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PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIROMENT AND PARKS
WATER MANAGEMENT BRANCH

DISTRICT OF SURREY
SERPENTINE RIVER AND CRESCENT BEACH
FLOOD CONTROL WORKS
OPERATION AND MAINTENANCE MANUAL

Victoria, British Columbia
September, 1987
File Nos. P83-9, P84-3 and P85-9

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RECORD OF AMENDMENTS

AMENDMENT DATE	DESCRIPTION

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A. GENERAL

DISTRICT OF SURREY
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1. INTRODUCTION

1.1 Background

Under the terms of Agreements dated April 28, 1983 between the District of Surrey and the B.C. Ministry of Environment and Parks, construction of flood mitigation works on the Serpentine River and Crescent Beach were undertaken during 1983-86. Costs of the construction program were paid by the Province of British Columbia. The District of Surrey (hereinafter known as the Local Authority) accepted responsibility for maintenance under the terms of the Agreement.

1.2 Purpose

The purpose of this manual is to provide general instructions, methods, techniques and data pertinent to the operation and maintenance of flood control works on the Serpentine River and Crescent Beach.

1.3 Description of Works

The work carried out under the 1983-1984 Flood Control Program included upgrading of Crescent Beach between Wickson Road and Burlington Northern Railway right-of-way and upgrading of the dykes along north side of the Serpentine River between the Surrey-Delta boundary and 125A Street. Work carried out under the 1984-85 Flood Control Program included upgrading of the dyke along the north side of the Serpentine River from the King George Highway downstream to the Colebrook Dyking District boundary. Work carried out under the 1985-1986 Flood Control Program included upgrading of Crescent Beach east dykes between Wickson Road and Maple Street.

The Serpentine River dykes protect the low lying farmland against flooding during high tides.

Under the flood control program, the existing dykes were upgraded to improve flood protection and reduce maintenance costs. In general the height of the dyke was increased and brought to the uniform minimum design elevation, the crest of the dyke was widened and capped with gravel to provide a good driving surface for inspection and emergency vehicles. The dyke was widened at the base to improve stability, new rock bank protection was installed, and trees and brush were cleared from the land side of the dyke.

Crescent Beach and its adjacent dykes protect residential property from flooding during high tides and storms.

Under the flood control program, the existing beach was upgraded to improve protection against wave action, flooding during high tides and reduce maintenance costs. (Existing timber groins were upgraded and rock rip-rap placed along Crescent Beach.) The existing Crescent Beach East dykes were abandoned and a new set back dyke constructed between Maple Street pumping station and Dunsmuir Road.

The improvements were made to:

1. Approximately 2.4 km of dyke along the north bank of the Serpentine River immediately to the west of King George Highway and immediately to the east of the Delta/Surrey boundary.

2. Approximately 0.5 km of rock rip-rap beach protection along Crescent Beach between Wickson Road and Sullivan Street.

3. Approximately 1.5 km of timber groins along Crescent Beach between Wickson Road and Sullivan Street.

4. Approximately 1.2 km of dyke adjacent to Crescent Beach between Wickson Road and Maple Street.

1.4 Stream Behaviour and Historical Records

The Serpentine River and Crescent Beach water levels are governed by the tide in Mud Bay and Boundary Bay. The height of the tide in Mud Bay and Boundary Bay can be estimated using the Tide and Current Tables published for each year by the Federal Government of Canada, Fisheries and Oceans.

For Mud Bay and Boundary Bay the tide levels predicted for Point Atkinson in conjunction with corrections listed for Crescent Beach can be used to estimate the height and time of the tide.

It should be noted that the actual tide levels may vary significantly from the predicted values due to weather conditions. The wind and resulting waves; and low barometric pressure may substantially increase the tide levels. Different climatic conditions at Point Atkinson, Mud Bay and Boundary Bay may not necessarily produce coincidental extreme tides and waves at both locations.

The height and timing of the extreme tides vary slightly during each year. Record high tides as measured at Point Atkinson and as estimated for Crescent Beach (using the conversion in the 1987 Tide Tables) are listed below.

Date	Point Atkinson Tide (m)	Estimated Crescent Beach Tide Elevation	
		Tide Datum (m)	Geodetic Datum (m)
Dec. 16, 1982	5.61	5.06	2.06
Jan. 3, 1987	5.55	5.00	2.00

1.5 Dyke Right-of-Way

The Crescent Beach beach protection and the new Crescent Beach East dykes (refer to Section 1.3, Items 2, 3 and 4) are located within right-of-ways owned by the District of Surrey. The Serpentine River dyke (refer to Section 1.3, Item 1) is located on private land. Prior to the construction of the dyke improvements carried out under this program the District of Surrey submitted to the Ministry a written authorization to enter the private property and carry out the work.

All the bank protection and dyke improvements financed under this program are maintained by the District of Surrey.

2. GENERAL INSTRUCTIONS

2.1 Maintenance Requirements

Regular inspection and maintenance of flood control works is necessary to maintain the integrity of the system.

2.1.1 The responsibility for routine dyke maintenance rests with the District of Surrey. Provincial legislative authority relative to the construction and maintenance of dykes is covered under the "Dykes Maintenance Act", a consolidated version of which is attached in Appendix A. A list of agencies concerned with the dyke is attached in Appendix B.

2.1.2 Maintenance requirements are detailed in subsequent sections and generally comprise the following:

a. inspection of all works prior to and during the winter and mid-summer high tide periods and during the summer low tides;

b. removal of trees and brush as growth occurs, and mowing grass as required;

c. excavation and backfill of all animal holes;

d. repair of grass, cobblestone and rock rip-rap bank protection along the water face of dyke;

e. repair of dyke slopes damaged by sloughing, vehicles, cattle and wind or rain erosion;

f. reseeding of slopes as required;

g. inspection, cleaning and repair of drainage ditches, floodboxes and/or pumps constructed to remove seepage water and internal drainage;

h. restoration of the dyke crest to grade to compensate for settlement by adding fill as required, and regrading to a reasonably smooth driving surface;

i. checking and repairing fences and gates;

j. repairing culverts, headwalls, flap gates, etc.;

k. removal of debris and garbage;

l. inspection of new structures constructed in the vicinity of the dyke to verify that the standard of flood protection has not been reduced;

m. prior to the summer season remove rock rip-rap and logs from the beach area (Section 2.1.5);

n. inspect timber groins and repair as required.

2.1.3 Maintenance includes the control of development and construction on, through or in the vicinity of flood control works, to ensure that the standard of protection is maintained.

2.1.4 All work in and about streams is subject to regulatory controls. In addition to local bylaws, maintenance may be subject to Approval under the Water Act. Further information may be obtained from the Regional Water Manager, Water Management Branch. Also, work affecting wildlife and fisheries habitat and/or water quality is subject to regulation under the Fisheries Act as administered by the Fish and Wildlife Branch, B.C. Ministry of Environment and Parks; and Fisheries and Oceans Canada. (Addresses of pertinent agencies are included in Appendix B.)

2.1.5 Prior to each summer season displaced rock rip-rap and logs should be removed from the sandy beach area. Any rock picked up during clean up should be placed on the rip-rap beach embankment.

2.2 Local Authority Controls

Warning signs should be posted at all gates to inform the public of dangers and restrict vehicular access. All gates should be locked with keys released to authorized personnel only.

Livestock should not be allowed access to the dykes.

The Local Authority in conjunction with the Municipality should ensure that development or construction on, through or in the vicinity of the flood control works does not reduce the provided standard of flood protection nor impede ready access for patrolling, inspection and/or maintenance.

2.2.1 Excavation adjacent to and very close to the dykes, bank protection and other flood protection structures should be discouraged. Where excavation is unavoidable, expert advice should be obtained to ensure that the excavation is compatible with stability of the flood control works.

2.2.2 Where pipes, cables or other works must pass through the dyke, the correct use of seepage collars and compacted backfill materials is recommended. Rupture resistant pipe, with mechanical or equivalent joints which will not separate under settlement, shall be used where pipe is laid within the design dyke section. Soils removed should be replaced by a material of equivalent grain size, in a manner that will not reduce the standard of protection.

2.2.3 Trees, shrubs and buildings shall not be allowed to encroach on the dyke.

2.2.4 Access to the dyke crest, slopes and adjacent bank protection shall be maintained to permit inspection and repairs of the dyke, bank protection, and adjacent flood control works. The access road should be all weather and not subject to internal flooding.

2.2.5 Any work or works proposed on or in the immediate vicinity of flood control works comprising the dykes, bank protection, structures or internal drainage works, should be reviewed by the Local Authority, the Inspector of Dykes, and other affected regulatory agencies before work is approved to proceed.

2.2.6 Local bylaws and regulations may be required to regulate work on, through or in the vicinity of flood protection works and to ensure that future development is in accordance with accepted floodplain management practice. Advice on this aspect can be obtained from B.C. Ministry of Environment and Parks, Water Management Branch.

2.2.7 Where work or a new structure is proposed on or adjacent to flood control works and the stability of the works under the new conditions is suspect, an engineering evaluation should be made before the proposed work is approved.

2.3 Emergency Response Planning

Contingency plans and response procedures should be developed to cope with possible emergency conditions.

2.4 Inspections and Patrols

Arrangements should be made for routine semi-annual inspections of the flood control works by staff of the local authority. Additional patrols may be required during and after high tide periods.

2.5 Technical Advice and Assistance

Technical advice and assistance may be obtained through the Inspector of Dykes, B.C. Ministry of Environment and Parks, and other agencies listed in Appendix B.

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B. OPERATION AND MAINTENANCE

3. DYKE

3.1 Basis of Dyke Design

The dyke has been improved to comply with the standards approved by the Ministry of Environment. Under this standard the dyke has been constructed to:

a. Crest elevation - 3.00 metres geodetic

b. Crest width - 3.60 metres

c. Gravel on crest to provide access for patrolling and/or maintenance along the entire length of dyke

d. Side slopes - 2:1

3.1.1 Dyke design crest elevations are provided in metres above sea level, related to the Geodetic Survey of Canada Datum.

Bench Mark No. CM5630, located at the left side of Highway No. 99A over Highway 99 overpass is set at elevation 8.54 metres GSC.

Monument No. 5494 is located on Wickson Road and McBride Avenue and is set at elevation 2.173 metres GSC.

3.2 Seepage

Seepage at the landside toe along the length of dyke is to be expected at higher flood levels. This seepage is considered to be normal, provided flows are not concentrated in the form of boils, and provided that flow does not carry material. Close attention should be paid to seepage, as the safety of the dyke could be threatened by an unnatural increase or concentration of seepage flows.

3.2.1 Special attention should be paid to the landside toe of the dyke. This area should be cropped or mowed prior to high tide seasons so that it can be properly inspected for boils and seepage that could cause piping or slumping.

3.3 Maintenance of Dyke

3.3.1 Routine inspections and work should be undertaken to ensure that the dyke slopes are kept clear of tall weeds and brush on both water and land sides to facilitate inspection. Grass growth on dyke slopes should be preserved to prevent surface erosion.

3.3.2 The growth of trees or shrubs within the dyke should not be allowed since the roots encourage the development of 'pipes', through which flows may develop with sufficient velocity to carry soil particles, and possibly threaten the dyke with a piping failure. Furthermore, trees that are uprooted may reduce the dyke cross section, thus reducing the degree of protection.

3.3.3 The water side dyke slope should be examined for soil slips and instability which could be caused by the rapid drawdown of river levels or other conditions and for possible damage to bank protection (Section 4).

3.3.4 The dyke landside slope should be inspected for cracking and slumping, which could be caused by seepage during sustained high flow periods.

3.3.5 The dyke slopes should be periodically cleared of all debris and garbage.

3.3.6 The dyke should be checked to ensure that no damage has been caused by waves or rain erosion, excavations, pedestrians, vehicles, cattle or other animals. Points of access to the dyke should receive special attention, as damage will occur most frequently at points of greatest traffic. Where damage has occurred, the section should be rehabilitated to its original state.

3.3.7 The dyke crest should periodically be graded to achieve a reasonably smooth driving surface. Care must be exercised so that no material is graded over the edges, thus reducing available freeboard. About every five years the dyke should be surveyed to determine the crest profile and, if necessary, brought up to grade.

3.3.9 The dyke should be provided with vehicle barriers. Fences and gates should be checked prior to high tide periods to ensure that they are in good condition. The gates should open and close freely. Locks should be in working order, keys readily available, and all obstacles to patrolling should be removed from the dyke crest.

3.3.10 If animal holes or burrows are discovered during inspection, they should be excavated and backfilled with compacted fill. Trapping of the animals may be advisable in such areas after consultation with local Fish and Wildlife authorities.

4. BANK PROTECTION

4.1 Basis of Bank Protection Design

Portions of the water side face of the dyke and riverbank have been seeded, provided with a layer of cobblestone or shot rock rip-rap to protect against erosion by wave action and stream flows.

4.1.1 Cobblestone and quarried rock rip-rap was used as bank protection because it forms a flexible layer not impaired or weakened by slight movement resulting from settlement or other minor adjustments. Local damage or loss is readily repaired by the addition of rock where required. An additional thickness has been provided at the toe of new bank protection to offset possible scour.

4.1.2 Suitable durable cobblestone of required size and gradation was obtained from B&B Contracting Ltd. of Cloverdale. Shot rock was obtained from Texada Island. These sources of material may be used in the future repair or extension of the bank protection.

4.1.3 The specifications for cobblestone and rock rip-rap were stipulated on the construction drawings provided with the Contract and Specifications. For the title of this Contract and Specifications refer to List of Drawings in the Table of Contents. This documentation was prepared by Dayton & Knight Ltd. Consulting Engineers Ltd. Reference to those specifications should be made when preparing for maintenance of the works.

4.2 Maintenance of Bank Protection

The bank protection will require varying degrees of maintenance, depending upon location and degree, and frequency of exposure to attack by stream flow or wave action, as well as frost action and weathering processes, and possible dislodgement by foot traffic, floating logs, ice or debris.

4.2.1 Maintenance personnel should acquaint themselves with the areas where bank protection has been constructed and be aware of critical locations where impingement of high wave action and high velocity flows is most acute.

4.2.2 The bank protection works should be thoroughly inspected after the winter high tide period, during the summer low tide period and during the summer high tide period. The need for repair, strengthening or extension should be determined to permit completion of required work before the next high tide period. Subsequent inspection during the low tide should be made to check earlier observations. During the inspections attention should be given to:

a. possible dislodgement or loss of material from the protective layer;

b. possible slumping;

c. possible development of holes which may allow displacement or loss of filters or backing material;

d. deterioration of rock particles by weathering and/or abrasion;

e. possible damage to timber groins.

4.2.3 Routine maintenance of the cobblestone and rip-rap layer to design top elevation and required thickness could best be accomplished by using a backhoe (hydraulic excavator) or clamshell, particularly where additional rock is required at the toe of the bank.

4.2.3 Routine maintenance shall be carried out to repair any damage to the timber groins. Broken timbers and piles shall be replaced. Corroded or damaged connecting bolts shall be replaced.

4.2.4 Prior to the summer season the rip-rap dislodged from the bank protection shall be removed from the recreational beach and put back into the bank protection.

4.2.6 Where severe erosion has occurred or is occurring at points of concentrated attack, redesign of protection should be undertaken before permanent repairs are effected.

5. FLOODBOXES

5.1 Basis of Design of Floodboxes

The dyke has been provided with flapgated floodboxes to allow passage of internal drainage into the river as located on Drawing Nos. 84-6-1 and 85-9-1 and detailed on Drawing No. 85-9-8. These have been designed in accordance with local drainage works in existence at the time of construction of the dyking system.

During high tide levels, the flapgates will automatically close under pressure from the rising water and prevent intrusion of river water. At such times, it is possible that local runoff, snowmelt and rising groundwater tables will cause temporary disruption to local drainage within the dyked area. In extreme circumstances it may be advisable to employ temporary pumping to alleviate such conditions.

5.2 Maintenance of Floodboxes

5.2.1 The inlets, trashracks and outlets of all floodboxes should be regularly cleared and cleaned of debris and sediment. At the same time the floodbox barrels should be examined and cleared of blockages.

5.2.2 The slopes adjacent to structures should be periodically cleared and trimmed as necessary to ensure that material cannot slough over the openings. A check should be made that neither the inlet nor outlet has been undermined by erosion or scour, and appropriate repairs made. Drainage ditches leading to and/or from the floodbox should be cleared.

5.2.3 The flapgates should be periodically cleaned and lubricated ensuring that they swing freely and close properly with a good seal. The gates should be painted as required with a high quality rust resistant primer and paint.

6. INSPECTIONS AND PATROLS

6.1 Routine Semi-annual Inspections

Inspections should be undertaken during low tide periods specifically in early fall before winter high tides and also in early summer prior to summer high tides. The purpose of these inspections would be to assess the need for routine maintenance as discussed in Sections 3 and 4 of this manual.

6.2 Patrols During High Tide and Extreme Storm Periods

Additional inspections should be undertaken as conditions warrant during high tide periods and storms. During very high tide events, frequent patrols along the dyke crest would be advisable.

The Local Authority should establish a local control headquarters and prepare a contingency plan for activities during the extremely high tides and/or during the forcasted or unexpected extreme storms, after earthquakes, or during or after any other event which may impact on stability of the dykes and related facilities.

The local control headquarters should be:

- located above the potential flood levels;
- accessible via roads not affected by the potential flooding and within easy reach of the dykes;
- equipped with telephone and other communication equipment warranted.

The contingency plan should provide for:

a. appointment of a coordinator responsible for preparation and activation of the local control headquarters and the contingency plan;

b. yearly review of the tide tables and preparation of a dyke patrol schedule for the duration of the extreme high tides (two person patrols are desirable);

c. regular monitoring of weather forcasts for extreme storms and regular monitoring of weather in the Local Authority area for unexpected extreme storms; provision for activation of the dyke patrols when conditions warrant;

d. preparation of a list of personnel who can be called for unscheduled dyke patrols during the extreme storms and after earthquakes (two person patrols are desirable);

e. purchase, storing and maintenance of material and equipment for the patrols including:

- two way portable radios
- keys to all dyke, farm and pumping station gates
- equipment and tools for minor repairs and flood gate opening
- lights
- life jacket preservers
- life lines and reaching poles
- first aid kit

f. arrangements for mobilization of working crews, equipment and materials for emergency dyke repairs.

6.2.1 Local Authority patrols should observe and report to their local control headquarters any occurrence that could signal a weakening of the works such as:

a. excessive seepage on the landside slopes;

b. slumping slopes or other signs of slope instability;

c. boiling near the landside toe of the dyke;

d. seepage along cables or pipes through the dyke;

e. problems experienced with culverts;

f. areas of low freeboard;

g. erosion or slumping of bank protection;

h. cracking or settlement of the dyke crest;

i. floodbox blockages;

j. pumping station malfunction.

Coordination of emergency work should be the sole responsibility of the local control headqarters.

6.3 Dyke Inspection Log

A log, similar to that illustrated in Appendix C, and signed by the inspector, should be kept of all inspections, and reported to the office of the local control headquarters daily. The log should include the following data:

a. date and times commencing and completing inspection;

b. location of areas of seepage, with comments on changes in conditions;

c. location of boils, with comments on number and size, rate of flow, and change in conditions;

d. description of problems experienced at floodboxes;

e. description of any other damage to dykes, bank protection, structures and/or property;

f. description of the condition of dyke crest and sideslopes.

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C. EMERGENCY RESPONSE PLANNING

7. EMERGENCY MEASURES AND REPAIR WORK

7.1 Men and Equipment

The Local Authority should ensure that there is adequate equipment and materials readily available to respond to emergency conditions, and that contingency plans are prepared for more serious circumstances. As the high tide season approaches or extreme storms are forcasted, crews should be advised that they may be called upon, at short notice, to cope with emergencies related to the flood protection works.

7.2 Flood Emergency Procedures

7.2.1 Patrols During High Tide Periods - Inspections should be undertaken as conditions warrant during high tide and extreme storm periods as specified in Section 6.2. Attention should be directed to detection of possible damage to the works. Special attention should be paid to items identified in Section 6.2.1 of this manual.

7.2.2 The Local Authority's work crews should be equipped and on short notice called to undertake emergency work to correct conditions such as:

a. Active Boiling - Active boils can be identified by the seepage water which will be observed to be carrying fine silts and sands. Active boils should be controlled by coverage with a blanket of free drainage filter gravel. Care must be exercised so that the punctured surface layer is not extended or disturbed at other areas. All active areas which cannot be arrested should be reported immediately to the local dyke emergency organization. All "springs" and flowing inactive boils should be flagged and closely monitored throughout the high tide period in case soil transportation is initiated.

b. Excessive Slope Seepage - Where seepage on the dyke's landside slope leads to soggy unstable conditions, free draining fill berms may be added; however, in critical situations expert advice should be obtained, if possible, before taking corrective action.

c. Wave Erosion - Where waves are eroding the face of the dyke, additional rock bank protection may be dumped; however, expert advice should be obtained if critical conditions occur.

d. Local Overtopping - Patrols should pay close attention to occurrence of local overtopping. If a danger of local overtopping presents itself, fill should be added to bring up the crest level.

e. Blocked and Damaged Floodgates - When floodgates become blocked or damaged patrols should be equipped to remove any debris from the floodgate.

f. Special Considerations - Close attention should be paid to areas of special concern as discussed in other sections of this manual.

7.2.3 Under extreme circumstances, should the possibility of uncontrollable dyke failure arise, appropriate emergency warning of the population located in the floodplain would be advisable. Endangered residents should be advised of the nature of the situation and recommendations should be made regarding possible temporary evacuation or other action. Such procedure would best be implemented through the cooperative effort of Local Authority officials with the local R.C.M.P. detachment and the local Provincial Emergency Program Coordinator. The local control headquarters should initiate emergency procedures by informing the local R.C.M.P. detachment and the local Provincial Emergency Program Coordinator. Contingency plans should be developed in anticipation of such conditions by the local control headquarters.

7.2.4 Engineering advice should be obtained regarding permanent corrective action following emergency situations. The Inspector of Dykes should be advised promptly of emergencies so that the area may, if possible, be inspected under critical conditions.

7.3 Records

Cases of severe damage should be recorded. Photographs with locations and dates should be obtained, if possible, before repairs are effected, but this must not in any way interfere with or prejudice emergency work.

APPENDIX A

"Dykes Maintenance Act"

DYKE MAINTENANCE ACT

CHAPTER 99

[Act administered by the Ministry of Environment]

[Consolidated October 15, 1982.]

Interpretation

1. In this Act

"dyke" means an embankment, wall, fill, piling, pump, gate, floodbox, pipe, sluice, culvert, canal, ditch, drain or any other thing that is constructed, assembled or installed to prevent the flooding of land;

"dyking authority" means the commissioners of a district to which Part 2 of the *Drainage, Ditch and Dyke Act* applies, a person owning or controlling a dyke other than a private dyke, a regional district, a municipality or an improvement district;

"improvement district" means an improvement district within the meaning of the *Municipal Act;*

"Inspector of Dykes" means the Inspector of Dykes referred to in section 2 and includes the Assistant Inspector of Dykes;

"municipality" means a municipality as defined for the purposes of the *Municipal Act;*

"order" includes a decision or direction of the Inspector of Dykes;

"private dyke" means a dyke built on private property without public funds to protect only the property of the person owning the private dyke.

RS1960-123-2; 1965-11-2; 1977-75-8; 1978-18-2; 1980-36-17, effective January 1, 1980.

Inspector of Dykes

2. (1) There shall be an official of the Ministry of Environment known as the Inspector of Dykes.

(2) The Inspector of Dykes has general supervision of all dykes and the operation of all dyking authorities relative to the construction and maintenance of dykes, and without limiting the generality of the foregoing he has the power to

(a) enter on any land and on a dyke at any time;

(b) require a dyking authority to repair, replace, renew, alter, add to, improve or remove a dyke, or a part of a dyke, or anything used in connection with a dyke;

(c) require a dyking authority to construct or install a work or thing that in the opinion of the Inspector of Dykes is necessary to protect a dyke or to increase its efficiency;

(d) require a person who is physically fit and over 17 and under 60 years of age, except a railroadman, telegrapher or dispatcher on duty, or a medical practitioner, to do or assist in any work of dyke construction or repair believed necessary to prevent the flooding of property;

(e) require a person to make available to the Inspector of Dykes equipment or material owned or controlled by the person and believed by the Inspector of Dykes to be necessary to prevent the flooding of property;

(f) authorize and empower any person, on conditions the Inspector of Dykes may impose, to place, construct, renew, alter, repair, maintain, operate and use any buildings, structures, machinery, ways, rails, roads, pipes, poles, towers, cables, wires, conduits, conveyers or other works on, along, across, through, over or under any dyke in charge of a dyking authority or any land, so far as an interest in it is held by a dyking authority, and to enter into and on a dyke or land, so far as an interest in it is held by a dyking authority.

(3) The Inspector of Dykes, Assistant Inspector of Dykes and those employees considered necessary may be appointed under the *Public Service Act*.

(4) Except with the approval in writing of the Inspector of Dykes, no dyking authority shall

(a) lower, or cause or allow to be lowered, the elevation or decrease, or cause or allow to be decreased, the width or cross section of a dyke;

(b) install, or cause or allow to be installed, any culvert, pipe, flood box or any structure through a dyke;

(c) construct, or cause or allow to be constructed, any works on or over a dyke or dyke right of way;

(d) alter, or cause or allow to be altered, the foreshore adjacent to a dyke.

RS1960-123-3; 1965-11-3; 1975-73-7; 1977-75-39; 1978-18-3.

Failure to carry out order of inspector

3. If a dyking authority fails to carry out an order or direction of the Inspector of Dykes by the date required, the Inspector of Dykes may do the things required, either by contract or otherwise, and that cost, including any interest he may have to pay, is a debt owing by the dyking authority to Her Majesty the Queen in right of the Province.

RS1960-123-4; 1965-11-4.

Failure by dyking authority to fulfil obligations

4. If a dyking authority fails to pay to Her Majesty the Queen in right of the Province any sum payable by the dyking authority under section 3, the sum may be recovered at the suit of Her Majesty the Queen in right of the Province in any court of competent jurisdiction.

RS1960-123-6; 1965-11-6.

Appeals

5. (1) An appeal lies to the minister from every order of the Inspector of Dykes.

(2) Every appeal under this section shall be taken within 15 days from the date on which the Inspector of Dykes makes the order appealed from.

(3) An appeal is taken within the meaning of this section when notice of intention to appeal has been delivered to the minister and a copy delivered to the Inspector of Dykes.

(4) The appellant from an order of the Inspector of Dykes shall give such further notice of his intention to appeal as may be directed by the Inspector of Dykes.

(5) The minister may, on an appeal under this section, confirm, quash, vary or add to the order appealed from and make any order as to costs as he deems just, and his decision is final.

1965-11-8.

Offence

6. A person commits an offence who

(a) injures or interferes with a dyke or its operation;

(b) hinders a dyking authority, the Inspector of Dykes, or a person acting on behalf of either of them from protecting property from flooding; or

(c) contravenes section 2 (4) or an order of the Inspector of Dykes or the minister.

1978-18-5.

Orders made by inspector

7. Every order made by the Inspector of Dykes shall be in writing, signed by the Inspector of Dykes, and shall be delivered or sent by registered mail to the person or authority to whom it is directed.

RS1960-123-10; 1965-11-10.

Regulations

8. The Lieutenant Governor in Council may make regulations.

RS1960-123-11.

APPENDIX B

List of Agencies Concerned with the

Flood Control Works

List of Project Personnel

Contractors, Engineers, Suppliers

APPENDIX B

Agencies Concerned with the Flood Control Works

AGENCY	INTEREST
Surrey Dyking District 5669 - 176A Street P.O. Box 1180 Cloverdale, Surrey, B.C. V3S 4R2	Safety of the dyke; Structures on or near the dyke; Operation and Maintenance.
Inspector of Dykes Water Management Branch Ministry of Environment and Parks 34345 Vye Road Abbotsbord, British Columbia V2S 4N2	Safety of the dyke; Technical advice.
Ministry of Environment and Parks Water Management Branch Office of the Director Parliament Buildings Victoria, British Columbia V8V 1X5	Safety of the dyke; Future adequacy of the dyke; Floodplain management; Technical advice.
Regional Water Manager Lower Mainland Region Ministry of Environment and Parks 10334 - 152A Street Surrey, B.C. V3R 7P8	Administration of Water Act; Approvals in and about stream; Floodplain management.
Fisheries & Oceans Canada 1090 West Pender Street Vancouver, British Columbia V6E 2P1	Environment, habitat protection; Recreation and commercial fisheries propagation and protection; Fisheries Act.
Regional Manager Fish & Wildlife Branch Ministry of Environment and Parks 10334 - 152A Street Surrey, B.C. V3R 7P8	Environment, habitat protection; Recreational fishing and fish propagation; Fisheries Act.
Manager, Land Administration Ministry of Forests and Lands Lower Mainland Regional Operations (Lands) 210 - 4240 Manor Street Burnaby, B.C V5G 1B2	Dyke right-of-way on Crown land.

APPENDIX B

List of Project Personnel, Engineers, Contractors, Suppliers

	INTEREST
Dayton & Knight Ltd. 626 Clyde Avenue West Vancouver, B.C. V7V 3N9	Consulting Engineer
Golder Associates Ltd. 224 West 8th Avenue Vancouver, B.C. V5Y 1N5	Soil Consultant
Progressive Contracting Ltd. 201 - 5631 No. 3 Road Richmond, B.C. V6K 2C7	General Contractor (1983-1984 Flood Control Program)
District of Surrey 14245 - 56th Avenue Surrey, B.C. V3W 1J2	General Contractor (1985-1986 Flood Control Program)
Ocean Point Contractors Ltd. 1 - 155 Riverside Drive North Vancouver, B.C. V7H 1T6	General Contractor (1984-1985 Flood Control Program)

APPENDIX C

Dyke Inspection Reports

File _____

SEMI ANNUAL DYKE INSPECTION REPORT

Inspector _____

Date _____

The condition of the _____ Flood Control works is as reported below:

DYKES: (slumping, settlement, cracking, erosion, seepage, holes, vegetative growth, garbage, obstructions, access.)

BANK PROTECTION: (Loss of material, settlement, slumping, deterioration of rock)

FLOODBOXES: (sediment, ditches, flapgates)

OTHER: (Water Level Gauges, fences, obstructions on dyke, debris accumulations, emergency materials, sandbags, pumps)

ACTION TAKEN:

_____

Foreman's Signature/Date

Note to Inspector: Circle Applicable items, give location and describe. Attach photographs and plans as required.

File _____

HIGH WATER INSPECTION REPORT

Inspector _____
Date _____

1. Water Levels

2. Freeboard

3. Debris accumulations

4. Water Side Erosion

5. Saturation and Slope Seepage

6. Slope stability, cracking

7. Active boils

8. Culverts/Floodboxes, Internal Drainage

9. Other, Access, etc.

ACTION TAKEN:

Note to Inspector: For use during highwater patrol as per Section 7.2. Attach sketches as required.

APPENDIX D

As-Constructed Drawings

MUD BAY

D.L. 491

D.L. 52

D.L. 231

MON. 8627 ELEV. 3.928m G.S.C. AT ℄ SULLIVAN AND BEECHER

TBM 'C' ELEV. 3.024m G.S.C. TOP BOLT N.E. CORNER OF WHARF

GOVERNMENT WHARF

NORTH BEACH

WEST BEACH

BOUNDARY BAY

MON. 3489 ELEV. 3.279 G.S.C. AT SULLIVAN POINT

SULLIVAN POINT

LIMIT OF CONTRACT

TBM 'A' ELEV. 2.650m G.S.C. NUT AT ARROW ON HYDRANT AT S.W. CORNER OF BEECHER AND O'HARA LANE

TBM 'B' ELEV. 2.970m G.S.C. POST IN S.W. CORNER CONCRETE BLOCK HEADWALL

CROSBY PROPERTY

TULLOCH RD.

CRESCENT ROAD

BURLINGTON NORTHERN RAILWAY

GORDON AVE

MAPLE ST

MCKENZIE AVE

MCBRIDE AVE

SULLIVAN

BEECHER

ALEXANDRA

GARDINER

WICKSON RD

NORTH BEACH

0 50 100 150 200 METRES
1:2500

SITE PLAN

DISTRICT OF SURREY

SEE SITE PLAN

CRESCENT BEACH

BOUNDARY BAY

MUD BAY

1000 0 2000 4000 6000 8000 METRES
1:100 000

KEY PLAN

INDEX TO DRAWINGS

Drawing No.	
5454-6-1	- KEY PLAN, SITE PLAN, INDEX TO DRAWINGS.
	NORTH BEACH
5454-6-2	- NICKSON ROAD TO TABOTT STREET.
5454-6-3	- TABOTT STREET TO SULLIVAN POINT.
	WEST BEACH
5454-6-4	- SULLIVAN POINT TO ALEXANDRA STREET.
5454-6-5	- ALEXANDRA STREET TO BEECHER STREET.
5454-6-6	- BEECHER STREET TO MAPLE STREET.

LEGEND G.S.C. - GEODETIC SURVEY OF CANADA.
0+000 - CHAINAGE IN METRES.
DWL = 2.7m G.S.C.

280 250

REFERENCES			REVISIONS		
DWG. No	DESCRIPTION	DATE	No	DESCRIPTION	DATE
			1	RECORD DRAWING	MAR./87

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG. NO. 196-4 SHT. 1 OF 6

SURVEYED M.MCH.
DATE JUNE 1983
DESIGNED D.K.
CHECKED BV
DATE 28.JUN.83
DRAWN J.S.
CHECKED
DATE

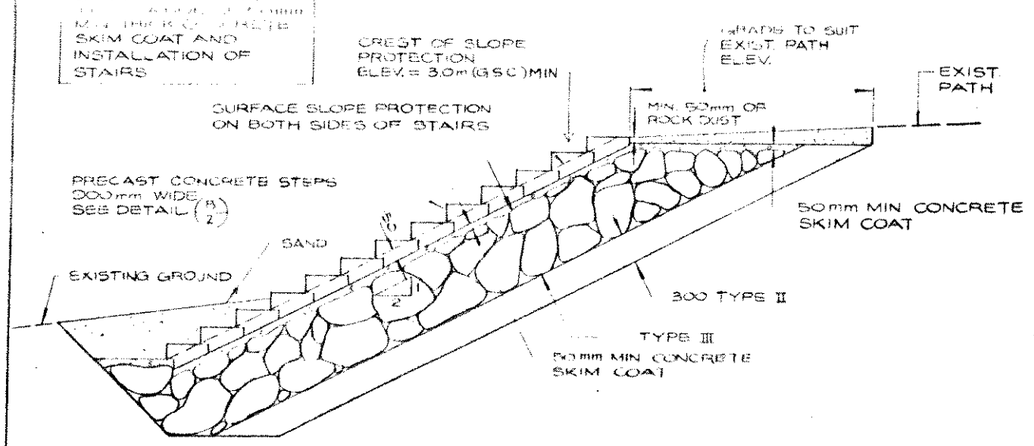
ENGINEER DATE 28 JUN 83 RECOMMENDED DATE APPROVED DIRECTOR DATE

Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

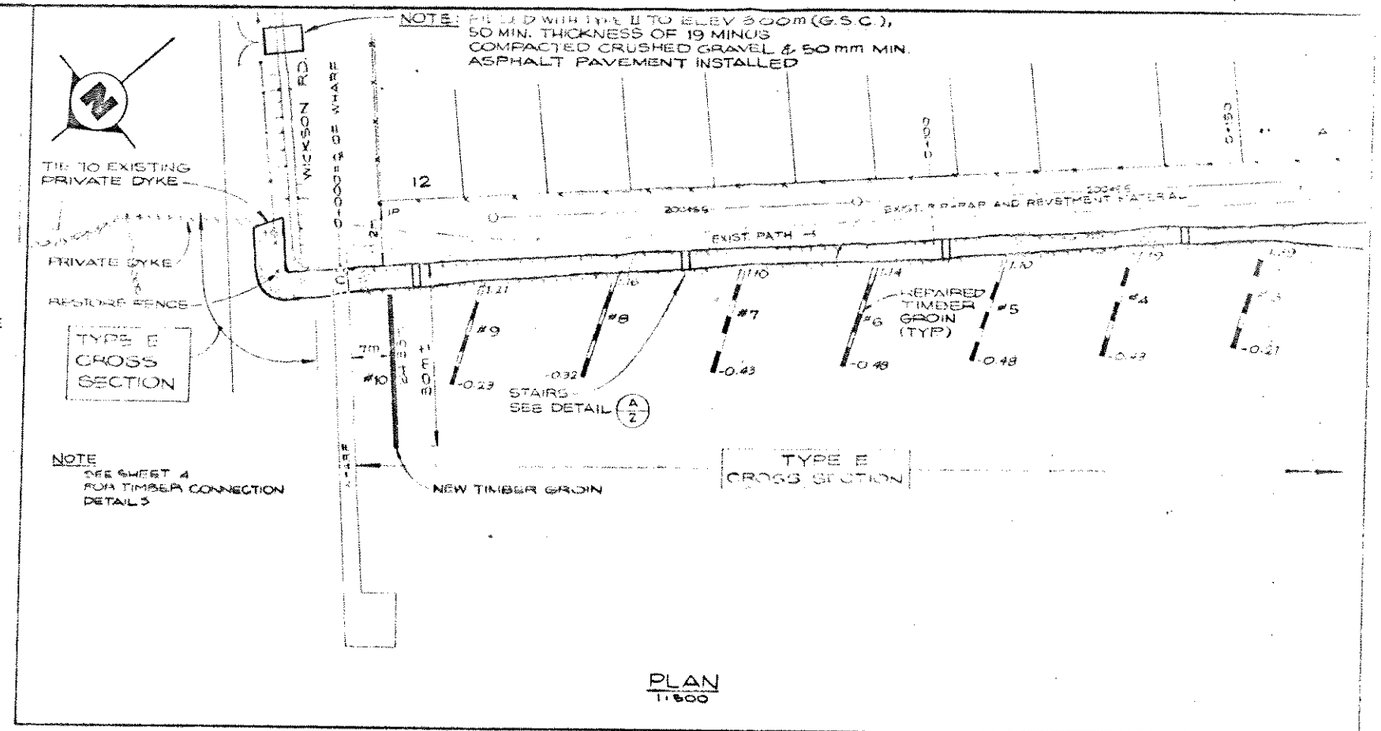
1983 - 1984
FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT No. 1
CRESCENT BEACH EROSION PROTECTION
KEY PLAN, SITE PLAN, INDEX TO DRAWINGS

FILE NO P-83-2
NO. PROJECT NO
AS SHOWN
DRAWING NO. 5454-6-1
SHEET

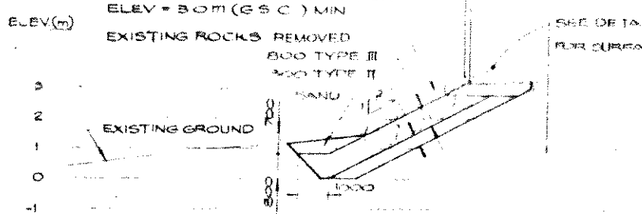
NOTE:
SURFACE OF RIP-RAP GRADED
[illegible] 300mm
[illegible] 50mm
MIN. THICKNESS CONCRETE SKIM COAT AND INSTALLATION OF STAIRS



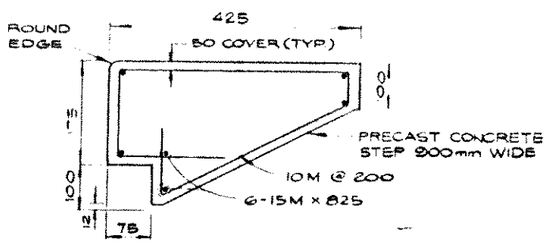
STAIRS DETAIL (A/2)
N.T.S.



PLAN
1:600



TYPE E CROSS SECTION
1:100

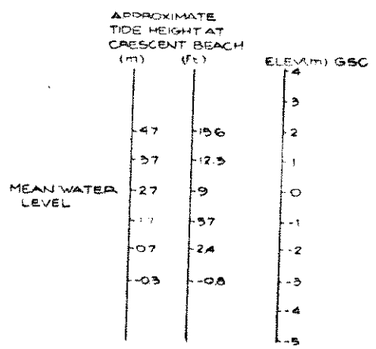


STEP DETAIL (B/2)
N.T.S.

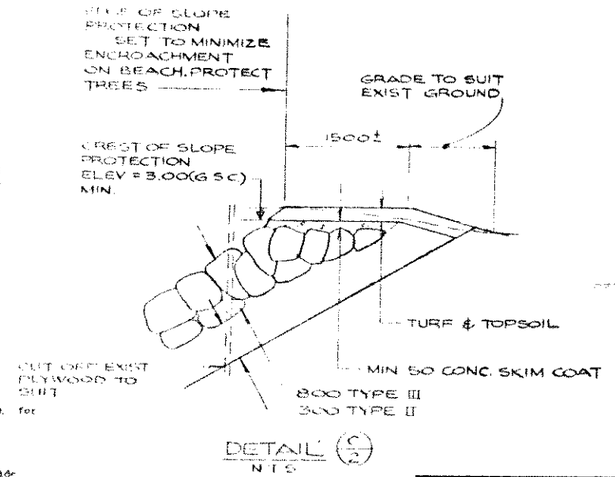
DESCRIPTION OF FILL MATERIALS

TYPE I	NATIVE BEACH MATERIAL
TYPE II	GRADED 150mm MINUS MATERIAL
TYPE III	GRADED 600mm (800 Kg) MINUS ROCK RIP-RAP

TYPE III - ROCK RIP RAP	
PARTICLE SIZE	PERCENTAGE BY WEIGHT FINER THAN
300 kg	100
180 kg	70-80
90 kg	45-55
18 kg	20-30
7 kg	not exceeding 10



Point Atkinson is the reference port for Crescent Beach.
For Point Atkinson Elev. 0 m GSC is approximately a 1 m (10 foot) tide.
For Crescent Beach:
- at Higher High Water the datum Tide is 0.94 m (3.1 ft.) lower than at Point Atkinson.
- at Lower Low Water the datum Tide is 0.41 m (1.4 ft.) lower than at Point Atkinson.



DETAIL (C/2)
N.T.S.

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG NO. 196-4 SHT. 2 OF 6

REFERENCES		
DWG No.	DESCRIPTION	DATE

REVISIONS		
No.	DESCRIPTION	DATE
1	DESIGN OF BANK PROTECTION CHANGED.	AUG.24/83
2	RECORD DRAWING	MAR./87

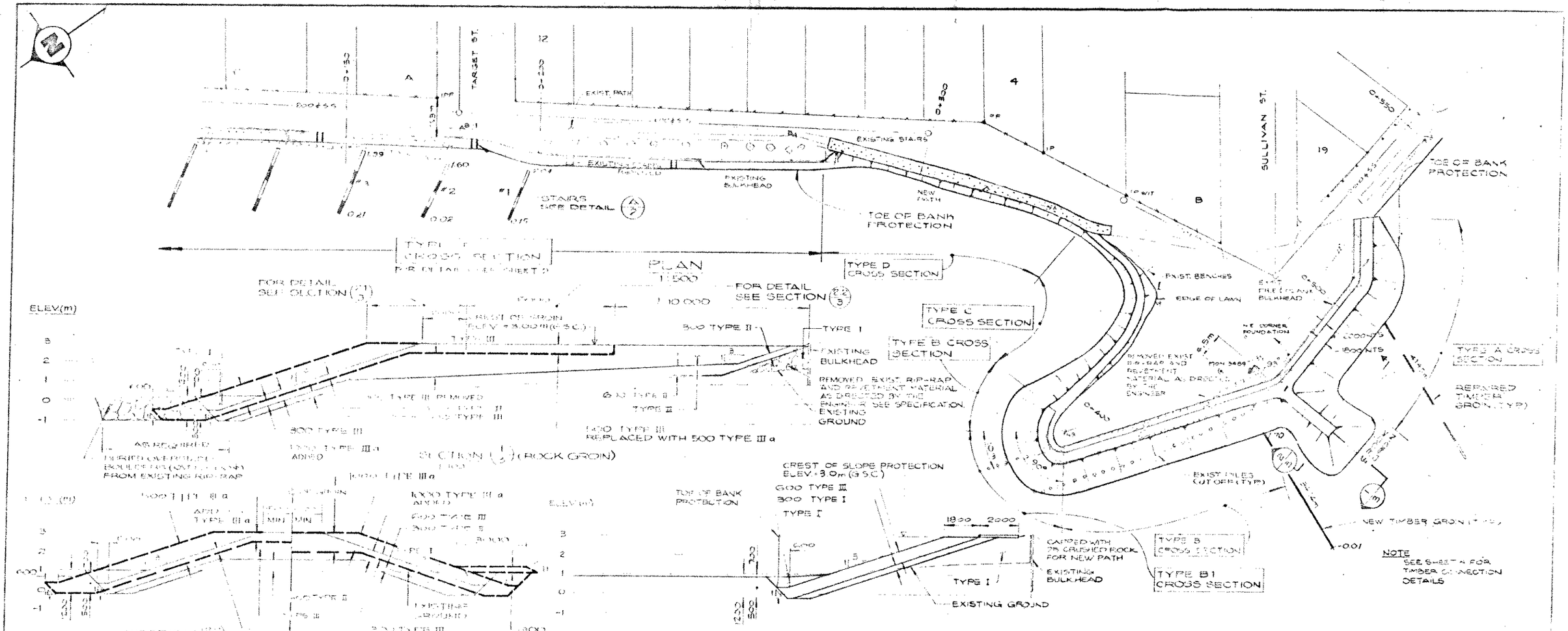
SURVEYED M.McH
DATE JUNE 1983
DESIGNED D.K.
CHECKED BW
DATE 28 July 83
DRAWN J.S.
CHECKED
DATE

Province of British Columbia — Ministry of Environment — WATER MANAGEMENT BRANCH

1983 - 1984
FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 1
CRESCENT BEACH EROSION PROTECTION
MICKSON ST. TO TARGET ST.

B Hilton 28 July 83 — ENGINEER — DATE
RECOMMENDED — DATE
APPROVED — DIRECTOR — DATE

280 251
FILE NO. 1-P-83-2
ENG. PROJECT NO.
MIS MAP NO.
SCALE AS SHOWN
DRAWING NO. 5454-6-2
SHEET 2 OF 6



TYPE III a RIP-RAP ROCK PARTICLE SIZE	PERCENTAGE OF TOTAL WEIGHT OF EACH GIVEN PARTICLE SIZE
600 Kg	100
300 Kg	65 - 80
130 Kg	40 - 55
35 Kg	15 - 25
12 Kg	NOT EXCEEDING 10

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG. NO. 196-4 SHT. 3 OF 6

REFERENCES		
DWG No	DESCRIPTION	DATE

No	REVISIONS DESCRIPTION	DATE
1	DESIGN OF BANK PROTECTION CHANGED	AUG 24/83
2	SECTIONS 1, 2, 8 AND RELATED PORTIONS OF PLAN REVISED	DEC. 1/83
3	RECORD DRAWING	MAR./87

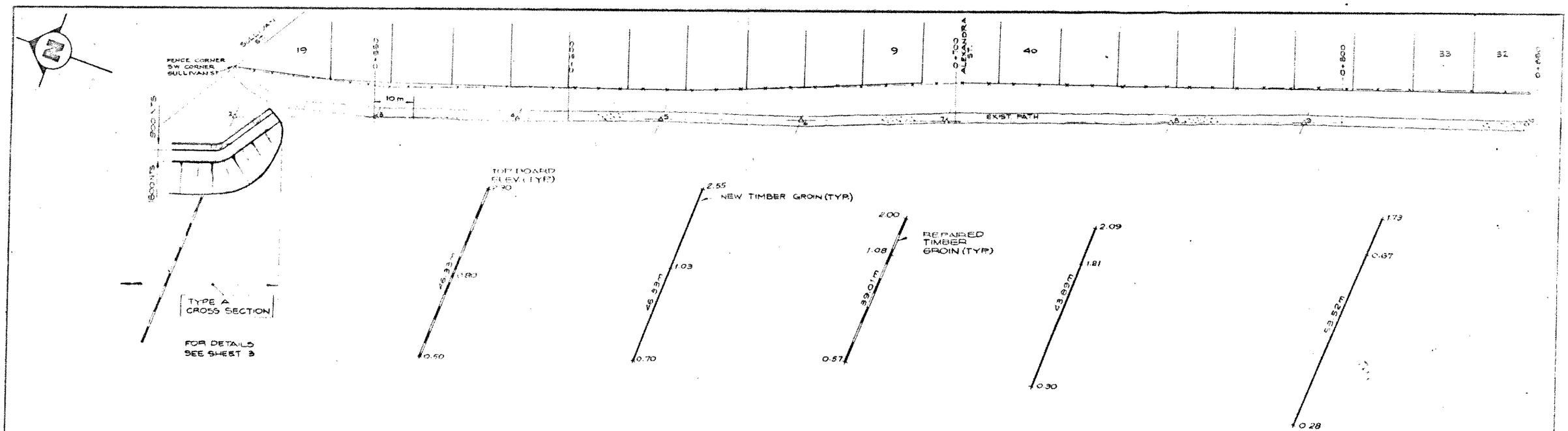
SURVEYED — DATE JUNE 1983
DESIGNED D.M.
CHECKED RW
DATE 28 JULY 83
DRAWN J.S.
CHECKED DMK
DATE 28/11/83
ENGINEER DATE 28 JULY 83
RECOMMENDED DATE
APPROVED DIRECTOR DATE

Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

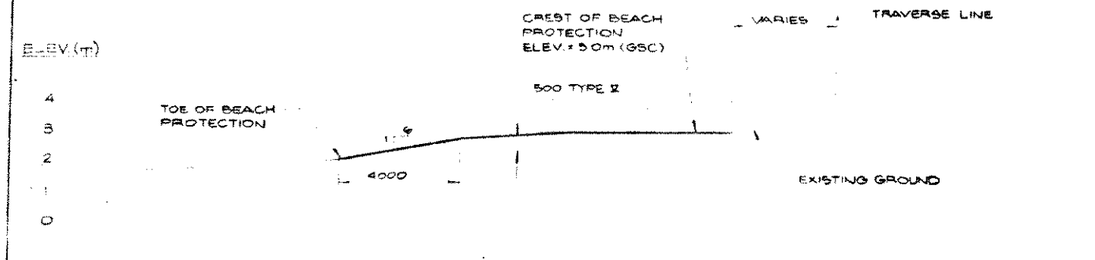
1983 - 1984
FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 1
CRESCENT BEACH EROSION PROTECTION
TARGET ST. TO SULLIVAN POINT

FILE NO D - 83 - 0
ENG PROJECT NO
NTS MAP NO
SCALE AS SHOWN
DRAWING NO 5454 - E - 03
SHEET 3 OF 6

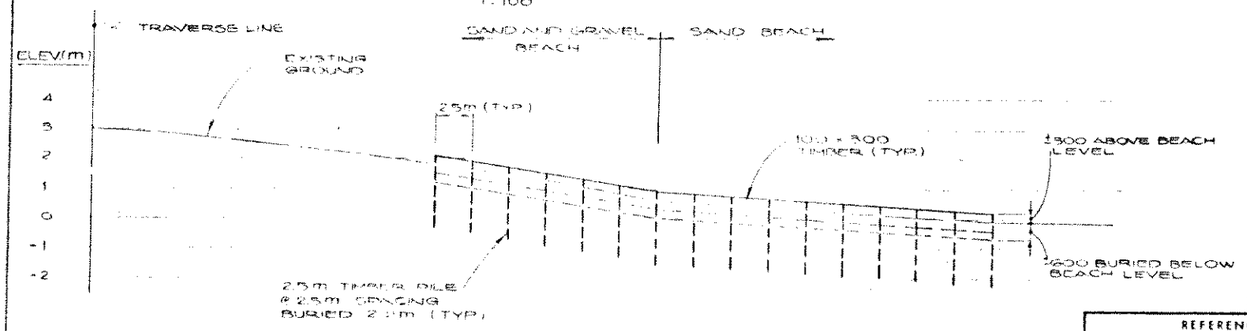
280 252



PLAN
1:500

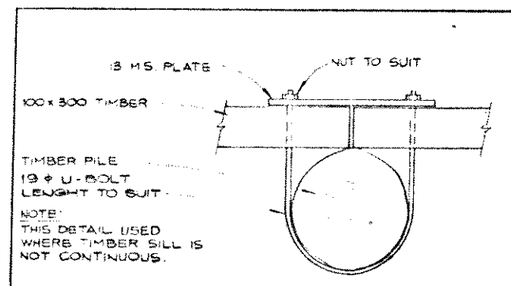


TYPE K CROSS SECTION
1:100

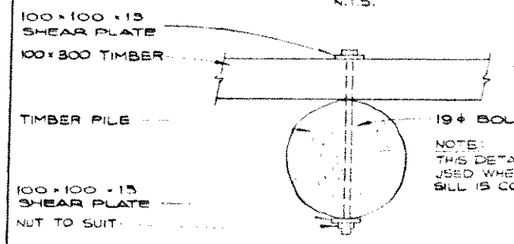


TYPICAL CROSS SECTION ALONG THE ALIGNMENT OF TIMBER GROINS
HORIZ. 1:250
VERT. 1:100

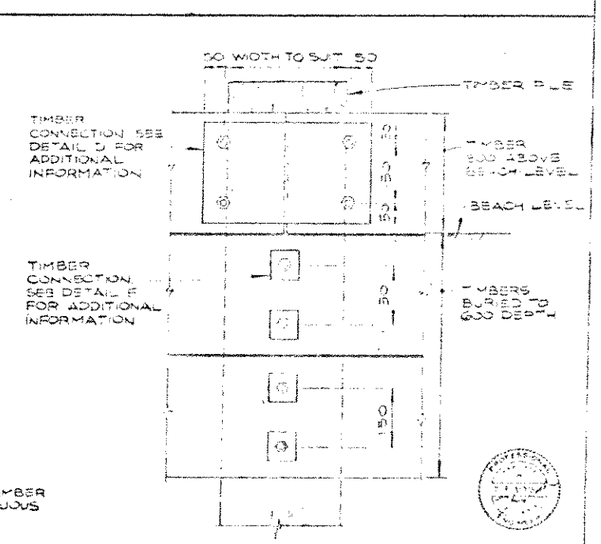
NOTE:
FOR INFORMATION ON TIDE HEIGHTS SEE SHEET 2.



TIMBER CONNECTION DETAIL D
N.T.S.



TIMBER CONNECTION DETAIL E
N.T.S.



TIMBER CONNECTION DETAIL F
N.T.S.

NOTE:
1. ALL BOLT ASSEMBLIES AND PLATES GALVANIZED
2. SEE SPECIFICATION FOR WOOD PRESERVATIVES.

REFERENCES		
DWG No	DESCRIPTION	DATE

REVISIONS		
No	DESCRIPTION	DATE
1	RECORD DRAWING	MAR./87

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG. NO. 196-4 SHT. 4 OF 6

SURVEYED M.M.H.
DATE JUNE 1982
DESIGNED D.K.
CHECKED BW
DATE 28 July 83
DRAWN J.S.
CHECKED
DATE

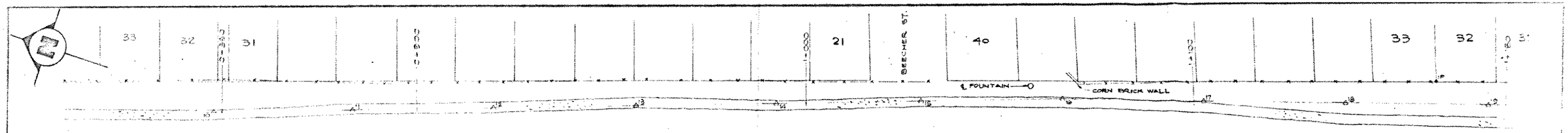
ENGINEER DATE 28 July 83
RECOMMENDED DATE
APPROVED DIRECTOR DATE

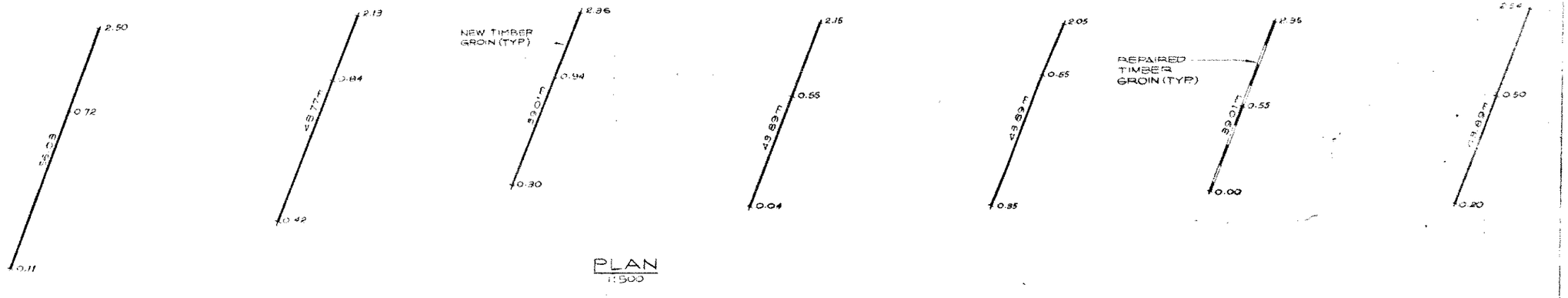
Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

1983 - 1984
FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 1
CRESCENT BEACH EROSION PROTECTION
SULLIVAN POINT TO ALEXANDRA ST.

280253

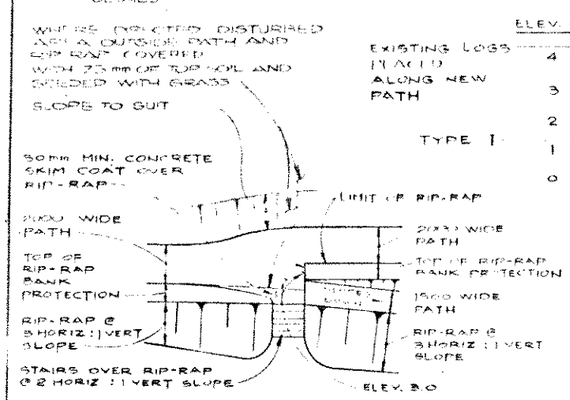
FILE NO P-88-2
ENG. PROJECT NO
NTS MAP NO
SCALE AS SHOWN
DRAWING NO
SHEET



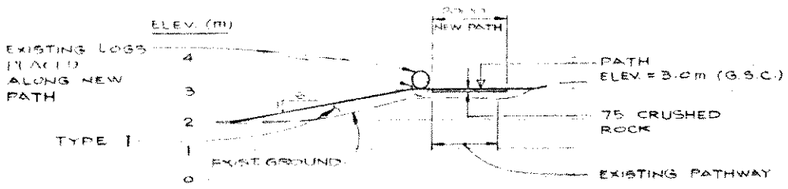


PLAN
1:500

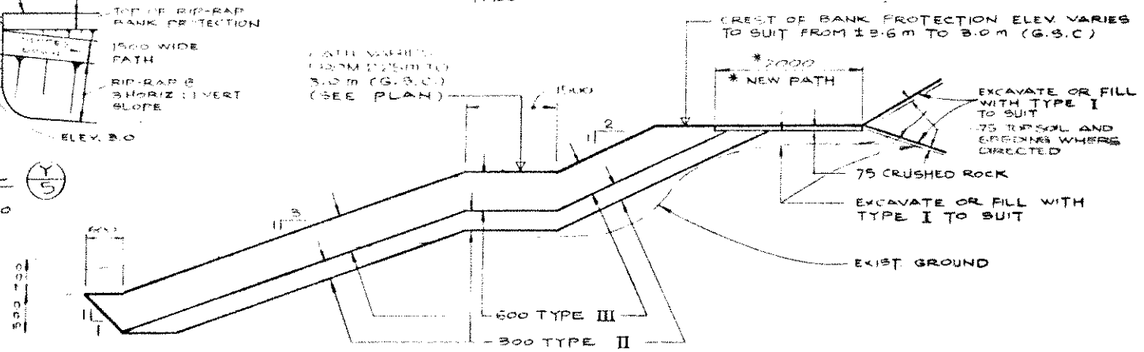
NOTE:
SEE SHEET 4 FOR TIMBER CONNECTION DETAILS



DETAIL (Y/5)
1:200



TYPE L CROSS SECTION
1:100



TYPE M CROSS SECTION
1:50

NOTE:
* NEW PATH AT VICINITY OF MAPLE STREET ONLY

NOTES:

1. THE MINIMUM 28 DAY STRENGTH OF CONCRETE USED FOR SKIM COAT SHALL BE 27.5 MPa. THE CONCRETE MIX SHALL BE SUITABLE FOR SEA WATER EXPOSURE AND SHALL BE SUBMITTED TO THE CORPORATION FOR APPROVAL.
2. EXPANSION JOINTS IN SKIM COATS SHALL BE FORMED AT A MAXIMUM SPACING OF 12 M.
3. CONTRACTING JOINTS SHALL BE CONSTRUCTED AT MAX. 2 M INTERVALS BY FORMING A GROOVE THROUGH SURFACE OF CONCRETE TO A DEPTH OF 12 MM.
4. REINFORCEMENT TO CONTINUE THROUGH EXPANSION AND CONTRACTING JOINTS.
5. THE SURFACE OF CONCRETE SKIM COAT SHALL BE FINISHED PRIOR TO FINAL SET BY BRUSHING TO PROVIDE A UNIFORM, NON-SKID FINISH.

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG. NO. 196-4 SHT. 5 OF 6

REFERENCES			REVISIONS		
DWG No	DESCRIPTION	DATE	No	DESCRIPTION	DATE
			1.	CROSS SECTIONS TYPE L & M AND DETAIL D ADDED.	NOV. 17/83
			2	RECORD DRAWING	MAR./87

SURVEYED M.McH
DATE June 1983
DESIGNED D.K.
CHECKED
DATE 28 July 83
DRAWN MR.
CHECKED
DATE

B. Walker 28/July/83
ENGINEER DATE

RECOMMENDED DATE

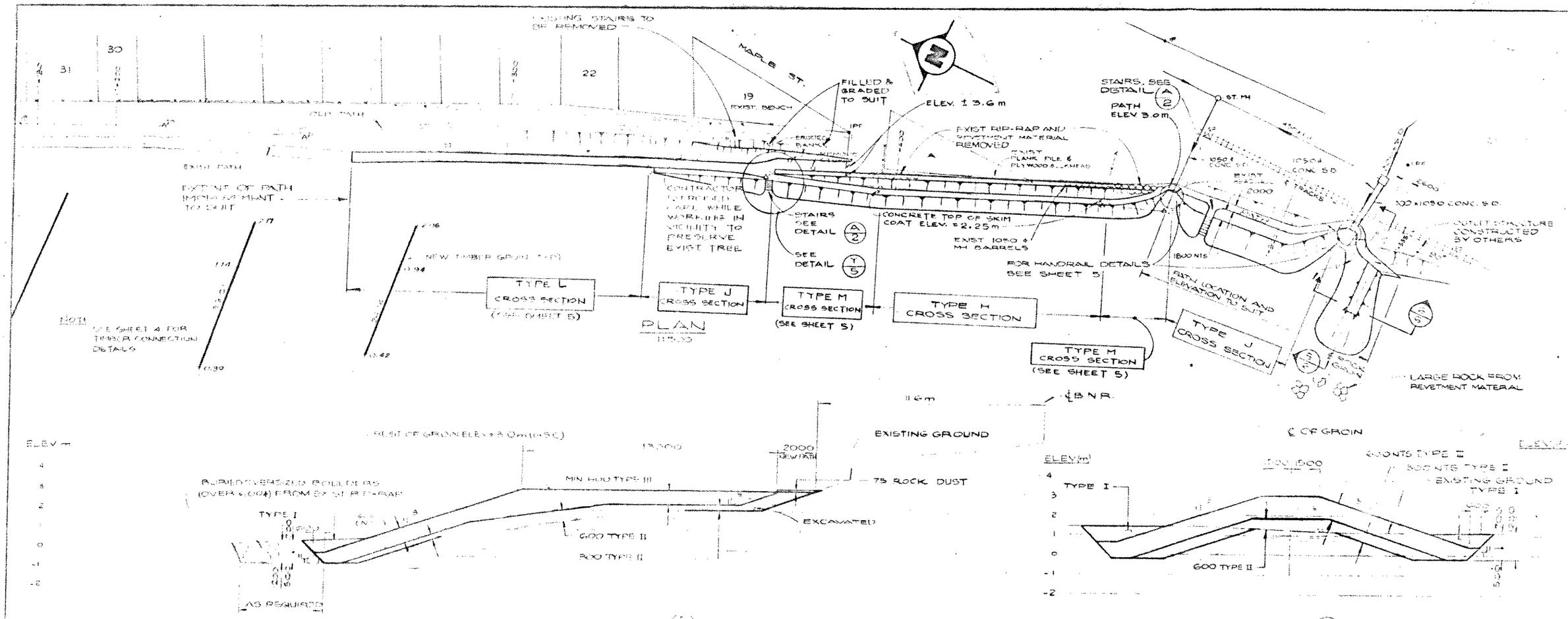
APPROVED DIRECTOR DATE

Province of British Columbia — Ministry of Environment — WATER MANAGEMENT BRANCH

1983 - 1984
FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 1
CRESCENT BEACH EROSION PROTECTION
ALEXANDRA ST. TO BEECHER ST.

280254

FILE NO D-58-9
ENG PROJECT NO
NTS MAP NO
SCALE 1:500 H 1:50 V
DRAWING NO D-58-9-5
SHEET 5 OF 6



NOTE:
FOR INFORMATION ON TIDE HEIGHTS SEE SHEET 2

280255

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG. NO. 196-4 SHT. 6 OF 6

REFERENCES		
DWG No	DESCRIPTION	DATE

REVISIONS		
No	DESCRIPTION	DATE
1	NOTE ADDED TO PRESERVE TREE	AUG 25/83
2	DESIGN OF BANK PROTECTION CHANGED	NOV 17/83
3	RECORD DRAWING	MAR 1/84

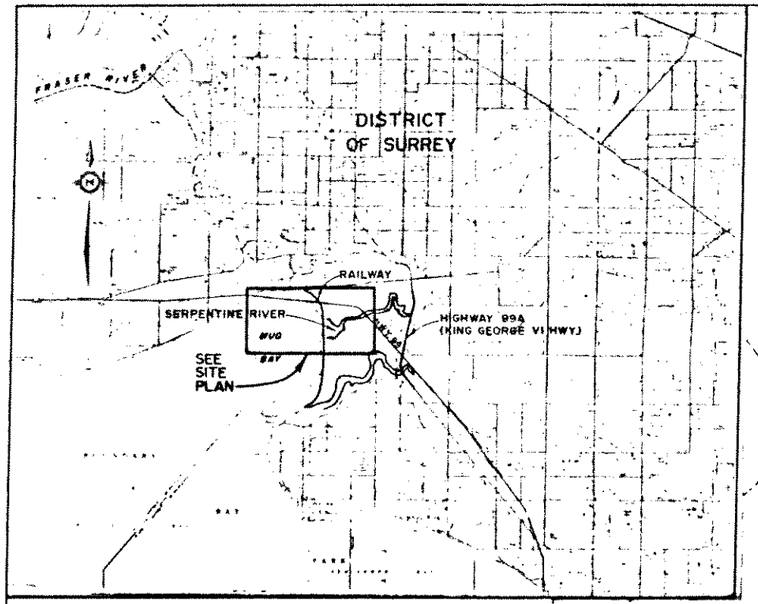
SURVEYED M. Mack DATE JUNE 1983
DESIGNED D.K.
CHECKED BW DATE 15 July 83
DRAWN J.D.
CHECKED DATE

Province of British Columbia — Ministry of Environment — WATER MANAGEMENT BRANCH

1983 - 1984
FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 1
CRESCENT BEACH EROSION PROTECTION
BELCHER ST. TO NAILE ST.

ENGINEER B Washer 28 JULY 83 DATE
RECOMMENDED DATE
APPROVED DIRECTOR DATE

LMD
ENG PROJECT NO
NTS MAP NO
SCALE AS SHOWN
DRAWING NO
SHEET 6 OF



KEY PLAN
1:100 000

SITE PLAN

1:4800

COLEBROOK DYKING DISTRICT BOUNDARY

RECONSTRUCTION OF EXISTING DYKE UNDER SURREY DISTRICT JURISDICTION

RECONSTRUCTION OF EXISTING DYKE UNDER COLEBROOK DYKING DISTRICT JURISDICTION

T.B.M. 'A' ELEV. 3.73m G.S.C. YELLOW MARK ON S.W. ABUTMENT OF NORTHBOUND BRIDGE

T.B.M. 'B' ELEV. 4.33m G.S.C. SPIKE IN TOP N.E. CORNER OF RAILWAY BRIDGE

T.B.M 'C' ELEV 4.30m G.S.C. NAIL IN TOP OF FENCE POST WHERE DYKE MEETS HWY. 99

T.B.M. 'D' ELEV 4.85m G.S.C. TOP OF SOUTH GATE POST ON AT SURREY DELTA BOUNDARY

COLEBROOK DYKING DISTRICT JURISDICTION

CLEARWATER CREEK

SERPENTINE RIVER

RLY.

HYDRO

B.C. ROAD

RAILWAY ROAD

COLEBROOK

HIGHWAY

NORTHERN RAILWAY

BURLINGTON

MUD BAY

TOE DITCH

EXIST. 1200 ϕ CMP CULVERT

EXIST. 900 ϕ CMP CULVERT

GATE

1+626 ℄ OF RAILWAY TRACKS

600ϕ F.R.P. FORCEMAIN STA. 1+810
750ϕ STEEL FORCEMAIN STA. 1+807
STARTS AT MH ON NORTH SIDE OF DYKE

1050 ϕ FLOOD BOX (EXIST.)

0+000 ℄ NE SOUTHBOUND LANE

EXIST 300 ϕ CMP CULVERT

GATE STA. 0+022

GATE STA 0+184.6

ROAD STA. 0+298

NEW 3'-1800 ϕ FLOOD BOX STA. 0+389

1050 ϕ FLOOD BOX STA. 0+516

0+800

1+000

1+200

1+400

E+500

E+000

3+500

3+000

4+000

4+313 ℄ DITCH

4+313 GATE

DRAWING NO. — INDEX TO DRAWINGS

DRAWING NO.	
5451-17- 1	Key Plan, Site Plan, Index to Drawings.
5451-17- 2	Dyke cross sections - STA 0+000 to 0+435
5451-17- 3	Dyke cross sections - STA 0+500 to 0+900
5451-17- 4	Dyke cross sections - STA 1+000 to 1+100
5451-17- 5	Dyke cross sections - STA 1+397 to 1+615
5451-17- 6	Dyke cross sections - STA 1+[illegible] to 2+126
5451-17- 7	Dyke cross sections - STA 2+126 to 2+696
5451-17- 8	Dyke cross sections - STA 2+778 to 3+128
5451-17- 9	Dyke cross sections - STA 3+128 to 3+[illegible]
5451-17-10	Dyke cross sections - STA [illegible] to 3+[illegible]
5451-17-11	Dyke cross sections - [illegible]
5451-17-12	Dyke cross sections - STATIONS 0+075, 1+317, 3+[illegible], [illegible] and 4+[illegible]
5451-17-13	Type A, B, C, D dyke sections
5451-17-14	Clearwater creek floodbox - Existing Topography
5451-17-15	Clearwater creek floodbox - Site Plan
5451-17-16	Clearwater creek floodbox - Sections
5451-17-17	Clearwater creek floodbox - Sections and Details

LEGEND

G.S.C. – GEODETIC SURVEY OF CANADA

D.W.L. – DESIGN WATER LEVEL

Colebrook Dyking District - Serpentine River
1983 - 1984 Flood Control Program

STATION	TOP OF DYKE ELEV	DESCRIPTION
0+075	2.67	Gate
0+080	2.66	
0+180	2.62	
0+199	2.90	
0+280	2.90	
0+380	2.98	
0+480	3.19	
0+580	3.12	
0+680	3.05	
0+780	3.56	
0+880	3.59	
0+980	3.32	
1+060	3.22	
1+180	3.24	
1+260	3.17	
1+380	3.38	
1+480	3.38	
1+580	3.20	
1+605.5	2.71	
1+626		BNR Tracks
1+636	2.92	
1+680	2.98	
1+780	2.92	
1+880	2.92	
1+980	2.97	
2+080	3.05	
2+169	2.74	
2+180	2.92	
2+219	2.78	
2+275	3.23	
2+280	3.23	
2+380	3.03	
2+436	3.00	
2+480	2.92	
2+580	2.84	
2+680	2.86	
2+780	2.94	
2+880	3.02	
2+980	2.97	
3+080	3.13	

Colebrook Dyking District - Serpentine River
1983 - 1984 Flood Control Program

STATION	TYPE OF X-SECTION	DESCRIPTION
0+000 to 0+010	No Work	West lane of Hwy. 99
0+010 to 0+060	C	
0+060 to 0+130	D	
0+130 to 0+340	A2	
0+340 to 0+360	C	
0+360 to 0+415	B1	
0+415 to 0+510	A2	
0+510 to 0+515	B1	
0+515 to 0+560	A1	
0+560 to 0+775	B1	
0+775 to 0+810	D1	
0+810 to 0+890	A2	
0+890 to 1+130	C	
1+130 to 1+300	B	
1+300 to 1+650	No Work	BNR Tracks
1+650 to 1+675	A1	
1+675 to 1+750	B2	
1+750 to 1+800	A1	
1+800 to 1+850	B2	
1+850 to 1+900	A1	
1+900 to 2+050	B2	
2+050 to 2+250	A1	
2+250 to 2+275	B2	
2+275 to 2+850	C	
2+850 to 2+875	No Work	
2+875 to 2+925	B2	
2+925 to 3+050	C	
3+050 to 4+313	No Work	Delta/Surrey Boundry

NOTE : SURVEYED MARCH 5, 1987

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA 280 25S

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DWG. NO. 196-2 SHT 1 OF 17

REFERENCES			REVISIONS		
DWG No.	DESCRIPTION	DATE	No.	DESCRIPTION	DATE
			1	RECORD DRAWING FOR DISTRICT OF SURREY JURISDICTION	MAR 87

SURVEYED M.W.H. DATE APRIL 1983
DESIGNED D.K.
CHECKED [illegible] DATE June 20/83
DRAWN J.S.
CHECKED D.K. DATE June 20/83

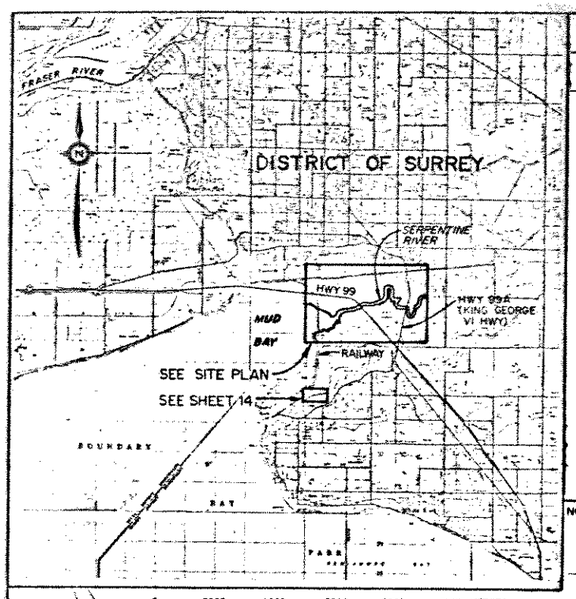
ENGINEER [illegible] DATE June 20/83
RECOMMENDED [illegible] DATE
APPROVED [illegible] DIRECTOR DATE June 21/83

Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

1983-1984 FLOOD CONTROL PROGRAM
COLEBROOK DYKING DISTRICT
CONTRACT NO. 1
SERPENTINE RIVER
DOWNSTREAM FROM HIGHWAY 99
KEY PLAN, SITE PLAN, INDEX TO DRAWINGS

FILE NO P 83-6
ENG PROJECT NO
NTS MAP NO
SCALE AS SHOWN
DRAWING NO. 5451-17-1
SHEET 1 OF 17

KEY PLAN



SITE PLAN

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Colebrook Dyking District - Serpentine River
1984 - 1985 Flood Control Program

STATION	TOP OF DYKE ELEV.	DESCRIPTION
0+004		King George Hwy.
0+100	2.89	
0+200	2.99	
0+300	2.91	
0+400	2.96	
0+500	2.97	
0+600	2.93	
0+665	3.18	
0+700	2.93	
0+800	2.80	
0+900	3.16	
1+000	3.05	
1+100	2.99	
1+200	2.88	
1+300	2.94	
1+400	2.98	
1+500	2.85	
1+600	3.08	
1+700	3.07	
1+800	2.95	
1+900	2.93	
2+000	2.98	
2+100	2.94	
2+200	2.95	
2+300	2.92	
2+400	2.95	
2+500	2.93	
2+600	2.92	
2+700	2.87	
2+800	2.96	
2+839	2.97	Fenceline

NOTE: SURVEYED MARCH 5, 1987

Colebrook Dyking District - Serpentine River
1984 - 1985 Flood Control Program

STATION	TYPE OF X-SECTION	DESCRIPTION
0+000 to 0+013	No Work	King George Hwy.
0+013 to 0+077	A	
0+077 to 0+262	E	Type III @ toe
0+262 to 0+280	A	
0+280 to 0+359	E	Type IV @ toe
0+359 to 0+410	A	
0+410 to 0+470	E	Type IV @ toe
0+470 to 0+535	E	Type III @ toe
0+535 to 0+563	E mod.	Type III @ toe
0+563 to 0+614	A	
0+614 to 0+637	E mod.	Type III @ toe
0+637 to 0+654	A	
0+654 to 0+690	E mod.	Type III @ toe
0+690 to 0+855	A	
0+855 to 0+935	E	Type III @ toe
0+935 to 1+050	B	
1+050 to 1+263	F	
1+263 to 1+561	E	
1+561 to 1+653	E	Type III @ toe
1+653 to 1+752	E	
1+752 to 1+772	A	
1+772 to 1+782	A	Type IV grading
1+782 to 1+845	A	
1+845 to 1+950	E mod.	
1+950 to 2+000	E mod.	Type III @ toe
2+000 to 2+050	E mod.	Type IV @ toe
2+050 to 2+243	A mod.	
2+243 to 2+457	E mod.	Type III @ toe
2+457 to 2+601	A	
2+601 to 2+611	A	Type IV grading
2+611 to 2+633	A	
2+633 to 2+655	E mod.	
2+655 to 2+825	E	Highway 99

INDEX TO DETAIL DRAWINGS

DRAWING NO.		
84-6-1	-	KEY PLAN, SITE PLAN, INDEX TO DRAWINGS
		MUD BAY DYKING DISTRICT (SERPENTINE SOUTH BANK)
84-6-2	-	DYKE CROSS SECTION - STA. 0+000 TO 0+731.5
84-6-3	-	DYKE CROSS SECTION - STA. 0+823 TO 1+463
84-6-4	-	DYKE CROSS SECTION - STA. 1+544.5 TO 1+981.2
84-6-5	-	DYKE CROSS SECTION - STA. 2+116.4 TO 2+758.4
84-6-6	-	DYKE CROSS SECTION - STA. 2+849.9 TO 3+490
84-6-7	-	DYKE CROSS SECTION - STA. 3+581.4 TO 3+852.7
		COLEBROOK DYKING DISTRICT (SERPENTINE NORTH BANK)
84-6-8	-	DYKE CROSS SECTION - STA. 0+000 TO 0+640
84-6-9	-	DYKE CROSS SECTION - STA. 0+700 TO 1+200
84-6-10	-	DYKE CROSS SECTION - STA. 1+250 TO 1+779
84-6-11	-	DYKE CROSS SECTION - STA. 1+800 TO 2+500
84-6-12	-	DYKE CROSS SECTION - STA. 3+581.4 TO 3+852.7
84-6-13	-	TYPICAL DYKE CROSS SECTION
84-6-14	-	TYPE G CROSS SECTIONS AND STANDARD DETAILS
84-6-15	-	STANDARD DETAILS AND FLOODBOX REPLACEMENT ON NICOMEKL RIVER

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DWG. NO. 196-9 SHT. 1 OF 15

REFERENCES			REVISIONS		
DWG. NO.	DESCRIPTION	DATE	NO.	DESCRIPTION	DATE
			1	RECORD DRAWING FOR DISTRICT OF SURREY JURISDICTION	MAR 87

Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

1984-1985 FLOOD CONTROL PROGRAM
COLEBROOK / MUD BAY DYKING DISTRICTS
CONTRACT NO. 1
SERPENTINE RIVER
KING GEORGE HWY. TO BURLINGTON NORTHERN RAILWAY
KEY PLAN, SITE PLAN, INDEX TO DRAWINGS

FILE NO.	84-3
WC PROJECT NO.	
MINISTRY NO.	
SCALE	AS SHOWN
DRAWING NO.	84-6-1
SHEET	1 OF 15

280 257

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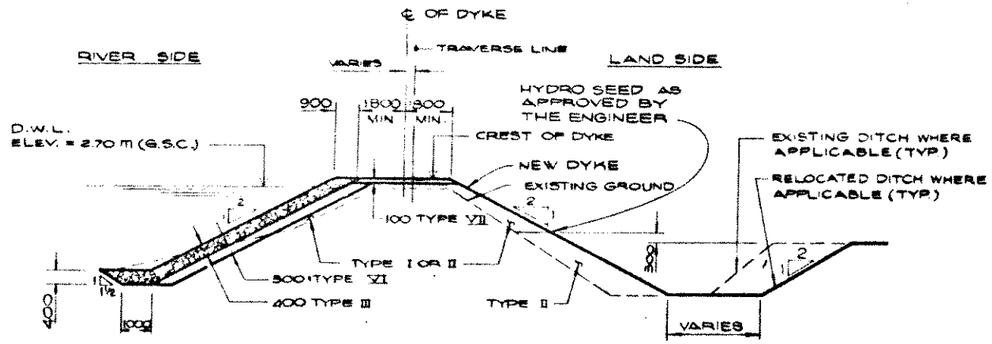
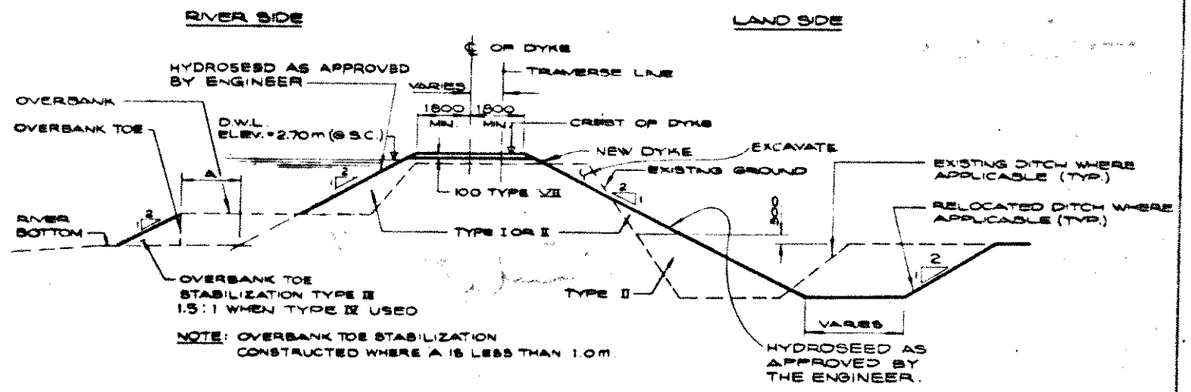


TYPE A CROSS SECTION



NOTE: OVERBANK TOE STABILIZATION CONSTRUCTED WHERE A IS LESS THAN 1.0m

TYPE E CROSS SECTION

TYPE III - COBBLESTONE	
PARTICLE SIZE	PERCENTAGE BY WEIGHT FINER THAN
200.00 mm	100
150.00 mm	65-100
75.00 mm	15-30
50.00 mm	not exceeding 10

TYPE IV - QUARRY TAILING	
PARTICLE SIZE	PERCENTAGE BY WEIGHT FINER THAN
220.0 mm	100
150.0 mm	65-85
125.0 mm	40-60
75.0 mm	15-35
25.0 mm	not exceeding 10

TYPE I - GENERAL FILL
TYPE II - IMPORTED FILL
TYPE III - COBBLES
TYPE IV - QUARRY TAILINGS
TYPE V - RIP-RAP
TYPE VI - FILTER MATERIAL
TYPE VII - DYKE SURFACING MATERIAL
TYPE VIII - TOE DRAIN MATERIAL

NOTE:

1. WHERE THE EXISTING DYKE CREST ELEVATION IS 3.0m G.S.C OR MORE AND THE WIDTH AND THE LOCATION OF THE CREST CONFORMS TO THE NEW DYKE CROSS SECTION, A 100mm LAYER OF TYPE VII MATERIAL BE PLACED ON THE TOP OF THE EXISTING DYKE CREST
2. IN AREAS WHERE THE EXISTING DYKE CREST SURFACING IS UNSUITABLE A 200 mm LAYER OF TYPE II MATERIAL PLACED TO PROVIDE A COARSE BASE FOR THE 100 mm LAYER OF TYPE VII MATERIAL AS DIRECTED BY THE ENGINEER.

280 258

REFERENCES			REVISIONS		
DWG No	DESCRIPTION	DATE	No	DESCRIPTION	DATE
			1	RECORD DRAWING	NOV. '84

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DWG NO 196-9 SHT 13 OF 15

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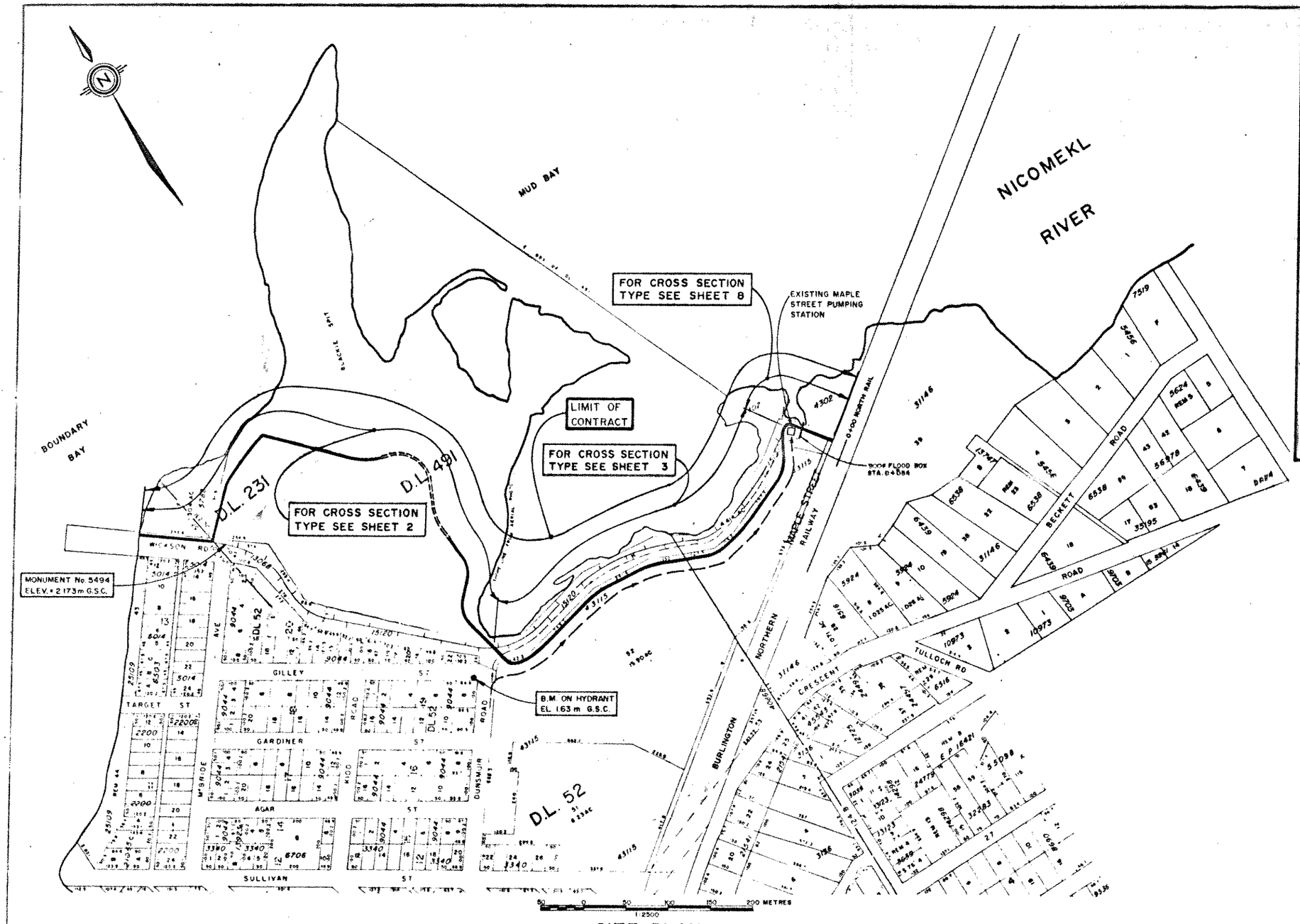
DATE
DRAWN R.H.
CHECKED
DATE
ENGINEER DATE
RECOMMENDED DATE
APPROVED DIRECTOR DATE

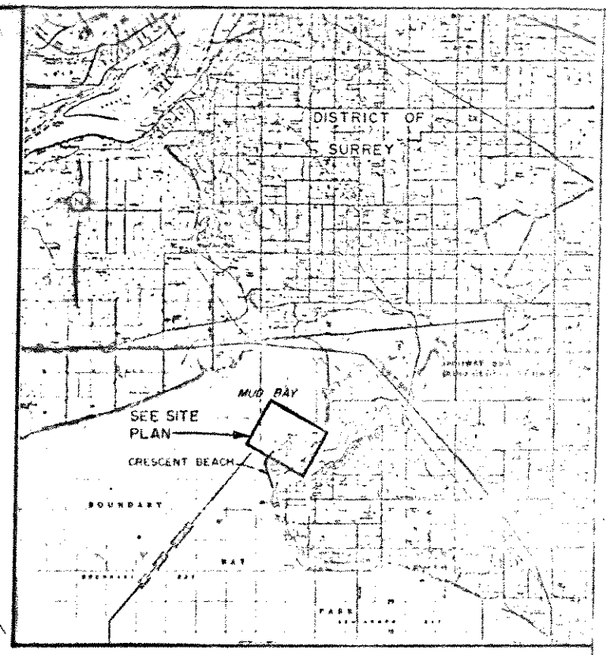
Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

1984-1985 FLOOD CONTROL PROGRAM
COLEBROOK/MUD BAY DYKING DISTRICTS
CONTRACT NO. 1
SERPENTINE RIVER
KING GEORGE HWY. TO BURLINGTON NORTHERN RAILWAY
TYPICAL DYKE CROSS SECTIONS

FILE NO P84-3
ENG PROJECT NO
NTS MAP NO
SCALE N.T.S.
DRAWING NO 84-6-13
SHEET 13 OF 15



SITE PLAN



KEY PLAN

INDEX TO DETAIL DRAWINGS

DRAWING NO.	
85-9-1	KEY PLAN, SITE PLAN, INDEX TO DRAWINGS
85-9-2	DETAIL PLAN - DUNSMUIR ROAD TO WICKSON ROAD STA 0+575 TO 1+212
85-9-3	DETAIL PLAN - MAPLE STREET TO DUNSMUIR ROAD STA 0+300 TO 0+575
85-9-4	DYKE CROSS-SECTIONS - STA 0+120 TO 0+355
85-9-5	DYKE CROSS-SECTIONS - STA 0+410 TO 0+545
85-9-6	TYPICAL DYKE CROSS-SECTIONS
85-9-7	TYPICAL DYKE CROSS-SECTIONS
85-9-8	FLOOD BOX, PLAN AND DETAILS

LEGEND

G.S.C.	GEODETIC SURVEY OF CANADA
D.W.L.	DESIGN WATER LEVEL
1+100	CHAINAGE IN METRES
	TOE DITCH
	DYKE CREST
	WALKWAY
	EXIST. TOE DITCH
	EXIST. DYKE

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DWG. NO. 196-6 SHT. 1 OF 8

REFERENCES			REVISIONS		
DWG. No.	DESCRIPTION	DATE	No.	DESCRIPTION	DATE
			1	RECORD DRAWING	APR./87

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA

280.259

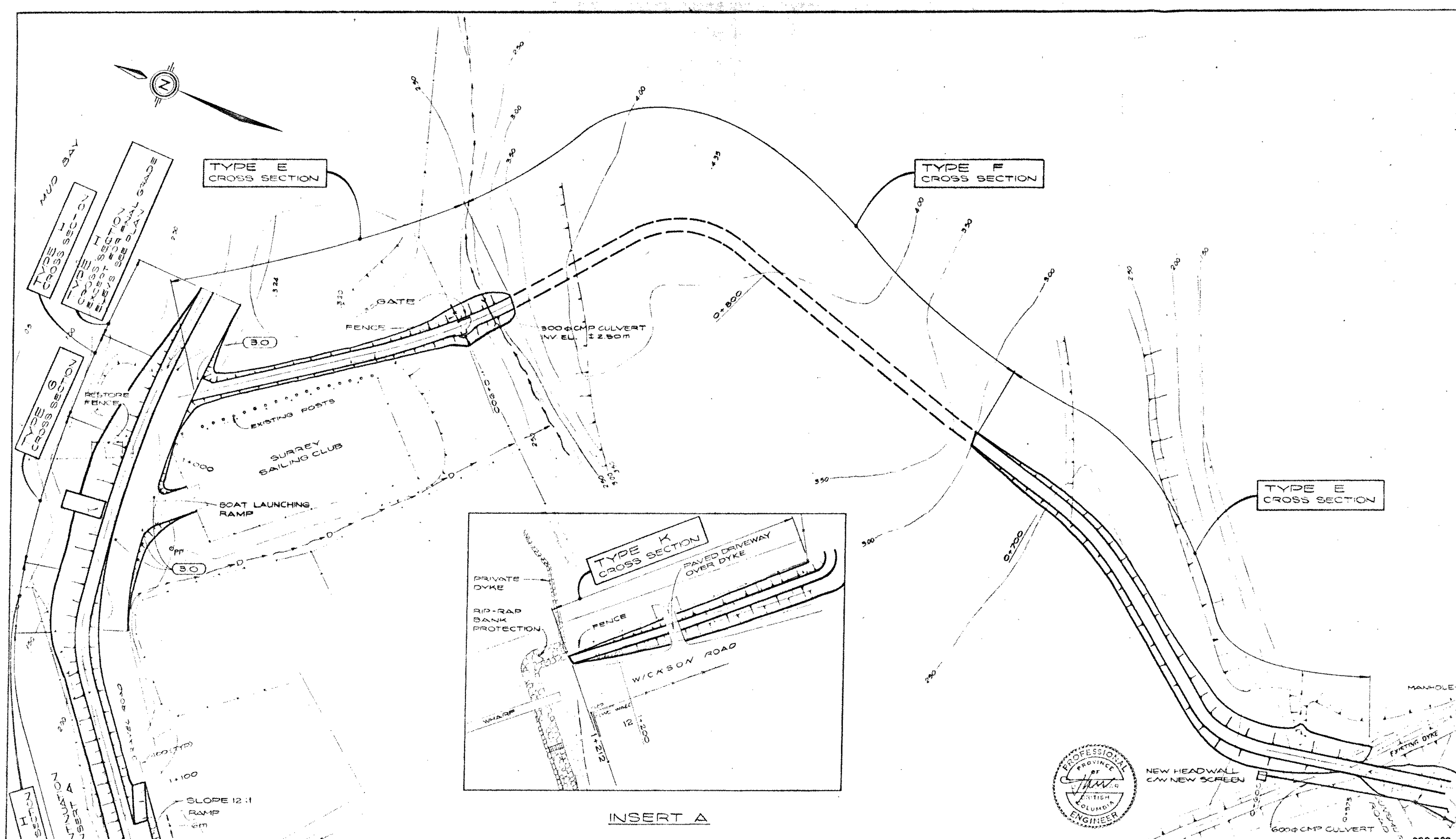
SURVEYED M.M. DATE APR. 2,1985
DESIGNED J.S.
CHECKED
DATE Oct. 22, 1985
DRAWN MR.
CHECKED JS
DATE Oct. 22, 1985

Province of British Columbia — Ministry of Environment — WATER MANAGEMENT BRANCH

1985-1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 2
CRESCENT BEACH EAST DYKE RECONSTRUCTION
KEY PLAN, SITE PLAN, INDEX TO DRAWINGS

FILE NO P 85-9.
ENG. PROJECT NO.
NTS MAP NO.
SCALE AS SHOWN
DRAWING NO. 85-9-1
SHEET 1 OF 8

Oct 22-1985 ENGINEER DATE
RECOMMENDED DATE
APPROVED DIRECTOR DATE



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DWG. NO. 196-6 SHT. 2 OF 8

REFERENCES		
DWG No.	DESCRIPTION	DATE

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No.	DESCRIPTION	DATE
1	RECORD DRAWING	APR./87

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DESIGNED J.S.
CHECKED BW DATE Oct 22, 1985
DRAWN [illegible]
CHECKED JS DATE Oct. 22 1985

Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

1985-1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 7
CRESCENT BEACH EAST DYKE RECONSTRUCTION
DETAIL PLAN
DUNSMUIR ROAD TO WICKSON ROAD

ENGINEER — DATE Oct 28 1985
RECOMMENDED — DATE
APPROVED A/DIRECTOR — DATE

FILE NO. P 85-9
ENG. PROJECT NO.
NTS MAP NO.
SCALE 1:500
DRAWING NO. 85-9-2
SHEET 2 OF 8

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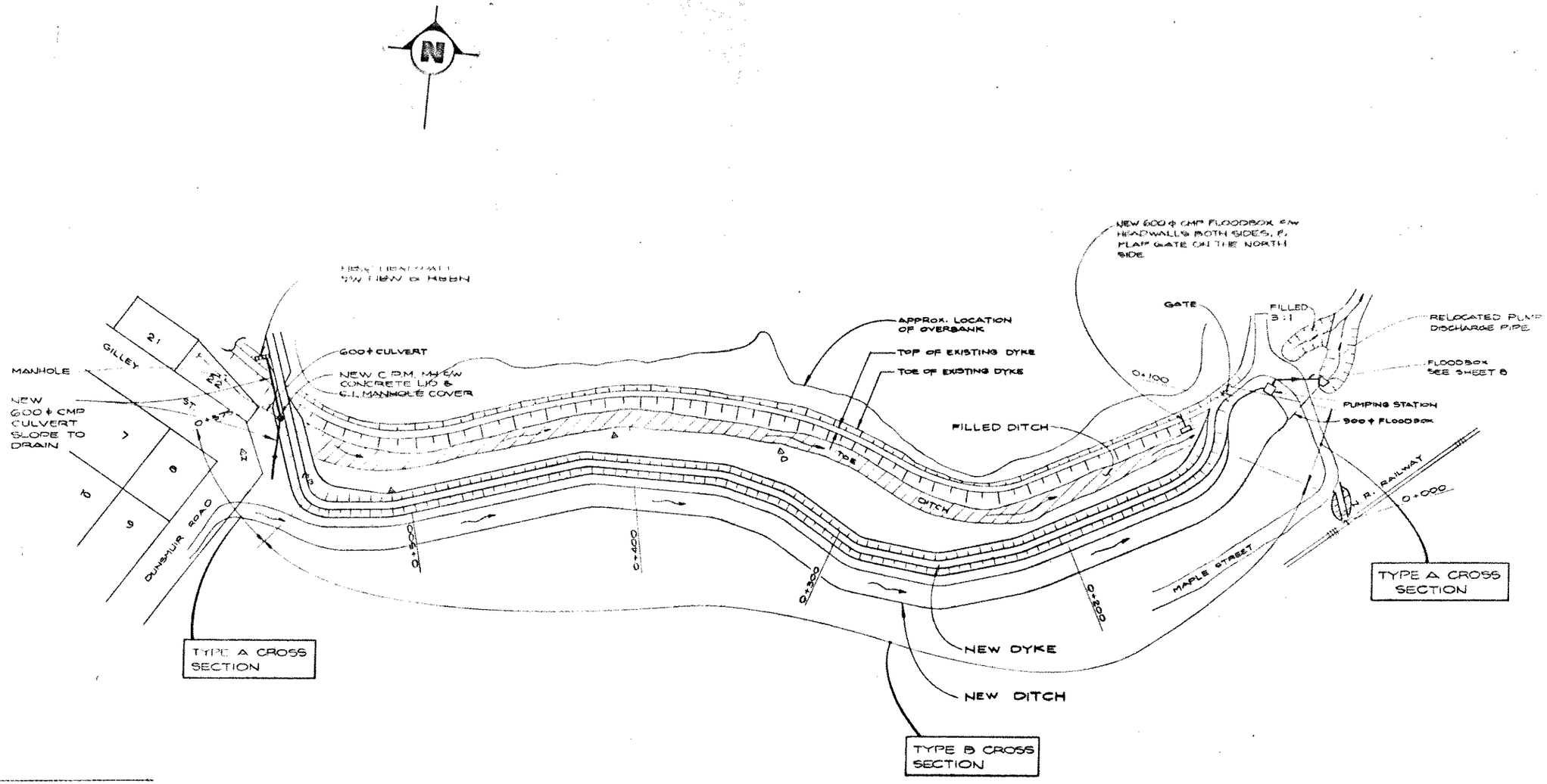

Surrey Dyking District - Crescent Beach
1985 - 1986 Flood Control Program

STATION	TOP OF DYKE ELEV	DESCRIPTION
0+050	3.07	
0+073		West Wall of P/S
0+092	2.98	
0+100	2.96	
0+140	1.14	
0+147	3.13	Iron Pin
0+150	3.17	
0+200	2.66	
0+211.4	2.72	Iron Pin
0+247.6	2.86	Iron Pin
0+250	2.88	
0+283.9	3.08	Iron Pin
0+300	3.22	
0+323.4	3.21	Iron Pin
0+350	3.07	
0+351.8	3.04	Iron Pin
0+400	3.13	
0+418	3.27	Iron Pin
0+450	3.37	
0+500	3.08	
0+505.7	3.06	Iron Pin
0+541.8	3.17	Iron Pin
0+550	3.17	
0+593.4	3.23	
0+600	3.11	
0+650	3.02	
0+700	3.06	
0+719.2	2.93	Iron Pin
0+750	3.43	
0+758.5	3.71	Iron Pin

NOTE : SURVEYED MARCH 5, 1987

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DWG. NO. 196-6 SHT. 3 OF 8

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			1	RECORD DRAWING	APR/87

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CHECKED
DATE Oct 22 1987
DRAWN K. S.
CHECKED J S
DATE Oct 22, 1987

Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

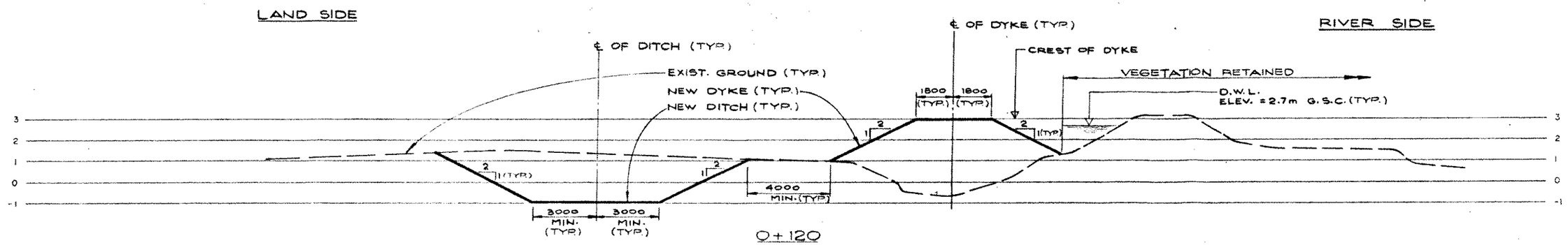
1983 - 1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 2
CRESCENT BEACH EAST DYKE RECONSTRUCTION
DETAILED PLAN
MAPLE ROAD TO DUNSMUIR ROAD

ENGINEER Oct 20/1987 DATE
RECOMMENDED DATE
APPROVED DIRECTOR DATE

280 261

FILE NO P 85-9
ENG PROJECT NO
NTS MAP NO
SCALE 1:1000
DRAWING NO 85-9-3
SHEET 3 OF 8

D



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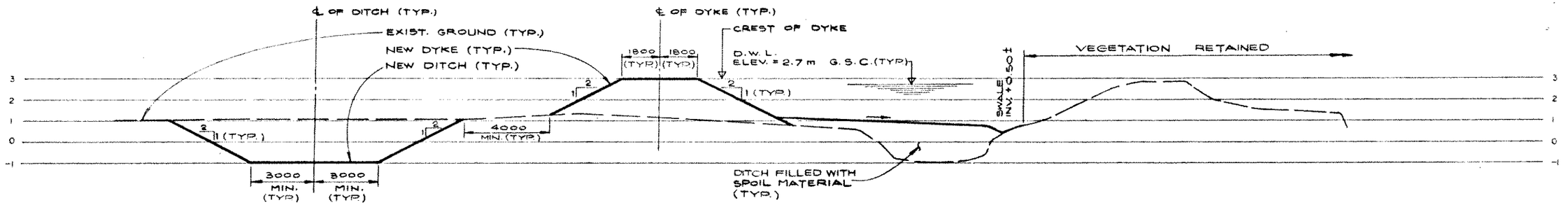

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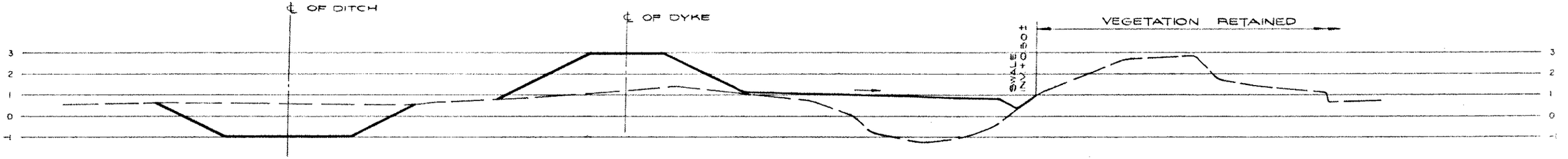

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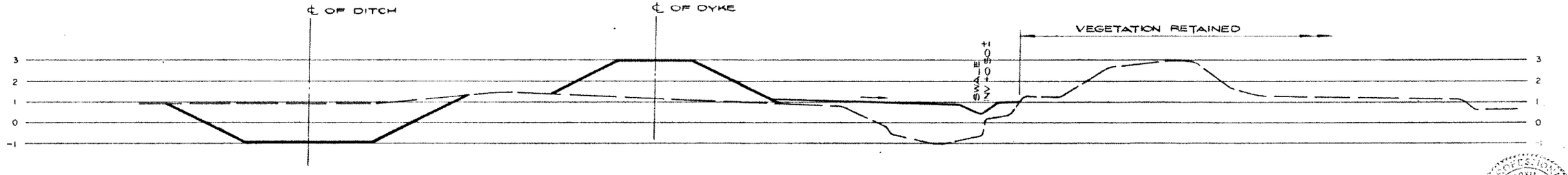

0+335

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA 280262

REFERENCES			REVISIONS		
DWG No.	DESCRIPTION	DATE	No.	DESCRIPTION	DATE
			1	RECORD DRAWING	APR./87

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DWG. NO. 196·6 SHT. 4 OF 8

SURVEYED M.M. DATE APR. 2/1985
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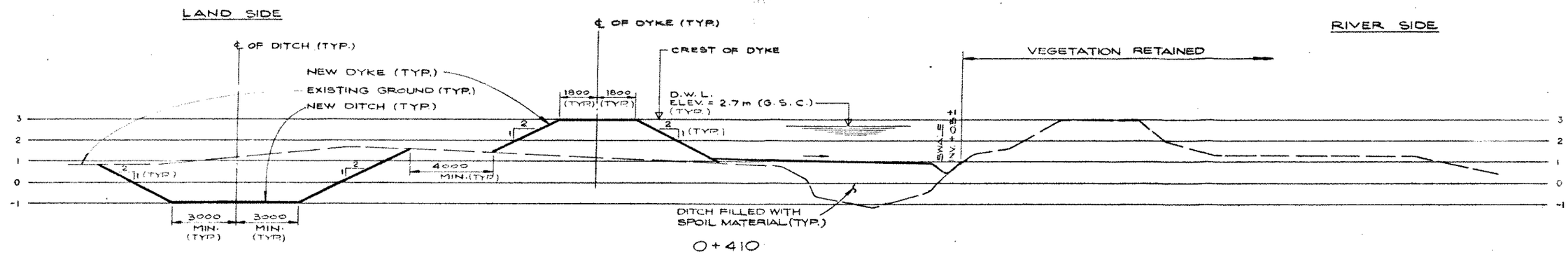
CHECKED JS
DATE OCT 22 1987

Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

1985-1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 2
CRESCENT BEACH EAST DYKE RECONSTRUCTION
DYKE CROSS-SECTIONS
STA 0+120 TO 0+335

ENGINEER DATE Oct 22 1987 — RECOMMENDED DATE — APPROVED DIRECTOR DATE

FILE NO P 85-9
ENG. PROJECT NO
NTS MAP NO
SCALE 1:100 HORIZ 1:100 VERT
DRAWING NO 85-9-4
SHEET 4 OF 8



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DWG. NO. 196-6 SHT. 5 OF 8

REFERENCES			REVISIONS		
DWG No	DESCRIPTION	DATE	No	DESCRIPTION	DATE
			1	RECORD DRAWING	APR/87

SURVEYED M.M. DATE APR. 2, 1985
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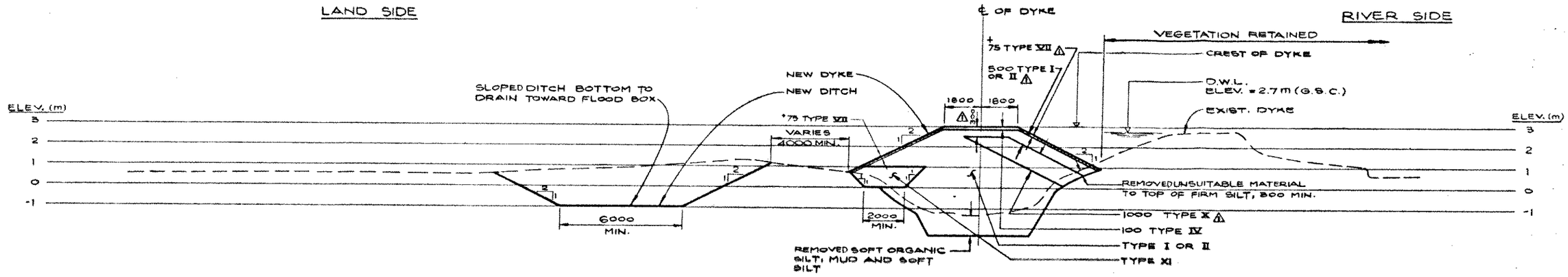
DRAWN K.S.
CHECKED JS DATE Oct. 22 1985
ENGINEER DATE Oct 22 1985 RECOMMENDED DATE APPROVED DIRECTOR DATE

Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

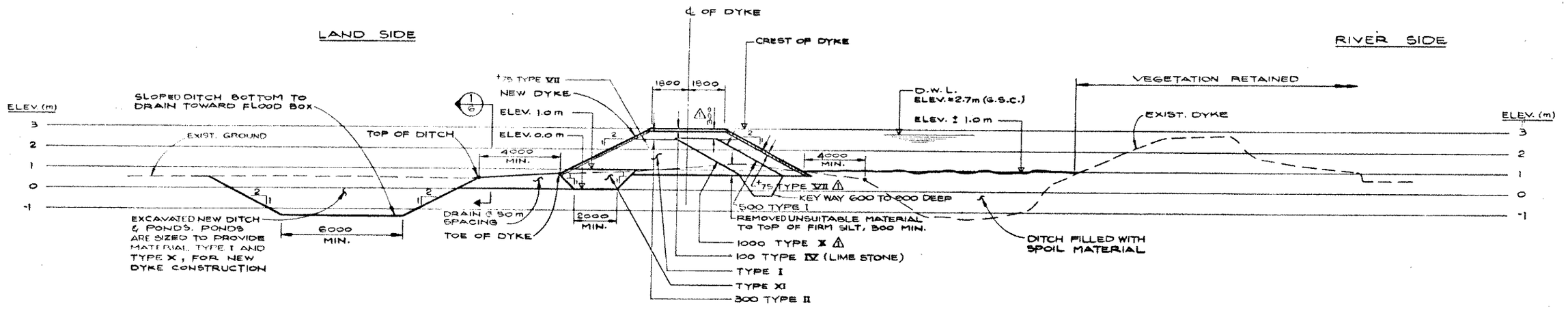
1985-1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 2
CRESCENT BEACH EAST DYKE RECONSTRUCTION
DYKE CROSS-SECTIONS
STA 0+410 TO 0+545

FILE NO P 85-9
ENG PROJECT NO
NTS MAP NO
SCALE 1:100 HORIZ 1:100 VERT
DRAWING NO 85-9-5
SHEET 5 OF 8

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA 280 263



TYPE A CROSS SECTION



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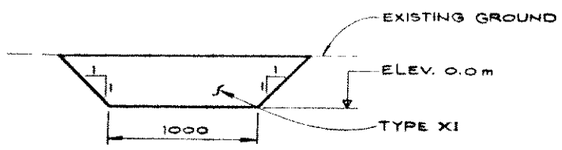


SECTION (1/6)

NOTE:
+ ONLY IF TYPE II MATERIAL USED FOR DYKE CONSTRUCTION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

280 264

REFERENCES			REVISIONS		
DWG No.	DESCRIPTION	DATE	No	DESCRIPTION	DATE
			1	TYPE X SILT CORE REDUCED FROM 2000 To 1000	NOV 29/85
			2	RECORD DRAWING	APR./87

THIS DRAWING REDUCED TO HALF SIZE

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS

DWG. NO. 196-6 SHT. 6 OF 8

SURVEYED M.M. DATE APR. 2, 1985
DESIGNED J.S.
CHECKED GW DATE OCT 22 1985
DRAWN K.S.
CHECKED JS DATE OCT 22, 1985
ENGINEER DATE Oct 22, 1985 — RECOMMENDED DATE — APPROVED DIRECTOR DATE

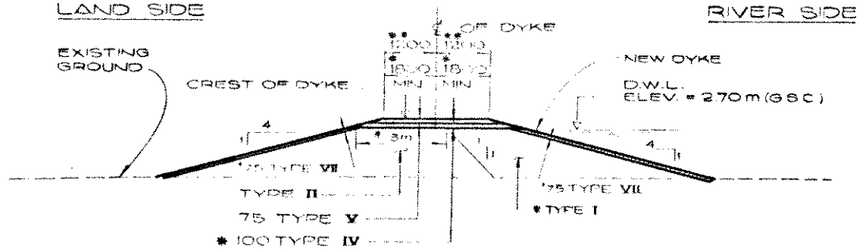
Province of British Columbia — Ministry of Environment, WATER MANAGEMENT BRANCH

1985 - 1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 2
CRESCENT BEACH EAST DYKE RECONSTRUCTION
TYPICAL DYKE CROSS SECTIONS

FILE NO. P 85-9
ENG. PROJECT NO.
NTS MAP NO.
SCALE N.T.S.
DRAWING NO. 85-9-6
SHEET 6 OF 8

TYPE III - QUARRY TAILING	
PARTICLE SIZE	PERCENTAGE BY WEIGHT FINER THAN
220.0 mm	100
150.0 mm	65-85
125.0 mm	40-60
75.0 mm	15-35
25.0 mm	not exceeding 10

LAND SIDE — RIVER SIDE

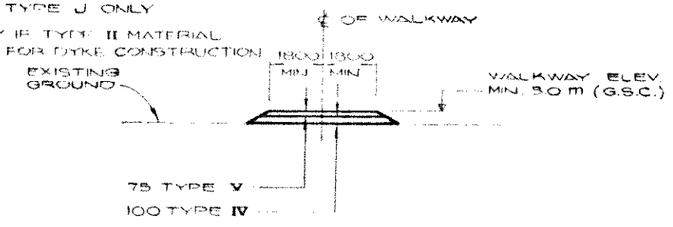


TYPE E & J CROSS SECTION
(FOR LOCATION SEE SHEET 2)

* FOR TYPE E ONLY

** FOR TYPE J ONLY

\+ ONLY IF TYPE II MATERIAL USED FOR DYKE CONSTRUCTION



TYPE F CROSS SECTION
(FOR LOCATION SEE SHEET 2)

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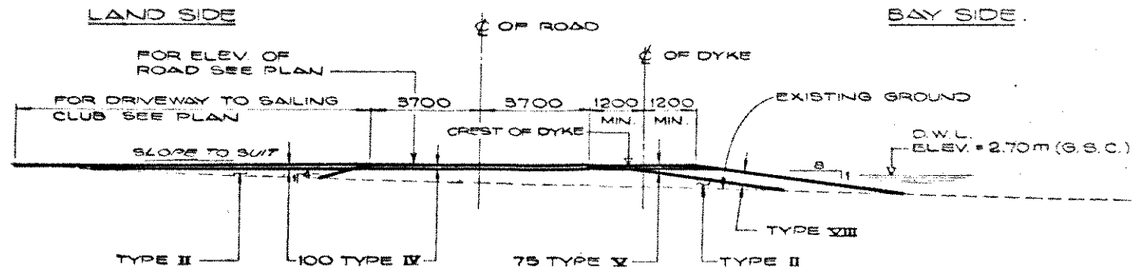
CONSULTING ENGINEERS

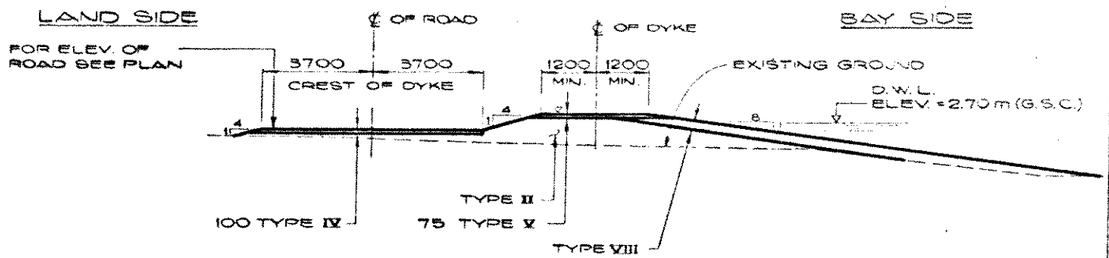
DWG. NO. 196-6 SHT. 7 OF 8

LAND SIDE — BAY SIDE

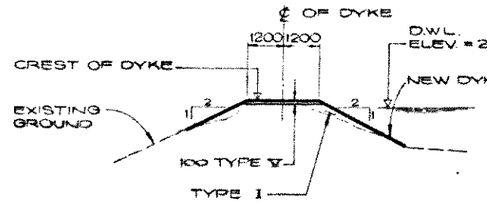


TYPE G CROSS SECTION
(FOR LOCATION SEE SHEET 2)

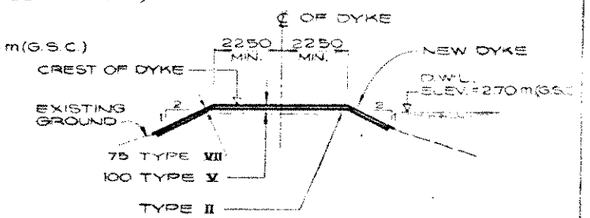
LAND SIDE — BAY SIDE



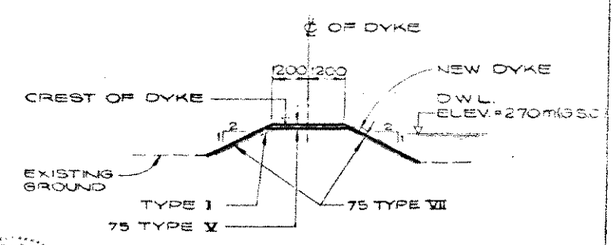
TYPE H CROSS SECTION
(FOR LOCATION SEE SHEET 2)



TYPE L CROSS SECTION
(FOR LOCATION SEE SHEET 8)



TYPE M CROSS SECTION
(FOR LOCATION SEE SHEET 8)



TYPE K CROSS SECTION
(FOR LOCATION SEE SHEET 2)

DYKE FILL MATERIALS

TYPE I - GENERAL FILL
TYPE II - IMPORTED FILL
TYPE III - QUARRY TAILINGS
TYPE IV - ROAD GRAVEL
TYPE V - LIME STONE
TYPE VI - FILTER MATERIAL
TYPE VII - TOP SOIL
TYPE VIII - BEACH GRAVEL
TYPE IX - NOT APPLICABLE
TYPE X - SILT CORE
TYPE XI - TOE FILTER

REFERENCES			REVISIONS		
DWG No.	DESCRIPTION	DATE	No.	DESCRIPTION	DATE
			1	RECORD DRAWING	APR./87

SURVEYED M.M. DATE APR. 2, 1985
DESIGNED JS
CHECKED RW DATE Oct 22, 1991
DRAWN AR
CHECKED VJ DATE Oct 22 1991

Province of British Columbia — Ministry of Environment — WATER MANAGEMENT BRANCH

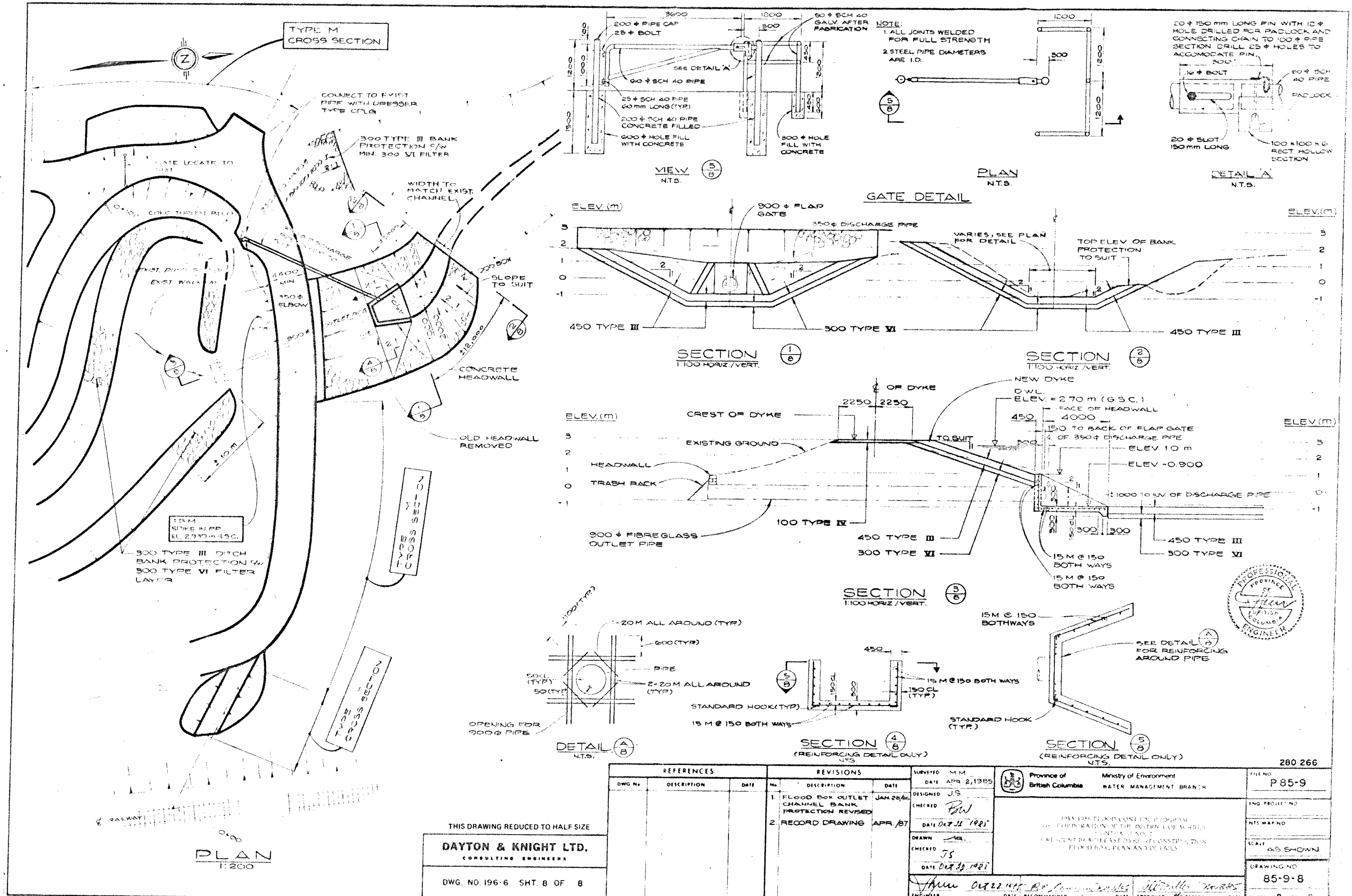
1985-1986 FLOOD CONTROL PROGRAM
THE CORPORATION OF THE DISTRICT OF SURREY
CONTRACT NO. 2
CRESCENT BEACH EAST DYKE RECONSTRUCTION
TYPICAL DYKE CROSS SECTIONS

Oct 22 1991 ENGINEER DATE — RECOMMENDED DATE — APPROVED DIRECTOR DATE

280 265

FILE NO. P 85-9
ENG. PROJECT NO.
NTS MAP NO.
SCALE N.T.S.
DRAWING NO. 85-9-7
SHEET 7 OF 8

D



280 266

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CONSULTING ENGINEERS

DWG. NO. 196-6 SHT. 8 OF 8

REFERENCES		
DWG No.	DESCRIPTION	DATE

REVISIONS		
No.	DESCRIPTION	DATE
1.	FLOOD BOX OUTLET CHANNEL BANK PROTECTION REVISED	JAN 28/86
2.	RECORD DRAWING	APR. /87

SURVEYED	M.M.
DATE	APR 2, 1985
DESIGNED	J.S.
CHECKED	BW
DATE	Oct 31 1985
DRAWN	
CHECKED	JS
DATE	Oct 31 1985

Province of British Columbia — Ministry of Environment — WATER MANAGEMENT BRANCH

FILE NO. P 85-9

SCALE AS SHOWN

DRAWING NO. 85-9-8

SHEET 8 OF 8

ENGINEER — DATE Oct 22 1985 — RECOMMENDED — DATE — APPROVED DIRECTOR — DATE