Application for water regulatory permits and approvals for the Flambeau Project. 1989

Green Bay, Wisconsin: Foth & Van Dyke and Associates, Inc., 1989

Kennecott Minerals Company
1515 Mineral Square
P.O. Box 11248
Salt Lake City, Utah 84147
Telephone (801) 322-8460
FAX (801) 583-3129

December 20, 1989

Kennecott

87K10

Mr. Roger Jasinski
Wisconsin Department of Natural Resources
Park Falls Area Office
P. O. Box 220
Park Falls, WI 54552

Dear Mr. Jasinski:

RE: Flambeau Project
Chapter 30 Permit Applications

We are forwarding a revised Joint State/Federal Application for Water Regulatory Permits and Approvals for the Flambeau Mining Company's (Flambeau) proposed mine site located approximately 1.6 miles south of Ladysmith on STH 27. The required fee of $115 was previously forwarded to the Wisconsin Department of Natural Resources (WDNR) with the original application dated April 1, 1989. The application encompasses the following permit and/or approval requests:

	Permit	Fee
1.	Riprap for two outfall structures (Wis. Stat. 30.12 (3)(a)3)	$75
2.	Site grading and artificial drainageways [Wis. Stat. 30.19(1)(a)(b) and (c)]	$10
3.	Culvert placement in intermittent Stream C (Wis. Stat.30.123)	$10
4.	Realignment of intermittent Stream C (Wis. Stat 30.195)	$10
5.	Removal of materials from the bed of non-navigable intermittent Streams A & B (Wis. Stat. 30.20)	$10

Currently, WDNR has indicated that Stream C is navigable for the lower 1,000 to 1,500 feet of its course. However, since a final judgement has not been made for its upper reaches in the area to be constructed, Flambeau is applying for permits regarding this stream in order to expedite the overall project permitting process.

At your suggestion, these requests are being submitted as one application. Attached to the application is the supporting data separately prepared for each request. Also enclosed is a general description for the entire project. Reference will be made to the Environmental Impact Report or Mining Permit Application where possible. These documents include a full legal description of the project among other things.

In reviewing the document, please note that the title blocks for the figures have not been changed to reflect the name of Flambeau Mining Company. Since the document is filed by the Flambeau Mining Company, the fact that this change has not been made is immaterial.

If you have any questions concerning this application, please contact Gerald W. Sevick, P.E. at (414) 497-2500, or myself. Mr. Sevick is an engineer with Foth & Van Dyke and Associates Inc., Green Bay, Wisconsin, Flambeau's consultant for this project.

Sincerely,

Flambeau Mining Company

Lawrence E. Mercando

Lawrence E. Mercando
Vice President

LEM:kmc

Enclosures

DISTRIBUTION LIST

No. of Copies	Sent To
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1	Edwarde R. May Principal Geological Engineer James Askew Associates, Inc. Suite 312A 5600 S. Quebec Street Englewood, CO 80111
1	Flambeau Mining Company Ladysmith Office P. O. Box 166 Ladysmith, WI 54848
3	Henry J. Handzel DeWitt, Porter, Huggett, Schumacher & Morgan S.C. 121 S. Pinckney Street Madison, WI 53703
1	John Kaiser, Chairman Rusk County Board 114 W. Miner Avenue Ladysmith, WI 54848
1	Robert Plantz, Chairman Town of Grant N3356 Plantz Road Ladysmith, WI 54848
1	Martin Reynolds, Mayor City of Ladysmith c/o City Hall 120 W. Miner Avenue Ladysmith, WI 54848

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APPLICATION FOR WATER REGULATORY PERMITS AND APPROVALS FOR THE FLAMBEAU PROJECT

Prepared for:

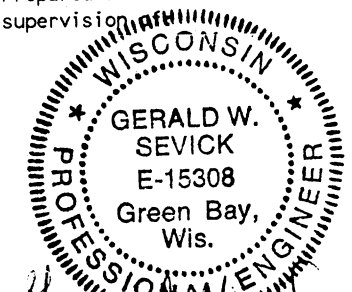
FLAMBEAU MINING COMPANY

Prepared by:

FOTH & VAN DYKE and Associates Inc.
and Contributors
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012

Revised DECEMBER 1989

Engineering contributions by Foth & Van Dyke and Associates Inc. Prepared under the direct supervision of:



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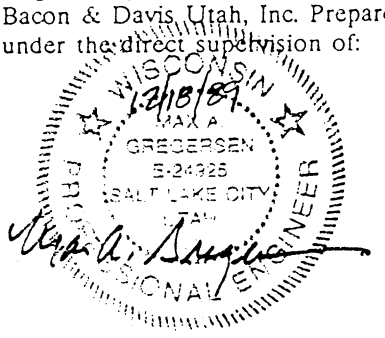

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1.0 DESCRIPTION OF THE PROPOSED PROJECT

1.1 Introduction

The project facilities will consist of an open pit mine; an unlined (Type I) stockpile for storage of overburden, saprolite, sandstone, and waste rock containing very low levels of sulfide mineralization; a lined (Type II) stockpile for storage of saprolite and waste rock containing slightly higher levels of sulfide mineralization; a topsoil stockpile; water control features; a wastewater treatment plant; and ancillary facilities such as an office, railroad spur line, and maintenance building.

Figure No. 1 has been prepared to graphically illustrate the proposed project. The figure is a plan view of the mine area showing the location and relative size of key project elements.

1.2 Geology

1.2.1 Description of Site Geology

Precambrian volcanic rock, Cambrian sandstone, and Quaternary glacial and fluvial sediments are present beneath the project area. The geology has been defined from hundreds of soil borings and core samples drilled on site and from scattered outcrops along the banks of Meadowbrook Creek.

The steeply dipping Precambrian rock has been highly altered during mountain building processes to schist, which was later weathered and further altered. The top ten to 20 feet of Precambrian waste rock has been weathered to a silty-clay rock termed saprolite.

Small amounts of disseminated pyrite have been oxidized below the saprolite to several tens of feet in depth. This rock is termed Type I waste rock, and contains less than one percent sulfur. Type I material has been leach column-tested and found

to produce water of quality that can be discharged without treatment. Type II waste rock occurs in the lower levels of the proposed open pit. Because this material contains greater than one percent sulfur, it will be stored on a lined stockpile area.

The Precambrian rock is overlain by Cambrian sandstone which consists of a poorly cemented, fine to coarse-grained quartz sand. Thickness of the sandstone varies from zero to greater than 30 feet within the proposed pit perimeter.

Near-surface materials consist of unconsolidated Quaternary glacial-fluvial sediments. Most of the deposit is covered by a dense, silty-sand glacial till. Glacial-fluvial sand and gravel generally occur in the northwest part of the project area in the vicinity of the abandoned gravel pit.

1.2.2 Deposit Description

The Flambeau deposit is tabular in shape, strikes in a northeast direction, and dips steeply to the northwest. The upper portion of the sulfide mineralization has been enriched in copper as a result of ancient fluctuating groundwater tables to about 225 feet below the present land surface. The deposit to be mined is 2,600 feet long, averages 50 feet wide, and contains approximately 1.9 million tons of material. The upper part of the deposit consists of zero to 30 feet of iron oxide-rich gossan. Below the gossan are varying proportions of chalcocite and bornite (copper sulfide minerals) in a matrix of chert (cryptocrystalline quartz) and pyrite (iron sulfide). No significant or economic amounts of sulfide mineralization have been found by drilling in either direction from the deposit. Sulfide mineralization occurring beneath the proposed pit has been determined by Flambeau to be uneconomical based upon projected metal prices.

1.3 Description of Key Project Elements

1.3.1 General Mine Plan

Enriched ore will be mined from an oval-shaped open pit designed to cover approximately 32 acres to a maximum pit depth of 225 feet. All excavated materials will be hauled to the surface, which is at about 1,140 feet Mean Sea Level. Ore will be transported by truck to a crushing facility adjacent to the pit and crushed to minus 12 inches for rail shipment to an out-of-state processing facility.

Two open pit mining phases will be used. The first will mine the southwest half of the deposit to the 970-foot elevation. The second mines the balance of the pit to its final lateral limits and extends the pit bottom to the 900-foot elevation. Due to variation in the orebody grades, two ore-mining faces will be available at all times. Hydraulic shovels will operate from 20-foot high benches. The next bench is prepared as soon as working room becomes available to allow for construction of a sump to handle in-pit water flows and for emergency storage during heavy precipitation.

Waste material will be classified in the pit by sulfur content and stored on either lined or unlined storage sites adjacent to the pit. Eventually waste materials from the separate stockpiles will be returned to the pit as backfill. Upon completion of the mining operation, the project site will be contoured and reclaimed. Land owned by Flambeau but not included in the project area will mostly remain in its current use.

1.3.2 Mining Operation

Preproduction activities will take approximately 10 months to develop the open pit, the waste rock stockpiles, and plant facility. Chief tasks will be clearing the site; preproduction

stripping; construction of access roads, the railroad spur, powerline, wastewater treatment plant, storage areas, etc. Disturbed soil areas will be stabilized and water control measures installed at that time.

The Flambeau orebody will be mined from the open pit over a period of approximately six years. The pit area at the end of the mine life will embrace an oval-shaped area of approximately 32 acres. The pit will be 2,600 feet long and average about 550 feet wide. Open pit mining will take place five to six days a week, eight hours per day, to produce approximately 320,000 dry short tons of ore per year.

The steeply dipping rocks will accommodate a pit, with slopes at 36 degrees for the glacial till and 50 degrees interramp for rock sections. Twenty-seven-foot wide catch benches will be left at 60-foot intervals for safety considerations. The access ramp has a design width of 60 feet and a gradient of ten percent.

Overburden and waste rock will be excavated from 20-foot high benches and ore from ten foot benches using conventional mining equipment. The excavated overburden will be transported to the Type I stockpile or to construction areas elsewhere on the project site.

It is anticipated that most of the Cambrian sandstone, all of the saprolite and some of the oxidized waste rock (Type I) can be broken by using a dozer with a ripper blade. However, certain areas of the deposit, such as those portions of the orebody that contain quartz or hard waste rock, will require drilling and blasting. Fresher and harder rock and ore can be expected as the open pit deepens during the first year of full production. Therefore, blasting during preproduction and into the first year of production will likely be performed only on an infrequent basis.

Controlled blasting procedures will be used to minimize the generation of seismic waves and noise. Due to the small scale of the mining method and operations, ore blasts will be relatively small. Blasting is anticipated to occur from one to five times per week. A set of blasting standards will be carefully followed to keep risks of flyrock, ground vibrations, and noise to a minimum.

Two four-cubic yard shovels and a seven-cubic yard loader will be used to load the broken ore and other materials into 35-ton or 50-ton trucks. At first, only four trucks will be required. The truck fleet will be increased to a maximum of seven trucks as the pit deepens and haul distance increases. A 4,000-gallon water truck will wet haul roads and truck unloading areas for dust control.

Anticipated production and operation schedules are found in Table No. 1-1. The tonnages shown in the table are averages since ore and spoils production vary from year to year.

TABLE NO. 1-1

Anticipated Production and Operation Data

Preproduction Stripping	1,500,000 tons
Daily Ore Production	1,300 tons
Annual Ore Production	320,000 tons
Total Ore Production	1,900,000 tons
Total Overburden & Waste Rock	8,000,000 tons
Total Material Moved (Includes Backfill)	17,500,000 tons
Open Pit Size	32 acres
Project Area	300 acres
Total Project Life	8 to 9 years
Preproduction and Construction	1 year
Mining	6 years
Rehabilitation & Backfilling	1 to 2 years
Open Pit Operating Schedule	5 to 6 days/week 8 hours/day, 1 shift
Crushing Plant	5 to 6 days/week 8 hours/day, 1 shift
Employment During Operations	
Initial	56
Peak	61
Average	55

1.3.3 Water Inflow Controls

When topsoil is stripped and excavation begins, control methods will be provided for surface water and groundwater that could flow into the open pit. Hydrologic studies indicate that a simple system of grading and ditching to a series of sumps can capture and control most of the water expected to inflow. The water will then be diverted to settling ponds or to the wastewater treatment plant. A slurry wall of either grout or bentonite clay will be constructed at the end of the pit adjacent to the river to minimize potential inflow from that

direction. Detailed geologic mapping will be routinely conducted to identify, monitor, and control any areas of significant water inflow which might develop.

Two water collection systems are planned for the pit. During preproduction stripping, an upper sump will catch surface and groundwater inflows from the glacial overburden and Cambrian sandstone. This water, which will not come into contact with sulfide mineralization, but which could carry suspended solids such as clays, will be pumped to settling ponds to remove suspended materials and colloids. The clear overflow will be discharged to the Flambeau River or possibly used to provide water to an adjacent wetland. A lower sump will collect all groundwater inflow and precipitation that comes into contact with ore and waste rock. Water from the lower sump will be pumped to the wastewater treatment plant, treated, and then separately discharged to the Flambeau River or an adjacent wetland.

A flood control dike will be constructed at the west end of the open pit to prevent overflow of the river into the pit during potential severe flooding conditions (100-year flood). The dike will be constructed using specially selected materials overlying the orebody. The west toe of the flood-control dike would be approximately 70 to 90 feet from the east edge of the current Flambeau River channel. The edge of the open pit will be no closer than 140 feet from east edge of the river channel.

1.3.4 Crushing Facilities

The crushing facility consisting of a crusher, crushed ore stockpile, and railcar loading area will be built on the southwest side of the Type II waste rock stockpile. The crusher will be separated from the Type II stockpile by a retaining wall to contain rock and runoff water. The proximity of the crusher facility and stockpile to the pit minimizes haul distances. The crushing and ore loading areas will be contoured and underlain

with a 60-mil HDPE liner to direct water to a runoff catchment pond for transfer to the wastewater treatment plant. All crushing will occur during daylight operations. The crusher will be oriented in a southwest direction to direct noise away from populated areas. The crusher is designed to crush coarse ore to minus 12 inches. A dust suppression spray system will control dust generated by the crusher and conveyor belt discharge point.

The crushing facility is designed for 250 tons per hour and allows for production variations and maintenance. Crushed and bypassed ore will be discharged onto a conveyor belt and transported to the crushed ore stockpile, where a front-end loader will load railroad cars at an average rate of approximately 12 cars per working day. It is planned to ship an average of approximately 24 loaded cars every other operating day.

1.3.5 Infrastructure

1.3.5.1 General

Several buildings will be erected to support the open pit operation and crushing plant. Chief infrastructure components will consist of a wastewater treatment plant, railroad spur, utilities, administrative building and shop, storage tanks, and explosives magazine. Most of these ancillary facilities will be clustered east of the crushing plant.

1.3.5.2 Wastewater Collection and Treatment Plant

The wastewater treatment plant, located southeast of the crushing facility, will be designed to treat water from four sources: 1) pit contact water, 2) ore haul road drainage, 3) Type II waste material storage pad drainage and runoff, and 4) site runoff from the crushing and loadout facilities and other ancillary facilities. Water from these combined sources will average approximately 296 gallons per minute on an annual basis.

A uniform feed of untreated wastewater to the treatment plant aids optimum plant performance. It is important, though, to consider surge capacity in its design, since water volume and metal loading can change with the seasons. Therefore, the wastewater treatment plant design provides for water storage in both a lined runoff catchment pond and a lined wastewater treatment surge reservoir. The open pit will also be used for emergency water storage. A 25-year rainfall event has been used as the design basis for the wastewater treatment system.

The wastewater treatment plant has been designed to process wastewater for acid neutralization and metal removal in a three-stage process. The process consists of lime treatment, sulfide precipitation, and multi-media filtration.

Precipitate handling and treated water disposal make up the final components of the wastewater treatment system. Some of the treated water will be recycled for plant operations, makeup water, washdowns, and dust control with the balance discharged to the Flambeau River or an adjacent wetland. Precipitate at approximately 25 percent solids will be trucked from the treatment plant to the Type II stockpile where it will be stored with the waste rock.

1.3.5.3 Access Roads and Railroad Spur

Two access roads and a railroad spur will be constructed for the project. A new, paved plant site access road will be built from State Highway 27 into the project site. The road will be constructed opposite the intersection of Jansen Road and State Highway 27. A second access road to a visitors' observation platform is planned to be constructed approximately 2,700 feet north of the plant access road.

A single line railroad spur approximately 6,500 feet long will be constructed from the Wisconsin Central Ltd. railroad line southwesterly to the crusher plant site to provide access to

railroad cars used for shipping ore. The spur line at the crusher plant site will consist of two parallel tracks for ease in loading and switching railroad cars. The primary route for the railroad spur is north of Jansen Road along a location which avoids as much of existing wetlands as possible.

1.3.5.4 Utilities

The electrical power supply for the Flambeau Project will be delivered at 13.8 Kv from the Northern States Power Company power grid to a main substation adjacent to the wastewater treatment plant. Natural gas will be extended to the site for space heating needs.

A low-capacity potable water well will be drilled to supply water to field offices and shops.

1.3.5.5 Buildings and Shops

A maintenance shop, office building, and guard house will be erected south and east of the crushing plant. The existing utility building east of the pit will be used to house a limited inventory of equipment and supplies. A peripheral security fence will be constructed around the entire plant site and open pit.

1.3.5.6 Mining Materials and Storage Tanks

Two portable magazines will be located in a remote bunkered area north of the Type I stockpile settling ponds. A blasting cap storage building will also be located in the same general area, but separated from the magazines. A 15,000-gallon diesel fuel tank and associated piping will be installed to provide fuel for mining equipment.

1.3.6 Solid Materials Stockpiles

Topsoil, overburden, and Type I and Type II material will be removed and segregated in accordance with their characteristics, then stockpiled in the appropriate location for use in reclamation following the completion of mining.

1.3.6.1 Topsoil Stockpile

The top 12 to 18 inches of soil will be removed from all construction sites and placed in the topsoil stockpile. In some areas, such as the railroad spur cut and fill banks, access road slopes, and exposed berms, the topsoil will be moved to one side and then returned to stabilize and support temporary revegetation of these areas upon completion of construction. Topsoil from the open pit, crusher plant and excess topsoil from the storage areas will be removed and stockpiled. The topsoil stockpile area will be located east of the pit. This stockpile will serve as a visitors' viewing area. Stockpiled topsoil will be used to reclaim the site after mining activities are completed. The topsoil stockpile area will cover approximately seven acres.

1.3.6.2 Overburden/Type I Stockpile

Overburden and Type I material (less than one percent sulfur) will be stored on an unlined area located between the open pit and Blackberry Lane. A bermed swale at the base of the stockpile will contain internal runoff and direct it to the settling ponds. The stockpile will occupy about 40 acres, reach a height of about 60 feet, and have a design capacity of approximately 2.8 million cubic yards.

1.3.6.3 Type II Stockpile

Type II material (more than one percent sulfur) will be stockpiled separately in a lined area located southeast of the

open pit and northeast of the crushing plant site. Approximately 27 acres will be required for this stockpile, which has been designed with a capacity of 2.2 million cubic yards. The Type II stockpile will be built with an impervious liner and leachate collection system at its base. A lined berm and runoff containment swale will encircle the area to collect all precipitation that comes into contact with this material. Collected leachate and runoff will ultimately be directed via piping to the surge reservoir and then to the wastewater treatment plant.

Perimeter berms for the Type II stockpile will be constructed using overburden or soil excavated during base grade preparation. A protective layer of coarse-grained soils will be placed over the HDPE liner to protect the liner as waste rock is hauled onto the stockpile. The projected height of the stockpile is approximately 70 feet. The outside of the perimeter berm will be topsoiled and vegetated.

1.3.7 Surface Water Controls

As previously discussed, precipitation falling within the limits of the open pit, Type I and II storage piles, and plant area will be collected and directed to either the settling ponds or the wastewater treatment plant. Some of the surface water drainage originating from outside the active mine area will be intercepted by a series of drainage swales and directed to existing natural drainage features.

1.3.8 Reclamation

Disturbed soil areas will be revegetated and woodlands maintained during the life of the mining project. The open pit will be backfilled once mining is complete. The plan is to return the project site to close to approximate original contours, such that it will be suitable for other land uses. Stockpiled Type II material will be placed at the bottom of the

pit, with Type I waste rock placed over it and compacted as part of normal traffic of equipment used for backfilling. Saprolite, followed by sandstone and till will then be placed within the pit over the Type I waste rock. Finally, the pit site will be covered with topsoil and the area revegetated. Surface facilities, including the railroad spur, will be dismantled at the end of mine operations unless a beneficial plan for keeping all or some of the facilities is developed by Flambeau, the WDNR, and local residents.

Section 2.0

Completed Forms and Supplemental Information

State of Wisconsin
Department of Natural Resources
(Return to appropriate
DNR District Office)
(Hwy. 70, WEST, Box 309
SPOONER, WI 54801)

U.S. Army Corps of Engineers
St. Paul District
Regulatory Functions
1135 U.S. Post Office Bldg.
St. Paul, Minnesota 55101

JOINT STATE/FEDERAL APPLICATION FOR WATER REGULATORY PERMITS AND APPROVALS
Form 3500-53 Rev. 2-87

PLEASE COMPLETE BOTH SIDES OF THIS APPLICATION. PRINT OR TYPE.

1. Applicant (Individual or corporate name)
Flambeau Mining Company

Street or Route
10 East South Temple, P. O. Box 11248

City, State, Zip Code
Salt Lake City, UT 84147

Telephone No. (Include area code)
801/322-8460

2. Agent/Contractor (firm name)

Street or Route

City, State, Zip Code

Telephone No. (Include area code)

3. If applicant is not owner of the property where the proposed activity will be conducted, provide name and address of owner and include letter of authorization from owner. Owner must be the applicant for structure, diversion and channel change activities.

Owner's Name: Applicant is the Owner | Street or Route | City, State, Zip Code

4. Is the applicant a business? [X] Yes [ ] No

If yes, is the permit or approval you are applying for necessary for you to conduct this business in the State of Wisconsin? [X] Yes [ ] No

If it IS necessary, please explain why (attach additional sheets if necessary):

5. Project Location

Street/Route 0.3 mile west of STH 27

Village/City/Town 1.6 miles south of Ladysmith

Waterway Flambeau River County Rusk

Govt. Lot ___ OR ___ all 1/4 of Section 9, Township 34 N, Range 6 ~~(West)(East)~~ lying east of Blackberry Lane and south of Flambeau River

6. Adjoining Riparian (Neighboring Waterfront Property Owner) Information

Name of Riparian #1 | Street or Route | City, State, Zip Code

Inapplicable as Flambeau owns Adjoining Property

Name of Riparian #2 | Street or Route | City, State, Zip Code

7. Project Information

(a) Describe proposed activity (include how this project will be constructed)
See attached sheet 16

(b) Purpose, need and intended use of project
Development of an open pit mining operation.

(c) I have applied for or received permits from the following agencies: (Check √)
[X] Municipal [X] County [X] Wis. DNR [X] Corps of Engineers

(d) Date activity will commence if permit is issued 1991; be completed 1999.

(e) Is any portion of the requested project now complete? [ ] Yes [X] No
If yes, identify the completed portion on the enclosed drawings and indicate here the date activity was completed:

Signature of Applicant: Lawrence B. Mercando | Date Signed: 12-20-89

LEAVE BLANK - FOR RECEIVING AGENCY USE ONLY

Corps of Engineers Process No. | Wisconsin DNR File No.

Received By | Date Received

Attachment to Application Form

7.(a) Project Information

(a) Describe proposed activity (include how this project will be constructed)

1) Riprap for two outfall structures (Wis. Stat. 30.12(3)(a)3)

2) Site grading and artificial drainageways [Wis. Stat. 30.19(1)(a)(b) and (c)]

3) Culvert Placement in Intermittent Stream C (Wis. Stat. 30.123)

4) Realignment of intermittent Stream C (Wis. Stat. 30.195)

5) Removal of material from the bed of a non-navigable intermittent Streams A and B (Wis. Stat. 30.20)

State of Wisconsin
Department of Natural Resources

INFORMATION REQUIRED TO ASSIST THE DEPARTMENT IN COMPLYING WITH s. 227.0105, WIS. STATS.
(1983 Wisconsin Act 91)
Form 3500-53B 7-85

1. **Is the applicant a business?** ☒ Yes ☐ No
If yes, please answer the next question.

2. **Is the permit or approval you are applying for necessary for you to conduct this business in the State of Wisconsin?** ☒ Yes ☐ No

If yes, please explain why This permit is necessary for the project to be built as discussed herein.

(Please attach additional sheets if necessary)

Note: This information is needed for the Department to determine whether permit processing time limits contained in chapter NR 305, Wisconsin Administrative Code, are applicable to your project.

2.1 Riprap for Two Outfall Sturctures

The two outfall structures to be constructed in the project area are generally shown in Figure No. 2 (outfall locations). One outfall (001) structure will be constructed at the outfall line from the wastewater treatment plant. The second outfall (002) structure will be constructed for the drainage channel from the settling ponds.

A backhoe will be used to dig the trench for the six-inch diameter pipe for outfall 001. The pipe will be placed on a six-inch compacted sand base with the remainder of the trench backfill consisting of compacted acceptable on-site materials. A concrete headwall will be constructed at the terminal point of the outfall pipe approximately 140 feet from the Flambeau River. A ripraped drainage channel will be constructed from the headwall structure to the Flambeau River. The riprap will extend 20 feet into the river.

For outfall 002 a backhoe will also be used to trench the drainage channel from the settling ponds to within approximately 180 feet of the river. A riprapped drainage channel will be constructed from this point to the Flambeau River. The riprap will extend 20 feet into the river.

Figure No. 3 contains a detail of the headwall structure for outfall 001; a plan view of the riprapped drainage channel for outfalls 001 and 002 showing the extension into the Flambeau River; and a section through the riprapped channel. Figure No. 4 contains a typical profile for both outfalls. The profile is along flood section 5.3 which is located near both discharges. The flood section location is shown on Figure No. 2. The section was used for the flood study conducted for the Flambeau project's Environmental Impact Report (EIR). The

profile presents information relating to the slope of the riprap for each outfall and the relationship of each outfall to the existing bed and bank of the river.

A permit is sought for the placement of riprap or similar material on the bed or bank of the Flambeau River under Wis. Stat. 30.12(3)(a)3. The proposed outfalls will not materially affect navigation and will not be detrimental to the public interest. The proposed outfall structure will protect the river bank, bed and adjacent land from erosion.

2.2 Site Grading and Artifical Drainageways

A permit for grading more than 10,000 square feet in the bank of any navigable water body and a permit for constructing and connecting artificial waterways and drainageways to a navigable stream are being sought under Wis. Stat. 30.19(1)(a)(b) and (c).

2.2.1 Site Grading

The proposed project will require general site grading for the area shown in Figure No. 1. The total area to be graded for the project is approximately 181 acres. However, the area that falls within the bank of any navigable water body is substantially less than the total disturbed area.

The grading will consist of the removal and stockpiling of topsoil and overburden materials. The removal of the overburden materials will expose the area that is to be developed as an open pit mine. This process is described in detail in the EIR and Mining Permit Application.

As part of the site grading process, a flood control dike and slurry wall will be constructed adjacent to the Flambeau River approximately 130 feet east of the river's edge. The purpose of the flood control dike is to keep the 100-year storm flood waters of the Flambeau River from entering the open pit. The dike is to be constructed of compacted overburden materials excavated from the site. The slurry wall will be built to reduce inflow of groundwater into the pit. Figure No. 1 shows the location of the dike and slurry wall.

The site grading process will also disturb some wetlands, as shown on Figure No. 5. Refer to the EIR Appendix 3.8-C titled, *"Wetlands Inventory and Assessment"* for detailed discussions concerning the affected wetland area.

In addition to wetland disturbances, the project will include the temporary storage of hydric soils in the disturbed Wetland No. 2 area (Figure No. 5). These soils will be used during the construction of a 7.5 acre wetland area to be located primarily on the west end on the open pit as part of site reclamation activities. This wetland will include an approximate 3.5 acre pond. The location of the wetland is shown on Figure No. 6.

Grading will also be involved in the reclamation of the site. Reclamation will consist of backfilling the open pit; the removal of surface facilities; grading the site to the contours shown on Figure No. 6; topsoiling; seeding; and, the planting of trees and shrubs.

All site grading activities will be done in a manner to prevent erosion and protect the Flambeau River from sedimentation. These measures are described in Section Nos. 4.8 and 5.0 of the Revised Mining Permit Application which is incorporated herein by reference.

2.2.2 Artificial Waterways and Drainageways

Two settling ponds will be constructed for certain runoff water which will be connected to the Flambeau River by an artificial drainageway. This drainageway ultimately enters the Flambeau River through outfall 002 discussed in Section 2.1. This waterway is described in greater detail in Section 4.7.4.1.3 of the Revised Mining Permit Application. Other artificial drainageways include outfall 001 discussed in Section 2.1 and an artificial drainageway along but outside the Type II stockpile which drains into intermittent Stream C (Figure No. 7). Finally, as noted above, as part of the reclamation plan a 7.5 acre wetland including a 3.5 acre pond and the replaced intermittent Stream B will be constructed at the west end of the open pit (see Figure No. 6). This waterway is described in greater detail in Section 5.11 of the Revised Mining Permit Application.

A permit is sought under Wis. Stat. 30.19(1)(a) and (b), for the connection of an artificial waterway into a navigable stream. All drainageways not riprapped will be vegetated following contouring activities. No other structures will need to be placed into or on the bed or bank of the Flambeau River or Stream C. None of the waterways will injure the rights of the public or riparian owners. Indeed, the waterways are all necessitated to protect or restore the environment and should benefit the public.

Other information required under Wis. Stat. 30.19 is provided as follows:

1. Name and address of applicant is attached on permit application forms.

2. Legal description for the project is contained in the Mining Permit Application, Section 2.1. Flambeau owns the real property adjacent to the affected water bodies. See revised Mining Permit Application, Figure No. 4-3. Drawings showing contours and cross-section profiles of the waterways and grading to be undertaken are shown in Figure Nos. 4-1, 4-7, 4-12, 4-14 and 4-43 of the revised Mining Permit Application.

2.3 Culvert Placement in Intermittent Stream C

Two culverts need to be placed in intermittent Stream C to assure that drainage through the stream is not interrupted by the construction of the railroad spur and access road. A general location of Stream C in relation to the project is shown in Figure No. 8.

First, it will be necessary to place a 48-inch corrugated metal pipe (CMP) culvert in intermittent Stream C where it crosses the proposed plant access road. During the placement of the 48-inch culvert pipe in the bed of intermittent Stream C, it will be necessary to disturb the side slopes and bottom of the stream. Straw bales will be strategically located downstream from the construction areas to alleviate possible problems of silt runoff. After placement of the culvert pipe, backfill materials will be compacted in 12-inch lifts to subgrade. A backhoe will be used for this work. The construction of the plant access road will proceed at that time. The straw bales will remain until the seeded, disturbed side slopes and filled areas have an established natural vegative growth. The straw bales will then be removed from the bed of stream.

Second, it will be necessary to place two 57 x 38 inch corrugated metal pipe arch culvert in Stream C at the point it crosses the proposed railroad spur. These twin culverts will be constructed in the same manner as the culvert for the access road.

A permit is sought under Wis. Stat. 30.123 for the placement of the culverts in Stream C in the event it is determined to be navigable. Issuance of such a permit is appropriate since the culverts will not materially impair navigation or be detrimental to the public interest.

Figure Nos. 9, 10, and 11 show cross-sections approximately perpendicular to the flow on the downstream side of the existing culvert in Stream C under STH 27 and on the downstream side of the two proposed new culverts. The locations of the cross-sections are shown on Figure No. 12. Information pertaining to upstream and downstream culvert inverts and culvert slope for the two proposed culverts is contained on the cross-sections. Therefore, a profile through each culvert is not shown. Since Stream C is intermittent, water levels in the stream typically vary.

A study of the hydrology and hydraulics of Stream C was conducted to properly size the two proposed culverts, and to assure compliance with all regulatory requirements. The results of the study along with all necessary documentation for WDNR review and approval are contained in Appendix A.

2.4 Realignment of Intermittent Stream C

In conjunction with the placement of the culvert under the railroad spur, a permit for a minor relocation of Stream C is sought under Wis. Stat. 30.195 in the event Stream C is determined to be navigable. The proposed relocation involves

moving approximately 190 feet of Stream C 30 feet to the north (Figure No. 12). This relocation meets the requirements of Wis. Stat. 30.195 for the following reasons:

1. A culvert under the railroad spur following the existing stream channel will require a culvert of approximately 150 feet in length. Given the limited culvert size and the gradient of Stream C, a culvert of approximately 150 feet could be subject to frequent blockage. Relocation of Stream C would reduce the culvert length to approximately 80 feet and minimize this problem.

2. The relocation of Stream C and the culvert will allow a drainageway running along but outside the Type II stockpile to drain into Stream C without the necessity of a separate culvert under the railroad spur.

3. Intermittent Stream C may not even be considered navigable at the point of proposed relocation. Even if it is, the stream channel is not well defined. Moving the channel will not adversely affect the flood capacity, as shown in Section 2.3, of the stream or be detrimental to public rights on the stream. Moreover, the applicant is the only riparian owner for the entire reach of Stream C.

2.5 Removal of Material From the Beds of Two Non-Navigable Streams

A permit is sought under Wis. Stat. 30.20 for the removal of material from the bed of intermittent Streams A and B. The location of the two stream is shown on Figure No. 13. The extent of the beds of the two streams from which materials will be removed is shown on Figure Nos. 7 and 14. The removal of materials from the beds of these two streams is necessary to

permit the construction of the project. Detailed descriptions of site grading and construction of the mine are contained in the EIR and the Revised Mining Permit Application.

The portion of intermittent Stream A to be removed is that portion of the stream in the vicinity of the topsoil and Type I stockpiles. Drainage from above the portion of the stream to be removed will be routed via a constructed drainage swale to the north into a planned wetland test plot (Figure No. 6) and then west via the Type I drainage swale to tie into the undisturbed portion of the stream near the northwest corner of the Type I stockpile.

The portion of intermittent Stream B to be removed is that portion located within the limits of the open pit. Drainage from above the portion of the stream to be removed will be routed via a constructed drainage swale to the south and into intermittent Stream "C".

It is planned that as part of site reclamation, the disturbed portions of intermittent Streams A and B will be replaced (Figure No. 6). The reclamation process is described in Section 5.0 of the revised Mining Permit Application.

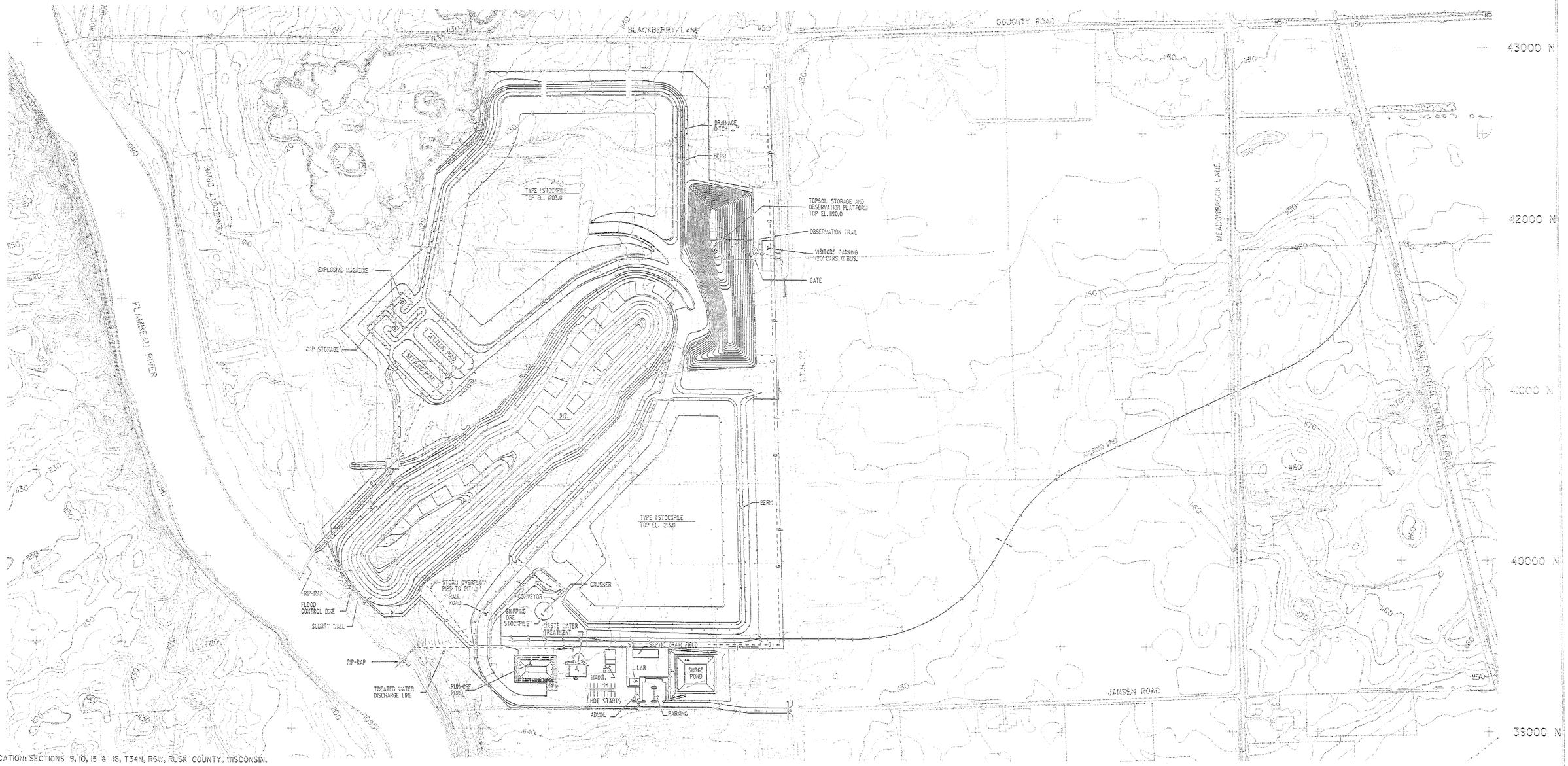
As part of final site grading during reclamation activities, a new section of intermittent Stream A will connect the discharge point from the wetland test plot with the undisturbed western portion of the stream. The western one-third to one-half of the recreated stream will be constructed to approximate original stream contours. The remaining portion of the stream will be constructed to contours as shown on Figure No. 6.

Generally, the disturbed portion of Stream B will be recreated to flow through the backfilled pit. The flood control dike described in Section 2.2 will be left in place as part of site

reclamation to create a wetland and pond on the west end of the pit. Stream B will flow into the east end of the wetland. Water will then exit the wetland via a weir discharge located in the dike. The weir will be used to control the water level in the wetland. Water will flow down a riprapped area on the west face of the dike and then into the preexisting Stream B channel before being discharged to the Flambeau River. Figure No. 6 shows the proposed final grades for the reclaimed site and the location of reclaimed Stream B.

The removal of a portion of Streams A and B is consistent with the public interest in the water because the removal is only temporary, not permanent, and because the water affected is of minimal significance.

Figures for Sections 1.0 and 2.0



NOTES:

1. SITE LOCATION: SECTIONS 9, 10, 15 & 16, T34N, R6W, RUSK COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP PREPARED FROM AERIAL SURVEY BY SURDEX CORPORATION, CHESTERFIELD, MISSOURI. DATE OF PHOTOGRAPHY - APRIL 24, 1970. ROADS, TREES AND BUILDINGS WERE UPDATED AS PER AERIAL PHOTOGRAPH TAKEN BY MARKHURD CORPORATON, MINNEAPOLIS, MINNESOTA. DATE OF PHOTOGRAPHY - SEPTEMBER 14, 1987.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS TWO FEET.
4. HORIZONTAL DATUM BASED ON PROJECT SITE GRID SYSTEM. SITE GRID COORDINATES CORRELATION TO STATE PLANE COORDINATES DERIVED AS FOLLOWS:

SITE GRID COORDINATES CONTROL MONUMENT F-1	STATE PLANE COORDINATES
40000 N =	587,357.8087 N
40000 E =	1,713,516.1229 E

THE ANGULAR ROTATION FROM STATE PLANE BEARINGS T. SITE GRID BEARINGS IS 359°-13'-23" RIGHT WITH CONTROL POINT F-1 AS THE BASE POINT.

5. MINE FACILITIES DESIGN BY FORD, BACON & DAVIS, INCORPORATED, SALT LAKE CITY, UTAH AND PINCOCK, ALLEN & HOLT, INCORPORATED, LAKEWOOD, COLORADO.

LEGEND

- 1100 — EXISTING CONTOUR
- EXISTING PAVED ROADWAY
- EXISTING TRAIL/GRAVEL SURFACE
- TREES AND/OR BRUSH
- FENCE
- F-1 CONTROL MONUMENT

N

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GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
185 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

FIGURE NO. 1
SITE PLOT PLAN

REFERENCES	DWG. NO.	DESCRIPTION

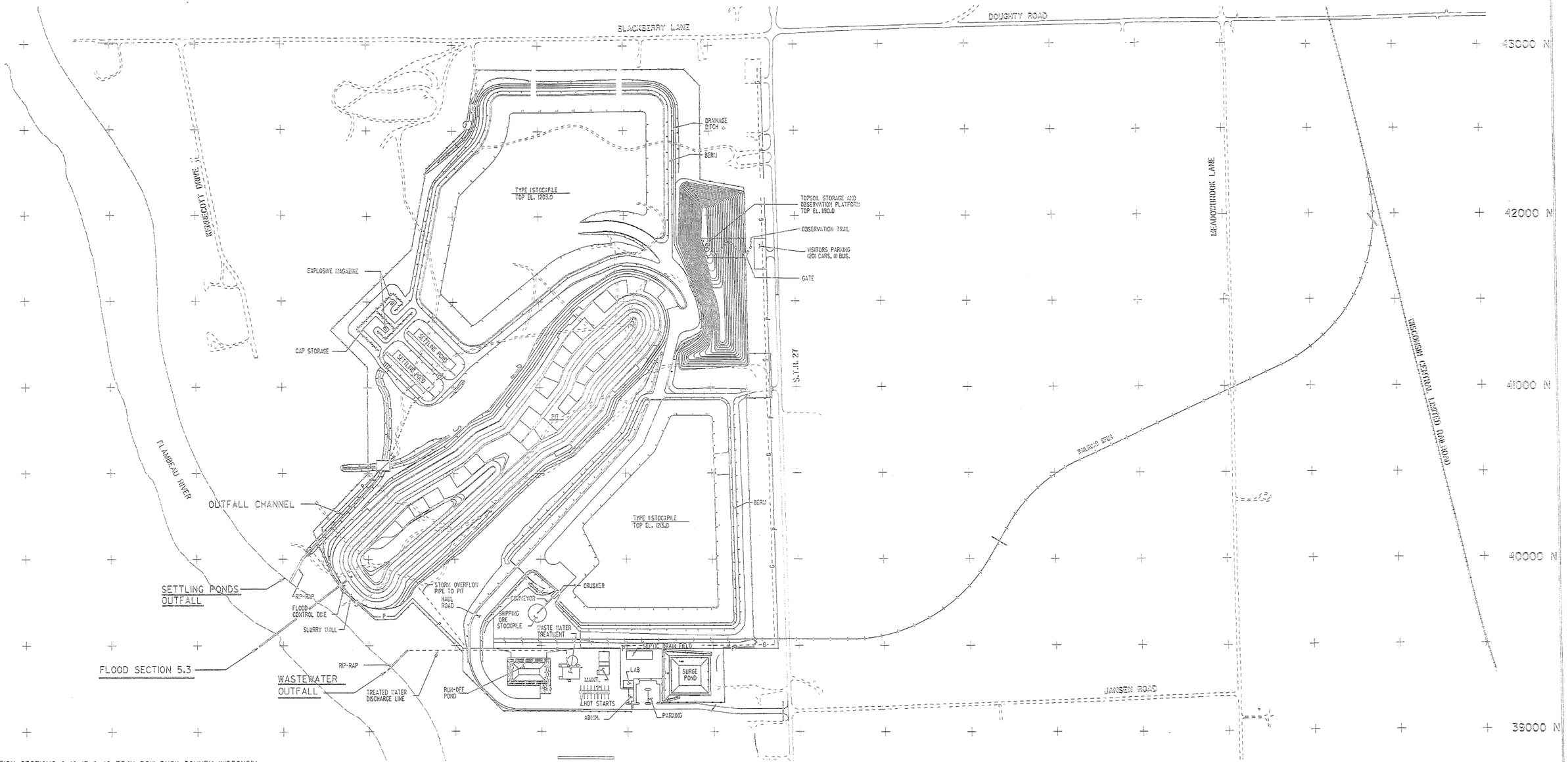
REFERENCES	DWG. NO.	DESCRIPTION	NO.	DATE	REVISIONS	BY	CH'D	ENG'R	ENG'R MGR.

NO.	DATE	REVISIONS	BY	CH'D	ENG'R	ENG'R MGR.
	12/89	UPDATED SITE PLAN	M.J.O.	J.W.S.		

	BY	DATE
PROJ. ENG'R		
DES. PROGRESS		
ENG'R MGR.		

	BY	DATE
DESIGN		
DRAIN	M.J.O.	12/89
CH'D	J.W.S.	12/89
DES. ENG'R		
SECT. ENG'R		

MICROFILM	JOB
DRAWING NO.	REV.
DIVISION DRAWING NO.	
SCALE	SEE BAR SCALE



NOTES:

1. SITE LOCATION: SECTIONS 9, 10, 15 & 16, T34N, R6W, RUSK COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP PREPARED FROM AERIAL SURVEY BY SURDEX CORPORATION, CHESTERFIELD, MISSOURI. DATE OF PHOTOGRAPHY - APRIL 24, 1970. ROADS, TREES AND BUILDINGS WERE UPDATED AS PER AERIAL PHOTOGRAPH TAKEN BY MARKHURD CORPORATON, MINNEAPOLIS, MINNESOTA. DATE OF PHOTOGRAPHY - SEPTEMBER 14, 1987.
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SITE GRID COORDINATES CONTROL MONUMENT F-1	STATE PLANE COORDINATES
40000 N =	587, 357. 8087 N
40000 E =	1, 713, 516. 1229 E

THE ANGULAR ROTATION FROM STATE PLANE BEARINGS TO SITE GRID BEARINGS IS 359°-13'-23" RIGHT WITH CONTROL POINT F-1 AS THE BASE POINT.

5. MINE FACILITIES DESIGN BY FORD, BACON & DAVIS, INCORPORATED, SALT LAKE CITY, UTAH AND PINCOCK, ALLEN & HOLT, INCORPORATED, LAKEWOOD, COLORADO.

LEGEND

EXISTING PAVED ROADWAY

EXISTING TRAIL/GRAVEL SURFACE

N

0 300' 600'

SCALE

FOTH & VAN DYKE

GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION

GREEN BAY, WISCONSIN

FLAMBEAU PROJECT

LADYSMITH, WISCONSIN

DWG. NO.	DESCRIPTION

REFERENCES

DWG. NO.	DESCRIPTION

NO.	DATE	REVISIONS	BY	CK'D	ENG'R	ENG'R MGR.
	12/89	UPDATED SITE PLAN	M.J.O.	J.W.S.		

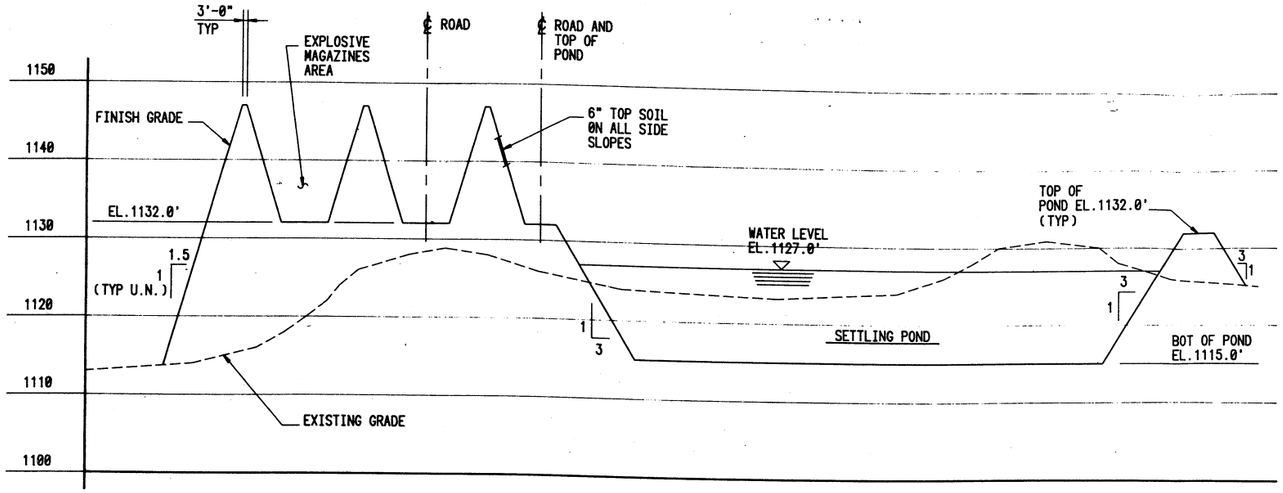
	BY	DATE
PROJ. ENG'R		
MGR. PROCESS ENG'R		
ENG'R MGR.		

	BY	DATE
DESIGN		
DRAWN	M.J.O.	3/89
CK'D	G.W.S.	3/89
DES. ENG'R		
SECT ENG'R		

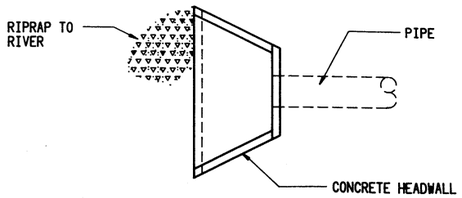
KENNECOTT MINERALS COMPANY
136 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

FIGURE NO. 2
SITE PLOT PLAN
OUTFALLS

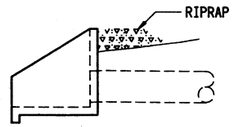
MICROFILM	JOB
DRAWING NO.	REV.
DIVISION DRAWING NO.	
SCALE	SEE BAR SCALE



SECTION D
H. 1"=50'
V. 1"=10'
FM-000-01-001 , -002



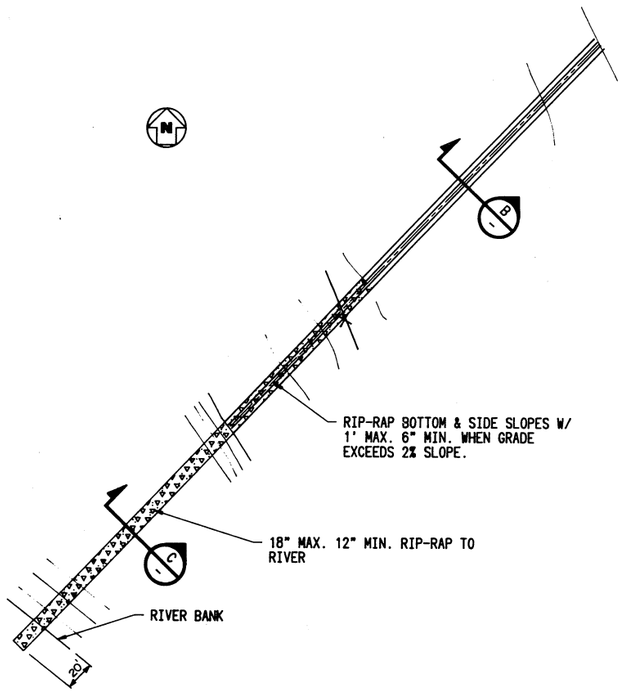
PLAN

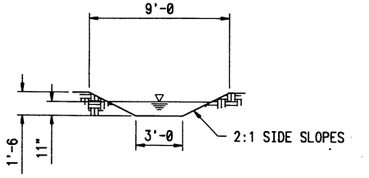


ELEVATION

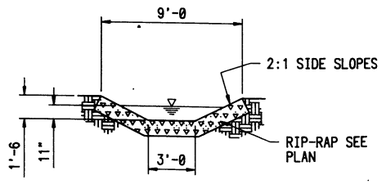
OUTFALL 001

TYPICAL OUTFALL TO RIVER
N.T.S.





SECTION B
1"=10'



SECTION C
1"=10'

OUTFALL 002

DETAIL 1
1"=50'
FM000-01-007

TYPICAL DRAINAGE SWALE & OUTFALL

REFERENCES	DWG. NO	DESCRIPTION

REFERENCES	DWG. NO	DESCRIPTION

NO	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR

NO	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR

	BY	DATE
PROJ. ENG'R		
MGR PROCESS ENG'R		
ENG'R MGR		

	BY	DATE
DESIGN		
DRAWN	GB	1-5-89
CHK'D		
DES. ENG'R	KTK	2/1/89
SECT ENG'R		

Ford, Bacon & Davis, Incorporated
ENGINEERS–CONSTRUCTORS
SALT LAKE CITY, UTAH

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

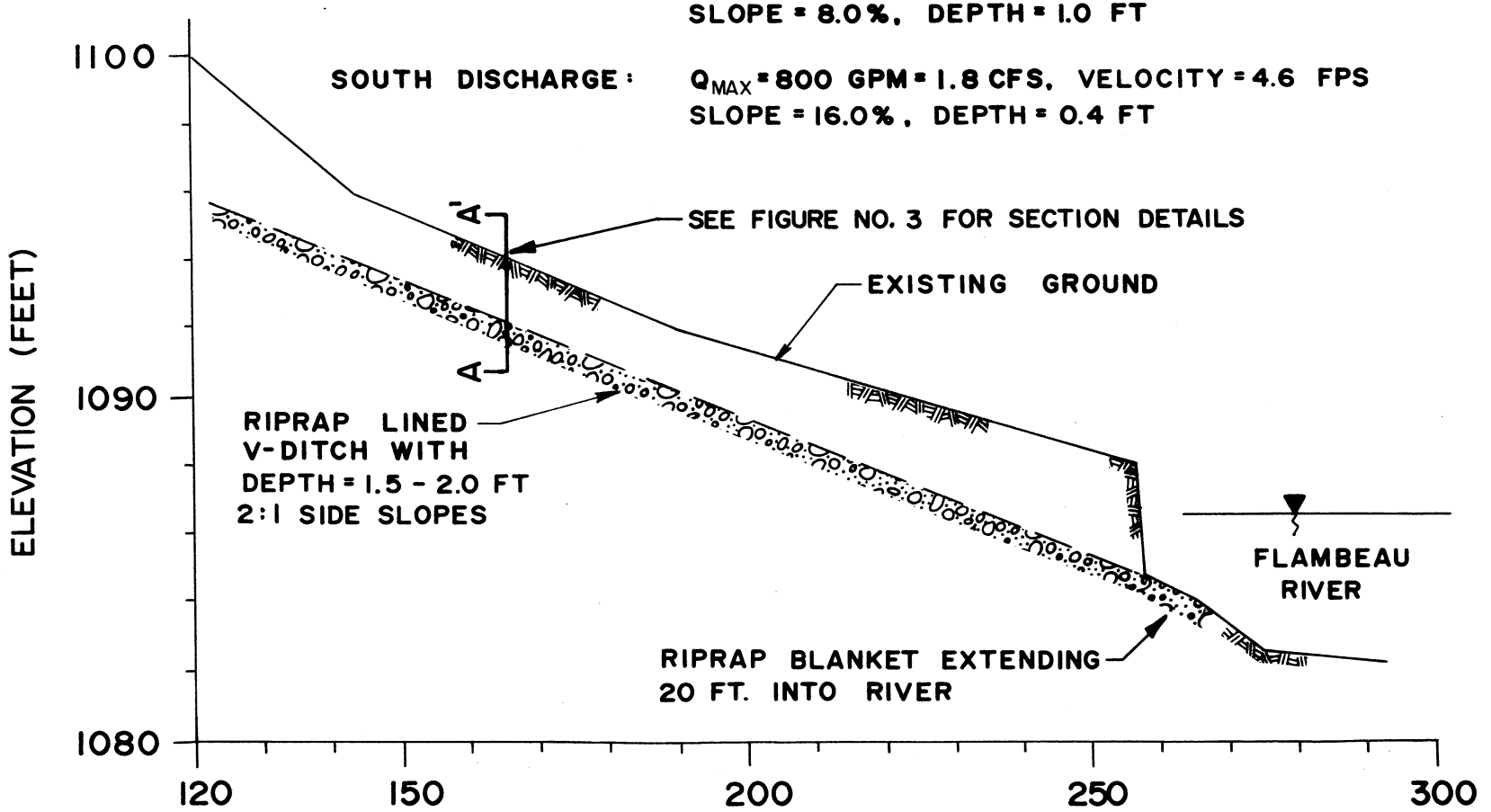
FIGURE NO. 3
SITE GRADING
MISC. SECTIONS

MICROFILM	JOB
	M6033R
DRAWING NO.	REV.
FM-000-01-015	1
DIVISION DRAWING NO.	
OWNER OPERATED	
SCALE	NOTED

NOTE: DRAWING REPRESENTS ACTUAL PROFILE AT FLOOD SECTION 5.3 SHOWING TYPICAL RELATIONSHIP OF DISCHARGE DITCH TO FLAMBEAU RIVER. ACTUAL LOCATION OF NORTH & SOUTH DISCHARGE DITCHES ARE SHOWN ON FIGURE NO. 1. PROFILES FOR THESE TWO LOCATIONS WOULD BE SIMILAR TO THAT SHOWN BELOW. DETAILS FOR EACH DISCHARGE ARE GIVEN BELOW.

NORTH DISCHARGE : Q_{25} = 17.7 CFS, VELOCITY = 6.3 FPS
SLOPE = 8.0%, DEPTH = 1.0 FT

SOUTH DISCHARGE : Q_{MAX} = 800 GPM = 1.8 CFS, VELOCITY = 4.6 FPS
SLOPE = 16.0%, DEPTH = 0.4 FT



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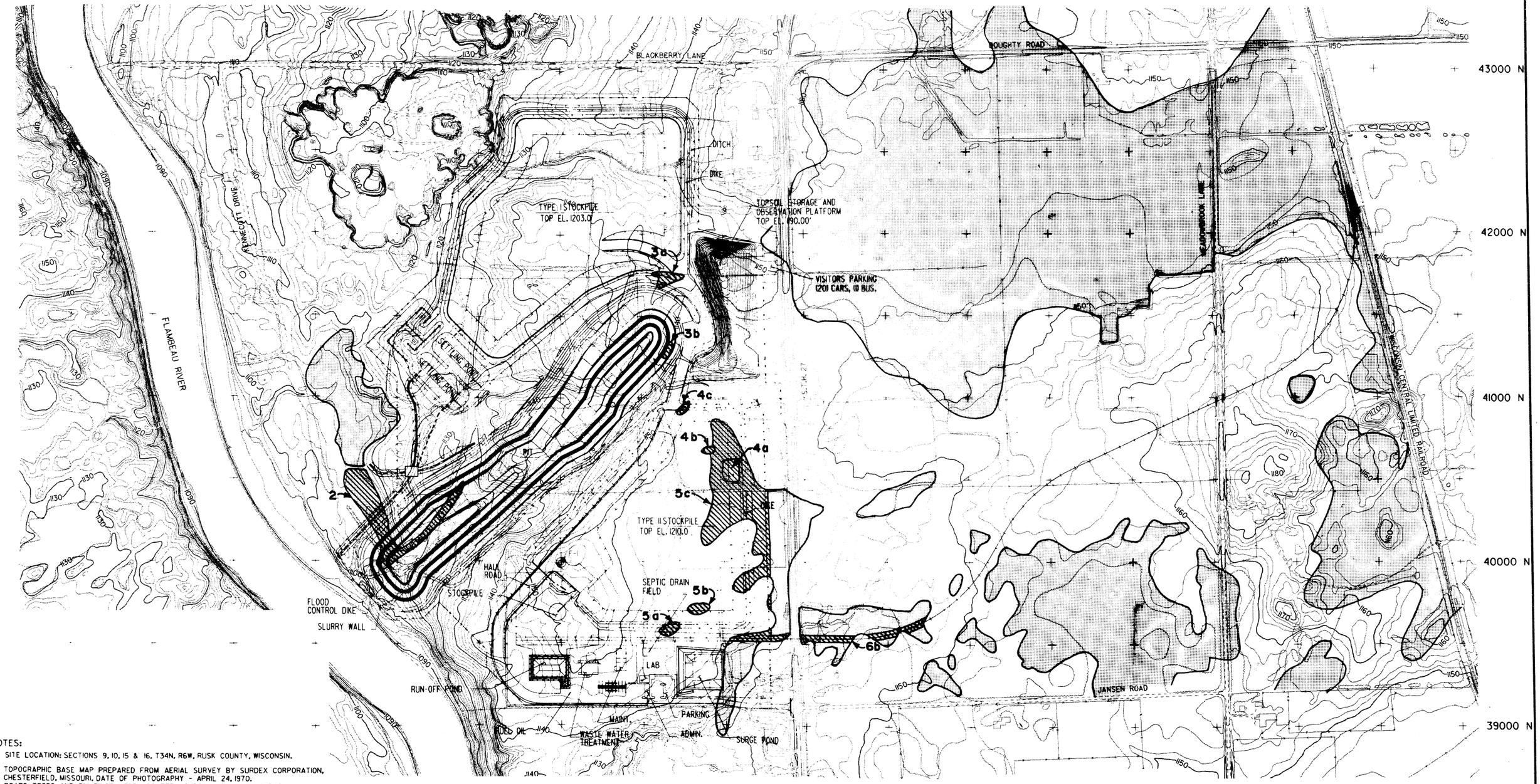
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

FIGURE NO. 4
TYPICAL PROFILE OF DISCHARGE DITCH

No	REVISIONS	NOTES	APPROVAL		DATE
			DESIGNED BY		
			DRAWN BY	SAG	11-27-89
			CHECKED BY	MDL	11-27-89
			APPROVED BY		
			CAD No.	SCALE NONE	

Job No | Dwg No | REV



NOTES:

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40000 E =	1, 713, 516. 1229 E

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5. MINE FACILITIES DESIGN BY FORD, BACON & DAVIS, INCORPORATED, SALT LAKE CITY, UTAH AND PINCOCK, ALLEN & HOLT, INCORPORATED, LAKEWOOD, COLORADO.

LEGEND

- 1100 — EXISTING CONTOUR
- EXISTING PAVED ROADWAY
- EXISTING TRAIL/GRAVEL SURFACE
- TREES AND/OR BRUSH
- FENCE
- F-1 CONTROL MONUMENT
- WETLANDS
- 5c DISTURBED WETLAND AREAS REFERENCED IN EIR REPORT APPENDIX 3.8-C

N

0 300' 600'
SCALE

NOTE: TOPSOIL STOCKPILE CONFIGURATION HAS BEEN REVISED (SEE FIGURE NO.1). REVISION DOES NOT AFFECT ANY WETLAND AREAS.

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LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
555 MINERAL SQUARE
SALT LAKE CITY, UTAH 84102

FIGURE NO. 5
DISTURBED WETLAND AREAS

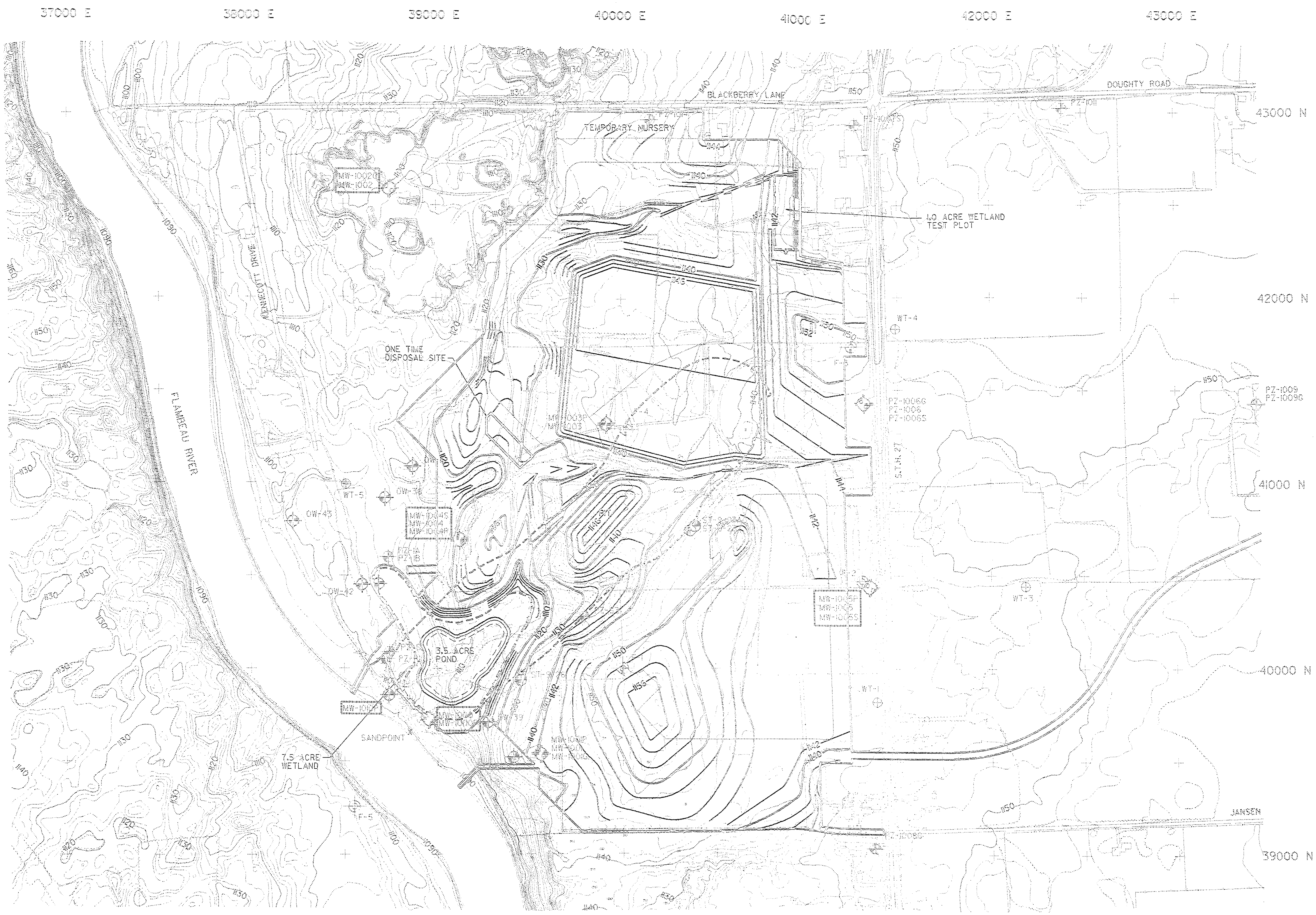
	BY	DATE
DESIGN		
DRAWN	SJL	FEB. 89
CHK'D	GWS	MAR. 89
DES. ENG'R		
SECT ENG'R		
PROJ. ENG'R		
MGR. PROCESS ENG'G		
ENG'R MGR.		

MICROFILM | JOB
DRAWING NO. | REV.
DIVISION DRAWING NO.
SCALE | SEE BAR SCALE

REFERENCES

DWG. NO.	DESCRIPTION

NO.	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR.



LEGEND

—— 1100 ——	EXISTING CONTOUR
	EXISTING PAVED ROADWAY
	EXISTING TRAIL/GRAVEL SURFACE
	TREES AND/OR BRUSH
—x—x—	FENCE
F-1	CONTROL MONUMENT
	MINE SITE

NOTES:

1. SITE LOCATION: SECTIONS 9, 10, 15 & 16, T34N, R6W, RUSK COUNTY, WISCONSIN.
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40000 E =	1, 713, 516. 1229 E

THE ANGULAR ROTATION FROM STATE PLANE BEARINGS TO SITE GRID BEARINGS IS 359°-13'-23" RIGHT WITH CONTROL POINT F-1 AS THE BASE POINT.

5. RAILROAD SPUR LINE CORRIDOR EAST OF STH 27 TO BE GRADED TO ITS APPROXIMATE ORIGINAL CONTOUR AS PART OF THIS GRADING PLAN.

0 300' 600'
SCALE

REFERENCES DWG. NO.	DESCRIPTION	REFERENCES DWG. NO.	DESCRIPTION	NO.	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR.	NO.	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR.

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

	BY	DATE		BY	DATE
PROJ. ENG'R			DESIGN		
MGR. PROCESS ENG'R			DRAWN	MJO	12/89
ENG'R MGR.			CHK'D	GWS	12/89
			DES. ENG'R		
			SECT ENG'R		

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

FIGURE NO. 6
RECLAIMED SITE FINAL
GRADING PLAN

MICROFILM	JOB
DRAWING NO.	REV.
DIVISION DRAWING NO.	
SCALE	SEE BAR SCALE

FOR CONTINUATION SEE DWG. NO. FM000-01-001

FOR CONTINUATION SEE DWG. NO. FM000-01-004

SETTLING PONDS

REALIGN STREAM

DRAINAGE DITCH

PHASE I

PHASE II

TYPE II STOCKPILE

SLURRY LINE

FLOOD CONTROL DIKE

RIP-RAP

FLAMBEAU RIVER

TREATED WATER DISCHARGE LINE

CRUSHER CONVEYOR

SHIPPING ORE STOCKPILE

TOP PILE EL. 1213.0

STATE HIGHWAY 27

E 38500 E 39000 E 39500 E 40000 E 40500 E 41000

N 40000 N 39500 N 39000

REFERENCES	DWG. NO	DESCRIPTION

REFERENCES	DWG. NO	DESCRIPTION	BY	DATE

NO	DATE	REVISIONS	BY	CHK'D	ENGR	PROJ MGR
1	2/23/89	GENERAL REVISIONS	PSH			
2	3/7/89	GENERAL REVISIONS	PSH			

	BY	DATE
PROJ ENGR		
DES PROCESS ENGR		
ENGR MGR		

	BY	DATE
DESIGN		
DRAWN	CEP\MCB	10/21/88
CHK'D		
DES ENGR	KTK	2/1/90
CONST ENGR		

Ford, Bacon & Davis, Incorporated
ENGINEERS-CONSTRUCTORS
SALT LAKE CITY, UTAH

FBD 1904

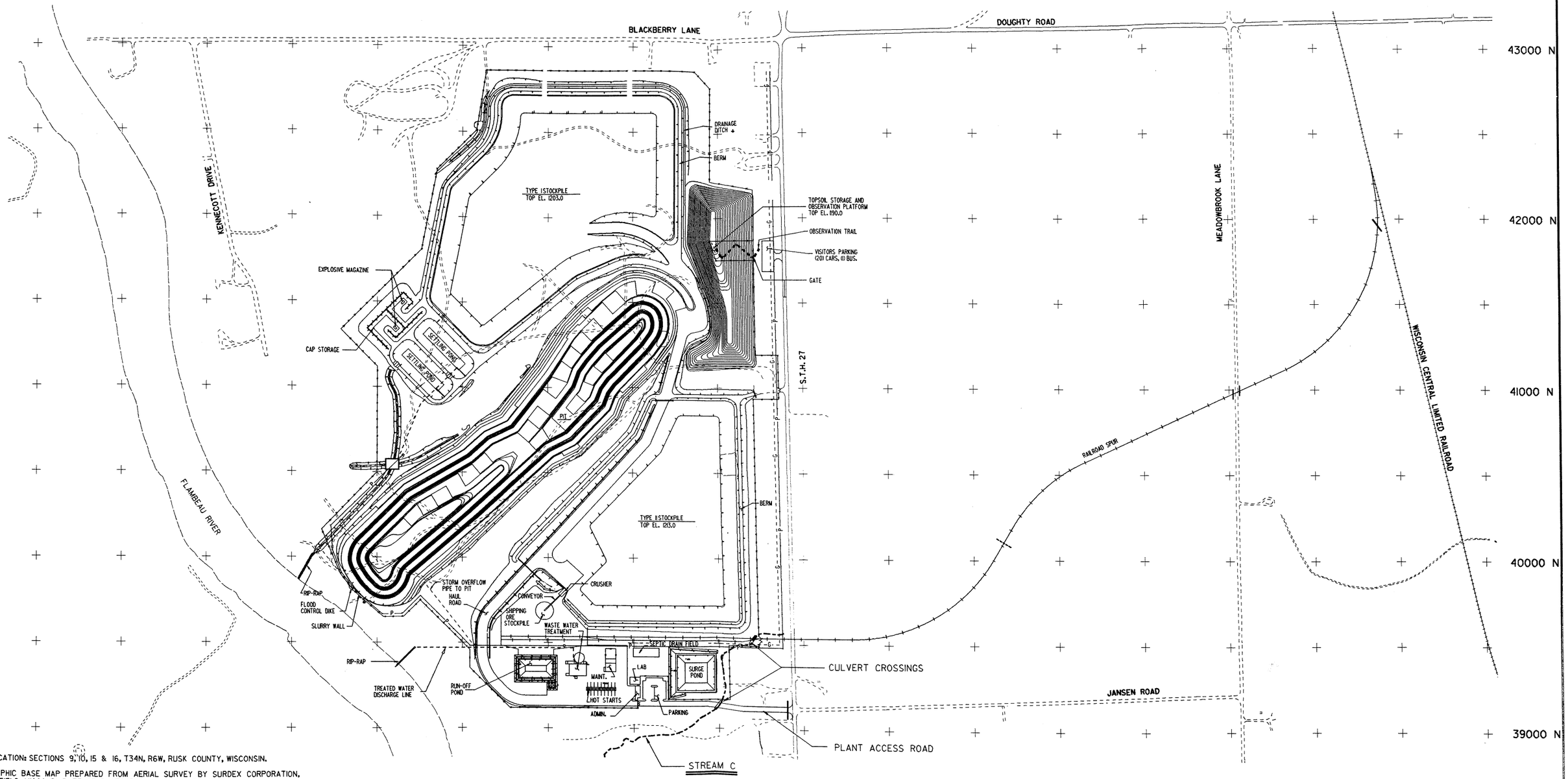
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 KENNECOTT BUILDING
SALT LAKE CITY, UTAH
CK18

FIGURE NO. 7
SITE GRADING AND DRAINAGE PLAN - SOUTH

MICROFILM	JCS
	M8033R
DRAWING NO.	REV.
FM000-01-002	2
DIVISION DRAWING NO.	
OWNER OPERATED	
SCALE	

LZ7502



NOTES:

1. SITE LOCATION: SECTIONS 9, 10, 15 & 16, T34N, R6W, RUSK COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP PREPARED FROM AERIAL SURVEY BY SURDEX CORPORATION, CHESTERFIELD, MISSOURI. DATE OF PHOTOGRAPHY - APRIL 24, 1970. ROADS, TREES AND BUILDINGS WERE UPDATED AS PER AERIAL PHOTOGRAPH TAKEN BY MARKHURD CORPORATON, MINNEAPOLIS, MINNESOTA. DATE OF PHOTOGRAPHY - SEPTEMBER 14, 1987.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS TWO FEET.
4. HORIZONTAL DATUM BASED ON PROJECT SITE GRID SYSTEM. SITE GRID COORDINATES CORRELATION TO STATE PLANE COORDINATES DERIVED AS FOLLOWS:

SITE GRID COORDINATES CONTROL MONUMENT F-1	STATE PLANE COORDINATES
40000 N =	587,357.8087 N
40000 E =	1,713,516.1229 E

THE ANGULAR ROTATION FROM STATE PLANE BEARINGS TO SITE GRID BEARINGS IS 359°-13'-23" RIGHT WITH CONTROL POINT F-1 AS THE BASE POINT.

5. MINE FACILITIES DESIGN BY FORD, BACON & DAVIS, INCORPORATED, SALT LAKE CITY, UTAH AND PINCOCK, ALLEN & HOLT, INCORPORATED, LAKEWOOD, COLORADO.

LEGEND

EXISTING PAVED ROADWAY

EXISTING TRAIL/GRAVEL SURFACE

N

REFERENCES DWG. NO.	DESCRIPTION

REVISIONS DWG. NO.	DESCRIPTION	NO.	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR.

NO.	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR.
	12/89	UPDATED SITE PLAN	M.J.O.			
			J.W.S.			

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

	BY	DATE
PROJ. ENG'R		
MGR. PROCESS ENG'R		
ENG'R MGR.		

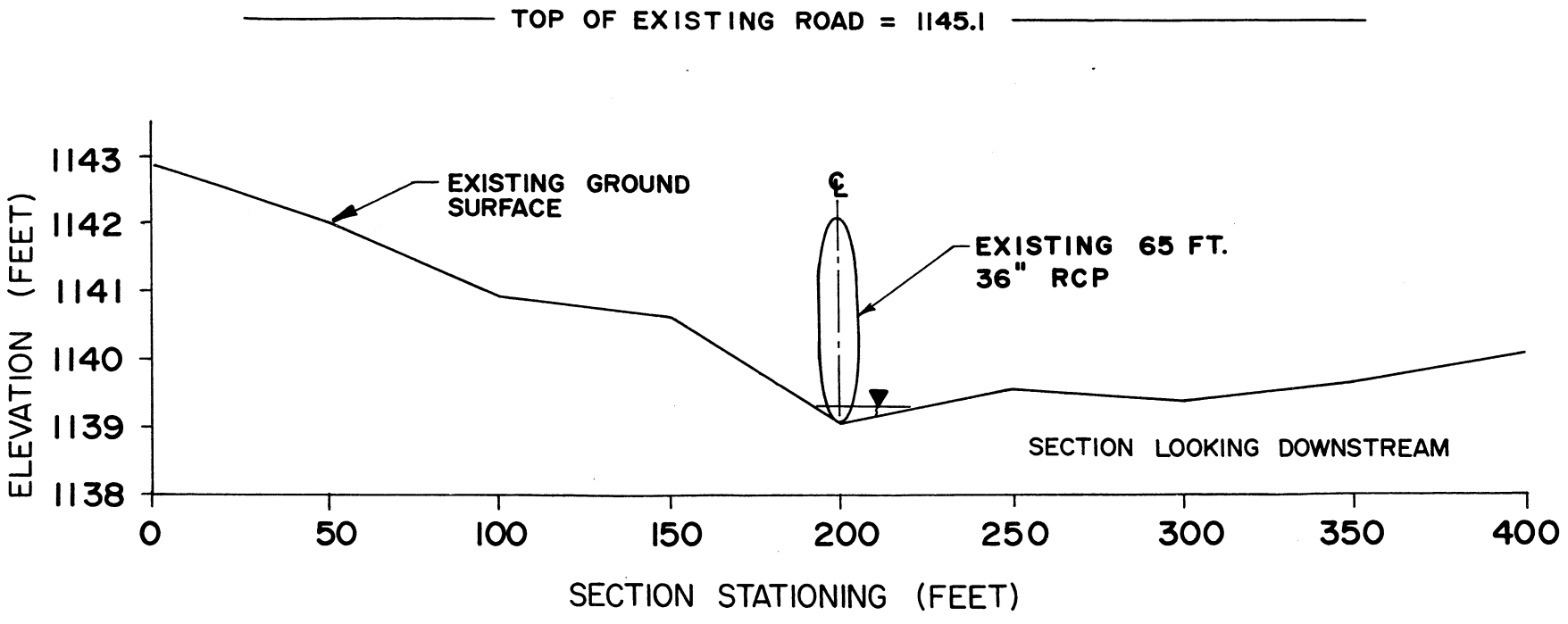
	BY	DATE
DESIGN		
DRAWN	M.J.O.	3/89
CHK'D	G.W.S.	3/89
DES. ENG'R		
SECT. ENG'R		

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

FIGURE NO. 8
SITE PLOT PLAN
CULVERT CROSSINGS
STREAM C

MICROFILM	JOB
DRAWING NO.	REV.
DIVISION DRAWING NO.	
SCALE	SEE BAR SCALE



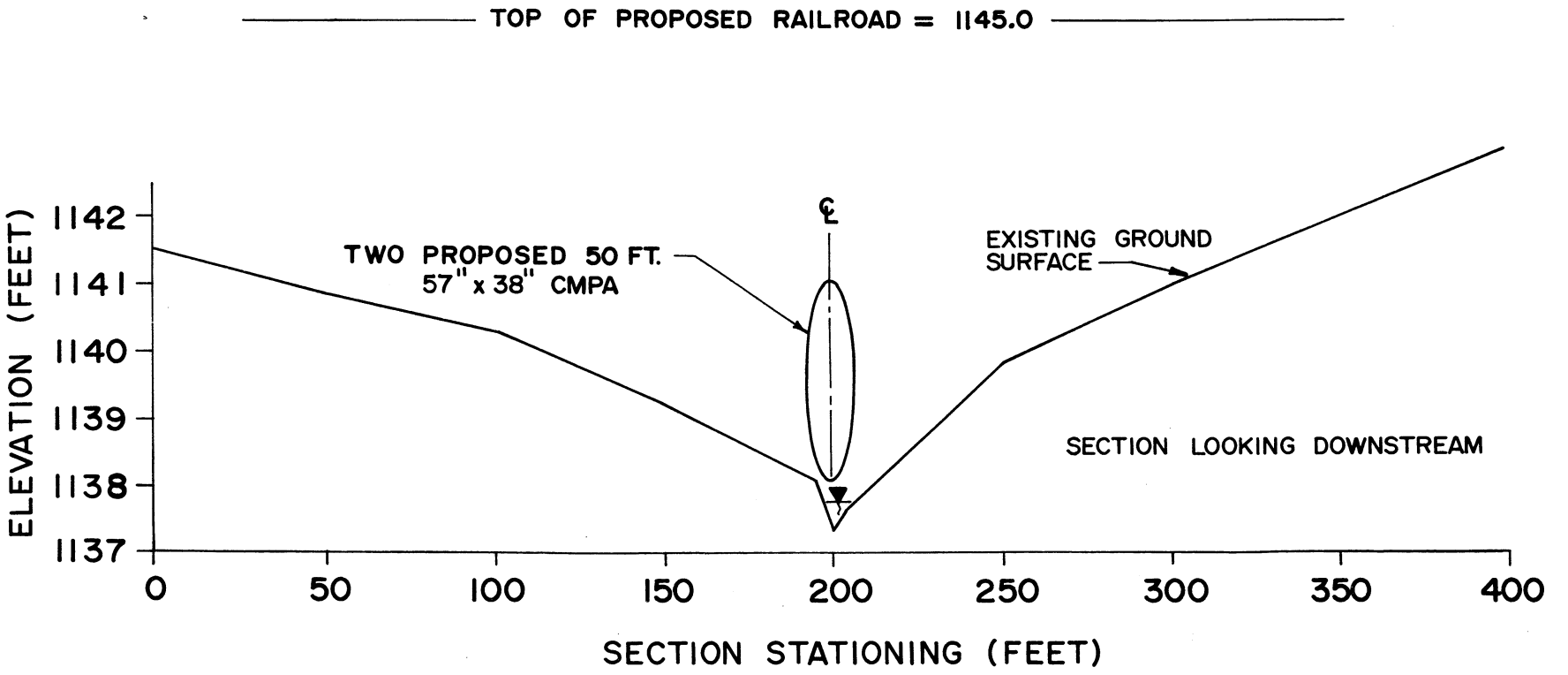
FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

FIGURE NO. 9
INTERMITTENT STREAM "C"
CROSS SECTION NO. 1

No	REVISIONS	NOTES	APPROVAL		DATE
			DESIGNED BY		
			DRAWN BY	SAG	11-27-89
			CHECKED BY	MDL	11-27-89
			APPROVED BY		
			CAD No.	SCALE NONE	

Job No	Dwg No	REV



1139.5 UPSTREAM INVERT
1138.0 DOWNSTREAM INVERT
3.0% CULVERT SLOPE

FOTH & VAN DYKE
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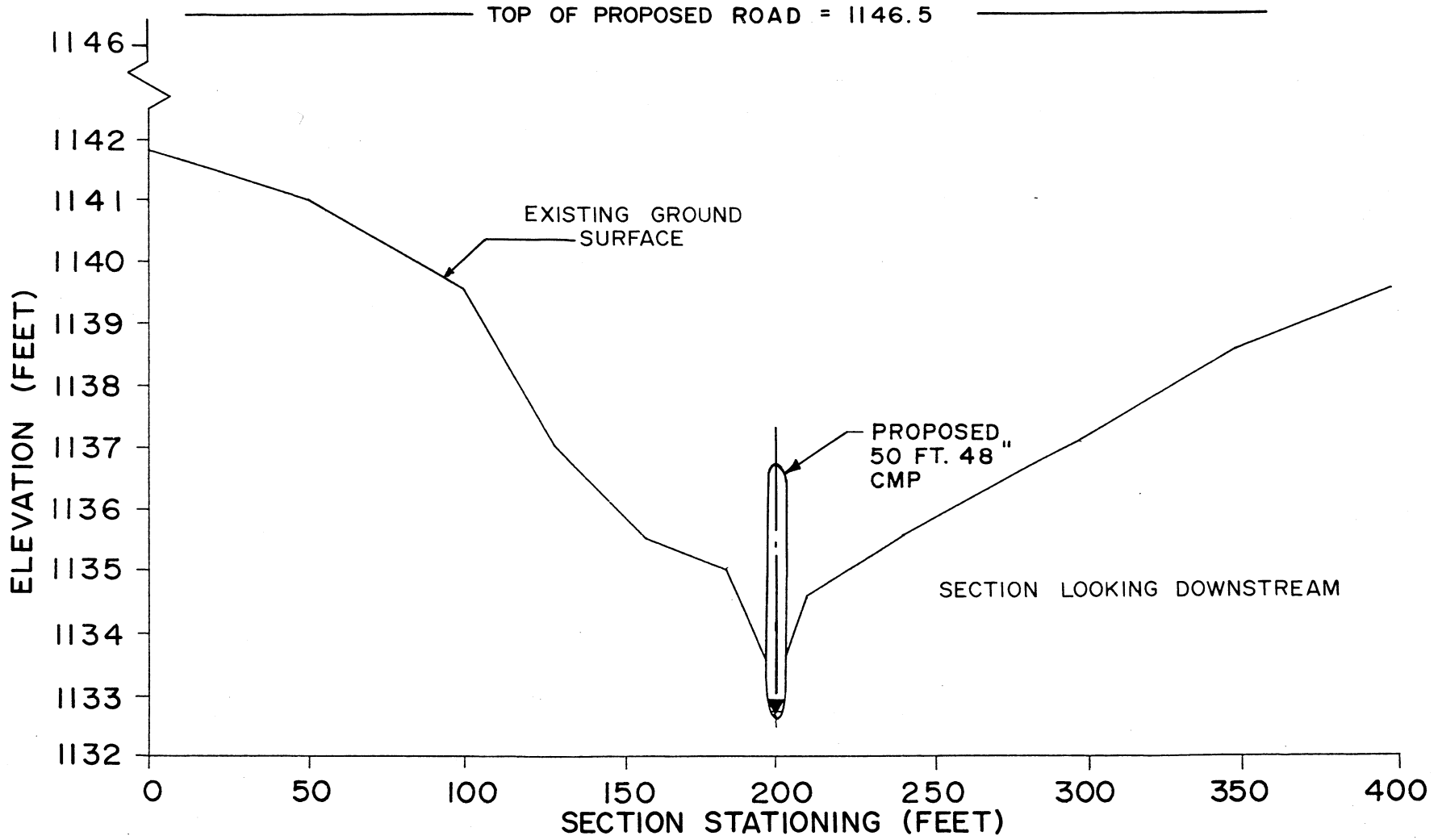
KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

FIGURE NO. 10
INTERMITTENT STREAM "C"
CROSS SECTION NO. 2

No	REVISIONS	NOTES	APPROVAL		DATE
			DESIGNED BY		
			DRAWN BY	SAG	11-27-89
			CHECKED BY	MDL	11-27-89
			APPROVED BY		
			CAD No.	SCALE NONE	

Job No	Dwg No	REV



1134.0 UPSTREAM INVERT
1132.5 DOWNSTREAM INVERT
3.0% CULVERT SLOPE

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

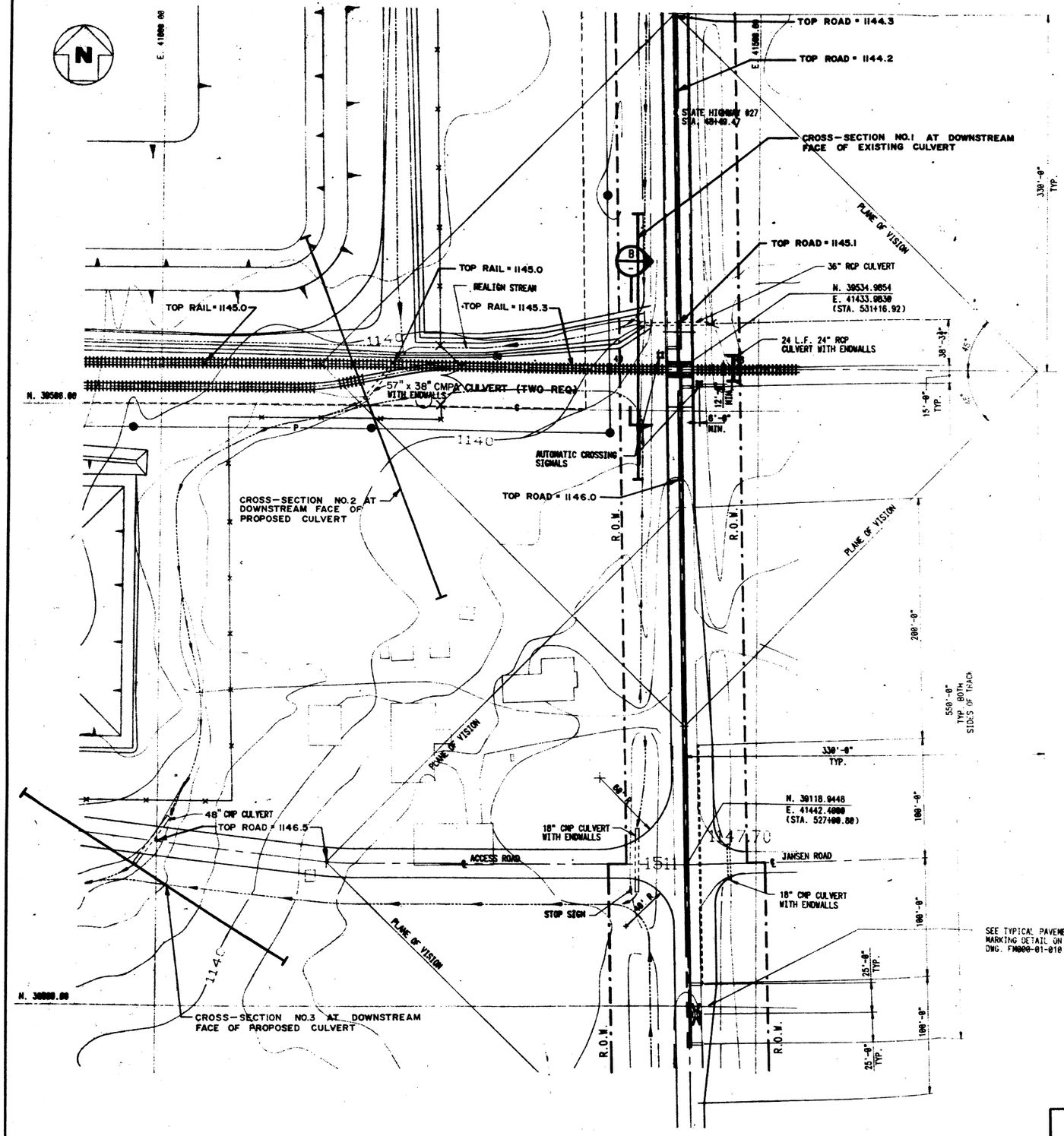
KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

FIGURE NO. 11

INTERMITTENT STREAM "C"
CROSS SECTION NO. 3

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SAG	11-27-89
			CHECKED BY MDL	11-27-89
			APPROVED BY	
			CAD No.	SCALE NONE

Job No | Dwg No | REV



N

LEGEND

- 1140 — EXISTING CONTOUR
- ROADWAY
- CULVERT
- DRAINAGE SWALE
- FENCE

NOTES:

1. SITE LOCATION: SECTIONS 9, 10, 15 & 16, T34N, R6W, RUSK COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP PREPARED FROM AERIAL SURVEY BY SURDEX CORPORATION, CHESTERFIELD, MISSOURI. DATE OF PHOTOGRAPHY - APRIL 24, 1970. ROADS, TREES AND BUILDINGS WERE UPDATED AS PER AERIAL PHOTOGRAPH TAKEN BY MARKHURD CORPORATION, MINNEAPOLIS, MINNESOTA. DATE OF PHOTOGRAPHY - SEPTEMBER 14, 1987.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS TWO FEET.
4. HORIZONTAL DATUM BASED ON PROJECT SITE GRID SYSTEM. SITE GRID COORDINATES CORRELATION TO STATE PLANE COORDINATES DERIVED AS FOLLOWS:

SITE GRID COORDINATES CONTROL MONUMENT F-1	STATE PLANE COORDINATES
40000 N =	587,357.8887 N
40000 E =	1,713,516.1229 E

THE ANGULAR ROTATION FROM STATE PLANE BEARINGS TO SITE GRID BEARINGS IS 359°-13'-23" RIGHT WITH CONTROL POINT F-1 AS THE BASE POINT.

5. MINE FACILITIES DESIGN BY FORD, BACON & DAVIS, INCORPORATED, SALT LAKE CITY, UTAH AND PINCOCK, ALLEN & HOLT, INCORPORATED, LAKEWOOD, COLORADO.

0' 50' 100'
SCALE

NO	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR

	BY	DATE
PROJ. ENG'R		
MGR PROCESS ENG'R		
ENG'R MGR		

	BY	DATE
DESIGN		
DRAWN	JCW	12/89
CHK'D	GWS	12/89
DES. ENG'R		
SECT ENG'R		

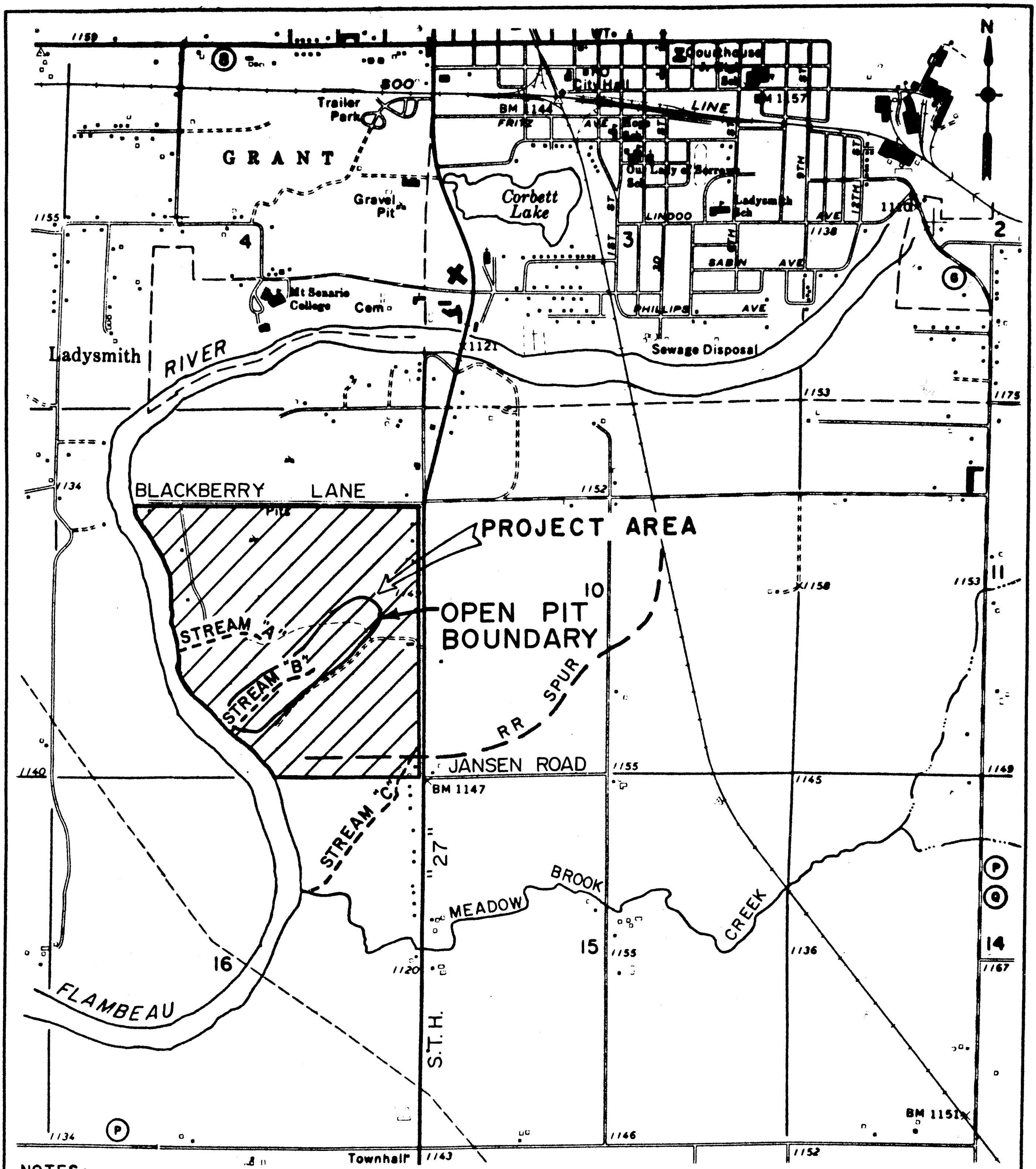
FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

FIGURE NO. 12
SECTION LOCATIONS AND STREAM C REALIGNMENT

MICROFILM	JOB
DRAWING NO.	REV.
DIVISION DRAWING NO.	
SCALE	SEE BAR SCALE

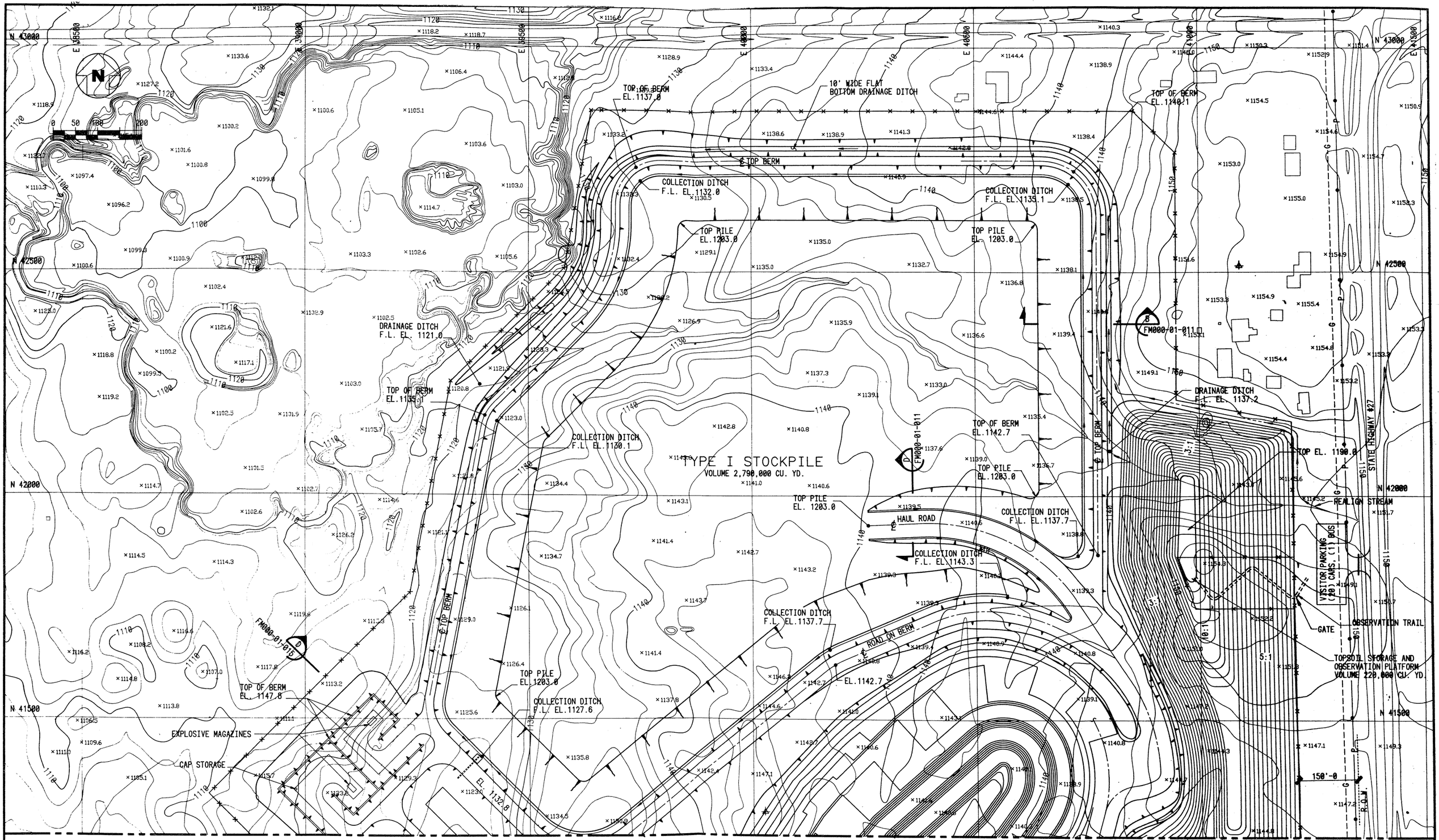


NOTES:

PROJECT AREA INCLUDES A 36 FOOT WIDE CORRIDOR ALONG RAILROAD SPURLINE EAST OF STH 27.

BASE MAP PREPARED FROM U.S.G.S MAPS 7.5 MINUTE SERIES, LADYSMITH AND THORNAPPLE WI. QUADRANGLES

FOTH & VAN DYKE GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION GREEN BAY, WISCONSIN			KENNECOTT MINERALS COMPANY FLAMBEAU PROJECT LADYSMITH, WISCONSIN
NOTES	APPROVAL	DATE	FIGURE NO. 13 INTERMITTENT STREAM LOCATIONS
	DESIGNED BY		
	DRAWN BY SJL	2/89	
	CHECKED BY GWS	3/89	
	APPROVED BY		
	CAD No. / SCALE 1" = 2000'		Job No / Dwg No / REV



FOR CONT. SEE DWG NO. FM000-01-002

REFERENCES

DWG. NO	DESCRIPTION

REFERENCES

DWG. NO	DESCRIPTION	BY	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR

NO	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR
1	2/23/89	GENERAL REVISIONS	PSH			
2	3/1/89	GENERAL REVISIONS	PSH			
3	0/26/89	REVISED TOPSOIL STOCKPILE	GWW			

	BY	DATE
PROJ. ENG'R		
MGR PROCESS ENG'R		
ENG'R MGR		

	BY	DATE
DESIGN	CEP	10/21/88
DRAWN	CEP\MGB	10/21/88
CHK'D		
DES. ENG'R	MTK	2/1/89
PROJ. MGR		

Ford, Bacon & Davis, Incorporated
ENGINEERS-CONSTRUCTORS
SALT LAKE CITY, UTAH

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH 84112

FIGURE NO. 14
SITE GRADING & DRAINAGE PLAN NORTH

MICROFILM	JOB
	M6033R
DRAWING NO.	REV.
FM000-01-001	3
DIVISION DRAWING NO.	
OWNER OPERATED	
SCALE	1"=100'

Appendix A

Culvert Hydrology and Hydraulic Study

December 20, 1989

MEMO

TO: FILES-Flambeau Project
Culvert Design
Intermittent Stream "C"

FR: Michael D. Liebman, P.E.
Water Resources Engineer

RE: Documentation of Culvert Design

GENERAL

As part of the engineering for the Flambeau Project, a service road and railroad spur were designed. At one point these new facilities cross an existing intermittent stream (Stream "C") of questionable navigability. To insure compliance with all regulatory requirements, the stream was treated as being navigable and all subsequent permits and design requirements were followed. As such, a detailed hydrologic study of the proposed culvert placement was completed to determine both the effect on the 100-year flood elevations as well as the adequacy for meeting all backwater requirements concerning the nearby STH "27". Preliminary culvert design work was completed by Ford, Bacon & Davis Utah, Inc. This work provided a basis for completion of the study.

HYDROLOGY

The SCS Method TR-55 was used to determine the estimated design flows for the various locations throughout the stream reach. The Conger regional regression equations and gauged basin comparison methods verified the TR-55 results.

Two noteworthy items concerning this hydrology evaluation should be pointed out. First, the existing drainage areas greatly exceed those which will exist for the project. This occurs because the proposed mining facilities and grading modifications will intercept some stormwater runoff currently going to Stream "C" and reroute it to a different location.

The second point of note is the change in the soil permeability between the drainage basins to the east and to the west of STH "27". Soils maps indicate that the soils east of the highway are less permeable and fall into the category of Type C soils in the hydrologic soil groupings. West of highway "27", however, the soils are more sand and gravel and fall into the range of the B type soils. Although changing the runoff curve numbers in the TR-55 methodology only slightly because of different land uses, the change did create differences in runoff values when compared to the preliminary study done by Ford, Bacon, and Davis Utah, Inc.

HYDRAULICS

The U.S. Corps of Engineers computer program HEC-2 was used to conduct the flood backwater computations for this stream. As stated, two points of concern were evaluated, the first being the effects of the 100-year flood on backwater upstream, and the second being the conveyance potential of the proposed culvert system as it relates to STH "27". Because of the fact that the entire upstream reaches of Stream "C" all the way to the basin divide are located on land owned by the Flambeau Mining Company, it was suspected that no additional backwater would pass on to other riparian lands as a result of the culvert installation. The HEC-2 study proved this to be the case.

During the second phase of the project, the culverts were sized. Preliminary sizing based on HEC-2 showed that 48" and 36" sized culverts at the service road and railroad crossing respectively, would not cause STH "27" to be overtopped during the 25-year flood. (It should be noted that this layout was used in the 100-year analysis discussed in the above paragraph as a conservative condition for proving the lack of backwater increase upstream). In actuality, a more detailed culvert analysis using the FHA/USGS Model WSPRO, shows that STH "27" would be overtopped by a 25-year storm under existing conditions. A 48" service road culvert and twin 38" x 57" arch culverts, respectively, are required to match existing condition backwater elevations immediately upstream of STH "27" for the 25-year event. A combination of HEC-2 and WSPRO was used - the output from one being used as input for the other - stepping upstream to properly model this proposed condition. These culverts, then, match the existing potential 25-year backwater at STH "27".

SUMMARY

The hydrologic/hydraulic analysis conducted for the culvert placement for the Flambeau Mine Site showed that with the placement of the 48 inch and twin 38 inch by 57 inch arch culverts and the proposed mine site layout, that the 100-year backwater would not be increased to effect upstream lands and that the existing 25-year flooding potential would not be increased at STH "27". The attached information includes the documentation for this work including mapping, HEC-2 results, WSPRO results, TR-55 results, and other supporting documentation.

Foth & Van Dyke

Client: KENNECOTT Scope I.D.: 89K
Project: CULVERT DESIGN Page: 1/1
Prepared by: MDL Date: 12-5-89
~~Checked~~ REVIEWED by: JWS Date: 12-20-89

HYDROLOGY SUMMARY

CHARACTERISTICS	DESIGN BASIN	SIMILAR GAGED BASIN 5359200	FACTOR	5360200	FACTOR	5371300	FACTOR
AREA (SQ. MI.)	0.24	0.86	.30	0.80	.32	0.28	0.87
SLOPE (FT./MI)	79	23.10	1.9	15.2	2.4	270.0	.53
STORAGE (%)	0.2	38.4	2.0	28.80	1.9	0.0	1.0
FOREST (%)	50.	86.1	1.0	48.70	1.0	50.0	1.0
PRECIP. (IN.)	31.5	33.0	1.0	30.0	1.0	30.2	1.0
$I_{24,2}$ (IN.)	2.6	2.53	1.0	2.65	1.0	2.83	1.0
SNOW (IN.)	42	48.0	1.0	42.0	1.0	40.0	1.0
SP	0.5 (0.8)	1.65	2.3 (1.66)	1.41	2.1 (1.49)	1.65	2.3 (1.66)
Q_{100} (CONGER)	140-185 CFS	105		51		182	
COMPOSITE FACTOR	—		2.6 (1.9)		3.1 (2.2)		1.1 (.77)
Q_{100} (MODIFIED)	—		273 (199)		158 (111)		200 (139)
TR55	169 CFS	—		—		—	

SUMMARY

TR55 SEEMS REASONABLE IN COMPARISON WITH THE BASINS OF SIMILAR CHARACTERISTICS. AS SHOWN, A SLIGHT MODIFICATION OF THE SOIL PERMEABILITY (SP) FACTOR BRINGS THE COMPARISON VALUES RIGHT IN LINE WITH TR55 RESULTS. AS AN SP ESTIMATE CANNOT BE ACCURATELY MADE, THIS VARIANCE IS ACCEPTABLE AND CONFIRMS THE TR55 RESULTS, WHICH ARE THEN USED FOR THE VARIOUS DESIGN POINTS. PROPOSED CONDITION AREAS DIMINISH EAST OF THE HIGHWAY AS REFLECTED IN TR55 OUTPUT.

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO DOWNSTREAM CROSS-SECTION (EXISTING)

CALCULATED 12-05-1989 08:11:59
DISK FILE : C:KENNECLV.GPD

Drainage Area	(acres)	157.0	0.2453 sq.mi.
Runoff Curve Number	(CN)	73	
Time of Concentration,Tc	(hrs)	1.3	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.3 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	10	25	100
Rainfall, P, 24-hr (in)	3.6	4.2	5.2
Initial Abstraction, Ia (in)	0.740	0.740	0.740
Ia/p Ratio	0.205	0.176	0.142
Unit Discharge, * qu (csm/in)	273	282	291
Runoff, Q (in)	1.25	1.67	2.44
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	81	112	169

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
C0	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	302.699	302.699	302.699
Ia/p	#2	0.300	0.300	0.300
C0	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	247.098	247.098	247.098
* qu (csm)		273	282	291

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO D/S CROSS SECTION- PROPOSED CONDITIONS

CALCULATED 12-08-1989 09:21:28
DISK FILE : C:KENECULV.GPD

Drainage Area	(acres)	128.1	0.2002 sq.mi.
Runoff Curve Number	(CN)	73	
Time of Concentration,Tc	(hrs)	1.34	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.3 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	25	50	100
Rainfall, P, 24-hr (in)	4.2	4.6	5.2
Initial Abstraction, Ia (in)	0.740	0.740	0.740
Ia/p Ratio	0.176	0.161	0.142
Unit Discharge, * qu (csm/in)	276	280	285
Runoff, Q (in)	1.67	1.97	2.44
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	90	107	135

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
C0	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	296.753	296.753	296.753
Ia/p	#2	0.300	0.300	0.300
C0	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	242.273	242.273	242.273
* qu (csm)		276	280	285

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO DOWNSTREAM CULVERT (EXISTING)

CALCULATED 12-05-1989 08:11:01
DISK FILE : C:KENNECLV.GPD

Drainage Area	(acres)	146.0	0.2281 sq.mi.
Runoff Curve Number	(CN)	73	
Time of Concentration,Tc	(hrs)	1.24	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.3 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	10	25	100
Rainfall, P, 24-hr (in)	3.6	4.2	5.2
Initial Abstraction, Ia (in)	0.740	0.740	0.740
Ia/p Ratio	0.205	0.176	0.142
Unit Discharge, * qu (csm/in)	282	290	300
Runoff, Q (in)	1.25	1.67	2.44
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	78	107	162

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
C0	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	312.128	312.128	312.128
Ia/p	#2	0.300	0.300	0.300
C0	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	254.766	254.766	254.766
* qu (csm)		282	290	300

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO NEW ROAD CULVERT - PROPOSED CONDITIONS

CALCULATED 12-08-1989 09:19:49
DISK FILE : C:KENECULV.GPD

Drainage Area	(acres)	117.1	0.1830 sq.mi.
Runoff Curve Number	(CN)	72	
Time of Concentration,Tc	(hrs)	1.24	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.2 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	25	50	100
Rainfall, P, 24-hr (in)	4.2	4.6	5.2
Initial Abstraction, Ia (in)	0.778	0.778	0.778
Ia/p Ratio	0.185	0.169	0.150
Unit Discharge, * qu (csm/in)	288	292	298
Runoff, Q (in)	1.60	1.89	2.35
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	82	98	124

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
C0	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	312.128	312.128	312.128
Ia/p	#2	0.300	0.300	0.300
C0	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	254.766	254.766	254.766
* qu (csm)		288	292	298

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO MIDDLE CULVERT (EXISTING)

CALCULATED 12-05-1989 08:09:20
DISK FILE : C:KENNECLV.GPD

Drainage Area	(acres)	137.7	0.2152 sq.mi.
Runoff Curve Number	(CN)	73	
Time of Concentration,Tc	(hrs)	1.17	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.3 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	10	25	100
Rainfall, P, 24-hr (in)	3.6	4.2	5.2
Initial Abstraction, Ia (in)	0.740	0.740	0.740
Ia/p Ratio	0.205	0.176	0.142
Unit Discharge, * qu (csm/in)	293	301	311
Runoff, Q (in)	1.25	1.67	2.44
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	76	105	158

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
C0	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	323.985	323.985	323.985
Ia/p	#2	0.300	0.300	0.300
C0	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	264.440	264.440	264.440
* qu (csm)		293	301	311

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO RAILROAD CULVERT - PROPOSED CONDITIONS

CALCULATED 12-08-1989 09:18:49
DISK FILE : C:KENECULV.GPD

Drainage Area	(acres)	113.4	0.1772 sq.mi.
Runoff Curve Number	(CN)	72	
Time of Concentration,Tc	(hrs)	1.17	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.2 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	25	50	100
Rainfall, P, 24-hr (in)	4.2	4.6	5.2
Initial Abstraction, Ia (in)	0.778	0.778	0.778
Ia/p Ratio	0.185	0.169	0.150
Unit Discharge, * qu (csm/in)	299	303	309
Runoff, Q (in)	1.60	1.89	2.35
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	82	99	125

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
CO	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	323.985	323.985	323.985
Ia/p	#2	0.300	0.300	0.300
CO	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	264.440	264.440	264.440
* qu (csm)		299	303	309

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = CO + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO UPSTREAM CULVERT (EXISTING AND PROPOSED)

CALCULATED 12-05-1989 08:06:44
DISK FILE : C:KENNECLV.GPD

Drainage Area	(acres)	107.4	0.1678 sq.mi.
Runoff Curve Number	(CN)	72	
Time of Concentration,Tc	(hrs)	1.11	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.2 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	10	25	100
Rainfall, P, 24-hr (in)	3.6	4.2	5.2
Initial Abstraction, Ia (in)	0.778	0.778	0.778
Ia/p Ratio	0.216	0.185	0.150
Unit Discharge, * qu (csm/in)	299	309	320
Runoff, Q (in)	1.19	1.60	2.35
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	58	81	122

Summary of Computations for qu

Ia/p	#1	0.100	0.100	0.100
C0	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	334.976	334.976	334.976
Ia/p	#2	0.300	0.300	0.300
C0	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	273.441	273.441	273.441
* qu (csm)		299	309	320

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

Quick TR-55 Version: 4.05 S/N: 89010304

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

KENNECOT FLAMBEAU PROJECT
CULVERT PLACEMENT / STREAM MODIFICATION
AREA TRIBUTARY TO UPSTREAM CULVERT - EXISTING AND PROPOSED

CALCULATED 12-08-1989 09:23:33
DISK FILE : C:KENECULV.GPD

Drainage Area	(acres)	107.4	0.1678 sq.mi.
Runoff Curve Number	(CN)	72	
Time of Concentration,Tc	(hrs)	1.11	
Rainfall Distribution	(Type)	II	
Pond and Swamp Areas	(%)	.2	0.2 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	25	50	100
Rainfall, P, 24-hr (in)	4.2	4.6	5.2
Initial Abstraction, Ia (in)	0.778	0.778	0.778
Ia/p Ratio	0.185	0.169	0.150
Unit Discharge, * qu (csm/in)	309	314	320
Runoff, Q (in)	1.60	1.89	2.35
Pond & Swamp Adjustment Factor	0.97	0.97	0.97
PEAK DISCHARGE, qp (cfs)	81	97	122

Summary of Computations for qu

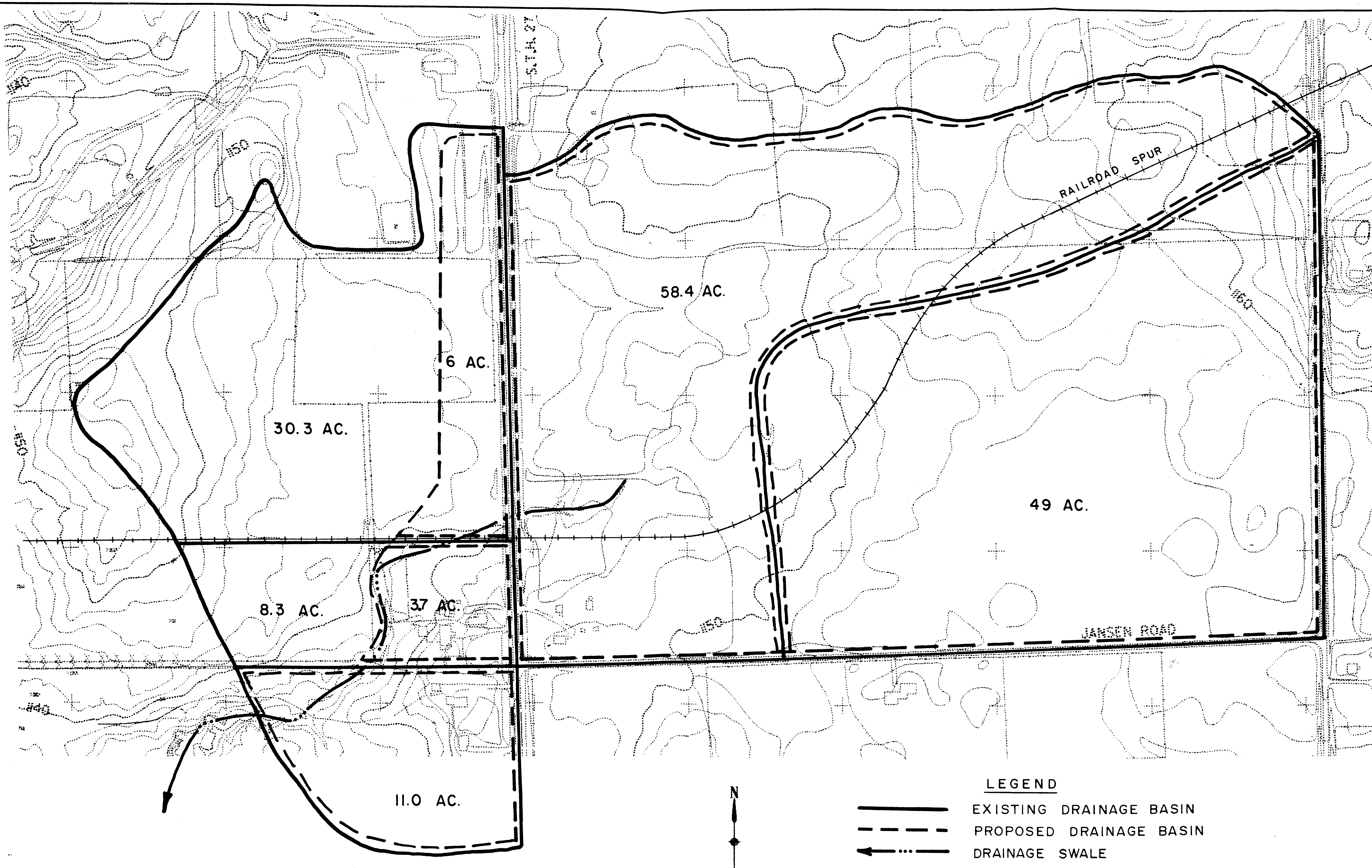
Ia/p	#1	0.100	0.100	0.100
CO	#1	2.553	2.553	2.553
C1	#1	-0.615	-0.615	-0.615
C2	#1	-0.164	-0.164	-0.164
qu (csm)	#1	334.976	334.976	334.976
Ia/p	#2	0.300	0.300	0.300
CO	#2	2.465	2.465	2.465
C1	#2	-0.623	-0.623	-0.623
C2	#2	-0.117	-0.117	-0.117
qu (csm)	#2	273.441	273.441	273.441
* qu (csm)		309	314	320

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = CO + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

```
Write fault error writing device PRN
Abort, Retry, Ignore, Fail? A

C:\HECEXE>ERASE KEN3CULV.DAT

C:\HECEXE>      Quick TR-55 Version: 4.05 S/N: 89010304

                >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

                KENNECOT FLAMBEAU PROJECT
              CULVERT PLACEMENT / STREAM MODIFICATION
          AREA TRIBUTARY TO UPSTREAM CROSS-SECTION 15.0 (EXISTING + PROPOSED)

                CALCULATED     12-07-1989     08:06:58
                DISK FILE : C:KENECULV.GPD

  Drainage Area                (acres)     49.0     0.0766 sq.mi.
  Runoff Curve Number          (CN)        72
  Time of Concentration,Tc     (hrs)       0.6
  Rainfall Distribution        (Type)      II
  Pond and Swamp Areas         (%)         .2          0.1 acres

                                        Storm #1    Storm #2    Storm #3
                                        --------    --------    --------
Frequency (years)                         10          25          100
Rainfall, P, 24-hr (in)                   3.6         4.2         5.2

Initial Abstraction, Ia (in)              0.778       0.778       0.778
Ia/p Ratio                                0.216       0.185       0.150
Unit Discharge, * qu (csm/in)             431         444         459
Runoff, Q (in)                            1.19        1.60        2.35
Pond & Swamp Adjustment Factor            0.97        0.97        0.97

PEAK DISCHARGE, qp (cfs)                  38          53          80
-------------------------------------------------------------------------

Summary of Computations for qu
------------------------------

        Ia/p      #1                      0.100       0.100       0.100
        CO        #1                      2.553       2.553       2.553
        C1        #1                     -0.615      -0.615      -0.615
        C2        #1                     -0.164      -0.164      -0.164
        qu (csm)  #1                    480.419     480.419     480.419

        Ia/p      #2                      0.300       0.300       0.300
        CO        #2                      2.465       2.465       2.465
        C1        #2                     -0.623      -0.623      -0.623
        C2        #2                     -0.117      -0.117      -0.117
        qu (csm)  #2                    396.004     396.004     396.004

    * qu (csm)                            431         444         459

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
  If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

                                                    2
  log(qu)  = CO + ( C1 * log(Tc) ) + ( C2 * (log(Tc)) )
  qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)
```



FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

KENNECOTT MINERALS COMPANY
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH
84112

FIGURE NO. A-1
HYDROLOGY / HYDRAULIC STUDY - DRAINAGE BASINS

	BY	DATE
DESIGN		
DRAWN	SAG	12/89
CHK'D	MDL	12/89
DES. ENG'R		
SECT ENG'R		

	BY	DATE
PROJ. ENG'R		
MGR. PROCESS ENG'R		
ENG'R MGR.		

MICROFILM | JOB
DRAWING NO. | REV.
DIVISION DRAWING NO.
SCALE 1" = 300'

REFERENCES DWG. NO.	DESCRIPTION

NO.	DATE	REVISIONS	BY	CHK'D	ENG'R	ENG'R MGR.

Foth & Van Dyke

Client: KENNECOTT Scope I.D.: 89K10
Project: CULVERT DESIGN Page: 1/2
Prepared by: MDL Date: 12-7-89
REVIEWED ~~Checked~~ by: JDS Date: 12-20-89

HYDRAULIC SUMMARY

THE BACKWATER COMPUTER MODEL HEC-2 WAS USED TO EVALUATE THE EFFECTS OF THE PROPOSED ROAD AND RAILROAD CROSSINGS ON THE REGIONAL FLOOD BACKWATER OF AN UNNAMED TRIBUTARY TO THE FLAMBEAU RIVER. THE ANALYSIS IS SOMEWHAT OF AN OVERKILL BECAUSE OF THE MARGINAL NAVIGABILITY OF THE UPSTREAM REACHES OF THIS WATERCOURSE, AND BECAUSE OF THE FACT THAT THE LANDS UPSTREAM TO THE BASIN DIVIDE ARE OWNED BY THE DEVELOPER SO ANY ADDITIONAL BACKWATER WOULD ONLY AFFECT PROJECT LANDS. THE EVALUATION DOES EXTEND UPSTREAM TO THE POINT WHERE NO ADDITIONAL BACKWATER IS EVIDENT, WHICH POINT REMAINS ON PROJECT LANDS.

THE SIMULATION FOR EXISTING CONDITIONS DOES INCLUDE TWO ALTERNATIVE MODELLING TECHNIQUES. THE MOST CONSERVATIVE (LOWER EXISTING ELEVATIONS) WAS USED FOR COMPARISON WITH PROPOSED CONDITION RESULTS. THE OTHER RUN INCLUDES ENCROACHMENTS AT THE EXISTING CULVERT WHICH GIVES SOME SLIGHT INCONSISTANCIES IN TERMS OF FLOW CONTINUITY AND ROAD OVERFLOW. AGAIN, THE MORE CONSERVATIVE RESULTS WERE USED FOR COMPARISON.

A TABLE SUMMARIZING THE HYDRAULIC STUDY RESULTS IS ATTACHED AS IS THE HEC2 DATA FILES AND OUTPUT. HYDROLOGY SUMMARY AND SUPPORTING DATA IS ALSO INCLUDED FOR DOCUMENTATION, AS IS A MAP, DELINEATING THE TRIBUTARY AREAS AND CROSS-SECTION LOCATIONS.

SIZING OF THE PROPOSED CULVERTS WAS DONE BASED ON THE NECESSITY OF NOT INCREASING BACKWATER DURING A 25-YEAR FLOODING EVENT, COMPARED TO EXISTING CONDITIONS. THE DESIGN FREQUENCY REQUIRED FOR THIS STH(27) CROSS DRAIN HIGHWAY CLASSIFICATION (FACILITIES DEVELOPMENT MANUAL 13-10-1, FIG. 1) REQUIRES A 25-YEAR DESIGN. THESE CALCULATIONS INDICATE ROAD OVERFLOW ON THE 25-YEAR FLOOD UNDER EXISTING CONDITIONS. PROPOSED DESIGN MATCHES EXISTING BACKWATER.

Foth & Van Dyke

Client: KENNECOTT Scope I.D.: 89K10
Project: CULVERT DESIGN Page: 1/2
Prepared by: MDL Date: 12-6-89
Reviewed ~~Checked~~ by: JWS Date: 12-20-89

HYDRAULIC SUMMARY

CROSS SECTION	100-YEAR FLOOD ELEVATIONS EXISTING	PROPOSED	COMMENTS
1.0	1133.27	1133.06	Q_{100} = 169 CFS (EXIST.) 135 CFS (PROP.)
2.0	1134.82	1134.60	
3.0	1135.55	1136.60	Q_{100} = 162 CFS (EXIST.) 124 CFS (PROP.)
4.0	1136.40	1137.61	DOWNSTREAM CULVERT 48"
5.0	1138.51	1139.76	
6.0	1139.49	1140.78	Q_{100} = 158 CFS (EXIST.) 124 CFS (PROP.)
7.0	1139.88	1145.24	RAILROAD CULVERT 36"
8.0	1140.57	1145.26	
9.0	1141.07	1145.26	Q_{100} = 122 CFS (EXIST. AND PROPOSED)
10.0	1144.70	1145.27	EXISTING CULVERT 36"
11.0	1144.70	1145.27	
12.0	1144.81	1145.32	
13.0	1145.48	1145.46	
14.0	1146.40	1146.40	
15.0	1147.94	1147.94	Q_{100} = 80 CFS (EXIST. AND PROPOSED)
16.0	1152.14	1152.14	
17.0	1154.42	1154.42	

FLOOD DESIGN FREQUENCY SELECTION CHART

DESIGN FREQUENCY - YEARS					DRAINAGE STRUCTURES
RURAL CLASS			URBAN CLASS		
STH (1) C1,C2,C3,C4 T1,T2,T3,T4,T5,T6	STH (2) C5 T7	STH (3)	Urban Streets 1,2,3,4,5	Urban Expressways And Freeways 1,2,3,	
See Procedure 13-10-1, discussion of Major Drainage Structures					Bridges & Box culverts
50	50	50	50	50	Underpass Storm Sewers
25	50	50	50	50	Main or Primary Channels
25	25	50	50	50	Cross Drain Pipe Culverts
25	25	25	25	25	Side Drain Pipe Culverts
25	25	25	25	25	Side Ditches and Channels
X	X	25	X	25	Median Ditches and Channels
X	X	X	10 (4) Check 25 Yr.	25	Urban Gutters, Inlets and Storm Sewers

(1) All State Trunk Highways with Design ADT under 1500.
(2) All State Trunk Highways with Design ADT of 1500 to 7000. ESTIMATED AT 3300
(3) All State Trunk Highways with Design ADT of over 7000.
(4) See Procedure 13-25-20

JUN 27 1986

Date June 23, 1986

FIGURE 1

A16

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T1       KENNECOT FLAMBEAU PROJECT                                  DECEMBER. 1989
T2       CULVERT PLACEMENT HYDRAULICS-100 YEAR                      FOTH & VAN DYKE:MDL
T3       SMALL TRIBUTARY TO FLAMBEAU RIVER-PROPOSED                 FILE: "KEN2CULV.DAT"
J1    -10                                .010                              135  1133.3
J2                          -1
NC   .100     .100     .075      .1       .3
X1    1.0        9      200      212
GR1138.6      0.0     1138      130     1136      175     1132      200  1130.2      207
GR1131.7      212     1132      235     1136      300     1144      500
X1    2.0        7      110      125      250      220      260
GR  1140      0.0     1136       85   1132.5      110   1131.8      120  1132.5      125
GR  1134      145     1136      250
*            LOCATION OF PROPOSED DOWNSTREAM CULVERT
NC   .080     .08      .05       .3       .5
X1    3.0       14      185      210      150      100      120
X2    125
X3                                 198.0                202.0
GR1147.5      0.0  1147.3       50  1147.0      100  1146.8      160  1146.6      185
GR1134.5    198.0  1133.3      199.0 1132.5     200  1133.2     201.0 1134.5     201.5
GR1146.5      210  1146.6      225  1146.7      300  1146.8      400
SB     1      1.5      2.5                1                12.6              1133.5  1132.5
X1    4.0                                  60       60       60                   1
X2                          1.0  1136.5  1146.5
X3                                 198.0  1146.5   202.0  1146.5
BT      7      185  1146.6  1146.6   198.0  1146.5  1134.5   199.0  1146.5  1135.7
BT    200  1146.5  1136.5   201.0  1146.5  1135.7   202.0  1146.5  1134.5      210
BT1146.5  1146.5
NC   .050     .050     .045
X1    5.0        7      260      285      200      185      190
X3                                 140                320
GR  1142      0.0     1140       75     1138      260  1135.9      270     1138      285
GR  1140      330     1144      650
*          LOCATION OF PROPOSED RAILROAD CULVERT
X1    6.0       10      195      210      170      200      210
X2    125
X3                                 100                320
GR1145.3      0.0  1145.2      100     1145      195  1138.9     198.5  1138.1     199.5
GR1137.4      200  1138.1    200.7  1138.9    201.5  1145.2      250  1145.3      400
X1    7.0                                  60       60       60                   1
X2                          1.0  1140.4     1145
X3                                  95                330
BT      7      195     1145     1145     198.5     1145  1138.9     199.5     1145  1139.6
BT    200     1145  1140.4    200.7     1145  1139.7    201.5     1145  1138.9      250
BT1145.2  1145.2
X1    8.0        7       35       45       60      120       70
GR  1145      -70     1145        0     1139       35     1138       40     1139       45
GR  1140       70     1142      160
NC   .05      .05     .035       .3       .5
*          LOCATION OF EXISTING 36" CULVERT
X1    9.0       10    198.5    201.5       70      100       85
X2    122
X3                                 140.0                420.0
GR1146.5      0.0     1146      100  1140.6      150  1140.5     198.5  1139.7     199.3
GR  1139      200  1139.7    200.7  1140.5    201.5  1144.2      400  1144.4      500
SB    1.0     1.5      2.5                1                7.1        1  1139.7     1139
X1   10.0                                  80       80     .  80                  .7
X2                          1.0     1142  1145.1
X3                                  100                430
BT      8      100     1146     1146      150  1145.6  1140.6     198.5  1145.1  1140.4
BT  199.3  1145.1  1141.2      200  1145.1     1142    200.7  1145.1  1141.2      201.5
BT1145.1  1140.4      400  1144.2  1144.2
NC   .078     .06      .05       .1       .3
X1   11.0        8      105      118      100      100      100
X3                                  70                150
```

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GR  1145      0.0     1144      100     1143      105   1142.4      110     1143      118
GR  1144      170   1144.3      260     1144      300
X1  12.0        6      110      128      100      100      100
X3                                              300
GR  1145      0.0     1144      100   1143.4      110   1142.8      115     1144      128
GR  1146      400
X1  13.0        7      290      310      100      100      100
X3                                              500
GR  1147      0.0     1146      100     1145      290     1144      300     1145      310
GR  1146      450     1148      600
X1  14.0        6      200      400      200      200      200
GR  1146      0.0     1146      120   1145.5      200   1146.2      320   1145.8      400
GR1148.5      600
NC    .09     .11     .075
X1  15.0        5      170      320      400      400      400
X2    80
GR  1150      0.0     1148      170   1147.5      250     1148      320   1148.5      400
X1  16.0        5      300      460      300      300      300
GR  1154      0.0     1152      300   1151.2      370     1152      460   1152.4      600
X1  17.0        5      200      300      350      350      350
GR  1155      0.0     1154      200   1153.8      250     1154      300     1157      600
EJ


ER


C:\HECEXE>TYPE KEN2CULV.OUT
```

```
1*************************************************
 *   WATER SURFACE PROFILES                      *
 *   VERSION OF SEPTEMBER 1988                   *
 *                                               *
 *                                               *
 *   RUN DATE     12/ 8/89    TIME    12:22:58   *
 *************************************************

                                  X      X  XXXXXXX   XXXXX
                                  X      X  X         X     X
                                  X      X  X         X
                                  XXXXXXX   XXXX      X           XXXXX
                                  X      X  X         X
                                  X      X  X         X     X
                                  X      X  XXXXXXX   XXXXX
 END OF BANNER
1
     12/ 8/89       12:22:58


 ************************************************
   HEC2 RELEASE DATED SEPT 88


 ************************************************

 T1       KENNECOT FLAMBEAU PROJECT                        DECEMBER, 1989
 T2       CULVERT PLACEMENT HYDRAULICS-100 YEAR            FOTH & VAN DYKE:MDL
 T3       SMALL TRIBUTARY TO FLAMBEAU RIVER-PROPOSED       FILE: "KEN2CULV.DAT"

 J1   ICHECK     INQ         NINV        IDIR        STRT        METRIC     HVINS      Q

     -10                     .010                    135   1133.3

 J2 NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1

       LOCATION OF PROPOSED DOWNSTREAM CULVERT
     LOCATION OF PROPOSED RAILROAD CULVERT
     LOCATION OF EXISTING 36" CULVERT
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```
    SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
    Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
    TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
    SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 #PROF 1

 CCHV=     .100 CEHV=     .300
 #SECNO 1.000
      1.00     2.86  1133.06      .00  1133.30  1133.16      .10      .00      .00  1132.00
      135.       3.       75.      56.       4.      24.      37.       0.       0.  1131.70
       .00      .97     3.10     1.52     .100     .075     .100     .000  1130.20   193.36
    .010058       0.       0.       0.        0        0        6      .00    58.90   252.26
0
 #SECNO 2.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      2.00     2.80  1134.60      .00      .00  1134.66      .06     1.49      .00  1132.50
      135.       15.      84.      35.      16.      37.      37.       0.       0.  1132.50
       .04      .97     2.29      .97     .100     .075     .100     .000  1131.80    94.98
    .004066      250.     260.     220.        3        0        0      .00    81.67   176.65
0
 CCHV=     .300 CEHV=     .500
 #SECNO 3.000

 3301 HV CHANGED MORE THAN HVINS

 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

 3470 ENCROACHMENT STATIONS=      198.0     202.0  TYPE=       1  TARGET=        4.000
      3.00     4.10  1136.60  1136.60      .00  1138.18     1.58     1.24      .76100000.00
      125.       0.      125.       0.       0.      12.       0.       1.       0. 100000.00
       .04      .00    10.09      .00     .000     .050     .000     .000  1132.50   198.00
    .084462      150.     120.     100.       20       14        0      .00     4.00   202.00
0

 SPECIAL BRIDGE

 SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
      1.00      1.50      2.50       .00      1.00       .00      12.60       .00   1133.50   1132.50

 #SECNO 4.000
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

PRESS FLOW BECAUSE EGLWC OF 1139.18 EXCEEDS 1.5 DEPTH
PRESSURE FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD	WEIRLN
1138.89	1139.18	.00	0.	125.	13.	3.	1136.50	1146.50	0.

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS= 198.0 202.0 TYPE= 1 TARGET= 4.000
ELENCL= 1146.50 ELENCR= 1146.50

4.00	4.11	1137.61	1137.61	.00	1139.18	1.57	5.05	-5.05	1147.60
125.	0.	125.	0.	0.	12.	0.	1.	0.	1146.50
.04	.00	10.07	.00	.000	.050	.000	.000	1133.50	198.00
.083951	60.	60.	60.	20	5	0	.00	4.00	202.00

0
#SECNO 5.000

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3470 ENCROACHMENT STATIONS= 140.0 320.0 TYPE= 1 TARGET= 180.000

5.00	3.86	1139.76	.00	.00	1139.76	.01	.11	.47	1138.00
125.	54.	58.	13.	133.	70.	34.	1.	1.	1138.00
.13	.41	.83	.37	.050	.045	.050	.000	1135.90	140.00
.000163	200.	190.	185.	5	0	0	.00	180.00	320.00

0
#SECNO 6.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

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    SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
    Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
    TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
    SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 3470 ENCROACHMENT STATIONS=      100.0     320.0  TYPE=      1  TARGET=      220.000
      6.00     3.38  1140.78  1140.78      .00  1141.31      .53      .11      .26  1145.00
      125.       0.      60.      65.       0.       9.      14.       2.       1.  1138.90
       .14      .00     6.85     4.79     .000     .045     .050     .000  1137.40   197.42
    .028533     170.     210.     200.       20       10        0      .00    18.54   215.96
0
 #SECNO 7.000

 3301 HV CHANGED MORE THAN HVINS


 3370 NORMAL BRIDGE, NRD=   7 MIN ELTRD=  1145.00 MAX ELLC=  1140.40

 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

 3470 ENCROACHMENT STATIONS=       85.0     330.0  TYPE=      1  TARGET=      245.000

 4677 BRIDGE DECK DEFINITION ERROR AT STATIONS     201.50    250.00
      7.00     6.84  1145.24  1145.24      .00  1145.25      .01      .06      .16  1146.00
      125.       0.      15.     110.       0.      20.     110.       2.       1.  1139.90
       .16      .00      .76     1.00     .000     .045     .050     .000  1138.40   195.44
    .000309     60.      60.      60.        3       19        0    -5.96    47.16   242.59
0
 #SECNO 8.000
 3280 CROSS SECTION      8.00 EXTENDED      3.26 FEET


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      8.00     7.26  1145.26      .00      .00  1145.26      .00      .00      .00  1139.00
      125.      16.      17.      92.     133.      68.     528.       3.       2.  1139.00
       .33      .12      .25      .17     .050     .045     .050     .000  1138.00   -70.00
    .000005     60.      70.     120.        0        0        0      .00   230.00   160.00
0
 CCHV=     .300 CEHV=     .500
 #SECNO 9.000
 3280 CROSS SECTION      9.00 EXTENDED       .86 FEET
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   SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
   Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
   TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
   SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 3470 ENCROACHMENT STATIONS=      140.0     420.0  TYPE=      1  TARGET=      280.000
     9.00     6.26  1145.26      .00      .00  1145.26      .00      .00      .00  1140.50
     122.      45.       4.      74.     270.      17.     599.       5.       2.  1140.50
      .51      .17      .22      .12     .050     .035     .050     .000  1139.00   140.00
  .000004      70.      85.     100.        1        0        0      .00   280.00   420.00
0

 SPECIAL BRIDGE

 SB  XK       XKQR      QOFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.00      1.50      2.50       .00      1.00       .00      7.10      1.00   1139.70   1139.00

 #SECNO 10.000
 3280 CROSS SECTION     10.00 EXTENDED       .17 FEET

 PRESSURE AND WEIR FLOW

  EGPRS     EGLWC      H3       QWEIR     QPR       BAREA     TRAPEZOID      ELLC      ELTRD     WEIRLN
                                                               AREA
   1152.14  1145.96       .00      119.        4.        7.        8.   1142.00   1145.10      218.


 3470 ENCROACHMENT STATIONS=      100.0     430.0  TYPE=      1  TARGET=      330.000
    10.00     5.57  1145.27      .00      .00  1145.27      .00      .01      .00  1141.20
     122.      53.       4.      65.     268.      14.     450.       6.       3.  1141.20
      .64      .20      .28      .15     .050     .035     .050     .000  1139.70   113.27
  .000009      80.      80.      80.        0        0        9      .00   316.73   430.00
0
 CCHV=     .100 CEHV=     .300
 #SECNO 11.000
 3280 CROSS SECTION     11.00 EXTENDED      1.27 FEET


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE


 3470 ENCROACHMENT STATIONS=       70.0     150.0  TYPE=      1  TARGET=       80.000
    11.00     2.86  1145.26      .00      .00  1145.27      .02      .00      .00  1143.00
     122.      22.      44.      56.      42.      33.      63.       7.       3.  1143.00
      .67      .52     1.32      .89     .078     .050     .060     .000  1142.40    70.00
  .000568      100.     100.     100.        0        0        0      .00    80.00   150.00
0
```

1

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 12.000

3470 ENCROACHMENT STATIONS= .0 300.0 TYPE= 1 TARGET= 299.999

12.00	2.52	1145.32	.00	.00	1145.33	.00	.05	.00	1143.40
122.	39.	12.	71.	98.	11.	144.	7.	4.	1142.80
.72	.40	1.10	.49	.078	.050	.060	.000	1142.80	.00
.000474	100.	100.	100.	2	0	0	.00	300.00	300.00

0

*SECNO 13.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS= .0 500.0 TYPE= 1 TARGET= 499.999

13.00	1.46	1145.46	1145.46	.00	1145.65	.19	.14	.05	1145.00
122.	21.	80.	20.	20.	19.	15.	8.	4.	1145.00
.73	1.04	4.17	1.35	.078	.050	.060	.000	1144.00	201.82
.020813	100.	100.	100.	20	14	0	.00	173.16	374.98

0

*SECNO 14.000

3280 CROSS SECTION 14.00 EXTENDED .40 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

14.00	.90	1146.40	.00	.00	1146.41	.01	.74	.02	1145.50
122.	47.	69.	6.	100.	98.	13.	8.	6.	1145.80
.82	.48	.71	.43	.078	.050	.060	.000	1145.50	.00
.001479	200.	200.	200.	6	0	0	.00	444.27	444.27

0

*SECNO 15.000

3235 SLOPE TOO STEEP, EXCEEDS .10

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

15.00	.44	1147.94	1147.94	.00	1148.06	.12	1.42	.03	1148.00
80.	0.	80.	0.	0.	29.	0.	10.	8.	1148.00
.86	.00	2.72	.00	.000	.075	.000	.000	1147.50	179.20
.141224	400.	400.	400.	20	8	0	.00	132.75	311.95

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#SECNO 16.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

16.00	.94	1152.14	.00	.00	1152.16	.01	4.09	.01	1152.00
80.	0.	79.	1.	2.	87.	4.	10.	9.	1152.00
.95	.20	.91	.16	.090	.075	.110	.000	1151.20	278.58
.004775	300.	300.	300.	10	0	0	.00	231.41	509.98

0

#SECNO 17.000

17.00	.62	1154.42	.00	.00	1154.44	.02	2.29	.00	1154.00
80.	10.	66.	4.	18.	52.	9.	11.	11.	1154.00
1.04	.57	1.25	.47	.090	.075	.110	.000	1153.80	115.31
.009477	350.	350.	350.	9	0	0	.00	227.04	342.35

0

THIS RUN EXECUTED 12/ 8/89 12:23: 7

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HEC2 RELEASE DATED SEPT 88

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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	1130.20	135.00	1133.06	.00	1133.16	100.58	3.10	64.87	13.46
*	2.000	260.00	.00	.00	1131.80	135.00	1134.60	.00	1134.66	40.66	2.29	89.18	21.17
*	3.000	120.00	.00	.00	1132.50	125.00	1136.60	1136.60	1138.18	844.62	10.09	12.39	4.30
*	4.000	60.00	1146.50	1136.50	1133.50	125.00	1137.61	1137.61	1139.18	839.51	10.07	12.42	4.31
*	5.000	190.00	.00	.00	1135.90	125.00	1139.76	.00	1139.76	1.63	.83	237.53	97.94
*	6.000	210.00	.00	.00	1137.40	125.00	1140.78	1140.78	1141.31	285.33	6.85	22.34	7.40
*	7.000	60.00	1145.00	1140.40	1138.40	125.00	1145.24	1145.24	1145.25	3.09	.76	129.99	71.16
*	8.000	70.00	.00	.00	1138.00	125.00	1145.26	.00	1145.26	.05	.25	728.12	585.45
	9.000	85.00	.00	.00	1139.00	122.00	1145.26	.00	1145.26	.04	.22	885.94	591.17
	10.000	80.00	1145.10	1142.00	1139.70	122.00	1145.27	.00	1145.27	.09	.28	732.17	417.95
*	11.000	100.00	.00	.00	1142.40	122.00	1145.26	.00	1145.27	5.68	1.32	138.38	51.19
	12.000	100.00	.00	.00	1142.80	122.00	1145.32	.00	1145.33	4.74	1.10	253.22	56.06
*	13.000	100.00	.00	.00	1144.00	122.00	1145.46	1145.46	1145.65	208.13	4.17	54.82	8.46
*	14.000	200.00	.00	.00	1145.50	122.00	1146.40	.00	1146.41	14.79	.71	210.31	31.72
*	15.000	400.00	.00	.00	1147.50	80.00	1147.94	1147.94	1148.06	1412.24	2.72	29.37	2.13
*	16.000	300.00	.00	.00	1151.20	80.00	1152.14	.00	1152.16	47.75	.91	91.95	11.58
	17.000	350.00	.00	.00	1153.80	80.00	1154.42	.00	1154.44	94.77	1.25	79.24	8.22

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	135.00	1133.06	.00	.00	-.24	58.90	.00
*	2.000	135.00	1134.60	.00	1.54	.00	81.67	260.00
*	3.000	125.00	1136.60	.00	2.00	.00	4.00	120.00
*	4.000	125.00	1137.61	.00	1.01	.00	4.00	60.00
*	5.000	125.00	1139.76	.00	2.15	.00	180.00	190.00
*	6.000	125.00	1140.78	.00	1.02	.00	18.54	210.00
*	7.000	125.00	1145.24	.00	4.46	.00	47.16	60.00
*	8.000	125.00	1145.26	.00	.02	.00	230.00	70.00
	9.000	122.00	1145.26	.00	.00	.00	280.00	85.00
	10.000	122.00	1145.27	.00	.01	.00	316.73	80.00
*	11.000	122.00	1145.26	.00	-.01	.00	80.00	100.00
	12.000	122.00	1145.32	.00	.06	.00	300.00	100.00
*	13.000	122.00	1145.46	.00	.14	.00	173.16	100.00
*	14.000	122.00	1146.40	.00	.94	.00	444.27	200.00
*	15.000	80.00	1147.94	.00	1.54	.00	132.75	400.00
*	16.000	80.00	1152.14	.00	4.20	.00	231.41	300.00
	17.000	80.00	1154.42	.00	2.28	.00	227.04	350.00

SUMMARY OF ERRORS AND SPECIAL NOTES

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WARNING SECNO=     2.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     3.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     3.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     3.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=     4.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     4.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=     5.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     6.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     6.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     6.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=     7.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     7.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     7.000  PROFILE=  1  BRIDGE DECK DEFINITION ERROR

WARNING SECNO=     8.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    11.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    13.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    13.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    13.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=    14.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    15.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    15.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    15.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=    15.000  PROFILE=  1  SLOPE TOO STEEP

WARNING SECNO=    16.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE


C:\HECEXE>
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EXISTING

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          TYPE KEN1CULV.DAT
T1      KENNECOT FLAMBEAU PROJECT                        DECEMBER, 1989
T2      CULVERT PLACEMENT HYDRAULICS                     FOTH & VAN DYKE:MDL
T3      SMALL TRIBUTARY TO FLAMBEAU RIVER                FILE: "KEN1CULV.DAT"
J1   -10                          .010                        169  1133.3
J2                    -1
NC  .100    .100    .075     .1      .3
X1   1.0       9     200     212
GR1138.6     0.0    1138     130    1136     175    1132     200  1130.2     207
GR1131.7     212    1132     235    1136     300    1144     500
X1   2.0       7     110     125     250     220     260
GR  1140     0.0    1136      85  1132.5     110  1131.8     120  1132.5     125
GR  1134     145    1136     250
*          LOCATION OF PROPOSED DOWNSTREAM CULVERT
NC  .085     .09     .07
X1   3.0      14     185     210     150     100     120
X2   162
GR1141.7     0.0    1141      50  1139.5     100  1135.5     160    1135     185
GR1133.3     198    1132.5    200  1133.3     202    1134     207  1134.5     209
GR1134.6     210    1135.1    225  1136.5     300  1139.5     400
X1   4.0                              60      60      60              1
NC  .050     .050    .045
X1   5.0       7     260     285     200     185     190
GR  1142     0.0    1140      75    1138     260  1135.9     270    1138     285
GR  1140     330    1144     650
*        LOCATION OF PROPOSED RAILROAD CULVERT
X1   6.0      10     195     210     170     200     210
X2   158
GR1141.5     0.0  1140.3     100    1138     195  1137.7     198  1137.6     199
GR1137.4     200  1137.6     205    1138     210  1139.8     250    1143     400
X1   7.0                              60      60      60              1
X1   8.0       7      35      45      60     120      70
GR  1142     -70    1140       0    1139      35    1138      40    1139      45
GR  1140      70    1142     160
NC   .05     .05    .035      .3      .5
*        LOCATION OF EXISTING 36" CULVERT
X1   9.0      10  198.5   201.5      70     100      85
X2   122
GR1146.5     0.0    1146     100  1140.6     150  1140.5   198.5  1139.7   199.3
GR  1139     200  1139.7   200.7  1140.5   201.5  1144.2     400  1144.4     500
SB   1.0     1.5     2.5              1             7.1       1  1139.7    1139
X1  10.0                              80      80      80             .7
X2                  1.0    1142  1145.1
BT     8     100    1146    1146     150  1145.6  1140.6   198.5  1145.1  1140.4
BT 199.3  1145.1  1141.2     200  1145.1    1142   200.7  1145.1  1141.2   201.5
BT1145.1  1140.4     400  1144.2  1144.2
NC  .078     .06     .05      .1      .3
X1  11.0       8     105     118     100     100     100
GR  1145     0.0    1144     100    1143     105  1142.4     110    1143     118
GR  1144     170  1144.3     260    1144     300
X1  12.0       6     110     128     100     100     100
GR  1145     0.0    1144     100  1143.4     110  1142.8     115    1144     128
GR  1146     400
X1  13.0       7     290     310     100     100     100
GR  1147     0.0    1146     100    1145     290    1144     300    1145     310
GR  1146     450    1148     600
X1 14.0        6     200     400     200     200     200
GR  1146     0.0    1146     120  1145.5     200  1146.2     320  1145.8     400
GR1148.5     600
NC   .09     .11    .075
X1  15.0       5     170     320     400     400     400
X2   80
GR  1150     0.0    1148     170  1147.5     250    1148     320  1148.5     400
X1  16.0       5     300     460     300     300     300
```

```
GR  1154     0.0    1152     300  1151.2     370    1152     460  1152.4     600
X1  17.0       5     200     300     350     350     350
GR  1155     0.0    1154     200  1153.8     250    1154     300    1157     600
EJ



ER

C:\HECEXE>LO

                    <<< MICROLOG SESSION STATUS >>>

 PC NAME:  50-03
  DIV ID:  GB
                       Initials:  MDL
                          Scope:  89K10
                   Billing Line:
                       Comments:

                    Elapsed time = 2 hours 0 minutes.

Press any key to continue...
```

```
WARNING SECNO=     6.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     7.000  PROFILE=  1  BRIDGE DECK DEFINITION ERROR
WARNING SECNO=     7.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     8.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    11.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    12.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    13.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    14.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    15.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    15.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    15.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=    15.000  PROFILE=  1  SLOPE TOO STEEP

WARNING SECNO=    16.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

C:\HECEXE>TYPE KENICULV.OUT
1*************************************************
*  WATER SURFACE PROFILES                       *
*  VERSION OF SEPTEMBER 1988                    *
*                                               *
*                                               *
*  RUN DATE    12/ 6/89   TIME   23:53:12       *
*************************************************

*****************************************
*  U.S. ARMY CORPS OF ENGINEERS         *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D           *
*  DAVIS, CALIFORNIA 95616              *
*  (916) 756-1104                       *
*****************************************
```

EXISTING

```
X     X  XXXXXXX   XXXXX             XXXXX
X     X  X        X     X          X     X
X     X  X        X                      X
XXXXXXX  XXXX     X         XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX

END OF BANNER
```

THIS RUN EXECUTED 12/ 6/89 23:53:13

****
HEC2 RELEASE DATED SEPT 88

****

T1 KENNECOT FLAMBEAU PROJECT DECEMBER, 1989
T2 CULVERT PLACEMENT HYDRAULICS FOTH & VAN DYKE:MDL
T3 SMALL TRIBUTARY TO FLAMBEAU RIVER FILE: "KEN1CULV.DAT"

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-10				.010			169	1133.3	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
			-1							

LOCATION OF PROPOSED DOWNSTREAM CULVERT
LOCATION OF PROPOSED RAILROAD CULVERT
LOCATION OF EXISTING 36" CULVERT

```
   SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
   Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
   TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
   SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 #PROF 1

 CCHV=     .100 CEHV=     .300
 #SECNO 1.000
     1.00     3.07  1133.27      .00  1133.30  1133.37      .11      .00      .00  1132.00
     169.        5.       88.       75.        5.       27.       46.        0.        0.  1131.70
      .00     1.09     3.30     1.65     .100     .075     .100     .000  1130.20   192.09
   .010010        0.        0.        0.        0        0        5      .00    63.48   255.57
0
 #SECNO 2.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

     2.00     3.02  1134.82      .00      .00  1134.88      .06     1.51      .00  1132.50
     169.       20.       99.       50.       19.       40.       49.        1.        0.  1132.50
      .04     1.05     2.46     1.02     .100     .075     .100     .000  1131.80    93.41
   .004172      250.      260.      220.        3        0        0      .00    94.79   188.20
0
 #SECNO 3.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

     3.00     3.05  1135.55      .00      .00  1135.69      .14      .78      .02  1135.00
     162.        6.       137.      19.        7.       42.       16.        1.        1.  1134.60
      .05      .86     3.28     1.18     .085     .070     .090     .000  1132.50   159.31
   .012350      150.      120.      100.        2        0        0      .00    89.59   248.89
0
 #SECNO 4.000
     4.00     2.90  1136.40      .00      .00  1136.60      .20      .90      .02  1136.00
     162.        3.       144.      14.        4.       38.       11.        1.        1.  1135.60
      .05      .82     3.78     1.31     .085     .070     .090     .000  1133.50   164.78
   .018455       60.       60.       60.        2        0        0      .00    76.53   241.31
0
 #SECNO 5.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

     5.00     2.61  1138.51      .00      .00  1138.71      .20     2.11      .00  1138.00
     162.       12.       147.       3.       12.       39.        3.        1.        1.  1138.00
      .07     1.02     3.77     1.02     .050     .045     .050     .000  1135.90   213.06
   .007368      200.      190.      185.        5        0        0      .00    83.36   296.42
0
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#SECNO 6.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

6.00	2.09	1139.49	.00	.00	1139.55	.06	.83	.01	1138.00
158.	58.	68.	31.	46.	27.	25.	1.	2.	1138.00
.10	1.25	2.51	1.25	.050	.045	.050	.000	1137.40	133.03
.002607	170.	210.	200.	4	0	0	.00	110.31	243.34

0
#SECNO 7.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

7.00	1.48	1139.88	1139.88	.00	1140.19	.31	.34	.08	1139.00
158.	40.	97.	21.	16.	18.	9.	1.	2.	1139.00
.10	2.48	5.37	2.48	.050	.045	.050	.000	1138.40	158.62
.020865	60.	60.	60.	20	19	0	.00	70.95	229.57

0
#SECNO 8.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

8.00	2.57	1140.57	.00	.00	1140.62	.05	.41	.03	1139.00
158.	60.	53.	45.	43.	21.	34.	2.	2.	1139.00
.11	1.39	2.56	1.31	.050	.045	.050	.000	1138.00	-20.03
.002336	60.	70.	120.	4	0	0	.00	115.78	95.75

0
CCHV= .300 CEHV= .500
#SECNO 9.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

9.00	2.07	1141.07	1141.07	.00	1141.30	.24	.39	.09	1140.50
122.	79.	26.	18.	26.	4.	9.	2.	2.	1140.50
.12	3.02	6.49	2.06	.050	.035	.050	.000	1139.00	145.68
.025711	70.	85.	100.	20	13	0	.00	86.21	231.89

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	GLOB	GCH	GROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB	XK	XKOR	CDFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.00	1.50	2.50	.00	1.00	.00	7.10	1.00	1139.70	1139.00

#SECNO 10.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

PRESSURE AND WEIR FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD	WEIRLN
1147.94	1142.00	.00	34.	89.	7.	8.	1142.00	1145.10	110.

10.00	5.00	1144.70	.00	.00	1144.70	.00	3.39	.00	1141.20
122.	57.	5.	60.	221.	13.	328.	2.	2.	1141.20
.22	.26	.37	.18	.050	.035	.050	.000	1139.70	118.53
.000018	80.	80.	80.	0	0	7	.00	270.69	389.21

0
CCHV= .100 CEHV= .300
#SECNO 11.000
3280 CROSS SECTION 11.00 EXTENDED .70 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

11.00	2.30	1144.70	.00	.00	1144.71	.01	.01	.00	1143.00
122.	10.	33.	79.	31.	26.	134.	3.	3.	1143.00
.26	.32	1.27	.59	.078	.050	.060	.000	1142.40	29.90
.000729	100.	100.	100.	2	0	0	.00	270.11	300.00

0
#SECNO 12.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

12.00	2.01	1144.81	.00	.00	1144.85	.04	.13	.01	1143.40
122.	31.	57.	33.	44.	27.	45.	4.	4.	1144.00
.28	.71	2.13	.75	.078	.050	.060	.000	1142.80	19.03
.003042	100.	100.	100.	2	0	0	.00	219.09	238.12

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#SECNO 13.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

13.00	1.48	1145.48	1145.48	.00	1145.65	.17	.62	.04	1145.00
122.	22.	79.	21.	22.	20.	16.	4.	4.	1145.00
.28	1.01	4.02	1.32	.078	.050	.060	.000	1144.00	198.92
.018944	100.	100.	100.	9	13	0	.00	178.19	377.11

0
#SECNO 14.000
3280 CROSS SECTION 14.00 EXTENDED .39 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

14.00	.90	1146.40	.00	.00	1146.41	.01	.74	.02	1145.50
122.	47.	69.	6.	99.	97.	13.	4.	5.	1145.80
.38	.48	.71	.43	.078	.050	.060	.000	1145.50	.00
.001524	200.	200.	200.	6	0	0	.00	443.95	443.95

0
#SECNO 15.000

3235 SLOPE TOO STEEP, EXCEEDS .10

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

15.00	.44	1147.94	1147.94	.00	1148.06	.12	1.46	.03	1148.00
80.	0.	80.	0.	0.	29.	0.	5.	8.	1148.00
.42	.00	2.72	.00	.000	.075	.000	.000	1147.50	179.20
.141224	400.	400.	400.	20	8	0	.00	132.75	311.95

0
#SECNO 16.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

16.00	.94	1152.14	.00	.00	1152.16	.01	4.09	.01	1152.00
80.	0.	79.	1.	2.	87.	4.	6.	9.	1152.00
.51	.20	.91	.16	.090	.075	.110	.000	1151.20	278.58
.004775	300.	300.	300.	10	0	0	.00	231.41	509.98

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

```
#SECNO 17.000
    17.00      .62  1154.42      .00      .00  1154.44      .02     2.29      .00  1154.00
     80.       10.       66.       4.       18.       52.       9.       7.       11.  1154.00
      .60       .57      1.25      .47      .090      .075      .110      .000  1153.80   115.31
   .009477     350.      350.      350.         9         0         0      .00   227.04   342.35
0
```

THIS RUN EXECUTED 12/ 6/89 23:53:19

****
HEC2 RELEASE DATED SEPT 88

****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	1130.20	169.00	1133.27	.00	1133.37	100.10	3.30	77.33	16.89
*	2.000	260.00	.00	.00	1131.80	169.00	1134.82	.00	1134.88	41.72	2.46	108.60	26.17
*	3.000	120.00	.00	.00	1132.50	162.00	1135.55	.00	1135.69	123.50	3.28	64.99	14.58
	4.000	60.00	.00	.00	1133.50	162.00	1136.40	.00	1136.60	184.55	3.78	53.15	11.92
*	5.000	190.00	.00	.00	1135.90	162.00	1138.51	.00	1138.71	73.68	3.77	53.74	18.87
*	6.000	210.00	.00	.00	1137.40	158.00	1139.49	.00	1139.55	26.07	2.51	98.81	30.95
*	7.000	60.00	.00	.00	1138.40	158.00	1139.88	1139.88	1140.19	208.65	5.37	42.65	10.94
*	8.000	70.00	.00	.00	1138.00	158.00	1140.57	.00	1140.62	23.36	2.56	98.16	32.69
*	9.000	85.00	.00	.00	1139.00	122.00	1141.07	1141.07	1141.30	257.11	6.49	38.62	7.61
*	10.000	80.00	1145.10	1142.00	1139.70	122.00	1144.70	.00	1144.70	.18	.37	561.90	289.00
*	11.000	100.00	.00	.00	1142.40	122.00	1144.70	.00	1144.71	7.29	1.27	190.68	45.20
*	12.000	100.00	.00	.00	1142.80	122.00	1144.81	.00	1144.85	30.42	2.13	115.33	22.12
*	13.000	100.00	.00	.00	1144.00	122.00	1145.48	1145.48	1145.65	189.44	4.02	57.50	8.86
*	14.000	200.00	.00	.00	1145.50	122.00	1146.40	.00	1146.41	15.24	.71	208.36	31.25
*	15.000	400.00	.00	.00	1147.50	80.00	1147.94	1147.94	1148.06	1412.24	2.72	29.37	2.13
*	16.000	300.00	.00	.00	1151.20	80.00	1152.14	.00	1152.16	47.75	.91	91.95	11.58
	17.000	350.00	.00	.00	1153.80	80.00	1154.42	.00	1154.44	94.77	1.25	79.24	8.22

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	169.00	1133.27	.00	.00	-.03	63.48	.00
*	2.000	169.00	1134.82	.00	1.56	.00	94.79	260.00
*	3.000	162.00	1135.55	.00	.72	.00	89.59	120.00
	4.000	162.00	1136.40	.00	.86	.00	76.53	60.00
*	5.000	162.00	1138.51	.00	2.10	.00	83.36	190.00
*	6.000	158.00	1139.49	.00	.99	.00	110.31	210.00
*	7.000	158.00	1139.88	.00	.39	.00	70.95	60.00
*	8.000	158.00	1140.57	.00	.69	.00	115.78	70.00
*	9.000	122.00	1141.07	.00	.50	.00	86.21	85.00
*	10.000	122.00	1144.70	.00	3.63	.00	270.69	80.00
*	11.000	122.00	1144.70	.00	-.00	.00	270.11	100.00
*	12.000	122.00	1144.81	.00	.11	.00	219.09	100.00
*	13.000	122.00	1145.48	.00	.67	.00	178.19	100.00
*	14.000	122.00	1146.40	.00	.92	.00	443.95	200.00
*	15.000	80.00	1147.94	.00	1.54	.00	132.75	400.00
*	16.000	80.00	1152.14	.00	4.20	.00	231.41	300.00
	17.000	80.00	1154.42	.00	2.28	.00	227.04	350.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 2.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 3.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 5.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 6.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 7.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 7.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 7.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO= 8.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 9.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 9.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 9.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO= 10.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 11.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 12.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 13.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 13.000 PROFILE= 1 MINIMUM SPECIFIC ENERGY

WARNING SECNO= 14.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 15.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 15.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 15.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO= 15.000 PROFILE= 1 SLOPE TOO STEEP

WARNING SECNO= 16.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

C:\HECEXE>

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**************************************************
*  WATER SURFACE PROFILES                        *
*  VERSION OF SEPTEMBER 1988                     *
*                                                *
*                                                *
*  RUN DATE    12/ 6/89   TIME   17:37:55        *
**************************************************
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```
**************************************
*  U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER *
*  609 SECOND STREET, SUITE D        *
*  DAVIS, CALIFORNIA 95616           *
*  (916) 756-1104                    *
**************************************
```

EXISTING
(ALTERNATIVE HYDRAULICS - WITH ENCROACHMENTS)

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX  XXXXX              XXXXXXX
```

END OF BANNER

1

12/ 6/89 17:37:55

THIS RUN EXECUTED 12/ 6/89 17:37:55

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**************************************************
  HEC2 RELEASE DATED SEPT 88

**************************************************
```

```
T1      KENNECOT FLAMBEAU PROJECT                DECEMBER, 1989
T2      CULVERT PLACEMENT HYDRAULICS             FOTH & VAN DYKE:MDL
T3      SMALL TRIBUTARY TO FLAMBEAU RIVER        FILE: "KENECULV.DAT"

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                    .010                          169     1133.3

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1
```

LOCATION OF PROPOSED DOWNSTREAM CULVERT
LOCATION OF PROPOSED RAILROAD CULVERT
LOCATION OF EXISTING 36" CULVERT

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#PROF 1

CCHV= .100 CEHV= .300

#SECNO 1.000

1.00	3.07	1133.27	.00	1133.30	1133.37	.11	.00	.00	1132.00
169.	5.	88.	75.	5.	27.	46.	0.	0.	1131.70
.00	1.09	3.30	1.65	.100	.075	.100	.000	1130.20	192.09
.010010	0.	0.	0.	0	0	5	.00	63.48	255.57

0

#SECNO 2.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

2.00	3.02	1134.82	.00	.00	1134.88	.06	1.51	.00	1132.50
169.	20.	99.	50.	19.	40.	49.	1.	0.	1132.50
.04	1.05	2.46	1.02	.100	.075	.100	.000	1131.80	93.41
.004172	250.	260.	220.	3	0	0	.00	94.79	188.20

0

#SECNO 3.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3.00	3.05	1135.55	.00	.00	1135.69	.14	.78	.02	1135.00
162.	6.	137.	19.	7.	42.	16.	1.	1.	1134.60
.05	.86	3.28	1.18	.085	.070	.090	.000	1132.50	159.31
.012350	150.	120.	100.	2	0	0	.00	89.59	248.89

0

#SECNO 4.000

4.00	2.90	1136.40	.00	.00	1136.60	.20	.90	.02	1136.00
162.	3.	144.	14.	4.	38.	11.	1.	1.	1135.60
.05	.82	3.78	1.31	.085	.070	.090	.000	1133.50	164.78
.018455	60.	60.	60.	2	0	0	.00	76.53	241.31

0

#SECNO 5.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

5.00	2.61	1138.51	.00	.00	1138.71	.20	2.11	.00	1138.00
162.	12.	147.	3.	12.	39.	3.	1.	1.	1138.00
.07	1.02	3.77	1.02	.050	.045	.050	.000	1135.90	213.06
.007368	200.	190.	185.	5	0	0	.00	83.36	296.42

0

```
    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST


 #SECNO 6.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      6.00      2.09  1139.49       .00       .00  1139.55       .06       .83       .01  1138.00
      158.       58.       68.       31.       46.       27.       25.        1.        2.  1138.00
       .10      1.25      2.51      1.25      .050      .045      .050      .000  1137.40   133.03
   .002607      170.      210.      200.         4         0         0       .00    110.31   243.34
0
 #SECNO 7.000
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
      7.00      1.48  1139.88  1139.88       .00  1140.19       .31       .34       .08  1139.00
      158.       40.       97.       21.       16.       18.        9.        1.        2.  1139.00
       .10      2.48      5.37      2.48      .050      .045      .050      .000  1138.40   158.62
   .020865       60.       60.       60.        20        19         0       .00     70.95   229.57
0
 #SECNO 8.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      8.00      2.57  1140.57       .00       .00  1140.62       .05       .41       .03  1139.00
      158.       60.       53.       45.       43.       21.       34.        2.        2.  1139.00
       .11      1.39      2.56      1.31      .050      .045      .050      .000  1138.00   -20.03
   .002336       60.       70.      120.         4         0         0       .00    115.78    95.75
0
 CCHV=      .300 CEHV=      .500
 #SECNO 9.000

 3301 HV CHANGED MORE THAN HVINS

 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

 3470 ENCROACHMENT STATIONS=      198.5     201.5  TYPE=       1  TARGET=        3.000
  ELENCL=   1145.10  ELENCR=   1145.10
      9.00      4.46  1143.46  1143.46       .00  1145.33      1.87       .38       .91  1140.50
      122.        0.      122.        0.        0.       11.        0.        2.       -2.  1140.50
       .12       .00     10.97       .00      .000      .035      .000      .000  1139.00   198.50
   .018460       70.       85.      100.        20        14         0       .00      3.00   201.50
0
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.00	1.50	2.50	.00	1.00	.00	7.10	1.00	1139.70	1139.00

#SECNO 10.000
6870 D.S. ENERGY OF 1145.33 IS HIGHER THAN COMPUTED ENERGY OF 1144.86
PRESSURE AND WEIR FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD	WEIRLN
1150.34	1146.03	.00	68.	55.	7.	8.	1142.00	1145.10	145.

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS= 198.5 201.5 TYPE= 1 TARGET= 3.000
ELENCL= 1145.10 ELENCR= 1145.10

10.00	4.66	1144.36	.00	.00	1146.04	1.68	.00	.00	1141.20
122.	0.	122.	0.	0.	12.	0.	2.	2.	1141.20
.12	.00	10.41	.00	.000	.035	.000	.000	1139.70	198.50
.032578	80.	80.	80.	20	0	7	.00	3.00	201.50

0
CCHV= .100 CEHV= .300
#SECNO 11.000
3280 CROSS SECTION 11.00 EXTENDED 2.25 FEET

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3470 ENCROACHMENT STATIONS= 70.0 150.0 TYPE= 1 TARGET= 80.000

11.00	3.85	1146.25	.00	.00	1146.26	.01	.05	.17	1143.00
122.	29.	38.	55.	77.	46.	94.	2.	2.	1143.00
.16	.38	.83	.58	.078	.050	.060	.000	1142.40	70.00
.000145	100.	100.	100.	3	0	0	.00	80.00	150.00

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#SECNO 12.000
3280 CROSS SECTION 12.00 EXTENDED .26 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3470 ENCROACHMENT STATIONS= .0 300.0 TYPE= 1 TARGET= 299.999

12.00	3.47	1146.27	.00	.00	1146.27	.00	.01	.00	1143.40
122.	39.	7.	77.	202.	16.	318.	3.	3.	1142.80
.28	.19	.43	.24	.078	.050	.060	.000	1142.80	.00
.000045	100.	100.	100.	2	0	0	.00	300.00	300.00

0
#SECNO 13.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3470 ENCROACHMENT STATIONS= .0 500.0 TYPE= 1 TARGET= 499.999

13.00	2.27	1146.27	.00	.00	1146.28	.00	.01	.00	1145.00
122.	47.	30.	45.	151.	36.	111.	4.	3.	1145.00
.34	.31	.85	.40	.078	.050	.060	.000	1144.00	72.50
.000385	100.	100.	100.	0	0	0	.00	398.13	470.63

0

THIS RUN EXECUTED 12/ 6/89 17:38: 0

****
HEC2 RELEASE DATED SEPT 88
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	1130.20	169.00	1133.27	.00	1133.37	100.10	3.30	77.33	16.89
*	2.000	260.00	.00	.00	1131.80	169.00	1134.82	.00	1134.88	41.72	2.46	108.60	26.17
*	3.000	120.00	.00	.00	1132.50	162.00	1135.55	.00	1135.69	123.50	3.28	64.99	14.58
	4.000	60.00	.00	.00	1133.50	162.00	1136.40	.00	1136.60	184.55	3.78	53.15	11.92
*	5.000	190.00	.00	.00	1135.90	162.00	1138.51	.00	1138.71	73.68	3.77	53.74	18.87
*	6.000	210.00	.00	.00	1137.40	158.00	1139.49	.00	1139.55	26.07	2.51	98.81	30.95
*	7.000	60.00	.00	.00	1138.40	158.00	1139.88	1139.88	1140.19	208.65	5.37	42.65	10.94
*	8.000	70.00	.00	.00	1138.00	158.00	1140.57	.00	1140.62	23.36	2.56	98.16	32.69
*	9.000	85.00	.00	.00	1139.00	122.00	1143.46	1143.46	1145.33	184.60	10.97	11.12	8.98
*	10.000	80.00	1145.10	1142.00	1139.70	122.00	1144.36	.00	1146.04	325.78	10.41	11.72	6.76
*	11.000	100.00	.00	.00	1142.40	122.00	1146.25	.00	1146.26	1.45	.83	217.25	101.33
*	12.000	100.00	.00	.00	1142.80	122.00	1146.27	.00	1146.27	.45	.43	535.49	182.25
*	13.000	100.00	.00	.00	1144.00	122.00	1146.27	.00	1146.28	3.85	.85	297.88	62.14

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	169.00	1133.27	.00	.00	-.03	63.48	.00
*	2.000	169.00	1134.82	.00	1.56	.00	94.79	260.00
*	3.000	162.00	1135.55	.00	.72	.00	89.59	120.00
	4.000	162.00	1136.40	.00	.86	.00	76.53	60.00
*	5.000	162.00	1138.51	.00	2.10	.00	83.36	190.00
*	6.000	158.00	1139.49	.00	.99	.00	110.31	210.00
*	7.000	158.00	1139.88	.00	.39	.00	70.95	60.00
*	8.000	158.00	1140.57	.00	.69	.00	115.78	70.00
*	9.000	122.00	1143.46	.00	2.89	.00	3.00	85.00
*	10.000	122.00	1144.36	.00	.90	.00	3.00	80.00
*	11.000	122.00	1146.25	.00	1.90	.00	80.00	100.00
*	12.000	122.00	1146.27	.00	.01	.00	300.00	100.00
*	13.000	122.00	1146.27	.00	.01	.00	398.13	100.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
WARNING SECNO=     2.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     3.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     5.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     6.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     7.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     7.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     7.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=     8.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     9.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     9.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     9.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=    10.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=    10.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=    11.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    12.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    13.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE


C:\HECEXE>MENU2

C:\HECEXE>hec2menu.exe
Stop - Program terminated.

C:\HECEXE>echo off
         ### COED ###
        November  1987
Line length set to  80 characters
    65 Lines read
Help cards loaded
Data Justification turned ONPress <ENTER> to quit, or R to resume edit:
OK

Stop - Program terminated.
C:\HECEXE>COPY KENECULV.DAT,KENICULV.DAT
       1 File(s) copied

C:\HECEXE>MENU2

C:\HECEXE>hec2menu.exe
```

```
        TYPE KENECULV.OUT
1**************************************************
 *  WATER SURFACE PROFILES                        *
 *  VERSION OF SEPTEMBER 1988                     *
 *                                                *
 *                                                *
 *  RUN DATE    12/ 7/89   TIME    9:41:22         *
 **************************************************

                                        **************************************
                                        *  U.S. ARMY CORPS OF ENGINEERS      *
                                        *  THE HYDROLOGIC ENGINEERING CENTER *
                                        *  609 SECOND STREET, SUITE D        *
                                        *  DAVIS, CALIFORNIA 95616           *
                                        *  (916) 756-1104                    *
                                        **************************************

                  X     X  XXXXXXX   XXXXX            XXXXX
                  X     X  X        X     X          X     X
                  X     X  X        X                      X
                  XXXXXXX  XXXX     X          XXXXX   XXXXX
                  X     X  X        X                 X
                  X     X  X        X     X           X
                  X     X  XXXXXXX   XXXXX            XXXXXXX

 END OF BANNER
1
    12/ 7/89       9:41:22                                                    PAGE    1


                                                  THIS RUN EXECUTED 12/ 7/89     9:41:22

 **************************************************
   HEC2 RELEASE DATED SEPT 88

 **************************************************

 T1      KENNECOT FLAMBEAU PROJECT                    DECEMBER, 1989
 T2      CULVERT PLACEMENT HYDRAULICS - 25 YEAR       FOTH & VAN DYKE:MDL
 T3      SMALL TRIBUTARY TO FLAMBEAU RIVER -EXISTING- FILE: "KENECULV.DAT"

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                     .010                          112     1133.3

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                         -1

           LOCATION OF PROPOSED DOWNSTREAM CULVERT
         LOCATION OF PROPOSED RAILROAD CULVERT
         LOCATION OF EXISTING 36" CULVERT
```

```
    SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
    Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
    TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
    SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 #PROF 1

 CCHV=     .100 CEHV=     .300
 #SECNO 1.000
      1.00     2.71  1132.91      .00  1133.30  1133.00      .09      .00      .00  1132.00
      112.        2.      66.      44.        3.      22.      31.        0.        0.  1131.70
       .00      .87     2.94     1.40     .100     .075     .100     .000  1130.20   194.30
    .009992        0.       0.       0.        0        0        7      .00    55.51   249.81
0
 #SECNO 2.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      2.00     2.63  1134.43      .00      .00  1134.48      .05     1.47      .00  1132.50
      112.       12.      74.      26.       13.      34.      28.        0.        0.  1132.50
       .04      .91     2.15      .92     .100     .075     .100     .000  1131.80    96.22
    .003968     250.     260.     220.        3        0        0      .00    71.34   167.56
0
 #SECNO 3.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      3.00     2.68  1135.18      .00      .00  1135.33      .14      .82      .03  1135.00
      107.        0.      102.       5.        1.      33.       5.        1.        1.  1134.60
       .05      .44     3.11      .96     .085     .070     .090     .000  1132.50   175.85
    .015387     150.     120.     100.        2        0        0      .00    53.60   229.45
0
 #SECNO 4.000
      4.00     2.65  1136.15      .00      .00  1136.30      .15      .97      .00  1136.00
      107.        0.      102.       4.        1.      32.       5.        1.        1.  1135.60
       .06      .40     3.22      .95     .085     .070     .090     .000  1133.50   177.60
    .017103       60.       60.       60.        2        0        0      .00    49.98   227.58
0
 #SECNO 5.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      5.00     2.31  1138.21      .00      .00  1138.39      .17     2.08      .00  1138.00
      107.        1.      105.       0.        2.      32.       1.        1.        1.  1138.00
       .07      .59     3.33      .59     .050     .045     .050     .000  1135.90   240.10
    .007595     200.     190.     185.        5        0        0      .00    49.74   289.84
0
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#SECNO 6.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

6.00	1.82	1139.22	.00	.00	1139.27	.05	.87	.01	1138.00
105.	34.	53.	18.	30.	23.	16.	1.	1.	1138.00
.10	1.11	2.29	1.11	.050	.045	.050	.000	1137.40	144.82
.002734	170.	210.	200.	5	0	0	.00	92.18	237.00

0
#SECNO 7.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

7.00	1.29	1139.69	1139.69	.00	1139.96	.27	.36	.07	1139.00
105.	21.	73.	11.	10.	15.	5.	1.	1.	1139.00
.11	2.13	4.83	2.13	.050	.045	.050	.000	1138.40	166.58
.021273	60.	60.	60.	20	19	0	.00	58.70	225.29

0
#SECNO 8.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

8.00	2.32	1140.32	.00	.00	1140.37	.05	.39	.02	1139.00
105.	37.	42.	27.	31.	18.	23.	1.	1.	1139.00
.12	1.18	2.29	1.15	.050	.045	.050	.000	1138.00	-11.50
.002211	60.	70.	120.	4	0	0	.00	96.29	84.79

0
CCHV= .300 CEHV= .500
#SECNO 9.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS= 198.5 201.5 TYPE= 1 TARGET= 3.000
ELENCL= 1145.10 ELENCR= 1145.10

9.00	3.56	1142.56	1142.56	.00	1143.99	1.43	.37	.69	1140.50
81.	0.	81.	0.	0.	8.	0.	1.	1.	1140.50
.12	.00	9.61	.00	.000	.035	.000	.000	1139.00	198.50
.020483	70.	85.	100.	20	14	0	.00	3.00	201.50

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.00	1.50	2.50	.00	1.00	.00	7.10	1.00	1139.70	1139.00

#SECNO 10.000
PRESSURE AND WEIR FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD	WEIRLN
1145.59	1144.69	.00	15.	66.	7.	8.	1142.00	1145.10	80.

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS= 198.5 201.5 TYPE= 1 TARGET= 3.000
ELENCL= 1145.10 ELENCR= 1145.10

10.00	3.57	1143.27	1143.27	.00	1144.69	1.42	2.09	-2.09	1141.20
81.	0.	81.	0.	0.	8.	0.	1.	1.	1141.20
.13	.00	9.57	.00	.000	.035	.000	.000	1139.70	198.50
.034327	80.	80.	80.	20	5	0	.00	3.00	201.50

0
CCHV= .100 CEHV= .300
#SECNO 11.000
3280 CROSS SECTION 11.00 EXTENDED .97 FEET

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3470 ENCROACHMENT STATIONS= 70.0 150.0 TYPE= 1 TARGET= 80.000

11.00	2.57	1144.97	.00	.00	1144.98	.01	.14	.14	1143.00
81.	12.	31.	37.	32.	29.	53.	1.	2.	1143.00
.16	.38	1.07	.71	.078	.050	.060	.000	1142.40	70.00
.000437	100.	100.	100.	4	0	0	.00	80.00	150.00

0

12/ 7/89 9:41:22

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

#SECNO 12.000

3470 ENCROACHMENT STATIONS=			.0	300.0	TYPE=	1	TARGET=	299.999	
12.00	2.22	1145.02	.00	.00	1145.03	.01	.05	.00	1143.40
81.	24.	11.	46.	66.	10.	92.	2.	2.	1142.80
.21	.36	1.14	.50	.078	.050	.060	.000	1142.80	.00
.000625	100.	100.	100.	3	0	0	.00	267.21	267.21

0

#SECNO 13.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=			.0	500.0	TYPE=	1	TARGET=	499.999	
13.00	1.35	1145.35	1145.35	.00	1145.51	.17	.18	.05	1145.00
81.	9.	63.	9.	11.	17.	8.	2.	2.	1145.00
.22	.82	3.69	1.07	.078	.050	.060	.000	1144.00	224.06
.019369	100.	100.	100.	20	11	0	.00	134.53	358.59

0

THIS RUN EXECUTED 12/ 7/89 9:41:28

****
HEC2 RELEASE DATED SEPT 88
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	1130.20	112.00	1132.91	.00	1133.00	99.92	2.94	56.25	11.20
*	2.000	260.00	.00	.00	1131.80	112.00	1134.43	.00	1134.48	39.68	2.15	75.93	17.78
*	3.000	120.00	.00	.00	1132.50	107.00	1135.18	.00	1135.33	153.87	3.11	38.74	8.63
	4.000	60.00	.00	.00	1133.50	107.00	1136.15	.00	1136.30	171.03	3.22	36.93	8.18
*	5.000	190.00	.00	.00	1135.90	107.00	1138.21	.00	1138.39	75.95	3.33	34.29	12.28
*	6.000	210.00	.00	.00	1137.40	105.00	1139.22	.00	1139.27	27.34	2.29	69.91	20.08
*	7.000	60.00	.00	.00	1138.40	105.00	1139.69	1139.69	1139.96	212.73	4.83	30.15	7.20
*	8.000	70.00	.00	.00	1138.00	105.00	1140.32	.00	1140.37	22.11	2.29	72.32	22.33
*	9.000	85.00	.00	.00	1139.00	81.00	1142.56	1142.56	1143.99	204.83	9.61	8.43	5.66
*	10.000	80.00	1145.10	1142.00	1139.70	81.00	1143.27	1143.27	1144.69	343.27	9.57	8.47	4.37
*	11.000	100.00	.00	.00	1142.40	81.00	1144.97	.00	1144.98	4.37	1.07	114.30	38.74
	12.000	100.00	.00	.00	1142.80	81.00	1145.02	.00	1145.03	6.25	1.14	167.56	32.40
*	13.000	100.00	.00	.00	1144.00	81.00	1145.35	1145.35	1145.51	193.69	3.69	36.81	5.82

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	112.00	1132.91	.00	.00	-.39	55.51	.00
*	2.000	112.00	1134.43	.00	1.52	.00	71.34	260.00
*	3.000	107.00	1135.18	.00	.75	.00	53.60	120.00
	4.000	107.00	1136.15	.00	.96	.00	49.98	60.00
*	5.000	107.00	1138.21	.00	2.07	.00	49.74	190.00
*	6.000	105.00	1139.22	.00	1.00	.00	92.18	210.00
*	7.000	105.00	1139.69	.00	.47	.00	58.70	60.00
*	8.000	105.00	1140.32	.00	.64	.00	96.29	70.00
*	9.000	81.00	1142.56	.00	2.24	.00	3.00	85.00
*	10.000	81.00	1143.27	.00	.71	.00	3.00	80.00
*	11.000	81.00	1144.97	.00	1.69	.00	80.00	100.00
	12.000	81.00	1145.02	.00	.06	.00	267.21	100.00
*	13.000	81.00	1145.35	.00	.32	.00	134.53	100.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 2.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 3.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 5.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 6.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 7.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 7.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 7.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO= 8.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 9.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 9.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 9.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO= 10.000 PROFILE= 1 WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO= 10.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO= 11.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 13.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 13.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 13.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

C:\HECEXE>

WSPRO DESIGN FILES - 25 YEAR

```
T1          KENNECOTT FLAMBEAU PROJECT                    FOTH & VAN DYKE: MDL
T2          PROPOSED ROAD AND RAILROAD CULVERTS           DECEMBER, 1989
T3          25-YEAR EVALUATION                            FILE: "KENECLV3"
Q            82
WS          1135.68
CV    3.0   360,200,50,1132.5,1134,1
CG          221,48
EX
ER
```

FROM 25-YEAR HEC2 RUN; X-1.0, 2.0, 3.0

```
C:\WSP>TYPE KENECLV6
T1          KENNECOTT FLAMBEAU PROJECT                    FOTH & VAN DYKE: MDL
T2          PROPOSED ROAD AND RAILROAD CULVERTS           DECEMBER, 1989
T3          25-YEAR EVALUATION                            FILE: "KENECLV6"
Q            82
WS          1140.37
CV    6.0   60,200,50,1137.4,1138.9,2
CG          324,36,58
EX
ER
```

FROM 25-YEAR HEC2 RUN; X-3.0, 5.0, 6.0

```
C:\WSP>TYPE KENECLV9
T1          KENNECOTT FLAMBEAU PROJECT                    FOTH & VAN DYKE: MDL
T2          PROPOSED ROAD AND RAILROAD CULVERTS           DECEMBER, 1989
T3          25-YEAR EVALUATION                            FILE: "KENECLV9"
Q            81
WS          1141.91
CV    9.0   1050,200,65,1139,1140,1
CG          221,36
EX
ER
```

FROM 25-YEAR HEC2 RUN; X-6.0, 8.0, 9.0

```
C:\WSP>TYPE KENECLVX
T1          KENNECOTT FLAMBEAU PROJECT                    FOTH & VAN DYKE: MDL
T2          PROPOSED ROAD AND RAILROAD CULVERTS           DECEMBER, 1989
T3          25-YEAR EVALUATION                            FILE: "KENECLVX"
Q            81
WS          1140.98
CV    9.0   1050,200,65,1139,1140,1
CG          221,36
EX
ER
```

FROM 25-YEAR EXISTING HEC2 RUN; X-1.0 THRU 9.0

C:\WSP>

HEC2 DESIGN FILES - 25 YEAR

```
T1       KENNECOT FLAMBEAU PROJECT                                  DECEMBER, 1989
T2       CULVERT PLACEMENT HYDRAULICS-25 YEAR                       FOTH & VAN DYKE:MDL
T3       SMALL TRIBUTARY TO FLAMBEAU RIVER-PROPOSED                 FILE: "KEN6CULV.DAT"
J1    -10                                                                    82 1139.10
J2                      -1
NC   .080      .08      .05       .1       .3   FROM WSPRO RUN 3
X1    3.0       14      185      210                                                1.
X3                                190.                 210.
GR1147.5       0.0   1147.3       50   1147.0       100  1146.8       160  1146.6       185
GR1134.5     198.0   1133.3    199.0   1132.5       200  1133.3     201.0  1134.0     202.0
GR1146.5       210   1146.6       225  1146.7       300  1146.8       400
NC   .050     .050     .045
X1    5.0         7      260      285       260      245       250
X3                                140                 320
GR   1142       0.0     1140       75      1138      260    1135.9       270     1138       285
GR   1140       330     1144      650
*          LOCATION OF PROPOSED RAILROAD CULVERT
X1    6.0        10      195      210       170      200       210
X3                                190      1145    211.5      1145
GR1145.3       0.0   1145.2       100      1145      195    1138.9     198.5  1138.3     199.2
GR1137.4       200   1138.3    200.8   1138.9       201.5  1145.2       250  1145.3       400
EJ


ER
```

```
C:\HECEXE>TYPE KEN8CULV.DAT
T1       KENNECOT FLAMBEAU PROJECT                                  DECEMBER, 1989
T2       CULVERT PLACEMENT HYDRAULICS-25 YEAR                       FOTH & VAN DYKE:MDL
T3       SMALL TRIBUTARY TO FLAMBEAU RIVER-PROPOSED                 FILE: "KEN9CULV.DAT"
J1    -10                                                                    82 1141.65
J2                      -1
NC   .05       .05      .045      .3       .5   FROM WSPRO RUN 6
X1    6.0         10      195      210                                                .5
X3                                190.5    1145    211.5      1145
GR1145.3       0.0   1145.2       100      1145      195    1138.9     198.5  1138.3     199.2
GR1137.4       200   1138.3    200.8   1138.9       201.5  1145.2       250  1145.3       400
X1    8.0         7       35       45       120      180       130
X3                                20                  85
GR   1145       -70     1145        0      1139       35      1138        40     1139        45
GR   1140        70     1142      160
NC    .05       .05     .035       .3       .5
*          LOCATION OF EXISTING 36" CULVERT
X1    9.0        10    198.5    201.5       70      100        85
X2     81
GR1146.5       0.0     1146      100   1140.6       150  1140.5     198.5  1139.7     199.3
GR   1139       200   1139.7    200.7   1140.5       201.5  1144.2       400  1144.4       500
EJ


ER
```

1 OF 4

EXISTING 25-YEAR HEC2 RUN

```
1*****************************************************
 *  WATER SURFACE PROFILES                           *
 *  VERSION OF SEPTEMBER 1988                        *
 *                                                   *
 *                                                   *
 *  RUN DATE    12/18/89   TIME   12:12:54           *
 *****************************************************

 ****************************************
 *  U.S. ARMY CORPS OF ENGINEERS        *
 *  THE HYDROLOGIC ENGINEERING CENTER   *
 *  609 SECOND STREET, SUITE D          *
 *  DAVIS, CALIFORNIA 95616             *
 *  (916) 756-1104                      *
 ****************************************

X     X  XXXXXXX   XXXXX             XXXXX
X     X  X        X     X          X     X
X     X  X        X                      X
XXXXXXX  XXXX     X          XXXXX   XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX            XXXXXXX

 END OF BANNER
1                                                                          PAGE    1
    12/18/89      12:12:54


                                                    THIS RUN EXECUTED 12/18/89    12:12:54

 ****************************************************
   HEC2 RELEASE DATED SEPT 88

 ****************************************************

 T1      KENNECOT FLAMBEAU PROJECT                  DECEMBER, 1989
 T2      CULVERT PLACEMENT HYDRAULICS - 25 YEAR     FOTH & VAN DYKE:MDL
 T3      SMALL TRIBUTARY TO FLAMBEAU RIVER          FILE: "KENXCULV.DAT"

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                     .010                          112     1133.3

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                         -1

           LOCATION OF PROPOSED DOWNSTREAM CULVERT
```

LOCATION OF PROPOSED RAILROAD CULVERT
LOCATION OF EXISTING 36" CULVERT

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CCHV= .100 CEHV= .300

*SECNO 1.000

1.00	2.71	1132.91	.00	1133.30	1133.00	.09	.00	.00	1132.00
112.	2.	66.	44.	3.	22.	31.	0.	0.	1131.70
.00	.87	2.94	1.40	.100	.075	.100	.000	1130.20	194.30
.009992	0.	0.	0.	0	0	7	.00	55.51	249.81

0

*SECNO 2.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

2.00	2.63	1134.43	.00	.00	1134.48	.05	1.47	.00	1132.50
112.	12.	74.	26.	13.	34.	28.	0.	0.	1132.50
.04	.91	2.15	.92	.100	.075	.100	.000	1131.80	96.22
.003968	250.	260.	220.	3	0	0	.00	71.34	167.56

0

*SECNO 3.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

3.00	2.68	1135.18	.00	.00	1135.33	.14	.82	.03	1135.00
107.	0.	102.	5.	1.	33.	5.	1.	1.	1134.60
.05	.44	3.11	.96	.085	.070	.090	.000	1132.50	175.85
.015387	150.	120.	100.	2	0	0	.00	53.60	229.45

0

*SECNO 4.000

4.00	2.65	1136.15	.00	.00	1136.30	.15	.97	.00	1136.00
107.	0.	102.	4.	1.	32.	5.	1.	1.	1135.60
.06	.40	3.22	.95	.085	.070	.090	.000	1133.50	177.60
.017103	60.	60.	60.	2	0	0	.00	49.98	227.58

0

*SECNO 5.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

5.00	2.31	1138.21	.00	.00	1138.39	.17	2.08	.00	1138.00
107.	1.	105.	0.	2.	32.	1.	1.	1.	1138.00
.07	.59	3.33	.59	.050	.045	.050	.000	1135.90	240.10
.007595	200.	190.	185.	5	0	0	.00	49.74	289.84

0
1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 6.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

6.00	1.82	1139.22	.00	.00	1139.27	.05	.87	.01	1138.00
105.	34.	53.	18.	30.	23.	16.	1.	1.	1138.00
.10	1.11	2.29	1.11	.050	.045	.050	.000	1137.40	144.82
.002734	170.	210.	200.	5	0	0	.00	92.18	237.00

0
*SECNO 7.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

7.00	1.29	1139.69	1139.69	.00	1139.96	.27	.36	.07	1139.00
105.	21.	73.	11.	10.	15.	5.	1.	1.	1139.00
.11	2.13	4.83	2.13	.050	.045	.050	.000	1138.40	166.58
.021273	60.	60.	60.	20	19	0	.00	58.70	225.29

0
*SECNO 8.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

8.00	2.32	1140.32	.00	.00	1140.37	.05	.39	.02	1139.00
105.	37.	42.	27.	31.	18.	23.	1.	1.	1139.00
.12	1.18	2.29	1.15	.050	.045	.050	.000	1138.00	-11.50
.002211	60.	70.	120.	4	0	0	.00	96.29	84.79

0
CCHV= .300 CEHV= .500
*SECNO 9.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

9.00	1.98	1140.98	1140.98	.00	1141.16	.18	.35	.07	1140.50
81.	51.	20.	10.	21.	4.	6.	1.	2.	1140.50
.13	2.37	5.51	1.63	.050	.035	.050	.000	1139.00	146.50
.020306	70.	85.	100.	20	9	0	.00	80.62	227.12

0
1

THIS RUN EXECUTED 12/18/89 12:12:58

****
HEC2 RELEASE DATED SEPT 88

****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	1130.20	112.00	1132.91	.00	1133.00	99.92	2.94	56.25	11.20
*	2.000	260.00	.00	.00	1131.80	112.00	1134.43	.00	1134.48	39.68	2.15	75.93	17.78
*	3.000	120.00	.00	.00	1132.50	107.00	1135.18	.00	1135.33	153.87	3.11	38.74	8.63
	4.000	60.00	.00	.00	1133.50	107.00	1136.15	.00	1136.30	171.03	3.22	36.93	8.18
*	5.000	190.00	.00	.00	1135.90	107.00	1138.21	.00	1138.39	75.95	3.33	34.29	12.28
*	6.000	210.00	.00	.00	1137.40	105.00	1139.22	.00	1139.27	27.34	2.29	69.91	20.08
*	7.000	60.00	.00	.00	1138.40	105.00	1139.69	1139.69	1139.96	212.73	4.83	30.15	7.20
*	8.000	70.00	.00	.00	1138.00	105.00	1140.32	.00	1140.37	22.11	2.29	72.32	22.33
*	9.000	85.00	.00	.00	1139.00	81.00	1140.98	1140.98	1141.16	203.06	5.51	31.20	5.68

1

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

EXISTING 25-YEAR WSPRO RUN

```
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

            *** RUN DATE & TIME: 12-21-89  09:07

   T1         KENNECOTT FLAMBEAU PROJECT                FOTH & VAN DYKE: MDL
   T2         PROPOSED ROAD AND RAILROAD CULVERTS       DECEMBER, 1989
   T3         25-YEAR EVALUATION                        FILE: "KENECLVX"
   Q           81
 *** Q-DATA FOR SEC-ID, ISEQ =              1
   WS         1140.98
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         KENNECOTT FLAMBEAU PROJECT                  FOTH & VAN DYKE: MDL
         PROPOSED ROAD AND RAILROAD CULVERTS         DECEMBER, 1989
         25-YEAR EVALUATION                          FILE: "KENECLVX"
            *** RUN DATE & TIME: 12-21-89  09:07

 *** START PROCESSING CROSS SECTION - "9.0   "
   CV   9.0  1050,200,65,1139,1140,1
   CG        221,36
   EX

 *** FINISH PROCESSING CROSS SECTION - "9.0   "
 *** NOTE -- CULVERT INPUT PRESUMED COMPLETE.
 *** CROSS SECTION "9.0   " WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "9.0   " AT SRD =   1050.  ERR-CODE =      0


 CULVERT PARAMETERS:  ISHAPE   IEQNO      CKE  CVALPH      CN
                         2.      8.      .90    1.12    .035

                      NBBL  CVLENG   USINV   DSINV    XCTR
                        1.    65.0 1140.00 1139.00   200.0

                      RISE    SPAN  BOTRAD  TOPRAD  CORRAD
                     36.00     .00     .00     .00     .00

 +++ BEGINNING PROFILE CALCULATIONS --   1
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         KENNECOTT FLAMBEAU PROJECT                  FOTH & VAN DYKE: MDL
         PROPOSED ROAD AND RAILROAD CULVERTS         DECEMBER, 1989
         25-YEAR EVALUATION                          FILE: "KENECLVX"
            *** RUN DATE & TIME: 12-21-89  09:07
     CULVERT SUMMARY:
```

ISHAPE	RISE	SPAN	BOTRAD	TOPRAD	CORNER
2	36.00	.00	.00	.00	.00

IEQNO	CKE	CN	CVALPH	CVLENG	CVSLPE
8	.90	.035	1.12	65.00	.0154

TWDEP	QBBL	HWIC	HWOC	OTFULL
1.98	81.00	10.03	13.74	5.86

DSUBC	ASUBC	DSUBN	ASUBN
2.82	6.89	3.00	7.07

VELOT	AOUT	VELIN	AIN	HWE
11.75	6.89	11.46	7.07	1152.74

ER

1 NORMAL END OF WSPRO EXECUTION.

C:\WSP>

25-YEAR WSPRO RUN AT X-3.0

```
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

              *** RUN DATE & TIME: 12-21-89  08:19

   T1         KENNECOTT FLAMBEAU PROJECT                 FOTH & VAN DYKE: MDL
   T2         PROPOSED ROAD AND RAILROAD CULVERTS        DECEMBER, 1989
   T3         25-YEAR EVALUATION                         FILE: "KENECLV3"
   Q           82
 *** Q-DATA FOR SEC-ID, ISEQ =              1
   WS         1135.68
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          KENNECOTT FLAMBEAU PROJECT                  FOTH & VAN DYKE: MDL
          PROPOSED ROAD AND RAILROAD CULVERTS         DECEMBER, 1989
          25-YEAR EVALUATION                          FILE: "KENECLV3"
             *** RUN DATE & TIME: 12-21-89  08:19

 *** START PROCESSING CROSS SECTION - " 3.0 "
   CV     3.0  360,200,50,1132.5,1134,1
   CG          221,48
   EX

 *** FINISH PROCESSING CROSS SECTION - " 3.0 "
 *** NOTE -- CULVERT INPUT PRESUMED COMPLETE.
 *** CROSS SECTION " 3.0 " WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID " 3.0 " AT SRD =    360.  ERR-CODE =       0


 CULVERT PARAMETERS:  ISHAPE    IEQNO      CKE  CVALPH       CN
                         2.       8.      .90    1.12     .035

                      NBBL  CVLENG   USINV   DSINV    XCTR
                        1.    50.0 1134.00 1132.50   200.0

                      RISE     SPAN  BOTRAD  TOPRAD  CORRAD
                     48.00      .00     .00     .00     .00

 +++ BEGINNING PROFILE CALCULATIONS --   1
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          KENNECOTT FLAMBEAU PROJECT                  FOTH & VAN DYKE: MDL
          PROPOSED ROAD AND RAILROAD CULVERTS         DECEMBER, 1989
          25-YEAR EVALUATION                          FILE: "KENECLV3"
             *** RUN DATE & TIME: 12-21-89  08:19
     CULVERT SUMMARY:
```

ISHAPE	RISE	SPAN	BOTRAD	TOPRAD	CORNER
2	48.00	.00	.00	.00	.00

IEQNO	CKE	CN	CVALPH	CVLENG	CVSLPE
8	.90	.035	1.12	50.00	.0300

TWDEP	QBBL	HWIC	HWOC	OTFULL
3.18	82.00	6.35	6.60	-.91

DSUBC	ASUBC	DSUBN	ASUBN
2.82	9.48	2.93	9.87

VELOT	AOUT	VELIN	AIN	HWE
7.65	10.71	8.31	9.87	1139.10

ER

1 NORMAL END OF WSPRO EXECUTION.

C:\WSP>

ISHAPE	RISE	SPAN	BOTRAD	TOPRAD	CORNER
2	48.00	.00	.00	.00	.00

IEQNO	CKE	CN	CVALPH	CVLENG	CVSLPE
8	.90	.035	1.12	50.00	.0300

TWDEP	QBBL	HWIC	HWOC	OTFULL
3.18	82.00	6.35	6.60	-.91

DSUBC	ASUBC	DSUBN	ASUBN
2.82	9.48	2.93	9.87

VELOT	AOUT	VELIN	AIN	HWE
7.65	10.71	8.31	9.87	1139.10

ER

1 NORMAL END OF WSPRO EXECUTION.

C:\WSP>

25-YEAR HEC2 RUN X-3.0 TO 6.0

```
1*****************************************************
 *  WATER SURFACE PROFILES                           *
 *  VERSION OF SEPTEMBER 1988                        *
 *                                                   *
 *                                                   *
 *  RUN DATE    12/21/89   TIME    8:33:15           *
 *****************************************************
```

```
****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616             *
*  (916) 756-1104                      *
****************************************
```

```
X    X  XXXXXXX   XXXXX            XXXXX
X    X  X        X    X          X    X
X    X  X        X                    X
XXXXXXX  XXXX    X         XXXXX   XXXXX
X    X  X        X                   X
X    X  X        X    X              X
X    X  XXXXXXX   XXXXX              XXXXXXX
```

END OF BANNER

1

THIS RUN EXECUTED 12/21/89 8:33:15

```
*****************************************************
  HEC2 RELEASE DATED SEPT 88

*****************************************************
```

```
T1      KENNECOT FLAMBEAU PROJECT                  DECEMBER, 1989
T2      CULVERT PLACEMENT HYDRAULICS-25 YEAR       FOTH & VAN DYKE:MDL
T3      SMALL TRIBUTARY TO FLAMBEAU RIVER-PROPOSED FILE: "KEN6CULV.DAT"

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                                                   82    1139.10

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1

        LOCATION OF PROPOSED RAILROAD CULVERT
```

1


```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST
```

```
 *PROF 1
0

 CCHV=     .100 CEHV=     .300
 *SECNO 3.000

 3470 ENCROACHMENT STATIONS=      190.0     210.0  TYPE=      1  TARGET=       20.000
     3.00     5.60  1139.10      .00  1139.10  1139.21      .11      .00      .00100001.00
      82.       0.      82.       0.       0.      31.       0.       0.       0. 100001.00
      .00      .00     2.61      .00     .000     .050     .000     .000  1133.50   194.13
   .003014       0.       0.       0.        0        0        0      .00    10.49   204.62
0
 *SECNO 5.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE


 3470 ENCROACHMENT STATIONS=      140.0     320.0  TYPE=      1  TARGET=      180.000
     5.00     3.43  1139.33      .00      .00  1139.34      .01      .13      .01  1138.00
      82.      27.      49.       6.      82.      60.      20.       1.       1.  1138.00
      .11      .32      .82      .32     .050     .045     .050     .000  1135.90   140.00
   .000197     260.     250.     245.        3        0        0      .00   175.05   315.05
0
 *SECNO 6.000
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

 3470 ENCROACHMENT STATIONS=      190.0     211.5  TYPE=      1  TARGET=       21.500
  ELENCL=   1145.00  ELENCR=   1145.00
     6.00     2.97  1140.37  1140.37      .00  1140.86      .49      .14      .15  1145.00
      82.       0.      46.      36.       0.       7.       8.       1.       1.  1138.90
      .12      .00     6.44     4.42     .000     .045     .050     .000  1137.40   197.66
   .029932     170.     210.     200.       20        9        0      .00    13.84   211.50
0
1
    12/21/89       8:33:15                                                                    PAGE    3



                                                                    THIS RUN EXECUTED 12/21/89      8:33:17

**************************************************
  HEC2 RELEASE DATED SEPT 88

**************************************************

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE  150

      SECNO      XLCH      ELTRD      ELLC      ELMIN       Q       CWSEL     CRIWS      EG       10*KS      VCH       AREA      .01K
```

	3.000	.00	.00	.00	1133.50	82.00	1139.10	.00	1139.21	30.14	2.61	31.39	14.94
*	5.000	250.00	.00	.00	1135.90	82.00	1139.33	.00	1139.34	1.97	.82	162.14	58.45
*	6.000	210.00	.00	.00	1137.40	82.00	1140.37	1140.37	1140.86	299.32	6.44	15.29	4.74

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	3.000	82.00	1139.10	.00	.00	.00	10.49	.00
*	5.000	82.00	1139.33	.00	.23	.00	175.05	250.00
*	6.000	82.00	1140.37	.00	1.03	.00	13.84	210.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 5.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 6.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 6.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 6.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

C:\HECEXE>

25-YEAR WSPRO RUN AT X-6.0

```
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

             *** RUN DATE & TIME: 12-21-89  08:44

   T1         KENNECOTT FLAMBEAU PROJECT                 FOTH & VAN DYKE: MDL
   T2         PROPOSED ROAD AND RAILROAD CULVERTS        DECEMBER, 1989
   T3         25-YEAR EVALUATION                         FILE: "KENECLV6"
   Q           82
 *** Q-DATA FOR SEC-ID, ISEQ =              1
   WS         1140.37
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          KENNECOTT FLAMBEAU PROJECT                   FOTH & VAN DYKE: MDL
          PROPOSED ROAD AND RAILROAD CULVERTS          DECEMBER, 1989
          25-YEAR EVALUATION                           FILE: "KENECLV6"
             *** RUN DATE & TIME: 12-21-89  08:44

 *** START PROCESSING CROSS SECTION - "6.0   "
   CV   6.0  60,200,50,1137.4,1138.9,2
   CG        324,36,58
   EX

 *** FINISH PROCESSING CROSS SECTION - "6.0   "
 *** NOTE -- CULVERT INPUT PRESUMED COMPLETE.
 *** CROSS SECTION "6.0   " WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "6.0   " AT SRD =     60.  ERR-CODE =       0


 CULVERT PARAMETERS:  ISHAPE   IEQNO      CKE  CVALPH       CN
                          3.      8.      .70    1.16     .035

                      NBBL  CVLENG   USINV   DSINV     XCTR
                        2.    50.0 1138.90 1137.40    200.0

                      RISE    SPAN  BOTRAD  TOPRAD  CORRAD
                     36.00   58.00   92.68   29.48    8.52

 +++ BEGINNING PROFILE CALCULATIONS --   1
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          KENNECOTT FLAMBEAU PROJECT                   FOTH & VAN DYKE: MDL
          PROPOSED ROAD AND RAILROAD CULVERTS          DECEMBER, 1989
          25-YEAR EVALUATION                           FILE: "KENECLV6"
             *** RUN DATE & TIME: 12-21-89  08:44
     CULVERT SUMMARY:
```

ISHAPE	RISE	SPAN	BOTRAD	TOPRAD	CORNER
3	36.00	58.00	92.68	29.48	8.52

IEQNO	CKE	CN	CVALPH	CVLENG	CVSLPE
8	.70	.035	1.16	50.00	.0300

TWDEP	QBBL	HWIC	HWOC	OTFULL
2.97	41.00	3.78	4.25	-1.11

DSUBC	ASUBC	DSUBN	ASUBN
1.51	6.49	1.40	5.99

VELOT	AOUT	VELIN	AIN	HWE
3.62	11.34	6.85	5.99	1141.65

ER

1 NORMAL END OF WSPRO EXECUTION.

C:\WSP>

1 OF 3

25-YEAR HEC2 RUN X-6.0 THRU 9.0

```
1*****************************************************
 *  WATER SURFACE PROFILES                           *
 *  VERSION OF SEPTEMBER 1988                        *
 *                                                   *
 *                                                   *
 *  RUN DATE    12/21/89   TIME    8:52:10           *
 *****************************************************
```

```
****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616             *
*  (916) 756-1104                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX            XXXXX
X     X  X        X     X          X     X
X     X  X        X                      X
XXXXXXX  XXXX     X         XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX  XXXXX              XXXXXXX
```

END OF BANNER

1

12/21/89 8:52:10 PAGE 1

THIS RUN EXECUTED 12/21/89 8:52:10

```
*****************************************************
  HEC2 RELEASE DATED SEPT 88

*****************************************************
```

```
T1     KENNECOT FLAMBEAU PROJECT                  DECEMBER, 1989
T2     CULVERT PLACEMENT HYDRAULICS-25 YEAR       FOTH & VAN DYKE:MDL
T3     SMALL TRIBUTARY TO FLAMBEAU RIVER-PROPOSED FILE: "KEN9CULV.DAT"

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                                                   82   1141.65

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1          .

        LOCATION OF EXISTING 36" CULVERT
```

1

12/21/89 8:52:10 PAGE 2

```
    SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
    Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
    TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
    SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 *PROF 1
0

 CCHV=     .300 CEHV=     .500
 *SECNO 6.000

 3470 ENCROACHMENT STATIONS=      190.5     211.5  TYPE=      1  TARGET=       21.000
  ELENCL=   1145.00  ELENCR=   1145.00
      6.00     3.75  1141.65      .00  1141.65  1141.80      .15      .00      .00  1145.50
       82.       0.       35.      47.       0.       10.      16.       0.       0.   1139.40
       .00      .00     3.37     2.96     .000     .045     .050     .000  1137.90   197.21
   .006028       0.       0.       0.        0        0        0      .00    14.29   211.50
0
 *SECNO 8.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE


 3470 ENCROACHMENT STATIONS=       20.0      85.0  TYPE=      1  TARGET=       65.000
      8.00     3.90  1141.90      .00      .00  1141.90      .01      .06      .04  1139.00
       82.       10.       27.      45.      24.       34.      86.       0.       0.   1139.00
       .07       .43       .79      .53     .050     .045     .050     .000  1138.00    20.00
   .000114      120.      130.     180.        2        0        0      .00    65.00    85.00
0
 CCHV=     .300 CEHV=     .500
 *SECNO 9.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE

      9.00     2.91  1141.91      .00      .00  1141.92      .01      .02      .00  1140.50
       81.       50.        7.      24.      74.        6.      53.       1.       0.   1140.50
       .11       .67     1.08      .45     .050     .035     .050     .000  1139.00   137.85
   .000369       70.       85.     100.        2        0        0      .00   139.39   277.25
0
1
    12/21/89       8:52:10                                                              PAGE    3
```

THIS RUN EXECUTED 12/21/89 8:52:11

****
HEC2 RELEASE DATED SEPT 88

****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	6.000	.00	.00	.00	1137.90	82.00	1141.65	.00	1141.80	60.28	3.37	26.31	10.56
*	8.000	130.00	.00	.00	1138.00	82.00	1141.90	.00	1141.90	1.14	.79	143.66	76.65
*	9.000	85.00	.00	.00	1139.00	81.00	1141.91	.00	1141.92	3.69	1.08	133.98	42.15

1 12/21/89 8:52:10 PAGE 4

SMALL TRIBUTARY TO FLAMB

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	6.000	82.00	1141.65	.00	.00	.00	14.29	.00
*	8.000	82.00	1141.90	.00	.25	.00	65.00	130.00
*	9.000	81.00	1141.91	.00	.02	.00	139.39	85.00

1 12/21/89 8:52:10 PAGE 5

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 8.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 9.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

C:\HECEXE>

25-YEAR WSPRO RUN AT X-9.0

```
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

             *** RUN DATE & TIME: 12-21-89  09:11

   T1         KENNECOTT FLAMBEAU PROJECT              FOTH & VAN DYKE: MDL
   T2         PROPOSED ROAD AND RAILROAD CULVERTS     DECEMBER, 1989
   T3         25-YEAR EVALUATION                      FILE: "KENECLV9"
   Q           81
 *** Q-DATA FOR SEC-ID, ISEQ =              1
   WS         1141.91
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          KENNECOTT FLAMBEAU PROJECT              FOTH & VAN DYKE: MDL
          PROPOSED ROAD AND RAILROAD CULVERTS     DECEMBER, 1989
          25-YEAR EVALUATION                      FILE: "KENECLV9"
             *** RUN DATE & TIME: 12-21-89  09:11

 *** START PROCESSING CROSS SECTION - "9.0   "
   CV   9.0  1050,200,65,1139,1140,1
   CG        221,36
   EX

 *** FINISH PROCESSING CROSS SECTION - "9.0   "
 *** NOTE -- CULVERT INPUT PRESUMED COMPLETE.
 *** CROSS SECTION "9.0   " WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "9.0   " AT SRD =   1050.  ERR-CODE =       0


 CULVERT PARAMETERS:  ISHAPE   IEQNO      CKE  CVALPH       CN
                         2.      8.      .90    1.12     .035

                      NBBL  CVLENG   USINV   DSINV    XCTR
                        1.    65.0 1140.00 1139.00   200.0

                      RISE    SPAN  BOTRAD  TOPRAD  CORRAD
                     36.00     .00     .00     .00     .00

 +++ BEGINNING PROFILE CALCULATIONS --   1
1
 WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          KENNECOTT FLAMBEAU PROJECT              FOTH & VAN DYKE: MDL
          PROPOSED ROAD AND RAILROAD CULVERTS     DECEMBER, 1989
          25-YEAR EVALUATION                      FILE: "KENECLV9"
             *** RUN DATE & TIME: 12-21-89  09:11
     CULVERT SUMMARY:
```

ISHAPE	RISE	SPAN	BOTRAD	TOPRAD	CORNER
2	36.00	.00	.00	.00	.00
IEQNO	**CKE**	**CN**	**CVALPH**	**CVLENG**	**CVSLPE**
8	.90	.035	1.12	65.00	.0154
TWDEP	**QBBL**	**HWIC**	**HWOC**	**OTFULL**	
2.91	81.00	10.03	13.74	5.86	
DSUBC	**ASUBC**	**DSUBN**	**ASUBN**		
2.82	6.89	3.00	7.07		
VELOT	**AOUT**	**VELIN**	**AIN**	**HWE**	
11.56	7.01	11.46	7.07	1152.74	

ER

1 NORMAL END OF WSPRO EXECUTION.

C:\WSP>