ponds under Project 4 will be determined on operating experiences and results of monitoring the quality of effluent discharges from the detention and brood ponds located adjacent to the rearing ponds. Available data indicates that adequate treatment of the rearing pond drainage can be accomplished in the retention and brood ponds proposed under Projects 1 and 2. The water pollution control facilities are discussed in a subsequent section.

C. Basis of Hydraulic Design.

1. Water Lines. The water transmission line from the wells to the rearing ponds is designed for 2000 gallons per minute (GPM). The design of the piping within the rearing ponds is designed on the basis of simultaneously filling two groups of four ponds or any combination of eight ponds. With the basic two wells producing 1200 GPM, the time required to fill eight ponds is 6.5 days. At an ultimate pumping rate of 2000 GPM, the filling time for eight ponds is reduced to 3.9 days.

2. Drain Lines and Lift Station. The main drain lines and lift station are designed for 3000 GPM. At a 3000 GPM flow rate, draining of 4 ponds will require 31 hours. The pipeline design is based on simultaneously draining any group of four ponds.

The lift station will have two pumps each of 1500 GPM which will operate automatically with the incoming flow and the water level in the station. Provisions for bypassing of storm water by gravity directly to the lake will be

included making it unnecessary to pump surface runoff to the retention ponds. A gated structure will be provided ahead of the lift station for routing of flows.

D. Water Supply. Two wells with a total capacity of 1200 gallons per minute (GPM) will be provided with Project 1 - Basic Facilities. A third well with a capacity of approximately 700 GPM is proposed with Project 2 - Expansion to 40 Rearing Ponds. The three wells will provide a total pumping capacity of 1900 GPM. The third well is proposed to be located to the southeast of Well No. 1. Should additional wells be required, the area to the east and north of Well No. 1 also appears to be favorable, but such locations would require acquiring easements or purchase of additional land.

Construction of a fourth well is proposed in conjunction with the fish hatchery. Capacity of the well will be in accordance with the water requirements for the hatchery. Such requirements are anticipated to be a maximum of 500 GPM. The location of the well is proposed to be in the vicinity of the pilot hole.

E. Rearing Ponds.

Rearing ponds are proposed for the development of the fish from the fry to the fingerling stage. The ultimate development will consist of 40 ponds. Construction of the ponds may be phased with 20 ponds being constructed in each phase.

Each rearing pond will have a surface area of approximately one acre and have a maximum water depth of 6 feet. Capacity of each pond will be approximately 4.3 acre feet (1,400,000 gallons). Two 4-inch valved inlet lines are provided on each pond to allow for filling from either end of the pond. Sluice gates are provided on each of the ponds to permit individual draining. In addition to the sluice gate, the control structure on each pond will have provisions for screens and an overflow.

Rearing ponds can be constructed with individual fish kettles or with outside fish kettles common to a group of 4 ponds. An evaluation was made of both types of fish kettles in conjunction with personnel of the Department of Game, Fish and Parks and the decision was made to provide outside fish kettles common to 4 rearing ponds. The outside kettles have numerous operational advantages in addition to being less costly. The estimated construction cost for outside kettles is \$1,500.00 less per rearing pond. A typical plan of rearing ponds with outside fish kettle is shown on Exhibit 3.

The slope of the pond dikes will be three horizontal to one vertical. The inside slopes will be riprapped from the top of the dike to a point one foot below high water level. Top width of the dikes will be 10 feet except roadway perimeter dikes will be 15 feet wide. The depth of water in the ponds at the normal operating level will vary from 4 to 6 feet. The two foot difference in the elevation of the pond bottom provides positive drainage from the pond. To provide natural fertility in the ponds for the next season, a crop is normally grown in the ponds following the harvesting of fish. Positive drainage is required to allow early access to the ponds for these cropping operations.

F. Pollution Control Facilities.

Data on waste characteristics, effluent requirements, and recommended treatment methods was obtained from the United States Environmental Protection Agency draft report "Development Document for Proposed Effluent Limitations Guidelines and New Source Performance Standards for Fish Hatcheries and Farms" dated April 1974. Based on data in EPA report, the treatment methods to be employed will meet the effluent limitations which must be achieved by July 1, 1983 and attainable through application of the best available technology economically achievable (BATEA). The BATEA is the highest degree of control technology that has been achieved or has been demonstrated to be capable of being designed for plant scale operation. The EPA report states that the BATEA for native fish pond culturing systems is sedimentation of the entire flow with sludge removal. The report further states that sedimentation ponds are the best documented and proven method of treatment.

The effluent limitations for pond draining discharges during harvesting are as follows:

<u>Effluent Characteristics</u>	<u>Effluent Limitation</u>
Settleable Solids	Maximum instantaneous concentration during draining period = 3.3 ml/l
Fecal Coliform Bacteria	Maximum concentration = 200 organisms/100 ml

Removal of settleable solids can readily be accomplished by sedimentation in an earthen retention pond. Data from similar operations indicates that an effluent containing less than 0.1 ml/l settleable solids can be accomplished with a relatively short detention time. Data in the EPA Report indicates the following efficiencies and effluent characteristics for a retention (stabilization) pond with a three to four day detention time:

<u>Pollutant</u>	<u>Raw Waste</u>	<u>Removal Efficiency</u>	<u>Effluent</u>
BOD	9.5 mg/l	60	3.8 mg/l
COD	43 mg/l	-	-
Suspended Solids	22 mg/l	60	8.8 mg/l
Settleable Solids	0.9 ml/l	90	0.1 ml/l
NH ₃ - N	0.54 mg/l	70	0.16 mg/l
TKN	1.37 mg/l	-	-
NO ₃ - N	1.63 mg/l	50	0.82 mg/l
Total PO ₄ - P	0.25 mg/l	80	0.05 mg/l

Fecal coliform are not expected to be produced by fish, however, some isolated studies have shown an increase in fecal coliform from some warm water fish culture facilities. Such increases have been attributed to contaminated feed or source water and resultant accumulation of bacteria in the fish.

The proposed retention (stabilization) pond will have a depth of 10 feet and a capacity of approximately 27 acre-feet or 3,320,000 gallons. At a continuous maximum lift station pumping rate of 3000 GPM, the theoretical detention

time is 2 days. Since it is highly unlikely that the maximum rate of pumpage will be continuous over an extended period of time, the actual detention time is expected to be in the order of 3 days minimum.

Based on performance data from the EPA Report, the effluent from the retention pond will meet the criteria for ZATFA presently recommended. Monitoring of the effluent will provide actual data on performance and future requirements for additional retention pond capacity. The retention ponds can be used as brood ponds if desired. Expansion of the rearing ponds to 40 units under Project 2 includes a 10-acre brood pond which can be used as a retention pond during harvesting operations. Project 4 further provides for 2-10 acre brood or detention ponds if required.

The data indicates that the retention pond under Project 1 will provide adequate treatment for the complete fish culture facility of 40 rearing ponds and hatchery. Results of effluent monitoring will determine the need for additional retention ponds. In the possible event fecal organism concentrations in excess of the limitations are experienced, chlorination equipment could readily be installed. After prolonged use, it may be necessary to remove accumulated sludge from the retention pond. Disposal of the sludge on land by approved methods is recommended.

G. Hatchery.

The proposed location of the hatchery is near the lake so that full advantage can be made of the natural beauty of the site. A concrete block building with brick exterior and a precast concrete roof system is proposed. Moisture considerations dictate that the interior facing of the block should be glazed or painted with an epoxy paint. Estimated cost of this facility is based on a building size of 3000 square feet. This size is based on a preliminary estimate of the space requirements and will be refined as fish culture goals and operational requirements become more defined.

The hatchery operations area will include provisions for a battery of 500 six-quart jar incubators and other required facilities. A reception and display area will be integrated into this section of the building for hatchery visitors.

The mechanical room will include the building heating and ventilating equipment, electrical panel, standby motor-generator, pump controls, equipment for tempering water to hatch temperatures, and other equipment for required water conditioning.

The hatchery building will include an office, laboratory, and rest rooms. A pair of concrete raceways 100 feet long by 8 feet wide are proposed near the hatchery building.

A constant supply of water is essential to the fish hatching operations, therefore, a well is proposed in conjunction with the construction of the hatchery. Power and controls for the well will be from the hatchery building. The rearing pond wells will also be connected to the hatchery to assure an adequate water supply.

A standby motor-generator is proposed in the hatchery to provide emergency power for one well and the basic equipment critical to the hatching operations.

H. Residence.

A permanent, modern residence for the hatchery manager is proposed to be constructed at the site. Completion of the residence on the same schedule as the hatchery would be desirable. A structure with approximately 1200 square feet of living area, a basement, and a double garage, is proposed. The residence will be located in the same vicinity as the hatchery so that both can utilize the same domestic water source and waste disposal facilities. Its proximity to the hatchery on high ground overlooking the entire site will also add a measure of security for the facilities.

I. Domestic Water Supply and Waste Disposal Facilities.

A small diameter well, complete with a submersible pump and pitless adapter, will supply water for domestic uses to the residence and hatchery. Complete separation will be maintained between this system and the system providing water for hatchery operations.

A septic tank and soil absorption field is proposed for the disposal of domestic wastewater. The limited quantity of wastes makes such a system practical. An added advantage is the complete separation of sanitary wastes from process wastes. The distance of the facilities from the lake will be adequate to prevent contamination.

J. Roadways and Parking.

Road construction under Project 1 will include gravel surfaced roads to the rearing ponds and wells and a small gravel surfaced parking lot. Eight of the rearing ponds under Project 2 are proposed south of the access road located along the section line. Consideration can also be given to abandoning the section line access road and constructing the eight rearing ponds adjacent to the other rearing ponds. The access road would need to be relocated between the rearing ponds and the brood pond. The access roads will have a top width of 24 feet except the road to the wells will have a 16 foot wide surface. Gravel surfacing to a compacted depth of 3 inches will be provided under Project 1 for the access roads and the rearing pond dikes.

Bituminous surfacing is proposed under Project 3 in conjunction with construction of the hatchery and residence. Road construction is proposed to be 6 inches compacted thickness of aggregate base course and 2 inches asphaltic concrete. Additional roads and parking lots as required for the hatchery and residence will be constructed with these facilities. A visitors parking lot for 30 cars and an employee parking lot for 10 cars are proposed.

IV. ESTIMATED COSTS. Cost estimates are provided for each project in the proposed phase development as outlined previously. Costs are based on a 1974 bid letting. Construction costs have increased dramatically during the past year. Future cost increases are difficult to predict, however, a minimum inflation factor of 15% from 1974 to 1975 is indicated. An inflation factor of 15% per year is, therefore, recommended for work delayed beyond 1974.

Estimated costs for the work under Project 1 are based on quantities from design plans and specifications. The estimated costs by projects are shown in the tables that follow.

TABLE 3. ESTIMATED COST - PROJECT 1
BASIC FACILITIES

A. GRADING & SITE WORK.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	Unclassified Excavation	130,000	C.Y.	\$ 0.60	\$78,000.00
2.	Riprap on Rearing Ponds	17,500	S.Y.	1.50	26,250.00
3.	Gravel Surfacing (3")	33,500	S.Y.	0.60	20,100.00
4.	Seeding	20.0	Acre	150.00	3,000.00
5.	18" RCP or CMP Road Culverts	162	L.F.	10.00	<u>1,620.00</u>

ESTIMATED CONSTRUCTION COST

\$128,970.00

B. WATER SYSTEM.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	12" Diameter Well	2	Each	\$6,000.00	\$12,000.00
2.	Pitless Adapter & Pump	2	Each	5,000.00	10,000.00
3.	Valve Manhole & Piping	2	Each	2,000.00	4,000.00
4.	Electrical & Controls	-	L.S.		10,000.00
5.	12" Pipe	1960	L.F.	11.00	21,560.00
6.	10" Pipe	953	L.F.	9.50	8,122.50
7.	8" Pipe	1823	L.F.	9.00	14,584.00
8.	6" Pipe	395	L.F.	6.50	2,567.50
9.	4" PVC Pipe	4115	L.F.	5.00	20,575.00
10.	2" PVC Pipe	165	L.F.	4.50	742.50
11.	8" Valve	2	Each	400.00	800.00
12.	4" Valve	40	Each	200.00	8,000.00
13.	2" Valve	5	Each	100.00	500.00

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
14.	12" x 12" x 8" Tee	2	Each	\$ 240.00	\$ 480.00
15.	12" x 12" x 6" Tee	2	Each	240.00	480.00
16.	12" x 12" x 4" Tee	1	Each	240.00	240.00
17.	12" x 10" Reducer	2	Each	150.00	300.00
18.	10" x 10" x 8" Tee	1	Each	200.00	200.00
19.	10" x 10" x 6" Tee	2	Each	200.00	400.00
20.	10" x 8" Reducer	1	Each	105.00	105.00
21.	10" Plug	1	Each	40.00	40.00
22.	8" x 4" Cross	12	Each	160.00	1,920.00
23.	8" x 8" x 4" Tee	1	Each	160.00	160.00
24.	8" x 6" Reducer	1	Each	100.00	100.00
25.	8" Plug	1	Each	40.00	40.00
26.	6" x 4" Cross	2	Each	105.00	210.00
27.	6" x 4" Reducer	1	Each	90.50	90.50
28.	4" x 4" x 4" Tee	7	Each	40.00	280.00
29.	4" - 90° Bend	72	Each	20.00	1,440.00
30.	4" x 4" x 2" Tee	5	Each	20.00	<u>100.00</u>

ESTIMATED CONSTRUCTION COST

\$120,037.00

C. DRAINAGE & FISH HARVESTING SYSTEM.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	10" VCP	1300	L.F.	\$ 7.00	\$ 9,100.00
2.	10" - 60° VCP Vye Branch	10	Each	25.00	250.00
3.	10" - 45° VCP Curve	10	Each	18.00	180.00
4.	12" RCP	1177	L.F.	8.00	9,416.00
5.	12" x 12" x 12" RCP Tee	1	Each	100.00	100.00
6.	21" RCP	2780	L.F.	13.00	36,140.00

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
7.	21" x 21" x 12" RCP Tee	1	Each	\$ 150.00	\$ 150.00
8.	Area Inlet	1	Each	800.00	800.00
9.	Manholes	7	Each	800.00	5,600.00
10.	Rearing Pond Outlet Structure	20	Each	2,450.00	49,000.00
11.	Rearing Pond Kettle Structure	5	Each	4,000.00	20,000.00
12.	Lift Station Structure & Mechanical	-	L.S.		28,400.00
13.	Lift Station Electrical & Controls	-	L.S.		6,500.00
14.	Force Main & Riprap	144	L.F.	18.00	2,592.00
15.	Retention Pond Outlet Control Structure & Drain	-	L.S.		<u>9,200.00</u>

ESTIMATED CONSTRUCTION COST

\$177,428.00

D. SUMMARY OF ESTIMATED COSTS.

Grading & Site Work	\$122,970.00
Water System	120,037.00
Drainage System & Fish Harvesting System	<u>177,428.00</u>
ESTIMATED CONSTRUCTION COST	\$426,435.00
CONTINGENCY @ 10%	43,000.00
TECHNICAL SERVICES	<u>16,565.00</u>
TOTAL ESTIMATED COST	\$516,000.00

TABLE 4. ESTIMATED COSTS - PROJECT 2
EXPANSION TO 40 REARING PONDS & BROOD POND

A. GRADING & SITE WORK.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	Unclassified Excavation - Rearing Ponds	110,000	C.Y.	\$ 0.60	\$66,000.00
2.	Unclassified Excavation - Brood Pond	65,000	C.Y.	0.50	42,500.00
3.	Riprap on Rearing Ponds	17,500	S.Y.	1.50	26,250.00
4.	Gravel Surfacing (3")	30,000	S.Y.	0.60	18,000.00
5.	Seeding	20.0	Acre	150.00	3,000.00
6.	18" RCP or CMP Road Culverts	150	L.F.	10.00	1,500.00
ESTIMATED CONSTRUCTION COST					\$131,000.00

B. WATER SYSTEM.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	12" Diameter Well	1	Each	\$6,000.00	\$ 6,000.00
2.	Pitless Adapter & Pump	1	Each	5,000.00	5,000.00
3.	Valve Manhole & Piping	1	Each	2,000.00	2,000.00
4.	Electrical & Controls	-	L.S.		3,000.00
5.	8" Pipe	1,460	L.F.	8.00	11,680.00
6.	6" Pipe	1,160	L.F.	6.50	7,540.00
7.	4" PVC Pipe	4,220	L.F.	5.00	21,100.00
8.	2" PVC Pipe	160	L.F.	4.50	720.00
9.	8" Valve	1	Each	400.00	400.00
10.	4" Valve	40	Each	200.00	8,000.00
11.	2" Valve	5	Each	100.00	500.00
12.	8" Cross	1	Each	200.00	200.00

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
13.	8" x 4" Cross	9	Each	\$ 160.00	\$ 1,440.00
14.	8" x 8" x 4" Tee	1	Each	160.00	160.00
15.	8" x 6" Reducer	2	Each	100.00	200.00
16.	8" x 4" Reducer	1	Each	100.00	100.00
17.	8" Plug	1	Each	40.00	40.00
18.	6" x 4" Cross	4	Each	105.00	420.00
19.	6" x 4" Reducer	2	Each	90.00	180.00
20.	4" x 4" x 4" Tee	8	Each	40.00	320.00
21.	4" - 90° Bend	47	Each	20.00	940.00
22.	4" x 4" x 2" Tee	5	Each	20.00	<u>100.00</u>

ESTIMATED CONSTRUCTION COST

\$70,040.00

C. DRAINAGE & FISH HARVESTING SYSTEM.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	10" VCP	1,300	L.F.	\$ 7.00	\$ 9,100.00
2.	10" - 60° VCP Wye Branch	10	Each	25.00	250.00
3.	10" - 45° VCP Curve	10	Each	18.00	180.00
4.	12" RCP	400	L.F.	8.00	3,200.00
5.	21" RCP	1,930	L.F.	13.00	25,090.00
6.	21" x 21" x 12" RCP Tee	1	Each	150.00	150.00
7.	Manholes	2	Each	800.00	1,600.00
8.	Rearing Pond Outlet Structure	20	Each	2,450.00	49,000.00
9.	Rearing Pond Kettle Structure	5	Each	4,000.00	20,000.00
10.	10" Gate Valve in Lift Station	1	Each	800.00	800.00
11.	10" CIP In Lift Station	10	L.F.	30.00	300.00
12.	14" x 10" Reducer	1	Each	160.00	160.00

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
13.	14" ACP Force Main	900	L.F.	\$ 15.00	\$13,500.00
14.	14" CIP Force Main	40	L.F.	25.00	1,000.00
15.	14" Quarter Bend	3	Each	240.00	720.00
16.	14" Tee	1	Each	320.00	320.00
17.	14" Plug	1	Each	60.00	60.00
18.	Retention Pond Intake Structure to Lift Station	-	L.S.		8,000.00
19.	Brood Pond Outlet Control Structure & Drain	-	L.S.		<u>9,500.00</u>
ESTIMATED CONSTRUCTION COST					\$142,930.00

D. SUMMARY OF ESTIMATED COSTS.

Grading & Site Work	\$131,000.00
Water System	70,040.00
Drainage System & Fish Harvesting System	<u>142,930.00</u>
ESTIMATED CONSTRUCTION COST	\$343,970.00
CONTINGENCY @ 10%	34,000.00
TECHNICAL SERVICES	<u>37,030.00</u>
TOTAL ESTIMATED COST	\$415,000.00

TABLE 5. ESTIMATED COSTS - PROJECT 3
HATCHERY & RESIDENCE

A. GRADING & SITE WORK.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	Unclassified Excavation	15,000	C.Y.	\$ 0.60	\$ 9,000.00
2.	Visitor Parking Lot	1,000	S.Y.	3.00	3,000.00
3.	Employee Parking Lot	600	S.Y.	3.00	1,800.00
4.	Roads For Hatchery & Residence	2,200	S.Y.	3.00	6,600.00
5.	Access Road Bituminous Surfacing	8,300	S.Y.	2.50	20,750.00
6.	Seeding & Landscaping	10	Acres	300.00	<u>3,000.00</u>
ESTIMATED CONSTRUCTION COST					\$44,150.00

B. STRUCTURES & EQUIPMENT.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	Hatchery Building	3,000	S.F.	\$ 35.00	\$105,000.00
2.	Hatchery Mechanical Equipment	-	L.S.		60,000.00
3.	Standby Motor Generator	-	L.S.		8,000.00
4.	Raceways	-	L.S.		20,000.00
5.	Residence & Garage	1,200	S.F.	35.00	<u>42,000.00</u>
ESTIMATED CONSTRUCTION COST					\$235,000.00

C. WATER, DRAIN & WASTE SYSTEMS.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	12" Diameter Hatchery Well	-	L.S.	\$	\$ 6,000.00
2.	Pitless Adapter & Pump	-	L.S.		5,000.00
3.	Well Electrical & Controls	-	L.S.		3,500.00
4.	6" Pipe Well Line	800	L.F.	6.50	5,200.00
5.	12" RCP Hatchery Drain Line	900	L.F.	8.00	7,200.00

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
6.	Manholes	3	Each	\$ 800.00	\$ 2,400.00
7.	Domestic Water Supply	-	L.S.		6,000.00
8.	Domestic Waste Disposal System	-	L.S.		<u>3,000.00</u>
	ESTIMATED CONSTRUCTION COST				\$38,300.00
D.	<u>SUMMARY OF ESTIMATED COSTS</u>				
	Grading & Site Work:				\$ 44,150.00
	Structures & Equipment				235,000.00
	Water, Drain & Water Systems				<u>38,300.00</u>
	ESTIMATED CONSTRUCTION COST				\$317,450.00
	CONTINGENCY @ 10%				32,000.00
	TECHNICAL SERVICES				<u>34,550.00</u>
	TOTAL ESTIMATED COST				\$384,000.00

TABLE 6. ESTIMATED COSTS .. PROJECT 4
ADDITIONAL BROOD OR DETENTION PONDS

A. GRADING & SITE WORK.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	Unclassified Excavation	147,000	C.Y.	\$ 0.50	\$73,350.00
2.	Gravel Surfacing (3")	16,000	S.Y.	0.60	9,600.00
3.	Seeding	10	Acre	150.00	<u>1,500.00</u>
ESTIMATED CONSTRUCTION COST					\$84,850.00

B. DRAINAGE SYSTEM.

<u>No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	14" ACP Force Main	5,100	L.F.	\$ 15.00	\$76,500.00
2.	14" CIP Force Main	72	L.F.	25.00	1,800.00
3.	14" Quarter Bend	2	Each	240.00	480.00
4.	14" Eighth Bend	1	Each	200.00	200.00
5.	14" Tee	1	Each	320.00	320.00
6.	14" Gate Valve & Box	2	Each	1,200.00	2,400.00
7.	Air Release Manhole	-	L.S.		700.00
8.	Retention Pond Transfer Control Structure & Piping	-	L.S.		5,750.00
9.	Retention Pond Outlet Control Structure & Piping	-	L.S.		<u>14,250.00</u>
ESTIMATED CONSTRUCTION COST					\$102,400.00

C. SUMMARY OF ESTIMATED COSTS.

Grading & Site Work	\$ 84,850.00
Drainage System	<u>102,400.00</u>
ESTIMATED CONSTRUCTION COST	\$187,250.00
CONTINGENCY @ 10%	18,000.00
TECHNICAL SERVICES	<u>20,750.00</u>
TOTAL ESTIMATED COST	\$226,000.00

TABLE 7. SUMMARY OF ESTIMATED COSTS
COMPLETE FISH CULTURE FACILITIES

<u>PHASE PROJECT</u>	<u>ESTIMATED COST</u>
Project 1 - Basic Facilities	\$ 516,000.00
Project 2 - Expansion to 40 Rearing Ponds & Brood Pond.....	415,000.00
Project 3 - Hatchery & Residence.....	384,000.00
Project 4 - Additional Brood or Detention Ponds.....	<u>226,000.00</u>
TOTAL ESTIMATED DEVELOPMENT COST.....	\$1,540,000.00

V. SUMMARY & CONCLUSIONS.

The site at Blue Dog Lake is well suited for the construction of the proposed fish culture facilities for the northeast lakes region. An adequate supply of acceptable quality water is available on the site for the initial installation, and additional wells can be developed on adjacent land if required in the future. Soil conditions are well suited for the construction of rearing ponds, brood pond, and pollution control facilities.

Acquisition of additional land will be required for full development of the installation. These land costs are not included in the tables on estimated project costs. The amount of land to be acquired will be significantly influenced by the extent of the pollution control facilities and brood ponds to be constructed. Presently available data indicates that the detention pond and brood pond included in the first two project phases will be adequate to meet effluent requirements for the total development of forty rearing ponds and the hatchery.

The basic facilities included in the first phase project can be constructed entirely on land owned by the Department of Game, Fish & Parks in Section 21, T22N, R49W, and located on the west side of Blue Dog Lake. Expansion to forty rearing ponds and one brood pond will require acquisition of adjacent property.

EXHIBITS

- EXHIBIT 1. Location Plan - Soil Borings & Groundwater Investigations
- EXHIBIT 2. Schematic Layout Plan
- EXHIBIT 3. Typical Rearing Ponds With Outside Fish Kettle

APPENDIX A

SOIL BORINGS

APPENDIX A

SOIL BORINGS BLUE DOG LAKE DAY COUNTY, SOUTH DAKOTA

A. PROPOSED SITE FOR REARING PONDS - WEST OF BLUE DOG LAKE.

Drilled For: South Dakota Department of Game, Fish and Parks.
 Drilled By: South Dakota Department of Transportation, Division of Highways.
 Location: Section 21, Township 122 North, Range 54 West (See Location Plan).
 Method: Auger.
 Dates: February 26 & 27, 1972.

DATA ON BORINGS

<u>Boring</u>	<u>Ground Elevation</u>	<u>Soil Classification</u>	<u>Depth</u>
1.	1321.5	Topsoil Clay Silt Sandy Clay	0' - 2' 2' - 4' 4' - 10'
2.	1313.5	Topsoil Sandy Clay	0' - 1' 1' - 10'
3.	1306.0	Topsoil Sandy Clay	0' - 1' 1' - 10'
4.	1316.8	Topsoil Sandy Clay	0' - 1' 1' - 10'
5.	1310.2	Topsoil Silty Clay Sandy Clay	0' - 3' 3' - 8' 8' - 10'
6.	1306.0	Topsoil Sandy Clay Sand	0' - 2' 2' - 7' 7' - 10'
7.	1306.2	Topsoil Sandy Clay	0' - 1' 1' - 10'
8.	1311.0	Topsoil Sandy Clay Gravelly Silty Sand	0' - 2' 2' - 4' 4' - 10'
9.	1320.2	Topsoil Sandy Clay	0' - 1' 1' - 13'
10.	1310.2	Topsoil Sandy Clay	0' - 1' 1' - 10'

B. PROPOSED SITE FOR RETENTION PONDS - NORTH OF LITTLE RUSH LAKE.

Drilled For: South Dakota Department of Game, Fish & Parks.
Drilled By: South Dakota Department of Transportation, Division of Highways.
Location: Section 29, Township 102 North, Range 54 West (See Location Plan).
Method: Auger.
Dates: April 16, 1974.

DATA ON BORINGS

<u>Boring</u>	<u>Ground Elevation</u>	<u>Soil Classification</u>	<u>Depth</u>
11.	1807.5	Topsoil Brown Clay Yellow Clay Sandy Clay	0' - 1.5' 1.5' - 4' 4' - 8' 8' - 9'
12.	1801.7	Topsoil Brown Clay Blue Clay	0' - 2' 2' - 5' 5' -
13.	1800.8	Topsoil Brown Clay Sand	0' - 2.5' 2.5' - 3' 3' -
14.	1796.4	Topsoil Light Clay Sand Yellow Clay	0' - 2' 2' - 4' 4' - 5' 5' -
15.	1801.8	Topsoil Light Clay Sandy Clay Blue Clay	0' - 1' 1' - 3' 3' - 4' 4' - 5'
16.	1798.8	Topsoil Heavy Brown Clay Sand Yellow Clay	0' - 1' 1' - 5' 5' - 5.5' 5.5' - 7'
17.	1804.8	Topsoil Brown Clay Sand Sand Heavy Yellow Clay	0' - 1' 1' - 5' 5' - 6' 6' - 8' 8' - 9'
18.	1807.2	Topsoil Light Brown Clay Sandy Clay Heavy Yellow Clay	0' - 1' 1' - 5' 5' - 7' 7' - 10.5'

<u>Boring</u>	<u>Ground Elevation</u>	<u>Soil Classification</u>	<u>Depth</u>
19.	1807.0	Topsoil Yellow Clay	0' - 1' 1' - 10'
20.	1804.5	Topsoil Brown Clay Heavy Brown Clay	0' - 1' 1' - 5' 5' - 10'

NOTE: Water surface elevation of Little Rush Lake in March 1974 was 1794.4.

C. PROPOSED SITE FOR LIFE STATION & DETENTION PONDS - WEST ACCESS AREA TO BLUE DOG LAKE.

Drilled For: South Dakota Department of Game, Fish & Parks.
 Drilled By: Lakes Region Electric Cooperative.
 Location: Section 28, Township 102 North, Range 54 West (See Location Plan)
 Method: Auger.
 Date: June 18, 1974.

DATA ON BORINGS

<u>Boring</u>	<u>Ground Elevation</u>	<u>Soil Classification</u>	<u>Depth</u>
21.	1801.0	Topsoil Black Sandy Clay Sand (Water)	0' - 0.5' 0.5' - 3' 3' - 4.5' 4.5'
22.	1800.5	Topsoil Grey Clay Heavy Grey Clay(Wat)	0' - 1.5' 1.5' - 3' 3' - 7'
23.	1799.2	Topsoil Heavy Grey Clay (Water)	0' - 1' 1' - 4.5' 4.5'
24.	1798.2	Topsoil Heavy Grey-Brown Clay (Water-30 Minutes)	0' - 2' 2' - 4' 2.5'
25.	1799.1	Topsoil Sandy Clay (Water)	0' - 0.5' 0.5' - 3.5' 3.5'

NOTE: Water surface elevation of Blue Dog Lake in June 1974 was 1796.6.

D. PERMEABILITY TEST OF SOIL.

Sample: Representative sample of Sandy Clay from Proposed Site For
Rearing Ponds West of Blue Dog Lake.

Laboratory: Twin City Testing & Engineering Laboratory.

Procedure: ASTM Designation: D 2434-68.

Test Results: Maximum Density.....111.4 Pounds/Cubic Foot
Optimum Moisture.....17.0%
K @ 20° C..... 4.0×10^{-8} cm/sec
or 0.0014 Inches/Day

APPENDIX B
GROUNDWATER INVESTIGATION TEST HOLES

APPENDIX B

TEST HOLE DRILLING LOGS BLUE DOG LAKE DAY COUNTY, SOUTH DAKOTA

GENERAL INFORMATION

Drilled for: South Dakota Department of Game, Fish and Parks.
Drilled by: Frederickson's, Inc.
Method: Reverse Rotary.
Size of Hole: 6 $\frac{1}{4}$ "

INDIVIDUAL TEST HOLES

Test Hole No. 1.

Date Drilled: April 26, 1973
Location: NW $\frac{1}{4}$, NW $\frac{1}{4}$, SE $\frac{1}{4}$, SE $\frac{1}{4}$, Sec. 21-122-54
Elevation: 1809

<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Thickness (Ft.)</u>
Top Soil	0	2	2
Clay	2	7	5
Sand	7	8	1
Clay with Rock	8	13	5
Clay	13	20 $\frac{1}{2}$	7 $\frac{1}{2}$
Sand	20 $\frac{1}{2}$	49	28 $\frac{1}{2}$
Clay	49	57	8

Test Hole No. 2.

Date Drilled: April 26, 1973
Location: NW $\frac{1}{4}$, NW $\frac{1}{4}$, SW $\frac{1}{4}$, SE $\frac{1}{4}$, Sec. 21-122-54
Elevation: 1808

<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Thickness (Ft.)</u>
Top Soil	0	1	1
Clay	1	3	2
Sand	3	4	1
Clay	4	15	11
Blue Clay	15	32	17
Sand	32	36	4
Sandy Clay	36	40	4
Sand	40	55	15
Clay	55	62	7

Test Hole No. 3.

Date Drilled: April 26, 1973
Location: SW $\frac{1}{4}$, SW $\frac{1}{4}$, SE $\frac{1}{4}$, NE $\frac{1}{4}$, Sec. 21-122-54
Elevation: 1818

<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Thickness (Ft.)</u>
Top Soil	0	3	3
Sandy Clay with Rock	3	17	14
Sand	17	23 $\frac{1}{2}$	6 $\frac{1}{2}$
Clay	23 $\frac{1}{2}$	24	$\frac{1}{2}$
Sand	24	35	11
Clay	35	57	22

Test Hole No. 4.

Date Drilled: April 27, 1973
Location: SW $\frac{1}{4}$, SW $\frac{1}{4}$, NW $\frac{1}{4}$, NE $\frac{1}{4}$, Sec. 9-122-53
Elevation: 1814

<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Thickness (Ft.)</u>
Top Soil	0	1	1
Sand with Gravel	1	32	31
Clay	32	42	10

Test Hole No. 5.

Date Drilled: April 27, 1973
Location: SE $\frac{1}{4}$, SE $\frac{1}{4}$, NW $\frac{1}{4}$, NE $\frac{1}{4}$, Sec. 9-122-53
Elevation: 1810

<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Thickness (Ft.)</u>
Top Soil	0	1	1
Sand	1	21 $\frac{1}{2}$	20 $\frac{1}{2}$
Sandy Clay	21 $\frac{1}{2}$	27	5 $\frac{1}{2}$

Test Hole No. 6.

Date Drilled: April 27, 1973
Location: SW $\frac{1}{4}$, NW $\frac{1}{4}$, NE $\frac{1}{4}$, SE $\frac{1}{4}$, Sec. 21-122-54
Elevation: 1808

<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Thickness (Ft.)</u>
Top Soil	0	2	2
Sandy Clay	2	22	20
Clayey Sand	22	27	5
Sandy Clay	27	33	6
Clayey Sand	33	37	4
Sand with Gravel & Rock	37	52	15
Rock	52	53	1
Clay	53	64	11

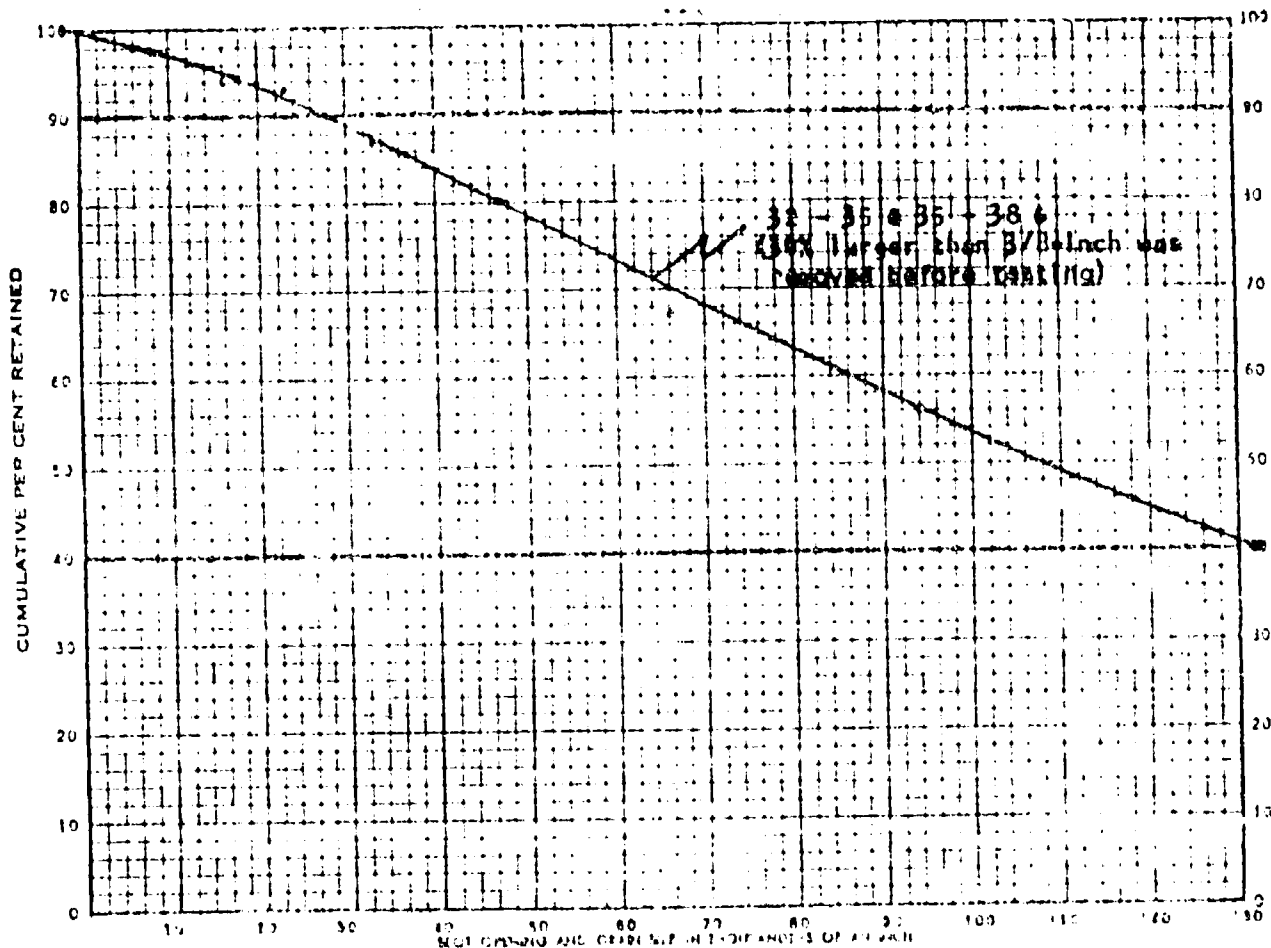
APPENDIX C
PRODUCTION TEST WELLS

Model No. Address
P. O. Box 1112
St. Paul, Minn.

SAND ANALYSIS

Johnson Division
Universal Oil Products Co.
1950 Old Highway 8
St. Paul, Minnesota

Sample sent in by Minnesota Drillers
Town Madison State Minnesota Date 7 Jan. 1974
From well of #2, Blue Dog Lake near Waubay, So. Dak.
Remarks _____



SIEVE OPENING NOS.	CUMULATIVE PER CENT RETAINED	
132	32	38
060	56	40
080		67
047	80	
033		87
025	93	
018		94
012		
008		
006	95	

NOTES:
Recommended Slot Opening Top 10' #80 slot
Bottom 10' #50 slot
Recommended Screen, Dia. 12 PS Length 20 Ft.
Set screen between 36 & 56 feet
by DLK

Sheet 1 of 2

SO MANY CONSIDERATIONS ENTER INTO THE MAKING OF A GOOD WELL THAT, WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED FROM SAND SAMPLES ARE CORRECT, WE ASSUME NO RESPONSIBILITY FOR THE SUCCESSFUL OPERATION OF JOHNSON WELL SCREENS

Mailing Address
P. O. Box 3118
St. Paul, Minn. 55108

SAND ANALYSIS

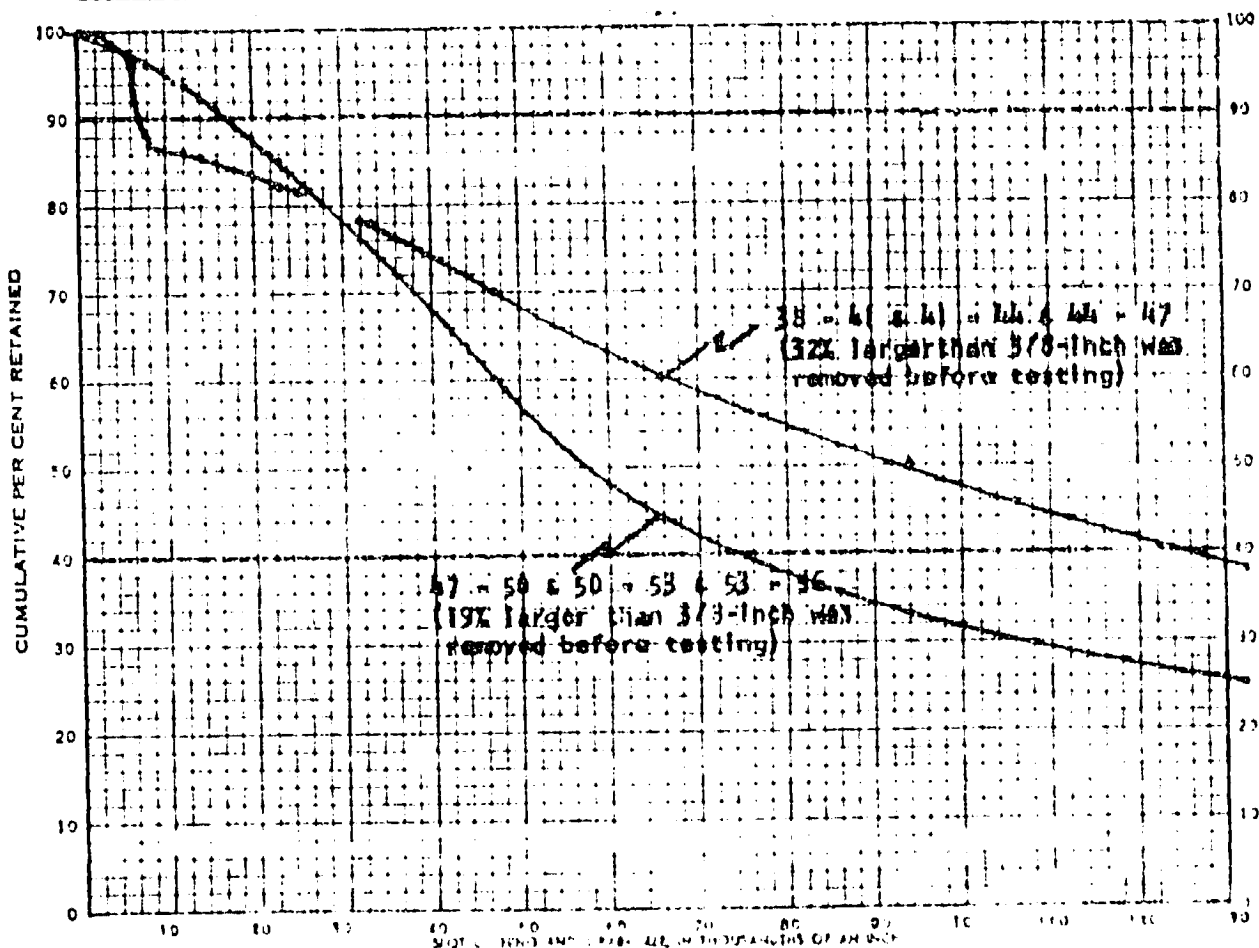
Johnson Division
Universal Oil Products Co.
1950 Old Highway E
Saint Paul, Minnesota

Sample sent in by _____

Town _____ State _____ Date 7 Jan. 1974

From well # 2

Remarks _____



SLAVE OPENING	47-56	38-47
132	33	38
094	44	40
060	70	78
047	85	82
031	91	85
023	94	86
018	96	87
012		
008		
004		

Recommended Slot Opening: _____

Recommended Screen Dia. _____ in. Length _____ ft.

Sheet 2 of 2

SO MANY CONSIDERATIONS ENTER INTO THE MAKING OF A GOOD WELL THAT, WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED FROM SAND SAMPLES ARE CORRECT WE ASSUME NO RESPONSIBILITY FOR THE SUCCESSFUL OPERATION OF JOHNSON WELL SCREENS



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

MAR 12 2003

6357-3

SD Dept of Game Fish & Parks
523 E Capitol
Pierre SD 57501

Dear Sir:

Enclosed is Water Permit and Water License No. 6357-3. The water license is the final water right document completing your process of obtaining a Water Right.

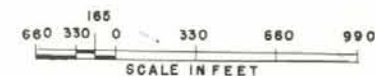
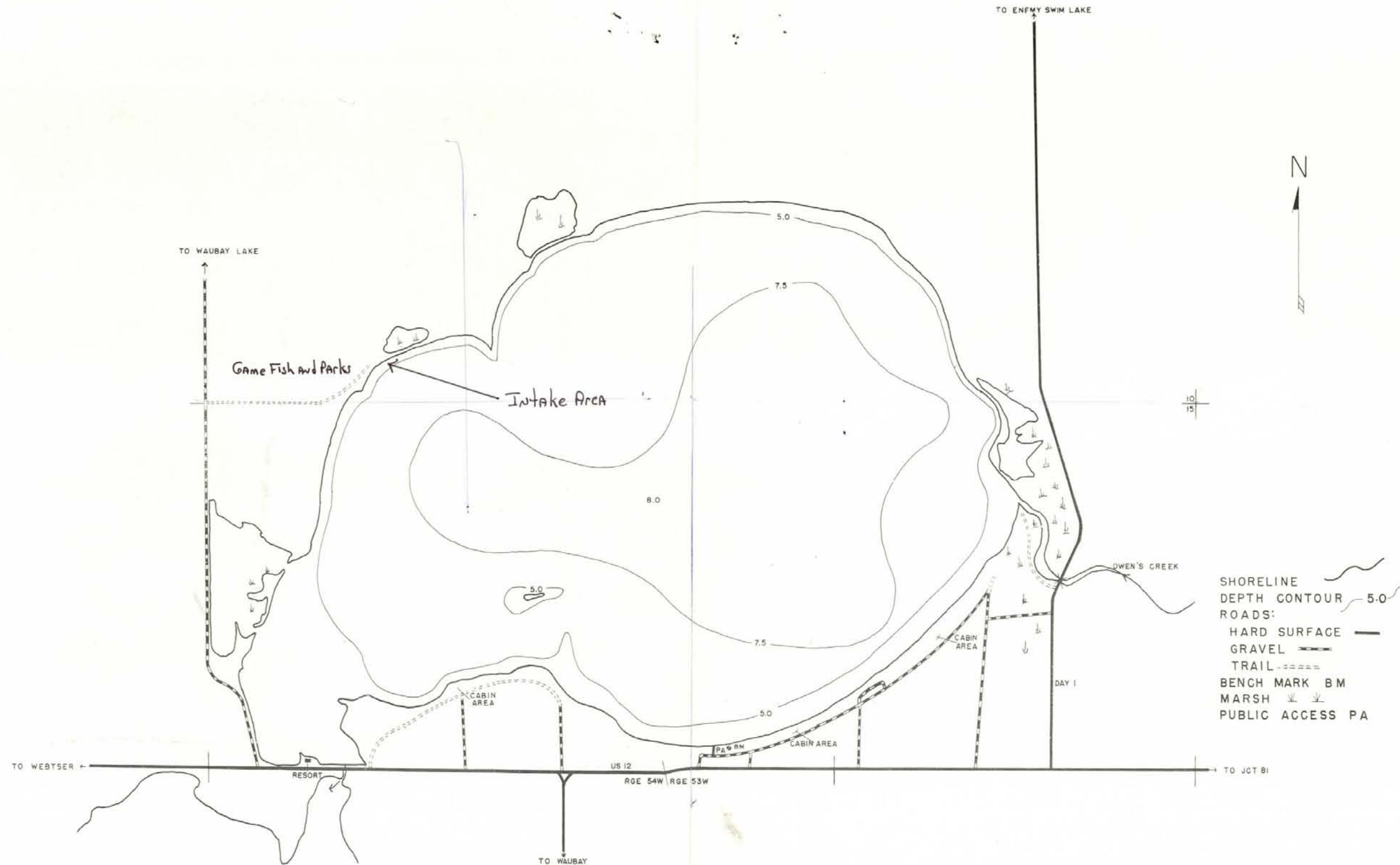
As long as you use the water beneficially, as stated in the Water License, State Water Laws provide that you have a continuing right to use the water.

Sincerely,

Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

NOTE: The applicable portions of No. 4385-3 and 4470-3 are incorporated into Water License No. 6357-3.

enclosures

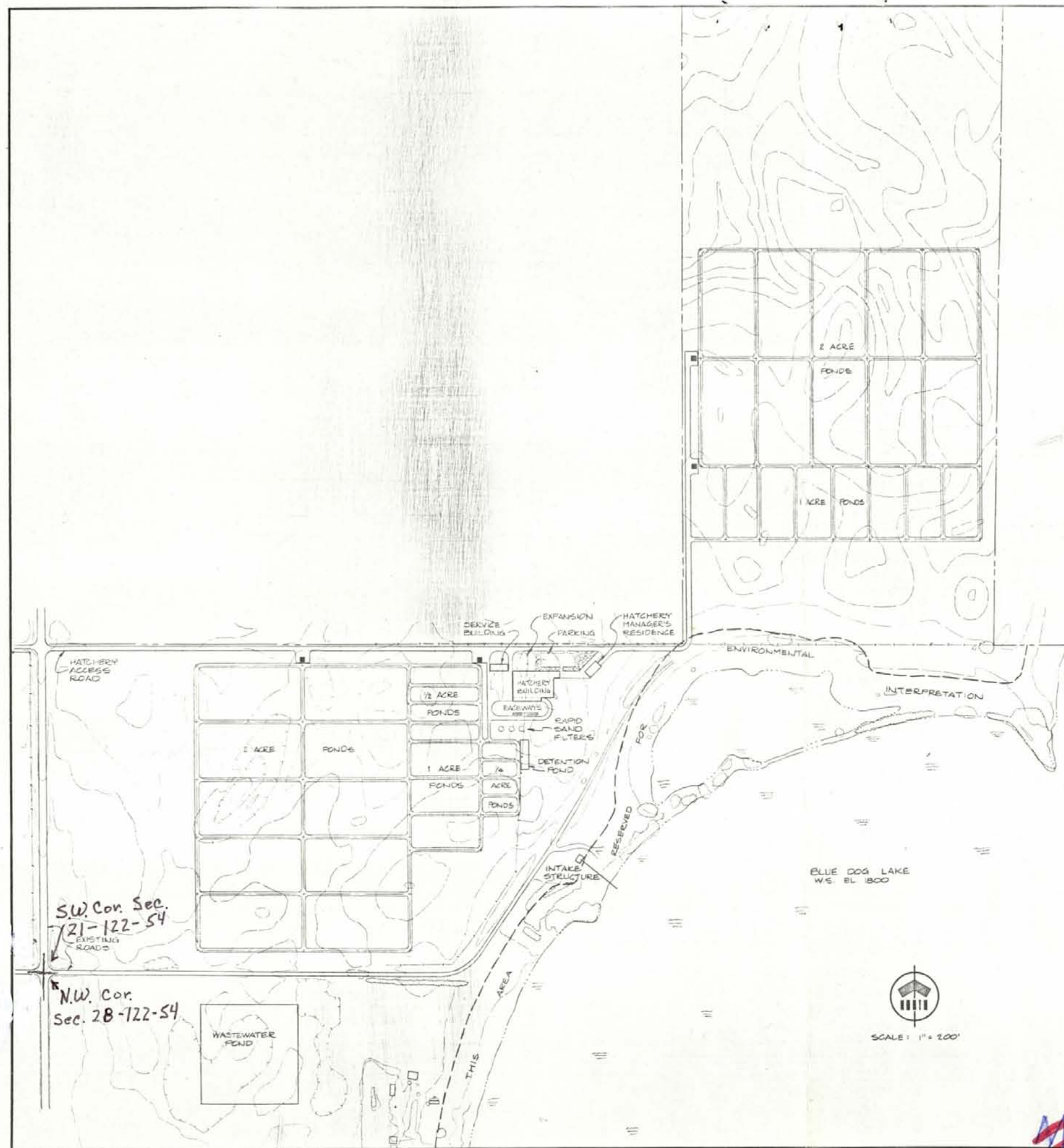


SOUTH DAKOTA
DEPT OF GAME, FISH AND PARKS
BLUE DOG LAKE
DAY COUNTY

WATER STAGE FULL PLANIMETER ACRES 1502

AERIAL PHOTO FIELD WORK DRAWN BY: LP, WJM
DATE: 1958 DATE: 9-30-63 DATE: 1-16-64
SEC. 9, 10, 15, 16 TWP. 122N RGE. 53W
SEC. 21, 27, 28 RGE. 54W
BM 7.5'

MAP No. 3695-3 Appl. 4470-3



LEGEND

- 12' WIDE ROAD
- EDGE OF WATER
- CATCH BASIN
- - - 150' SETBACK LINE
- - - PROPERTY LINE

NO.	REVISIONS	BY	DATE
PROJECT			
BLUE DOG LAKE SOUTH DAKOTA			
DRAWING TITLE			
PRELIMINARY POND LAYOUT #3			
The UMA Group			
UMA Engineers, Inc. PORTLAND, OREGON			
DATE	DESIGNED	CHECKED	APPROVED
1-8-80	RHL	SMC	
DRAWING NO.	SHEET	OF	REV.



~~Map No. 36953~~

Appl. 4470-3