



KGS
GROUP

PARKS CANADA/GOVERNEMENT OF CANADA

Peterborough Lift Lock Ram Repair Specification

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1.0 BACKGROUND INFORMATION

1.1 Project Goals and Objectives

1. A number of cracks have been detected on the lowest section of the rams (pistons) of the two main hydraulic presses that lift the boat chambers at the Peterborough Lift Lock. Parks Canada needs to replace these sections on both rams before the next navigation season resumes in May 2021.
2. Parks Canada Agency (PCA) requires a Contractor to perform design, manufacture and replacement of the lowest sections in the ram assemblies at Peterborough Lift Lock 21. The ability to resume operation in May 2021 is a firm requirement.

1.2 About Peterborough Lift Lock

1. The Ontario Waterways Field Unit of Parks Canada Agency (PCA) owns and operates the Peterborough Lift Lock 21 (PLL 21) as part of the 386 km long Trent-Severn Waterway system which extends from the Bay of Quinte on Lake Ontario to Port Severn just to the south of Georgian Bay on Lake Huron. The Peterborough Lift Lock is positioned on a manmade portion of the Trent Canal connecting the Otonabee River to Little Lake in the City of Peterborough.
2. The Peterborough Lift Lock was commissioned in 1904 and was designated a National Historic Site of Canada in 1979. The lift lock operates seasonally from the Friday before Victoria Day in May through to the second Monday in October and is a major local tourist attraction.
3. The facility is generally made up of three sections, the upper reach, the concrete/steel structure and the lower reach. Maritime vessels are raised and lowered between the upper and lower canal reaches by two boat chambers, west and east, filled with canal water with gates on each end. The boat chambers are attached to and moved by large vertical press/ram assemblies (one per chamber) which operate by gravity and use water as the hydraulic fluid. The 2.5 m (99.5") diameter press section of each ram is set within 4.3 m (170") diameter concrete-lined wells dug into the natural bedrock below the structure. The boat chambers are guided by rails mounted externally on the concrete towers and are approximately 39 m long by 10 m wide with an average lift of 19.8 m. Refer to Photo 1-1 on the following page which illustrates the concrete/steel structure with the west boat chamber in the raised position and Photo 1-2 on page 3 which identifies the lifting component arrangement.

PHOTO 1: PETERBOROUGH LIFT LOCK 21



Each boat chamber is operated by a single water-operated cylinder that moves the chamber through a travel of 19.8 meters. The boat chamber is connected to the cylinder at the crown. Each cylinder consists of one press, one ram and a gland (stuffing box) type seal. The 2.286 m (90") diameter ram supports a ram and the water filled boat chamber. This results in a system operating pressure of 4.00 MPa (580 psi) as measured at the top of the press which equates to a pressure of 4.23 MPa (610 psi) as measured at the bottom of the press. The actuation of a cross-over valve linking the two press/ram assemblies causes the water to flow from the upper press (under higher pressure) to the lower press. The upper chamber, filled to the water level of the upper reach contains more water than the lower chamber, making it heavier. The weight difference between the two boat chambers provides the driving force for the operation of the lift lock. In addition, two water pumps within the structure pressurize a large dead-weight accumulator in a piping system operating at a pressure of 4.83 MPa (700 psi) which provides the initial water in the presses during spring startup and also additional water in the system as required to make up for leaks experienced through the gland seal during operation.

PHOTO 2: PRESS, RAM AND CROWN



2.0 PROJECT SCOPE

2.1 Scope of Services

1. It is the intent of this specification to assist the Contractor in determining the most effective method in performing the required ram section replacement safely and within the available time.
2. The specification considers that the repair will consist of the manufacture, test and installation of a replacement of the bottom ram section in each ram in accordance with applicable standards and codes.
3. The methodology to create access to the components is to be determined by the Contractor based on requirements stated in this specification.
4. At a minimum the Contractor will perform the following services:
 - a. Design, construct and maintain all site access and work areas for the duration of the project.
 - b. Design and construct all temporary works including temporary roads, temporary bridges and supports.
 - c. Supply of site power.
 - d. Perform the design of a replacement bottom ram section by engineers registered in the province of Ontario.
 - e. Removal and reinstallation of new seals supplied by PCA into the press gland (stuffing box) in accordance with direction and materials provided by PCA.
 - f. Stabilize the boat chambers and rams to perform the work in a safe manner.
 - g. All mechanical dis-assembly and installation activities at site.
 - h. Transportation of equipment and supplies to and from site.
 - i. All off site inspections and fabrication work.
 - j. Storage, handling, and installation of all equipment and supplies at site.
 - k. Provide a proposed General Site Facilities plan site plan indicating areas designated for temporary buildings, equipment, delivery, laydown, storage, and fencing.
 - l. Arrange and coordinate testing with PCA.
 - m. Arrange and coordinate rewatering and operation of the lift lock with PCA in accordance with any restrictions indicated in this Specification.
 - n. Management of the Quality Plan approved by PCA.
 - o. Regular project tracking and reporting to PCA.
 - p. Any site trailers for Contractor and subcontractors is at Contractor discretion. PCA does not require any space or services for its staff.
 - q. Provide any consumables and garbage disposal required for its staff and subcontractors.
 - r. Management of site safety as the Contractor of Record. Prepare and provide a Site Specific Safety Management Plan (SSSMP) and Site Specific Environmental Management Plan (SSEMP).
 - s. Perform all lock out and tag out of equipment after dewatering by others with assistance from PCA.
 - t. If directed by the owner, obtain permits and approvals for the work.
 - u. Clean the site as per the Restoration Plan developed by the Contractor and approved by the PCA upon completion of the project

2.2 Scope Not Included

1. PCA will be responsible for the following:
 - a. Provision of PCA electricians to approve all contractor lock out and tag out work.
 - b. Dewatering the lift and accumulator systems in the fall (October) and lowering the boat chambers onto their winter stands prior to system disassembly.
 - c. Rewatering the lift and accumulator systems in the spring (April/May) when water is available for commissioning and testing required on the newly installed rams in preparation of the 2021 operating season.
 - d. Provision of new gland (stuffing box) seals prior to water up.
 - e. Operation of the facility at the Contractor's request during final commissioning and testing.

2.3 Project Milestones

The following milestones shall be used and identified in schedules.

TABLE 2-1 MILESTONES

Item	Milestone	Description
1	Design and Drawing Development	The milestone will be considered achieved upon receipt of fabrication drawings of the replacement components
2	Fabrication – East Ram Section	The work will be considered complete upon shop approval of the East Ram Section
3	Fabrication – West Ram Section	The work will be considered complete upon shop approval of the West Ram Section
4	Mobilization	Mobilization will be considered complete upon mobilization of site staff and facilities and successful completion of the site Lock Out and Tag Out by the Contractor
5	Removals – East Ram	The milestone will be considered achieved upon the successful removal of the lower section of the East Ram
6	Removals – West Ram	The milestone will be considered achieved upon the successful removal of the lower section of the East Ram
7	Installation – East Ram	The milestone will be considered complete upon the release of the East Ram for watering up.
8	Installation – West Ram	The milestone will be considered complete upon the release of the West Ram for watering up.
9	Commissioning	The milestone upon approval of successful testing of the ram operations.

Item	Milestone	Description
10	Demobilization	The milestone is completed upon removal of all contractor materials from site. Associated fees shall not be less than 50% of total mobilization and demobilization costs.

3.0 SAFETY AND ENVIRONMENTAL MANAGEMENT

3.1 General

1. The Contractor will ensure that all work is conducted as per the requirements of all federal, provincial, and municipal acts, regulations, permits and guidelines.
2. The Contractor will provide a completed Attestation and Proof of Compliance with Occupational Health and Safety (OHS) form as per Schedule B as a condition of gaining access to the work place.
3. The Contractor will be required to prepare and submit a Safety Specific Safety Management Plan and a Site Specific Environmental Management Plan for their work. A template for the Site Specific Safety Plan is included in Schedule A of this specification.
4. The Plans will be submitted to the Owner and Owner Representative prior to the commencement of any work. The Owner/Owner Representative will review the Plan and will either accept the plan or require additional information or adjustments to be made to the plan prior to the start of any construction activities.

3.2 Material Safety Data Sheets

1. The Contractor will make copies of any Material Safety Data Sheets (MSDS) readily available to workers, and a health and safety committee, if any, or to a site health and safety representative. As a rule, readily available means located close to the workers and accessible to workers during each shift. The Contractor will ensure compliance with all federal and provincial health and safety legislation.

3.3 Laydown and Work Areas

1. Temporary laydown and work areas will be required near the proposed site. Available laydown areas are provided in Schedule D. The Contractor will provide a description, location, and site plan for all proposed laydown areas prior to construction as part of the plan.

3.4 Environmental Management

1. The Contractor shall comply with the requirements outlined in Schedule C – General PCA Mitigation and Guidance.

4.0 QUALITY MANAGEMENT

1. The Contractor is responsible to develop a Quality Management Plan to monitor materials, workmanship and the quality of the work. The Contractor is also responsible to ensure that the work is completed in accordance with the requirements of the Province of Ontario Laws and Regulations.

4.1 Quality Management Plan

1. The Contractor shall develop and implement a project Quality Management Plan ("QA Plan") which must be approved by the Owner.
2. The QA Plan will provide a complete description of how the Contractor will ensure that all services be completed in accordance with the requirements of this Specification, the Province of Ontario Acts and Regulations, and/or other codes and standards as applicable.
3. The QA Plan must include the following attributes:
 - a. Include a method to provide the Owner with open access to all QA documentation throughout the execution of the work.
 - b. Identify a QA manager for the services who will oversee the implementation of the QA Plan.
 - c. Include the approved individual Inspection and Test Plans for all the construction activities, equipment manufacturing, and services supplied in this contract.
 - d. Establishing and maintaining a set of documented procedures that describe the methods used to produce the project design in accordance with contractual, legal, regulatory, and other specified requirements that includes:
 - i. Schedule for design output such as drawing, specification, calculation, analyses, etc.
 - ii. Method for design review/verification
 - iii. Control of Vendor's/Subcontractor's Design Work
 - iv. Engineering support to procurement and construction
 - e. Document Control shall be included: Numbering of Documents, Issuance and distribution of Documents, Document Changes, Control of Documents prepared by Vendor
 - f. Procurement Control shall be included: Approved Vendor List, Evaluation and Verification of Vendor's Performance,
4. All quality activities of the project are subject to audit for the duration of this project.

4.2 Inspection and Test Plan Requirements

1. The Inspection and Test Plan (ITP) is to be a detailed list of activities and must identify the materials and work to be inspected or tested. The ITP shall reference relevant codes, standards, procedures, acceptance criteria and the records to be maintained.
2. The Contractor will submit Inspection and Test Plans for the various activities, equipment, components and materials supplied for the project under this contract that will allow the Owner to understand the extent of Quality Control activities associated with the execution or fabrication of the specific project elements.

3. Inspection and Test Plans will be subject to review and approval by the Owner and will identify at a minimum:
 - a. The inspection event, describing the extent of the inspection activities and the stage of the work at which it occurs.
 - b. Define the acceptance criteria.
 - c. Define whether these events are hold points.
 - d. Define the participants.
4. A number of required tests to be included in the development of ITPs are identified in these Specifications and must be included.
5. The Contractor shall prepare ITPs for separate work packages in a logical manner and review each ITP prepared by its Subcontractors. The Contractor shall provide adequate witness and hold points to ensure the work is executed properly under that ITP.
6. Any hold point shall NOT be bypassed without written consent from nominated party.
7. If it is necessary to repeat any operations that have been previously performed, re-inspection is required as original hold/witness points or adding additional pages to the ITP, if required.

4.3 Non-Conformance Reports

1. The Contractor shall raise its own Non-Conformance Reports (NCRs) during manufacturing, installation and commissioning activities as part of its own quality system requirements. The disposition and correction of such non-conformances are the responsibility of the Contractor and any such NCR will be made available to the Owner inspectors for review at the time of inspection and as part of the Quality Control Turnover Package.
2. It is required that the Contractor seek approval from the Owner before proceeding with dispositions of NCRs which will result in a permanent deviation from the requirements of this Specification or the Contractor's own designs, drawings and instructions. The Owner reserves the right to reject any NCR disposition not previously approved for work that is not compliant with this Specification and/or standard and agreed designs.
3. Results of all Non-Conformance dispositions shall be recorded and are subject to inspection by the Owner.

4.4 Shop Inspection and Testing

1. The Contractor's new equipment must be assembled, aligned, and tested at the factory before shipment to the extent defined in the ITP.
2. Not less than two weeks' notice of witness tests or hold points shall be given to the Owner where the ITP requires the presence of the Owner.
3. The Contractor and its Subcontractors shall provide the Owner with electronic copies of manufacturing records. The Owner may elect to repeat or verify the Contractor's data. The Contractor shall perform equipment tests as specified in these Specifications and as per the accepted Inspection and Test Plans to confirm that the requirements of the contract have been met. The Contractor shall supply all test instruments, including calibration certificates, equipment, supplies and qualified test personnel to

perform the specified equipment tests. The Contractor shall submit to the Owner one copy of the site or shop test reports immediately and certified copies with the QC Turnover Package.

4. The Contractor shall correct within a reasonable time, at their expense, any defect which develops or is detected in the equipment during factory or site inspections and tests. The inspections and tests shall be repeated or continued until all the work is demonstrated to be acceptable and in compliance with the Specification.
5. The Contractor will ensure all instruments used for recording final results of any testing are calibrated.
6. Contractor shall provide the list of all certified welders and describe the system and practices established for qualification of welders and welding operator who will perform welding activities.

5.0 LOGISTICS

5.1 Project Site Location

1. The project site is located in Peterborough, Ontario.
2. Access to the job site shall be arranged with the PCA Representative prior to the start of Construction.

5.2 Mobilization/Demobilization

1. Mobilization shall include and not be limited to all activities and associated costs for transportation of the Contractor's personnel, general site facilities (refer to Section 7.12), operating supplies and equipment to the jobsite and preparing the site and equipment in readiness for use until completion of the Contract.
2. The Attestation Form in Schedule B must be submitted and approved by the owner prior to mobilization.
3. Designated laydown areas are provided in Schedule D.
4. PCA will issue a permit to authorize start of work under the Historic Canal Regulations after review and acceptance of EMP.
5. Demobilization shall include and not be limited to all activities and associated costs for the removal of the general site facilities, operating supplies and equipment in a sequence and timing to suit the Contract Schedule and the site restoration.

5.3 Site Restrictions

1. PCA shall be responsible for operation of the lift lock, when required by the Contractor with one week notification, during periods of time when water is available. Parks Canada staff is available to operate the lift lock between 9:00 am to 3:00 pm Monday to Friday, during periods when water is available.
1. Water is available for operation of the lift lock up to one week after Thanksgiving in October and starting in April of the new year.
2. The Contractor shall manage and organize the sequence and timing of construction to accommodate operation of the existing station and minimize the impact.
3. The Contractor will be responsible for the days and hours of on-site services that they will be providing for the Work. The Contractor shall indicate if they anticipate working any overtime, such as an extra shift(s), to mitigate potential schedule delays or to maintain the Contract Schedule and this should be identified as such in the Proposal.
4. The Work shall be performed only by the holders of current certificates of proficiency, issued pursuant to the Trades Qualification and Apprenticeship Act, R.S.O. 1990, c. T.17, for the applicable trades. A minimum of one qualified journeyman for each particular trade shall be present while Services involving that trade is being performed. Only the best workmanship executed by trades-persons skilled in their trades is acceptable.
5. Some winding and steep sections of the roads may present a restriction to heavily loaded or over dimensional trucks. During spring thaw, these sections may develop washouts and rutting. There is a

half-load season enforced by the MTO and local municipalities in the spring (March and April) that can affect heavy loads and should be researched and planned for by the Contractor.

6. On-site parking during construction will be restricted. The Contractor shall provide and maintain adequate parking for its construction vehicles, those of any Subcontractors, in such a location so as to ensure that roadways are maintained free and cleared for construction and other access.
7. The site is accessible to the Contractor outside of the normal operating hours of 9:00 am to 3:00 pm subject to adherence to a security process to be defined by PCA and subject to local bylaws for noise, lighting, etc.

5.4 Shipping and Receiving

1. All deliveries of materials and equipment to site including loading and unloading are the responsibility of the Contractor.

5.5 Site Entry and Exit Security Requirements

1. The Contractor will be limited to only those areas necessary to complete the contracted services. All other non-authorized areas are off limits.
2. The Contractor will obtain a key set from security via the Contract Administrator to access the facility.

5.6 Protection of Work and Property

1. The Contractor shall always ensure that the area outside the immediate work site is maintained in a safe manner. Any damage observed by the Contractor resulting from the Work or otherwise should be communicated to PCA immediately.
2. The Contractor will be responsible for providing signage/barriers to warn PCA staff and the public from entering the work site. Equipment and supplies shall always be secured.
3. Security of equipment and materials within the Project area is the responsibility of the Contractor at all times.
 - a. If any property of PCA is damaged, then the Contractor shall be fully liable for any and all damage and loss incurred.
 - b. The Contractor shall promptly repair all damage to the satisfaction of PCA at the Contractor's own expense.
4. Any additional fencing and enclosures required shall be supplied and maintained by the Contractor at all times throughout the Project.
5. Ensure site is secure and properly signed to prevent unauthorized access during Construction and off-hours.
6. The Contractor shall undertake a condition survey of existing buildings and structures within and near the project site for record purposes prior to starting Work.

5.7 Multiple Work Groups

1. The Contractor is being made aware that other workers or groups will be performing Work in the vicinity of the contracted Work.
2. The Contractor's Work at the Peterborough Lift Lock shall be coordinated with PCA staff and/ or additional contractors while working at site through PCA's Representative. The Contractor must coordinate his Work to minimize impact on other PCA projects.
3. In addition to the Work being performed in accordance with the Specification, PCA may be performing maintenance or other Project services during construction.

5.8 Buried and/or Embedded Services

1. The Contractor shall be responsible to complete all service locate reviews for buried and/or embedded PCA and other utilities cables/conduits/services both on and off PCA property prior to conducting any Work involving trenching, drilling, boring and cutting.
2. For all Buried and/or Embedded services:
 - a. Upon request, PCA will provide all available drawings of known services within the Work location, but it remains the responsibility of the Contractor to perform all duties under OSHA with respect to buried services.
 - i. The Contractor is expected to provide underground scanning in all areas requiring excavation or drilling. Identify, stake, and flag all existing service line locations and elevations.
 - ii. Maintain staking and flagging for the duration of the Project and leave in place on demobilization unless otherwise noted by PCA's Representative.
 - b. PCA is to be informed of any unknown services found prior to and during excavation. PCA reserves the right to inspect these unearthed services prior to execution of Project scope and before re-burial.
 - c. Notify PCA and the appropriate service providers (i.e. utilities as applicable), prior to carrying out operations in the vicinity of the buried services.
 - i. The Contractor will perform a review of all buried services prior to the start of the services and contact "Ontario One Call" for locates for any utilities owned by external agencies.
 - ii. Comply with the requirements of and co-operate fully with PCA and each utility for the location and protection of the service lines during the Services.
 - iii. It is the Contractor's responsibility for any claims resulting from damage to the service lines as a result of the Contractor's construction operations. Promptly notify PCA's Representative or Designated Delegate, (and utility if applicable) in the event of any damage or interruption to any services caused by the Contractor's construction operations.
 - iv. Co-operate with the utility in the restoration of service as promptly as possible and bear all costs arising from the damage or interruption.

5.9 Winter Work

1. The Contractor will be responsible for all winter heating, enclosures, and protection necessary relating to Contract scope of Work.

5.10 Hoarding

1. The Contractor shall protect the work site from inclement weather as required.
2. The Contractor shall stage its Work as to leave the work site weather tight at the end of each day if required.

5.11 Material Handling and Storage

1. Materials which do not need to be stored in weatherproof sheds will be located on site in a manner to cause least interference with Work activities. Materials may be offloaded and stored in a designed area in or near the facility as directed by the PCA Representative.
2. The Contractor shall protect all materials during transit and on the site from damage and from the elements.
3. All material shall be stockpiled in a manner approved by the manufacturer.
4. The Contractor is responsible for providing qualified staff for all material handling and rigging. Rigging materials shall be provided by the Contractor.
5. The Contractor is responsible for any other hoists, mobile cranes, forklifts, or other material handling equipment required to undertake the services.

5.12 Laydown Areas and Access Routes

1. The PCA Representative and the Contractor will agree on the area to be designated the construction site and will also designate the access route to the construction site. Offloading and laydown areas for the Work or services will be within the designated construction site.
2. The Contractor shall keep all access routes in clean and tidy condition and shall not obstruct operations.
3. Materials storage, parking and pre-fabrication Work areas shall be limited to the areas designated by the PCA Representative or his delegate.

5.13 Construction Site Services

1. Lunchroom, phone, office facilities and washrooms will be the responsibility of the Contractor.
2. The layout of the site facilities shall be provided in Contractor's proposed General Site Facilities plan.
3. Proposed general site facilities location shall meet with the concurrence of the PCA Representative and shall be completely removed from site after use.
4. No water or other services to the office trailer, lunchroom or washroom facilities will be supplied to the Contractor by PCA. All services required to perform the Work will be the responsibility of the Contractor.
5. Supply and usage of power and other utilities:
 - a. The Contractor will supply all site power for the Work.

- b. GFCI protection is required on all outdoor services and wet locations.
- c. The Contractor must supply their own certified electrician to make connections and disconnections.
- d. The Contractor must supply and install equipment required to make use of the power supplies.

5.14 Operation or Use of PCA Owned Assets and Equipment

- 1. PCA will provide operators for the lift lock when required with one (1) week advance notice.
- 2. If any new lifting devices and/or specialized tooling are fabricated specific for this Work, it will become the property of PCA at the end of the Project.
- 3. PCA will be responsible for routine maintenance of the lift lock for the duration of this Project.
- 4. None of the components/materials from the site should be removed / disposed without consultation and permission from PCA.

6.0 GENERAL DESIGN REQUIREMENTS

1. Metals and steels supplied and incorporated into the permanent work shall be new and of the highest quality and shall conform to the minimum requirements of the material specifications. Specifications, mill certificates and Non-Destructive Examination (NDE) records shall be obtained for all metals and issued to the Owner for the permanent record. These documents shall include, but are not limited to, heat numbers, chemical compositions/analysis and mechanical properties (yield and tensile strengths, elongation and Charpy V-notch impact test results).
2. The materials and workmanship shall be free from defects and shall be of the highest quality applicable to the Work. All materials shall be new and shall comply with the standards of the ASTM and other standards stated in this Specification.
3. The Owner will be the sole judge of materials and workmanship, among other things, furnished and supplied by the Contractor. No patching, plugging, shimming or other such means to overcome defects, discrepancies or errors shall be employed without prior written agreement from the Owner. Failure to comply with this requirement shall constitute grounds for rejection of the item in question.
4. The mechanical design, fabrication and inspection of pressure vessels shall be in accordance with ASME Section VIII Div. 1 or Div. 2, 2020 Revision.
5. The hemispherical head should be designed in accordance with ASME Section VIII Div. 1 or Div.2, 2020 Revision, section UG-28(d).
6. Design should also meet the applicable requirements of ASME 17.1/CSA B44 Safety Code for Elevators and Escalators, for “Plungers subject to External Pressure”, section 8.2.8.1.3.
7. Contractor may supplement propose alternative selections of materials and /or fabrication methods provided that they offer significant advantages in respect to price, delivery date, quality and / or suitability for the specific service without loss of capacity, quality, or shortening the anticipated life of the vessels.
8. Such designs shall be fully and clearly described and substantiated by sketches or drawings
9. The responsibility of good performance of the designs and their compliance with related codes and legal requirements shall be borne by the Contractor, and in no way shall the purchaser be held responsible for their failure or rejection by code inspectors or legal authorities.
10. The contractor is responsible for the adequacy of the mechanical design and also compliance with the applicable code requirements, the temperature and pressure conditions and /or other conditions as specified in this specification or site visit all relevant documents.
11. Fabrication shall not begin until contractor has received written approval of his detailed shop drawings from the client or his authorized representative. The contractor shall notify the purchaser or his authorized representative of the starting time of the fabrication.
12. The proper thicknesses of the vessel shown shall be identified by CONTRACTOR's drawings and sketches and they should consider fabrication and corrosion allowance. The selection of adequate thicknesses, to provide for thinning of material due to construction operations, is at CONTRACTOR's care and responsibility.
13. Design drawings shall show as a minimum the following information:
 - a. Substance contained in the Pressure Vessel,

- b. Maximum allowable working pressure or design pressure,
- c. Design temperature,
- d. ASME Code addition and addenda used for the design,
- e. Material specification,
- f. Material thicknesses (minimum required thickness including corrosion allowance),
- g. Corrosion allowance,
- h. Welding details (symbols),
- i. Non-destructive examination requirements,
- j. Post weld heat treat requirements,
- k. Material impact test requirements,
- l. Test pressure and temperatures.

6.1 Service Life

1. The intent of this repair is to bring the ram to a state where it will be able to operate safely with routine maintenance and no major shutdowns for the next 15 years. Following the 5 year service life the client intends to replace the entire lift system. The new ram sections should have adequate material allowances for a period of over 10 years. This objective should govern all work to be done on the ram by the Contractor. In those instances where components are replaced by new ones, the basic design / manufacturing aim will be to ensure the stated minimum longevity and durability of the components.

6.2 Applicable Standards

6.2.1 AMERICAN NATION STANDARDS INSTITUTE (ANSI)

1. ANSI B 1.1 – Unified Inch Screw Threads

6.2.2 AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. ASME BPVC – Boiler & Pressure Vessel Code
2. ASME 17.1/CSA B44 Safety Code for Elevators and Escalators

6.2.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A-27 - Standard Specification for Steel Castings, Carbon, for General Application
2. ASTM A609 - Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof
3. ASTM E-709 - Standard Guide for Magnetic Particle Testing
4. ASTM E-125 - Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings
5. ASTM A-788 - Standard Specification for Steel Forgings, General Requirements
6. ASTM A-36 - Standard Specification for Carbon Structural Steel
7. ASTM A-516- Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
8. ASNT-SNT-TC-1A -Recommended Practice for NDT Personal Qualification and Certifications.
9. AWS D 1.1 -Steel Structural Welding Code

10. ASME BPV code Sec. V -Nondestructive Examination
11. ASTM E2491-06 - "Standard guide for evaluating characteristics of phased array ultrasonic examination instruments and Systems"
12. ASTM E2700-09 - "Standard Practice for Contact Ultrasonic Testing of Welds Using Phased Arrays"
13. BS EN 1291-Non-destructive examination of welds – Magnetic particle testing of welds Acceptance levels
14. BS 2600 -Radiographic Examination of Fusion Welded Butt Joints in Steel
15. CWB Certified - CSA W47.1-Certification of Companies for Fusion Welding of Steel
16. ASTM/ASME SEC.II Material Specifications
17. ASME SEC.IX Welding and Brazing Qualifications

6.2.4 CSA – CANADIAN STANDARDS ASSOCIATION (CSA)

1. CSA W59 - Welded steel construction
2. CSA B51 - Boiler, pressure vessel, and pressure piping code

6.3 Castings

6.3.1 MATERIALS

1. Castings shall adhere to the following standards:
 - a. Carbon steel castings – ASTM A-27, Grade 70-40

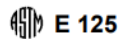
6.3.2 CASTING EXAMINATION

1. All castings shall be true to pattern, of uniform quality and condition, free from blowholes, porosity, hard spots, shrinkage defects, cracks, or other injurious defects and shall be properly cleaned for inspection. All bolt head and nut locations shall be spot or back faced and castings shall be machined on any part which acts as a bearing surface. The surfaces of castings which do not undergo machining shall be free from foundry irregularities, such as projections, ridges, hollows, honeycombing, pock marks, chip marks or entrapped sand. The largest fillets compatible with the design shall be incorporated wherever a change in section occurs. The moulds and casting practice shall provide proper ventilation and shall be designed to minimize the occurrence of high stresses and defects caused by air entrapment in the mould or the adverse effect of chills.
2. Test coupons from which test specimens are prepared shall be attached to all castings weighing 200 kg or more. The number, size and location of the test coupons shall meet with the Owner's acceptance. Heat numbers shall be permanently applied to all castings for reference.
3. All new castings that are fabricated be 100% **Advanced** ultrasonically tested (**Phased Array**). Ultrasonic examination shall be in accordance with ASTM A609 Acceptance Level 3 except in the fillet areas where Level 2 shall apply. The material shall generally be free from injurious defects as defined below.
4. 100% magnetic particle inspection, in accordance with ASTM E-709, shall be performed on all castings after heat treatment.
5. The personnel who perform MT and UT to this procedure shall be qualified and certified in Accordance with the requirements of, ASNT Recommended Practice No SNT-TC-1A,

6.3.2.1 Magnetic Particle Test

1. Magnetization technique for this procedure is the yoke technique, with wet type Ferromagnetic particles. This method shall only be applied to detect discontinuities that are on the surface of the part.
2. Alternating current yokes are superior to direct or permanent magnet yokes of equal lifting power for the detection of surface discontinuities. Only three phases, full-wave rectified current shall be used to magnetize the part.
3. Wet particles, including wet particle suspension vehicles and particle concentrations shall be in accordance with ASTM E 709.
4. Wet ferromagnetic particles shall be used. Wet particles are designed to be suspended in a vehicle such as water or oil at a given concentration for application to the test Surface by spraying.
5. The examiner shall be in the darkened area for at least 5 min prior to performing the examination to enable his eyes to adapt to dark viewing. If the examiner wears glasses or lenses, they shall not be photosensitive.
6. Satisfactory results are usually obtained when the surfaces are in the as-welded, as-rolled, as-cast, or as-forged conditions. However, surface preparation by grinding or machining may be necessary where surface irregularities could mask indications due to discontinuities.
7. Acceptance standard for magnetic particle inspection shall be as follows:
 - a. a. ASME BPV Code Sec. VIII, Div. 1 App. 6.
 - b. b. ASME BPV Code Sec. VIII, Div. 2 App. 9-1.
 - c. c. AWS D.1.1 Para. 6.10 & Table 6.1
 - d. All cracks and hot tears are not acceptable.
 - e. Indications exceeding limits given by ASTM E-125, listed below, are not acceptable.

i. Type I	None
ii. Type II	Degree 3
iii. Type III	Degree 3
iv. Type IV	Degree 2
v. Type V	Degree 1
vi. Type VI	Degree 2

**TABLE 1 Types of Discontinuities**

Type	Type of Discontinuity	Degree	Figure No. ^A	Definition
I	Linear discontinuities (hot tears and cracks)	1	I-1a, I-1b and I-1c	Ragged lines of variable width. May appear as a single jagged line or exist in groups. They may or may not have a definite line of continuity. They usually originate at the casting surface and generally become smaller as they go deeper.
		2	I-2a, I-2b and I-2c	
		3	I-3a, I-3b and I-3c	
		4	I-4a, I-4b and I-4c	
		5 (3 examples each)	I-5a, I-5b and I-5c	
II	Shrinkage	1 to 5	II-1, II-2, II-3, II-4 and II-5	Appears as a jagged area or irregular patches. Shrinkage is a subsurface discontinuity that may be brought to the surface by machining or other methods of metal removal.
III	Inclusions	1 to 5	III-1, III-2, III-3, III-4 and III-5	Isolated, irregular or elongated variations of magnetic particles occurring singly, in a linear distribution or scattered at random in feathery streaks. The indications are the result of the presence of sand, slag or oxides in the surface metal.
IV	Internal chills and unfused chaplets	1 to 5	IV-1, IV-2, IV-3, IV-4 and IV-5	A uniform line or band outlining the object and indicating lack of fusion between the metal object and the casting.
V	Porosity	2 examples	V-1 and V-2	Appears as rounded and elongated clusters of magnetic particles of various sizes; scattered at random.
VI	Welds: Weld porosity Incomplete penetration Undercutting Inclusions in weld Crater cracking	5 examples	VI-1 VI-2 VI-3 VI-4 VI-5	Incomplete fusion and penetration appears as a straight continuous or intermittent linear indication. Porosity, inclusions and linear discontinuities in welds appear as described above.

8. Prior to nondestructive testing, the surfaces of all castings to be inspected shall be cleaned and prepared to the extent necessary to ensure that the nondestructive testing inspection is thorough and permits precise interpretation. Castings showing evidence of excessive defects may be rejected by the Owner.

6.3.2.2 Phased Array Ultrasonic Test (PAUT)

1. For each ultrasonic examination, the following information should be identified and recorded.
 - a. Procedure
 - b. Ultrasonic examination equipment
 - c. Examination personnel identity and level
 - d. Calibration sheet identity
 - e. Identification and location of weld or volume scanned
 - f. Surface from which examination is conducted
 - g. Map or record of indications detected or areas clear
 - h. Date examination was performed
 - i. Couplants
2. Examination Coverage: The volume shall be examined by moving the search unit over the examination surface to scan the entire examination volume. Each pass of the search unit shall overlap a minimum of 10% of the transducer dimension perpendicular to the direction of the scan.
3. Phased array search units should be capable of appropriate wave physics for the crack sizing methods described in this procedure.
4. The calibration and reference blocks should be identified by type, part number or serial number on the system calibration record.

6.3.3 CLASSIFICATION OF DEFECTS

1. The following definitions shall be used in classifying defects:
 - a. **Injurious Defects:** A defect shall be considered injurious if its presence impairs the strength of the casting, causes unacceptable stress concentration, affects machinability or causes a contour variation unacceptable on a water passage. All linear discontinuities shall be considered injurious.
 - i. All injurious defects shall be completely removed, and repairs carried out to make the casting satisfactory for its intended purpose.
 - ii. Unusual defects, such as excessive segregation, shall be brought to the attention of the Inspector and the Owner.
 - b. **Major Defects:** Major defects shall be defined as those whose cavities after preparation for welding have depths requiring weld repair greater than 20% of the metal thickness, or 25 mm, whichever is the lesser, or have depths requiring weld repair greater than 2 mm over a continuous area of 150 mm by 150 mm or more.
 - c. **Minor Defects:** Minor defects shall be defined as those whose cavities, after removal of the defect, require repair welding less than the limits specified for major defects. Minor defects may be repaired by welding in accordance with an established commercial casting repair procedure.
 - d. **Other Defects:** In general, other visible defects such as blowholes and sand spots shall be considered injurious only if they are closely grouped or if they fall within fillets or areas designated for special inspection.
 - e. **Centerline Shrinkage:** In general, centerline shrinkage may not be considered as an injurious defect. However, these shall be repaired where there is a risk of interference with machining operations.

6.3.4 REPAIR OF CASTINGS

1. Castings may be repaired by welding, provided that the Contractor obtains prior agreement of his proposed procedures from the Owner, and that the strength, use, or machinability of the casting is not adversely affected.
2. Prior to weld repairs, injurious defects shall be completely removed to sound metal. Bridging of unsuitable material will not be accepted. Excessive segregation, impurities or alloys in a casting shall be cause for its rejection by the Owner. If the Contractor submits proof in writing for the Owner's review that such defects may be successfully repaired, then due consideration will be given.
3. Major repairs shall be made on the castings in the foundry prior to final stress relieving of the castings. Repair welds shall be done in accordance with the requirements specified below. Under no circumstances shall welds in excess of those permitted by the applicable ASME Code be applied after stress relieving unless agreed to in writing by the Owner.

6.4 Bolts and Cap Screws

1. Screw, bolts, studs, nuts and other fasteners shall be to ANSI Standards with Unified Inch Standard thread form in accordance with ANSI B 1.1.

6.5 Welding

1. All welded joints and materials must be selected, designed, performed and tested in conformity with the requirements of the latest editions of CSA Standard W59. Any parts classified as pressure vessels or pressure piping under CSA Standard B51 shall be fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII Division 1. Welded joints may be designed and tested based on internal design standards of manufacturers. Such standards shall be submitted to the Owner for comparison to CSA Standard W59 for structural elements and the ASME Boiler and Pressure Vessel Code, Sections VIII (Division 1, Appendix 12.). The Owner reserves the right to request additional information to confirm suitability of the proposed standard.
2. Welders and welding procedures shall be approved and certified by the Canadian Welding Bureau. All welders and welding procedures for parts classified as pressure vessels shall be certified by TSSA in accordance with the ASME BPV Code, Section IX. The Contractor may submit equivalencies within the jurisdiction of the manufacturing facilities for approval prior to starting manufacturing activities.
3. The welding rods and materials shall conform to the most recent requirements of CSA Standard W48 or ASME BPV Code, Section II, or AWS Standards. The Contractor may submit equivalencies for approval prior to starting manufacturing activities to ensure compatibility of the weld materials.
4. All welded parts that must be machined or embedded in concrete must receive a thermal stress relaxation/relieving, post-weld heat treatment before undergoing such operations, in accordance with the ASME BPV Code, Section VIII, Division 1. Pre-heating of materials to be welded shall be as required by, and in accordance, with the ASME BPV Code, Section IX.
5. Welding shall be performed so as to minimize distortion and residual stresses. Any welding of the Permanent Work that is to be performed to Standards or Codes other than specified herein shall be submitted by the Contractor for acceptance a minimum of 14 days prior to the commencement of such welding.
6. All welds are to be NDE inspected with magnetic particle inspection (MT) or dye penetrant inspection (PT) and radiographic inspection (RT) or ultrasonic examination (UT) as defined by the designs. NDE requirements shall be detailed in Inspection & Test Plans. All weld seams in vessel shall be 100% radiographically examined.
7. Welding book including weld map, Welding Procedure Specification (WPS) and supporting Procedure Qualification Reports (PQR) shall be provided by Contractor.
8. Welding electrodes, automatic or manual, shall deposit a composition corresponding to the material being welded. Where applicable, electrodes shall meet AWS specification. The electrodes used by the contractor should be of a type inspected and approved by the appointed inspector.

6.6 Steel Plates

1. Steel plates shall adhere to the following standards:
 - a. All material must be provided must be supplied per ASME section II-D
 - b. Steel for low temperature service must be supplied per USC-66.
2. All plate and structural steel shall be accurately fabricated, true to line and free from warp or twist. The edges to be joined shall expose sound metal, free of visual laminations, cracks and other defects. The

surface of plate steel runner blades shall be free from laminations and stringers. Non-destructive testing shall be performed wherever defects are suspected.

3. Whenever shaping (rolling, forming, forging, etc.) is required and affects material characteristics to the extent that they no longer fall within limits laid down by appropriate codes, shaping shall be followed by suitable heat treatment to ensure that material characteristics are brought back to limits prescribed. This applies in particular to components manufactured from normalized steel with or without subsequent tempering. No welding, hammering, pressing, or forming on the shells, heads, manholes, nozzles or other attachments, shall be performed after heat treatment.

6.7 Strength Requirements

1. Design, fabrication, welding, inspection, testing, and stress relieving of all high pressure components shall be in accordance with ASME BPV Code, Sections II, V, VIII, and IX.
2. All steel members shall be designed not to exceed 1/3 of the material yield stress during normal operation and 2/3 of the yield stress during exceptional operation.
3. Other heavy equipment steel members shall be designed not to exceed 60% of the material yield stress during normal operation (except for lifting equipment). In cases where the Contractor believes the maximum allowable stresses must be exceeded, they are to indicate why meeting the necessary safety limits are impossible or impractical and obtain Owner approval prior to proceeding.
4. Manufacturers who intend to use internal standards for design shall provide the proposed standard for approval. The manufacturer shall indicate which portions of the supply are covered by this standard and shall include sufficient information to define limits on allowable stresses and fatigue in the design and applied safety factors.
5. An FEA (Finite Element analysis) is required per ASME VIII-2, Part 5 to be submitted to the Owner and the Owner Representative for approval prior to manufacture.

6.8 Deformation Allowance

1. All equipment shall be able to withstand all static and dynamic stresses without damage or inelastic yielding under all operating conditions.
2. Elastic deformation shall be limited to what can be tolerated by the machine in operation without infringing on nominal operating fits and clearances.

6.9 Tolerance Requirements

1. Units shall be designed, manufactured, and assembled to tolerances commensurate with the function of the individual parts and assemblies. Additionally, the components shall have sufficient structural rigidity to maintain the equipment geometric tolerances during erection, placement of secondary concrete and design life. Appropriate heat treatment, transportation support, and structural strength shall be selected to maintain the equipment fits and clearances through the design life.
1. The dimensions and tolerances for diameters and lengths for surfaces mating with existing components shall be determined as follows. A series of a minimum of 8 measurements shall be taken of existing diameters and heights to match. The Contractor shall submit for approval the final dimension and

tolerances to be machined. At a minimum this will include the outside diameter, the spigot fit, and the height of the spigot fit and the overall length of the section to be replaced.

7.0 RAM REPLACEMENT

7.1 General Requirements

1. The Contractor is responsible to develop the methodology to provide the necessary access to the lowest section of the ram for replacement. At the time the Contractor will access the site, both east and west boat chambers will be lowered and sitting elevated on their winter stands.
2. The Contractor is to note that the bottom inside of the ram contains 4 to 6 feet of sediment and water that the Contractor may need to remove to access the bolts and seals connecting the cast steel lowest ram section to the remainder of the sections manufactured from cast iron. There is also water above the sediment that the Contractor may need to pump out.
3. Although the PCA winterization program for the locks includes partially pumping down the water in the press, water will remain in the press to an elevation of approximately 10 to 20 feet below the gland elevation on the press.
4. All components removed from the assembly shall be sandblasted or wire brush cleaned and visually inspected and the assessed condition recorded in the ITP.
5. The existing coating on some components may contain lead. The Contractor shall test existing paint on each component that is to be cleaned on site. If lead is detected, the Contractor shall take appropriate abatement measures.
6. All removed components that are to be reused shall be, as a minimum, degreased and cleaned. No fasteners are to be reused.
7. Parts shall be inspected for wear and damage as soon as they are accessible. The condition assessment should include photographs of any findings and supporting documents.
8. Measurements shall be recorded and provided to PCA as soon as they are available.
9. Contractor shall perform all matchmarking before dis-assembly.
10. Repairs not included in this specification shall have a recommended repair procedure and be quoted for PCA review. Repair work shall be approved by PCA prior to commencement.
11. All major components removed as part of the work must have an inspection and test plan (ITP), to be reviewed and accepted by PCA. The ITP must include all required physical measurements and NDT requirements and techniques with inspection log sheets.

7.2 Ram Replacement

1. The Contractor shall pre-fabricate a replacement section for the lowest section and replace it.
2. The section may be constructed from castings, forgings or steel plate as per the requirements of the general specifications
3. The Contractor shall prepare a design suitable for the intended installation strategy selected by the Contractor and submit the design for review and approval.
4. The design shall be prepared by engineers registered in the province of Ontario and shall comply with the requirements of the latest version of the ASME Boiler and Pressure Vessel Code, Sections II, V, VIII, and IX.

5. The new design shall replicate the dimensions of the original components but a hatch in the bottom is not required.
6. The new ram section should include safety discharge holes, quantity 30 of which were included in the original design of the ram as indicated on drawing reference t20-164220, designed to prevent excessive lifting of the ram and the boat chamber above the normal operating elevation.
7. The design shall address the possibility that the original components may not be perfectly round and will ensure no sharp edges remain after installation that may damage the seal in the stuffing box.
8. The lower section must be able to support the weight of the ram and water filled boat chamber with a total weight of 16,500 kN (3,700,000 lbs.).
9. The boat chamber internal dimensions are 140 ft x 33 ft and during operation each chamber contains up to 8 ft of water. The empty weight of the boat chamber and ram is 6,150 kN (1,382,000 lbs.). The ram is estimated to be 1100 kN (250,000 lbs.).
10. The lower section of the ram supporting the weight of the water filled boat chamber and the ram, measures 2.286 m (90") diameter resulting in a system operating pressure of 4.00 MPa (580 psi) as measured at the top of the press. This equates to a pressure of 4.23 MPa (610 psi) when measured at the bottom of the press.
11. The pump system which fills the press at startup operates at approximately 4.8 MPa (700 psi) but since the pumps deadhead at 5.2 MPa (750 psi), this latter value should be used as the design pressure for the ram.
12. An additional radial load applied to the ram by the gland packing material should be assumed to act over a 9 inch high section of the ram, assuming a gland ring insertion depth of 1.5 inches, at a pressure of 11.0 MPa (1,600 psi) . The maximum elevation of the ram for application of this load should be assumed to be 24.5 inches above the top face of the press below the gland ring as measured from the top of the 3 foot 5 inch high section. The pressure applied assumes a maximum operating torque applied to each of the 52, 1.5 inch gland ring mild steel studs of 100 ft.lb.
13. The lead seal shall be removed and disposed of appropriately.
14. A new seal shall be provided as a suitable custom or off the shelf seal. The material of the seal may be Buna-N, neoprene or other can be proposed by the designer that are suitable to the pressures, service life and medium. The proposed seal shall be submitted for review and approval.
15. The surface finish of the ram OD shall be no greater than 6.35 microns (250 microinch)
16. All loose fasteners, bolts, studs and washers removed from the lift lock as part of the work shall be replaced by the Contractor with new fasteners prior to reassembly.

8.0 DISASSEMBLY/RE-ASSEMBLY

8.1 General Requirements

1. The Contractor shall provide a qualified team to accomplish the dis-assembly and installation activities. Based on the scope of work, the Contractor shall have experienced technicians, workers with the necessary trade certificates for the work they are assigned.
2. The Contractor shall provide a plan to indicate how the work will be staged to access, remove and replace the lowest ram sections on both the east and west lift locks.
3. The Contractor shall provide, upon request, the qualification certificates or any other approved documents demonstrating that the personnel involved in the installation of the equipment have the necessary skills and licenses for doing the work.
4. The Contractor shall supply tools, installation equipment, workers and managing staff, consumables, and whatever else may be necessary to complete the work.
5. The Contractor shall demonstrate that all personnel involved in the installation of the equipment have received the health and safety training.
6. The Contractor shall submit an installation inspection and test plan (ITP) with blank Quality Control Records to capture measurements and records for review by PCA. The installation activities shall be integrated into the main schedule with sufficient breakdown to track the activities in the ITPs.
7. The Contractor shall provide notice and completed protocols or inspection records to PCA or its representatives one week prior to the completion of every hold point identified in the ITP. The Contractor shall provide PCA the means to access and take measurements at all inspection points.
8. After removing parts temporarily welded to the shell, the involved area shall be ground flush and checked by MT for thickness ≥ 50 mm and/or for material with ultimate tensile strength ≥ 490 MPa.

8.2 Applicable Standards, Codes and Guidelines

1. The following standards, codes and guides shall be used, as applicable, in the installation of the equipment:
 - a. Regulations and statutes of the Province of Ontario
 - b. Technical Specifications

8.3 Requirements

1. The tolerances below shall be regarded as the minimum requirements or the maximum allowable deviations of tolerances for installation unless tighter tolerances or requirements are specified in factory drawings, installation manuals, or provisions, agreements and contracts.
 - a. All measuring instruments and tools used for taking final recorded measurements shall be calibrated, and calibration certificates are to be effective during the installation period.
 - b. The Contractor shall be responsible for mechanical benchmark measurements.
 - c. The Contractor shall be responsible for match marking and identifying all components.

- d. The clearances on mechanical mating joints or seams between two mechanical components shall not exceed 0.05 mm, generally or shall not exceed 0.1 mm for more than 20% in aggregate of the total length of the seam. In such cases the insertion depth in individual locations shall be less than one-third of the total depth of the joint.
 - e. All matchmarking of components from the factory shall be respected.
- 2. The Contractor will record all running gaps and clearances of the boat chamber guide rails and rollers prior to disassembly if they are moved. These gaps will define the acceptable tolerances upon re-assembly.
- 3. The gland of the seal shall be torqued to 100 ft. lbs. or a lower value as may be defined by PCA during the ITP review process. The torque will be re-verified after moving the chamber up and down one cycle.
- 4. The Contractor shall describe in the documents submitted to PCA the dis-assembly and re-assembly process. At any time where such an operation presents significant risk, PCA retains the right to implement a hold point until the Contractor has defined a plan to ensure safety of the goods and the people involved. The plan shall have sufficient detail to allow evaluation by PCA or its representatives. PCA retains the right to request changes to the plan prior to release of the hold point.

9.0 TESTING

1. Prior to pressurizing the press and operating the boat chamber the Contractor will confirm completion of all installation activities and verify installation records to confirm the acceptance of installation results.
2. The Contractor will define any special steps and measures for re-pressurizing the system. PCA will perform the watering up and pressurizing of the system as per Contractor instructions.
3. The system pressure will be raised to the maximum operating pressure and the interior of the rams will be inspected for leaks. No leaks are permitted. The method for validation of this requirement shall be provided by the Contractor in advance in the commissioning / testing ITP.
4. The boat chamber will be raised and lowered three times. There will be no delay or interference in the boat chamber reaching their desired location at the upper and lower reach.
5. The integrity of the gland seal to ram interface will be checked through verification that with the boat chamber raised to the maximum normal operating level the ram should hold the alignment (within the 3" vertical range) for 10 minutes. The test shall be completed after the first and third raises as a minimum.
6. After the three operations the shaft seal performance will not have changed.

SCHEDULE A

Site Specific Safety Plan

SITE SPECIFIC SAFETY PLAN

General Contractor Name: _____

Project Name: _____

Project Location: _____

Date: _____

1. General Contractor Health and Safety Personnel

Position	Name	Cell Phone
Site Superintendent		
Site Foreman		
Safety Representative		

2. Main Site Activities or Tasks

Number	Description
1	
2	
3	
4	
5	

3. Activity Hazards and Mitigation Measures

Activity No.	Activity Description	Hazards	Control Measures to Mitigate Identified Hazards	Required Training/Certification and Equipment
1				
2				
3				

Activity No.	Activity Description	Hazards	Controls Measures to Mitigate Identified Hazards	Training/Certification Required
4			.	
5				
6				

SITE SPECIFIC EMERGENCY RESPONSE PLAN

1. Emergency Contact List

Fire: 9-1-1
Ambulance: 9-1-1
Police: 9-1-1

Contractor Name: _____ Phone: () _____

Main Office Address: _____

Site Superintendent: _____ Cell Phone¹: () _____

Site Foreman: _____ Cell Phone¹: () _____

Safety Representative: _____ Phone: () _____

¹ On-Site personnel listed as emergency contacts are to be readily available by cell phone at all times while job site is active.

Parks Canada Project Manager: _____ Cell Phone: () _____

Parks Canada Site Manager: _____ Cell Phone: () _____

2. Emergency Response

In the event of an injury on the site the following emergency procedure shall be followed:

1) Secure the area and make the casualty safe from further injury.

2) Administer first aid immediately.

(NOTE: First Aid kits are located in the _____.)

3) Have the nature and severity of the injury assessed by a person qualified in first aid.

(NOTE: The following personnel are qualified in first aide: _____.)

4) Transport the casualty to receive medical attention immediately.

Minor Injury: The casualty will be transported by company vehicle to the nearest hospital ².

² Map and/or directions to nearest hospital emergency room is attached.

Major (Life or Non - Life Threatening Injury): Dial 9 - 1 - 1 to dispatch an ambulance.

*Direct the ambulance to the project site: _____
(list address of the project site)*

5) Report the incident to the site foreman, site supervisor and Parks Canada Project Manager.

6) Assign a worker to meet the ambulance at the main entrance to the facility and direct them to the work area.

SITE SPECIFIC SAFETY HAZARDS REVIEW AND SAFETY PLAN POLICY

Project Name: _____

We, _____ are committed to identifying and controlling safety hazards on the project. By completing the Site Specific Safety Plan and the Emergency Response Plan and following applicable Health and Safety Regulation requirements, we accept responsibility to enforce the hazard control measures to protect the general health and safety of all persons on the job site and surrounding areas that may become affected as a result of the work.

Responsibilities

Management (Prior to Commencement of Work and Ongoing)

1. Initialize development of Site Specific Safety Plan and Emergency Response Plan.
2. Designate site supervisor responsible for job safety.
3. Review and identify with supervisor all foreseeable safety hazards and indicate controls to eliminate or mitigate consequences of each.
4. Provide a signed copy of the completed Safety Hazard Review to the Parks Canada Departmental Representative for approval.
5. Provide all required training as part of methods of control.
6. Ensure actions are taken by supervisor and workers to address all hazards identified.

Supervisor (Ongoing)

1. Identify all foreseeable hazards to Management and provide recommendations on how to eliminate or control said hazards.
2. Discuss hazards and controls with workers and collect concerns. Ensure all workers read the Site Specific safety plan and understand its requirements. Keep a copy at the work site.
3. Respond to workers' concerns immediately.
4. Ensure the form addresses the concern(s) and the actions to be taken. Revise form accordingly.
5. Provide any revised copies of the completed Safety Hazard Review Form to Parks Canada Departmental Representative for approval.

Worker (Ongoing)

1. Inspect workplace for perceived hazards prior to work.
2. Report any perceived hazards that may be un-addressed verbally to the site supervisor.

3. Provide recommendations to the supervisor on how to eliminate or control the hazards.
4. Inform management immediately if the supervisor does not respond to concerns.

Contractor Agreement

I, _____, on behalf of _____, confirm our commitment to health and safety on the job site. Methods of hazards control as identified in this Safety Hazards Review and applicable safety regulations will be enforced for the duration of work.

Signature Company Representative

Date

Site Specific Safety Plan Received By:

Parks Canada Departmental Representative

Date

The Departmental Representative, on behalf of Parks Canada, reserves the right to stop work at any time if it is deemed that methods of control are not being properly enforced and/or do not adequately address the needs of the hazards as identified in this Safety Hazards Review, as well as if any unforeseen hazards arising during work are being overlooked.

SCHEDULE B

Attestation and Proof of Compliance with
Occupational Health and Safety (OHS)

Attestation and Proof of Compliance with Occupational Health and Safety (OHS)

Submission of this completed form, satisfactory to Parks Canada, is a condition of gaining access to the work place.

Instructions:

Prime contractor must sign this form for all projects undertaken at Parks Canada work places.

This form is to be administered by the Project Manager and completed by the Prime Contractor AFTER contract award.

Parks Canada recognizes that federal OHS legislation places certain specific responsibilities upon Parks Canada as owner of the work place. In order to meet those responsibilities, Parks Canada is implementing a contractor safety regime that will ensure that roles and responsibilities assigned under Part II of the *Canada Labour Code* and the *Canada Occupational Health and Safety Regulations* are implemented and observed when involving contractor(s) to undertake works in Parks Canada work places.

Parks Canada Responsible Authority/Project Lead	Address	Contact Information
Project Manager/Contracting Authority (delete as required)		
Prime Contractor		
Subcontractor(s) (add additional fields as required)		

Location of Work

General Description of Work to be Completed

Mark "Yes" where applicable.

	A meeting has been held to discuss hazards and access to the work place and all known and foreseeable hazards have been identified to the contractor and/or subcontractor(s)
	The contractor and/or its subcontractor(s) will comply with all federal and provincial/territorial legislation and Parks Canada's policies and procedures, regarding occupational health and safety.
	The contractor and/or its subcontractor(s) will provide all prescribed safety materials, equipment, devices and clothing.
	The contractor and/or its subcontractor(s) will ensure that its employees are familiar with and use all prescribed safety materials, equipment, devices and clothing at all times.
	The contractor and/or its subcontractor(s) will ensure that its activities do not endanger the health and safety of Parks Canada employees.
	The contractor and/or its subcontractor(s) has inspected the site and has carried out a hazard assessment and has put in place a health and safety plan and informed its employees accordingly, prior to the commencement of the work.
	Where a contractor and/or its subcontractor(s) will be storing, handling or using hazardous substances in the work place, it will place warning signs at access points warning persons of the presence of the substances and any precautions to be taken to prevent or reduce any hazard of injury or death.
	The contractor and/or its subcontractor(s) will ensure that its employees are instructed in respect of any emergency procedures applicable to the site.

I, _____ (contractor), certify that I have read, understood and attest that my firm, employees and all sub-contractors will comply with the requirements set out in this document and the terms and conditions of the contract.

Name _____ Signature _____

Date _____

SCHEDULE C

Peterborough Lift Locks -Ram Replacement- PCA
Mitigation Guidance



Peterborough Lift Locks – Ram Replacement

General PCA Mitigation and Guidance

1 General

- 1.1** - The Owner, Parks Canada Agency (PCA) is the main Environmental Authority for Trent-Severn Waterway (TSW) projects. Issues pertaining to Federal and Provincial Legislation (i.e. Historic Canal Regulations, Species at Risk Act, Fisheries Act, Canadian Environmental Assessment Act, 2012, Endangered Species Act, Migratory Bird Convention Act, etc.), such as that pertaining to Species at Risk (SAR), invasive species, spills, water quality, etc., shall be directly reported to PCA.
- 1.2** Inform the PCA's Representative and Environmental Officer (TSW in Peterborough) regarding any changes to project plans and/or scheduling. Any changes not addressed under this Specifications document and any environmental assessment documents pertinent to the PCA permitting agreement will require approval from PCA and may require further mitigation measures.
- 1.3** Contractor is required to submit an Environmental Management Plan (EMP) to Parks Canada that outlines all the measures to be implemented by the contractor on the project site to eliminate or reduce environmental effects and address mitigation measures outlined in the Specifications document. In order to allow for the timely commencement of project activities, the EMP can be submitted as separate components as project details become available. The EMP, or its components, will be submitted in writing prior to implementation of project activities and must be accepted by Parks Canada and the Departmental Representative.
 - 1.3.1** PCA will not issue permit to authorize start of Work, under Historic Canal Regulations, prior to the review and acceptance of EMP.
 - 1.3.2** A copy of the EMP shall be kept on site for the duration of the project and all works, as applicable, shall be completed in compliance with the EMP.
- 1.4** The EMP will detail frequency of monitoring and list high-risk construction activities where an environmental professional must be onsite. Monitoring and testing should be adaptable to changing site conditions and will capture any event/incident for the length and scope of that event.
- 1.5** The proponent is to ensure that all on-site personnel are aware of, and comply with the prescribed mitigation measures within the Specifications document and any environmental assessment documents pertinent to the PCA permitting agreement.
 - 1.5.1** A copy of the permitting agreement and subsequent mitigation or protocols prescribed by Parks Canada shall be kept on site for the duration of the project.
- 1.6** The contractor shall adhere to all federal, provincial, and municipal legislation, by-laws, regulations, guidelines, safety standards, and codes governing construction activities. In cases of overlap, the most stringent will apply.
- 1.7** Should conditions at the work site indicate that there are negative impacts to fish, fish habitat, wildlife, cultural or visitor experience resources, all associated works shall cease until the problem has been corrected and PCA's ES staff have been consulted/notified. PCA has the right to require that work be altered or ceased immediately.
- 1.8** As per the Historic Canal Regulations (HCR) applicable to lands administered by the Trent Severn Waterway National Historic Site of Canada, a permit signed by PCA's Ontario Waterways Director or delegate will be required to authorize the project work prior to commencement of the project as per 1.3.1 (to be facilitated by PCA).



2 Equipment and Site Condition

- 2.1** Maintain equipment and machinery to avoid leakage of fuels and liquids. Ensure measures are in place to minimize impacts of accidental spills.
- 2.2** Equipment must be properly tuned, clean and free of contaminants, in good operating order, free of leaks (e.g., fuel, oil or grease), and fitted with standard air emission control devices and spark arrestors prior to arrival on site (if applicable).
- 2.3** All materials and equipment used for the purpose of site preparation and project completion shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum productions, debris etc.) from entering the water.
- 2.4** Any stockpiled materials, or concrete debris shall be stored and stabilized a safe distance away from any watercourse, drainage course or swales to prevent erosion and subsequent entry into the TSW or removed from the site, in accordance with all federal, municipal and provincial regulations.
- 2.5** Store all oils, lubricants, fuels and chemicals within sealed, impermeable containers, within secure areas and upon impermeable-lined drip/spill trays.
- 2.6** Vehicle and equipment re-fueling and/or maintenance shall be conducted over an impermeable-lined drip/spill tray to allow full containment of spill, off of slopes and away from the water at a recommended distance of 30 m if possible.
- 2.7** A designated re-fueling depot will minimize the potential for extensive impacts at the site due to accidental releases of substances; proper spill management equipment shall be in place for fueling.
- 2.8** Drip/spill trays shall be placed under all fuel-powered equipment. Drip trays shall be sized appropriately to encompass the outer perimeter of the equipment/machinery, providing adequate spacing for refueling activities.
- 2.9** All compressed air/fuel tanks shall be stored off to the side, away from on-going activity, and be adequately protected with an impact-protection barrier.
- 2.10** Any Above-ground Storage Tanks (ASTs) or other fuel storage tanks on site, are to be stored in compliance with Federal and Provincial storage tank requirements. Specifically, ASTs are to be placed within a secondary containment system of adequate holding capacity, based on the volume of the AST. See: <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/code-practice-storage-tank-systems/part-3.html>.
- 2.11** Self-contained fuel tanks, or fuel tanks so large where sizing a drip/spill tray to be placed underneath said tank would be impractical, at minimum, a spill tray is to be placed at the nozzle/hose end and utilized for all refueling activities.
- 2.12** There shall be no discharge of chemicals and cleaning agents in or near aquatic habitats; all such substances shall be disposed of at a facility licensed to receive them.
- 2.13** Spill control and emergency plans will be in place prior to initiation of construction; an emergency spill kit shall be kept on-site and employed immediately should a spill occur. The contractor shall ensure that adequate additional spill clean-up resources are available



- 2.14** In the event of a spill, PCA and the Ontario Spill Action Centre (1-800-268-6060) shall be notified immediately. Remediation will be conducted immediately to contain and clean up in accordance with federal and provincial regulatory requirements AND to the satisfaction of PCA. Documentation of remediation, testing and results will be provided to PCA. Spills should be reported directly to the PCA Environmental Officer on file (705-750-4900).
- 2.15** Spill-related environmental incidents or emergencies include (but is not limited to):
- 2.15.1** Chemical spill or petroleum spill;
 - 2.15.2** Poisonous or caustic gas emission;
 - 2.15.3** Biological or chemical explosion;
 - 2.15.4** Hazardous material spill;
 - 2.15.5** Sewage spill;
 - 2.15.6** Contaminated water into waterways;
 - 2.15.7** Release of turbidity into the waterway; and
 - 2.15.8** Release of water with pH <6 or >9 into the waterway.
- 2.16** Use biodegradable hydraulic fluids for machinery that will be working in or around the river.
- 2.17** The Material Safety Data Sheet (MSDS) of any unapproved substances to be utilized onsite (particularly that of substances to be in use in/adjacent to water) shall be provided to PCA EA for review and acceptance. MSDS information of known products to be utilized in/adjacent to water throughout the duration of the project should be incorporated as part of the EMP.
- 2.18** All materials and equipment used for the purpose of site preparation and project completion shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum productions, debris etc.) from entering the water.
- 2.19** Any part of a vehicle and/or equipment entering the water shall be free of fluid leaks and externally degreased to prevent any deleterious substance from entering the water.
- 2.20** Spill kits will be maintained on site and the contractor will ensure that adequate additional resources are available.
- 2.21** No tools, equipment, temporary structures or parts thereof, used or maintained for the purpose of this project, shall be permitted to remain at the site after completion of the project.

3 Water Quality, Fish and Fish Habitat

- 3.1** Ontario Drinking Water Quality Guidelines cannot be exceeded (beyond parameters that currently exist) due to project activities.
- 3.2** Salt and other road chemicals should be properly stored in designated areas only, preferably in dry sheds to prevent infiltration of leachate to the water table and surface runoff.
- 3.3** Accumulated snow that may be contaminated with salt should be disposed of only at approved dumpsites or designated areas.
- 3.4** Snow containing salt or sand should never be dumped in, or allowed to melt and run off into watercourses.
- 3.5** All works shall be completed in the dry by de-watering the work area.



- 3.6 Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life will form the baseline for water and streambed quality (see <http://ceqg-rcqe.ccme.ca/en/index.html#void>).
- 3.7 Activities causing turbidity or release of sediment will comply with the CCME Guidelines on Total Particulate Matter (see <http://ceqg-rcqe.ccme.ca/download/en/217>).
- 3.8 Existing river flows shall be maintained downstream of the dewatered work area without interruption, as per operational guidelines, during all stages of the work.
- 3.9 Should conditions at the work site indicate that there are negative impacts to fish or their habitat, all work shall cease until the problem has been corrected and Parks Canada EA staff has been consulted.

4 **Erosion and Sediment Control**

- 4.1 Erosion and sediment control measures shall be implemented prior to work and maintained during the work phase, to prevent entry of sediment into the water where site access or other activities cause exposed soil.
- 4.2 Monitor water quality for unacceptable suspended sediment levels during construction. Monitoring shall include the full scope and breadth of any incident.
- 4.3 All erosion and sediment control measures shall be inspected daily to ensure they are functioning properly and are maintained and/or upgraded as required to prevent entry of sediment into the water.
- 4.4 Environmental protection measures shall be checked after each extreme weather event.
- 4.5 If sediment and erosion control measures are not functioning properly, no further work shall occur until the sediment and/or erosion problem is addressed to the satisfaction of PCA.
- 4.6 All disturbed areas of the work site shall be stabilized immediately and re-vegetated as soon as conditions allow. All exposed areas should be covered with erosion control blankets or other measures to keep the soil in place and prevent erosion until vegetated in the spring.
- 4.7 Soils shall be protected by laying geotextile and covering with a suitable depth of gravel, >100mm to prevent crushing/compaction of existing soils; alternative methodology for soil-compaction prevention may be utilized (ex. blast mats), as reviewed and approved by PCA.
- 4.8 Sediment and erosion control measures shall be left in place until all areas of the work site have been stabilized.
- 4.9 Upon completion of the work all debris shall be completely removed and the area restored to its original state or better. Repair all damages to property due to project activities.
- 4.10 Sediment control measures and exclusion fencing must be removed in a way that prevents the escape or re-suspension of sediments.
- 4.11 Erosion and Sediment controls shall not be removed without acceptance from PCA.

5 **Dewatering and Pumping Activities**



- 5.1 If required, a de-watering Plan shall be submitted, as part of an EMP, to PCA for review and acceptance prior to any dewatering.
- 5.2 Discharged water should be filtered by means of an appropriately designed sediment basin, anionic flocculation or by physical means such as a filter press.
- 5.3 For de-watering, fish screens must comply with DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines when pumping in fish-bearing water to prevent impingement or entrainment of fish.

6 **Vegetation and Tree Protection**

- 6.1 In compliance with the *Migratory Bird Convention Act (MBCA)*, no removal of trees or other vegetation during the breeding bird window from April 1st to August 31st is to take place of any year.
- 6.2 Minimise ground disturbance and vegetation removal, when possible.
- 6.3 Minimise bare soil exposure (e.g., cover stockpiled material with tarps, plant native species, cover with natural mulch/ground coverings).
- 6.4 Stabilize and re-vegetate disturbed areas as soon as possible, ideally with native plants, soil and seed mix or otherwise approved by designated Parks Canada staff. If there is insufficient time remaining in the growing season, stabilize the site to prevent erosion and vegetate the following spring.
- 6.5 Root systems of trees identified to remain should be properly delineated and fenced off, so as to protect the root systems from being crushed and impacted by machinery.
- 6.6 In the event that the installation of root-protectant fencing is not possible and/or ideal, alternative measures, as approved by PCA, must then be implemented. Such measures must provide a sufficient amount of soil compaction prevention with regards to the highest level of activity to occur within the immediate area of protection.

7 **General Wildlife and Species at Risk (SAR)**

- 7.1 On-site workers must be made aware of and subsequently report any incidental sightings of Species at Risk (SAR) immediately to designated Parks Canada staff.
- 7.2 If active nests, dens or roosts are discovered, stop work within its immediate vicinity and contact designated Parks Canada staff immediately for direction.
- 7.3 Cover or fence hazardous areas when left unattended to reduce the potential for wildlife injury.
 - 7.3.1 Synthetic plastic Erosion Control Blankets/Mats should not be utilized, particularly during nesting season, as they pose as an entrapment hazard to turtles and other wildlife. Fibre-based bio-degradable Erosion Control Blankets/Mats are only to be utilized.
 - 7.3.2 Sediment fencing with synthetic plastic mesh backing is not to be utilized. The mesh material poses as an entrapment hazard to wildlife.
- 7.4 Wildlife is not to be approached, handled or harassed (i.e. feeding, baiting, luring).
- 7.5 If wildlife is observed at or near the work site, allow the animal(s) the opportunity to leave the work area. If the individual can not or will not leave the site, contact PCA for direction.
- 7.6 If injured/dead wildlife are encountered report to PCA immediately. PCA may require retrieval and storage on ice of carcass for laboratory testing.



7.7 Park on roads or disturbed area only.

7.8 Work areas will be kept clean and free of potential hazards to wildlife such as wire, cable, tubing, plastic, antifreeze or other materials that wildlife may eat or become entangled in.

8 Invasive Species

8.1 To reduce the risk of introducing invasive species, all equipment, clothing and footwear must be thoroughly cleaned prior to coming to the site. Any machinery that appears to have not been cleaned will not be permitted on site. For additional information or guidance on how to properly clean equipment, see the Clean Equipment Protocol for Industry developed by the Ontario Invasive Plant Council and found here: http://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean-Equipment-Protocol_June2016_D3_WEB-1.pdf

8.2 Should an invasive species be encountered (or at least suspected), a photo and report of the specimen should be sent to PCA's EA staff and the Invading Species Hotline at 1-800-563-7711 or online at EDDMapS Ontario: <https://www.eddmaps.org/ontario/>.

8.3 Use weed-free material (i.e. sand, gravel, etc.) for erosion control and stabilization and weed-free seed. Confirm that seed mix to be used for revegetation purposes does not (potentially) contain invasive plants.

9 Cultural Resources and Archaeology

9.1 Before any on-site mobilisation/construction work commences, PCA staff will clearly delineate any archaeologically sensitive areas and photo-document this activity for PCA records. These areas will be deemed no-go zones for staging, vehicular traffic and machinery.

9.2 Vehicular access routes and staging areas will be restricted to present-day roadways, parking lots, exposed bedrock areas and significantly disturbed areas. If this is not possible, the use of protective covering is required. All protective measures employed must be removed following construction and the area restored to a pre-construction state. Excavation is not permitted outside of cleared/reviewed areas in the AOA during installation or removal of protective covering.

9.3 If archaeological, cultural resources, or character-defining elements (e.g. structural features or artifact concentrations) are encountered or damaged during construction activities, work will cease in the immediate area and the PCA PM shall be informed. The PM should then contact PCA's Terrestrial Archaeology section for advice and assessment of significance, and if necessary, any further mitigation measures. Ensure that all exposed underwater cultural materials are kept submerged and/or wet while waiting direction.

10 Air Quality and Noise

10.1 All on-site vehicles are expected to have a Drive Clean Emissions Report in compliance with O. Reg. 361/98: Motor Vehicles under the Environmental Protection Act, R.S.O. 1990, c. E.19. EA Officers may stop a vehicle if they believe the vehicle is emitting excessive exhaust smoke or suspect that emission control equipment has been tampered with or removed.

10.2 Use well-maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust baffles, engine covers, etc. In addition, employ timing and location of construction activities to reduce or minimize the effect of noise on nearby residents, recreational users, and wildlife.



- 10.3** Machines shall not be left to unnecessarily idle in order to avoid emissions.
- 10.4** Adhere to local and municipal noise by-laws.
- 10.5** Due to the proximity of the work site to water, calcium chloride shall not be used to suppress concrete dust.
- 10.6** Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods

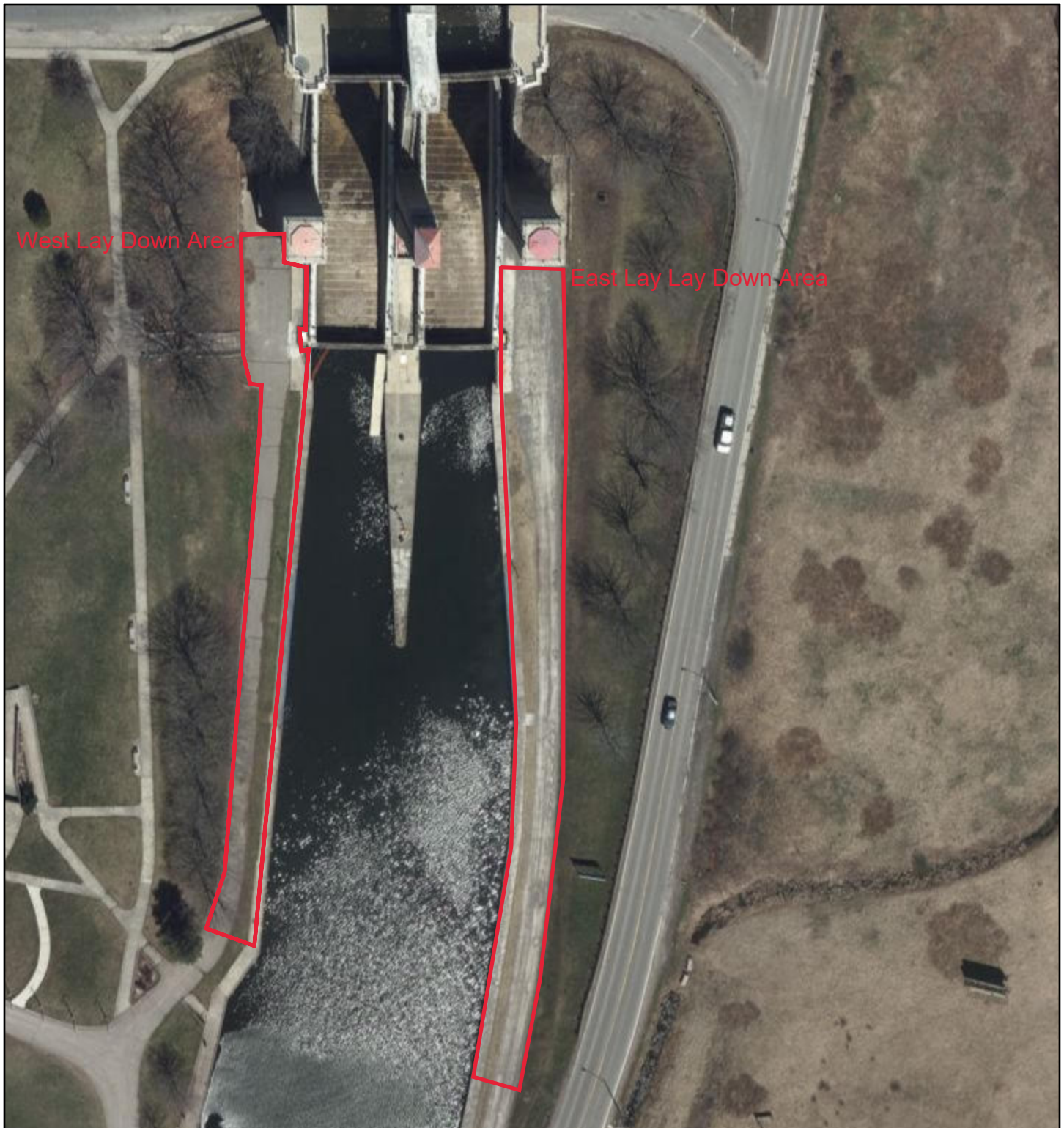
11 Waste Management

- 11.1** All wildlife attractants must be secured (e.g., petroleum products, human food, recyclable drink containers and garbage) in wildlife-proof containers, a secure building or vehicle. When possible, keep food waste separate from construction waste and remove daily.
- 11.2** Contain and stabilize waste material (e.g., construction waste and materials, vegetation) at a minimum of 30m from a waterbody.
- 11.3** Littering is prohibited. Garbage and waste material onsite is to be collected daily and stored in appropriate containers/bins.
- 11.4** All debris collected within the containment system shall be carefully emptied into an enclosed container daily, or more frequently if required, to ensure that no paint chips or debris escape into the surrounding environment, or remain at the site. All paint chips and debris shall be recovered, collected, and taken to a landfill site licensed to receive it for disposal in accordance with all applicable federal, provincial, and municipal laws, regulations, and guidelines.
- 11.5** Burning is not permitted within the protected heritage place unless approved by Parks Canada.

SCHEDULE D





Laydown Area

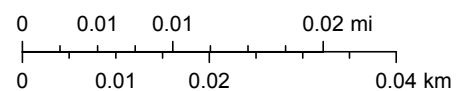
ArcGIS Web Map



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1:1,128

-  Waterways Geographic Townships
-  YellowBreasted / Paruline polyglotte DRAFT
-  Important Species - Espèces importante: Eastern Musk Turtle / Tortue musquée
-  Eastern Whip-poor-will / Engoulevent bois-pourri







Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

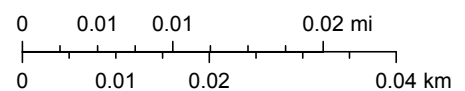
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-  Waterways Geographic Townships
-  YellowBreasted / Paruline polyglotte DRAFT
-  Important Species - Espèces importante: Eastern Musk Turtle / Tortue musquée
-  Eastern Whip-poor-will / Engoulevent bois-pourri

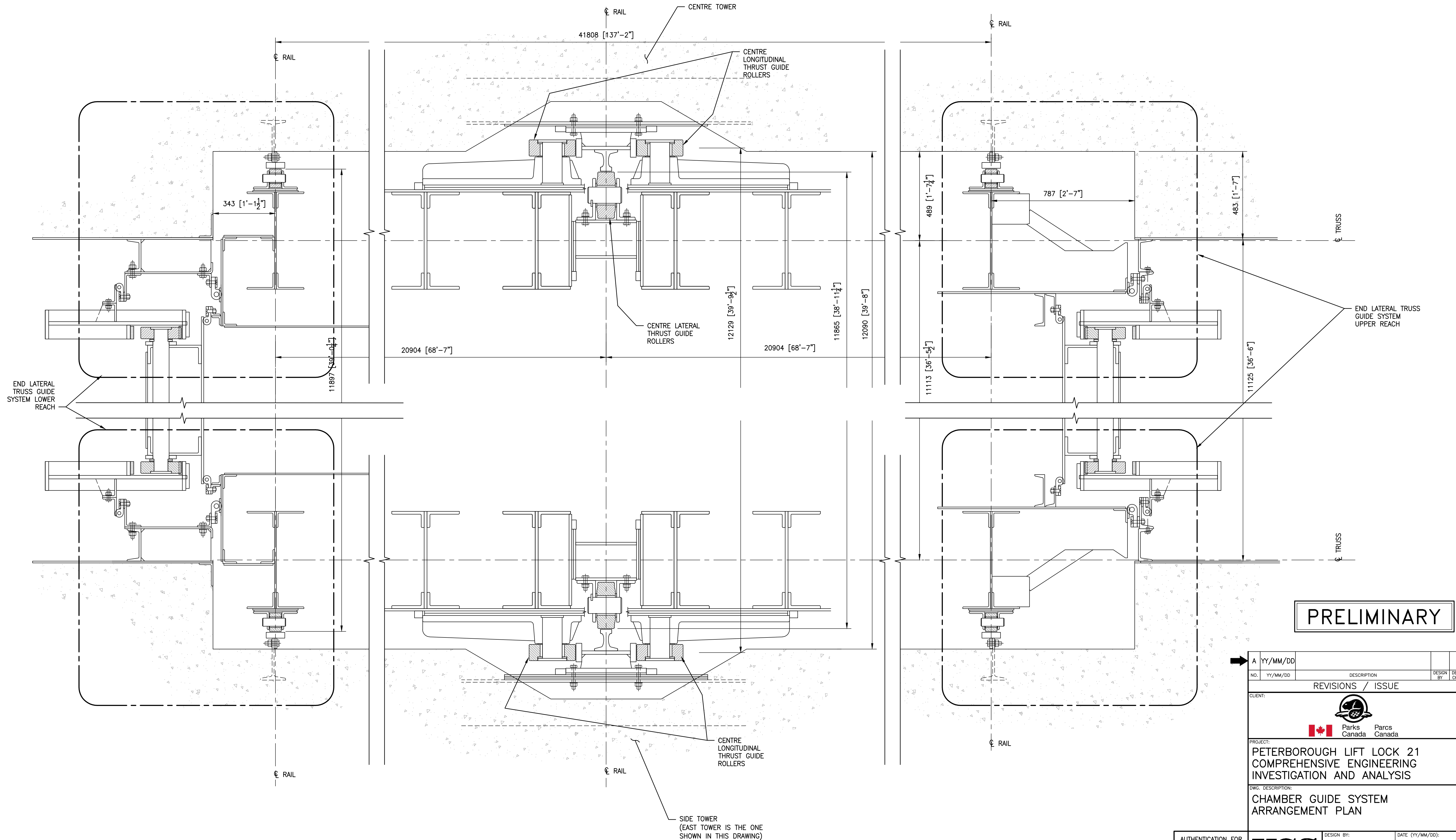


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

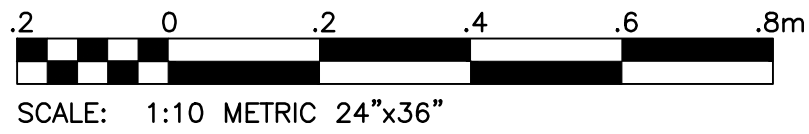
SCHEDULE E

Drawings

File: \\g:\projects\2015\15-1538-002\m01_recover.dwg - Tab: LAYOUT Plotted By: jcarlos 16/02/22 [Mon 9:38am]
24"x36" / PLOT SCALE: 1"=10'



CHAMBER GUIDE SYSTEM ARRANGEMENT PLAN
1:10



AUTHENTICATION FOR
CURRENT REVISION

ENG. STAMP

KGS
GROUP
CONSULTING
ENGINEERS

DESIGN BY:

DESIGN CHECK:

DRAWN BY:

DWG CHECK:

DATE (YY/MM/DD):

DATE:

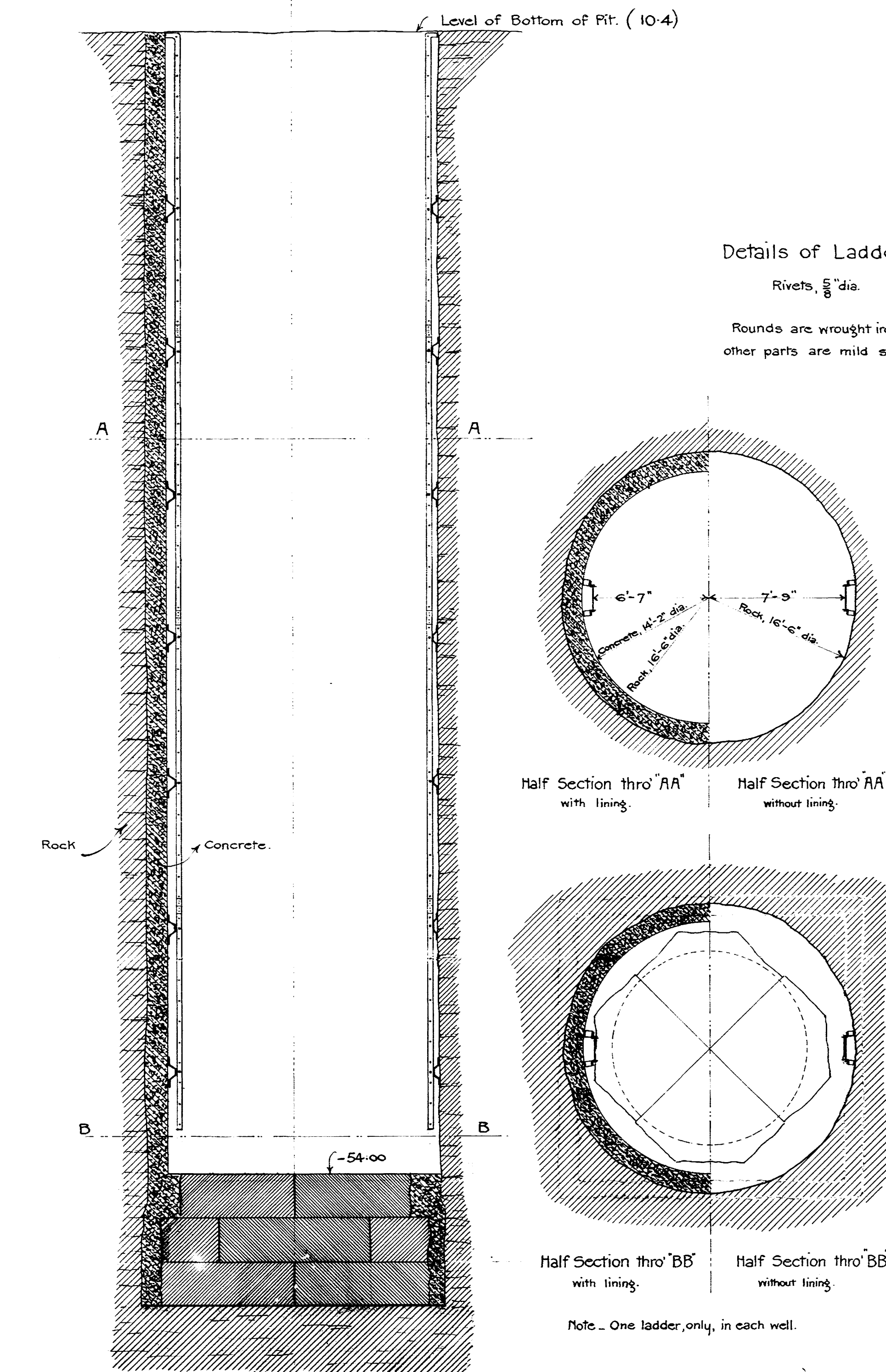
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REV:

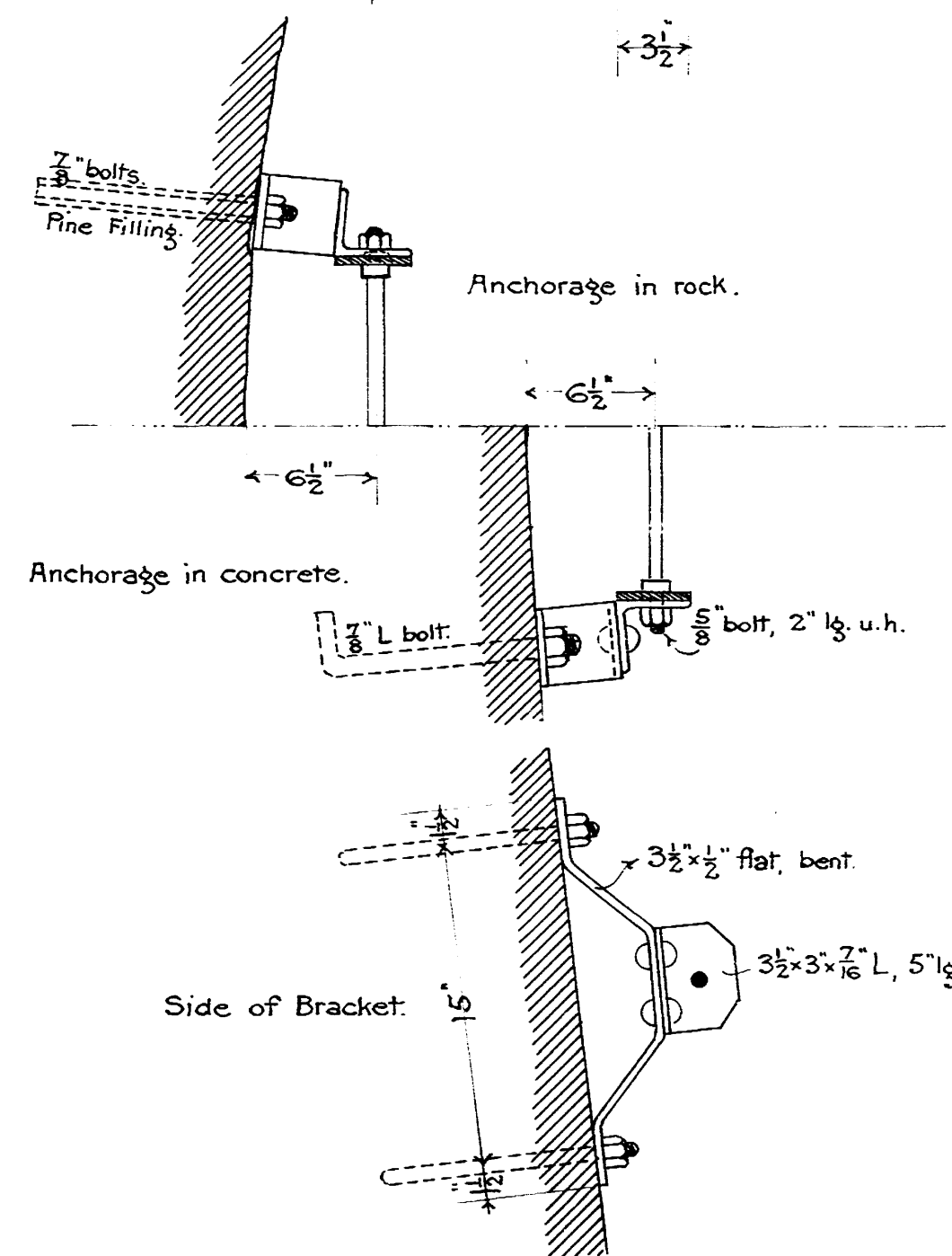
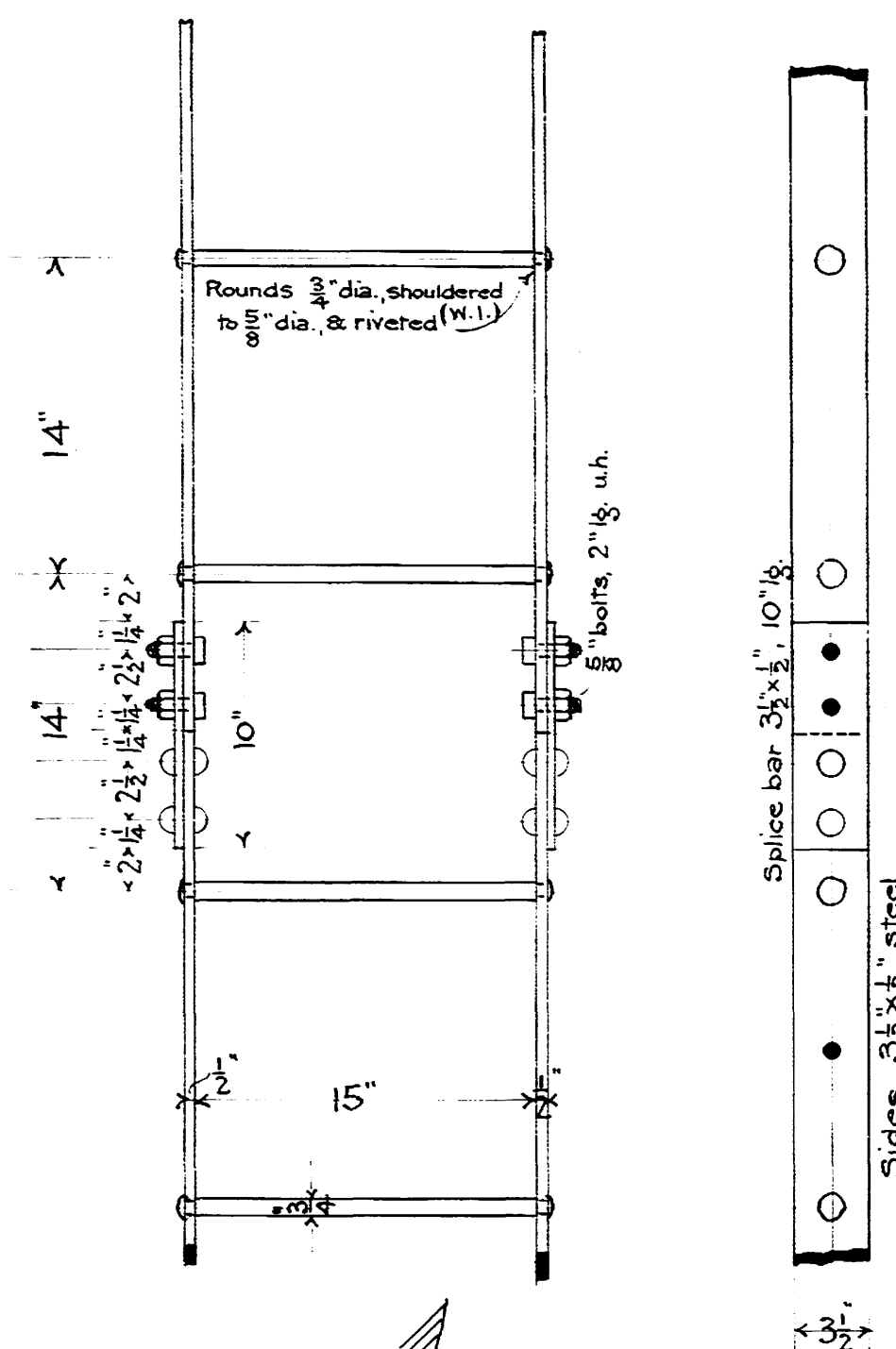
A



Details of Ladder,

Rivets, $\frac{5}{8}$ " dia.

Rounds are wrought iron; all other parts are mild steel.



TRENT CANAL

HYDRAULIC LIFT LOCK

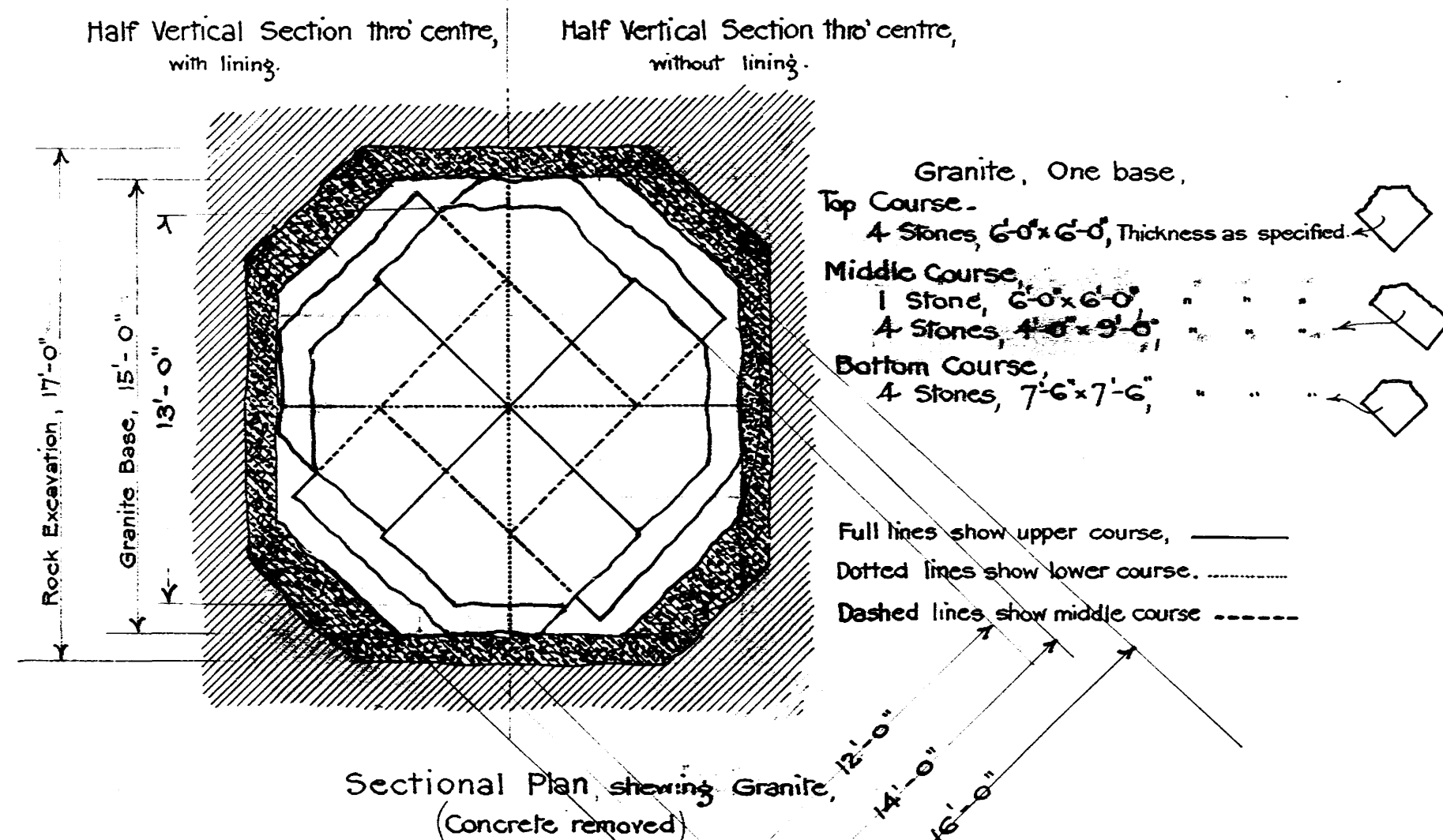
AT PETERBOROUGH

PLAN OF PRESS-WELLS.

Scales; $\frac{1}{5}$ " = 1', for Plan of Wells; $\frac{1}{2}$ " = 1', for Details.

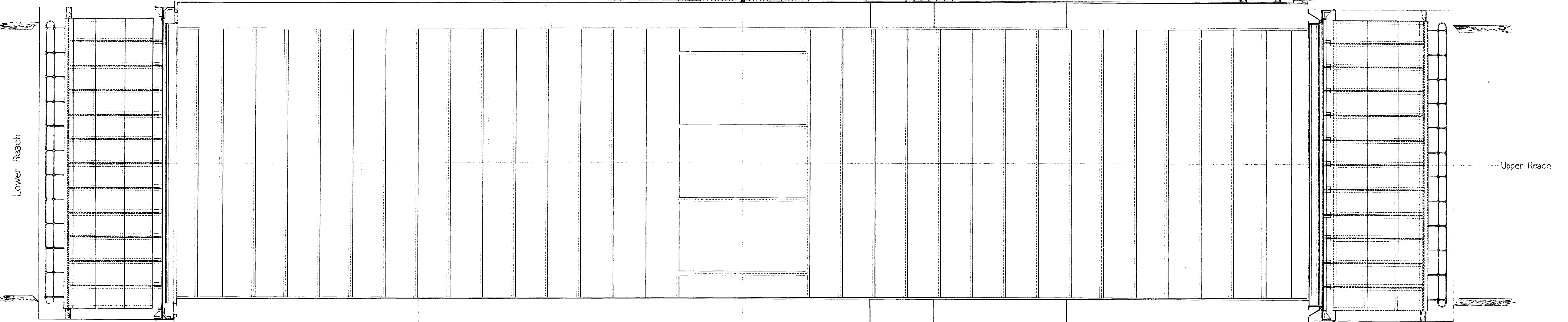
Rich. B. Rogers
Superintending Engineer.

Peterborough, Ont., Jan. 25, 1898.



Top Plan of West Lock Chamber

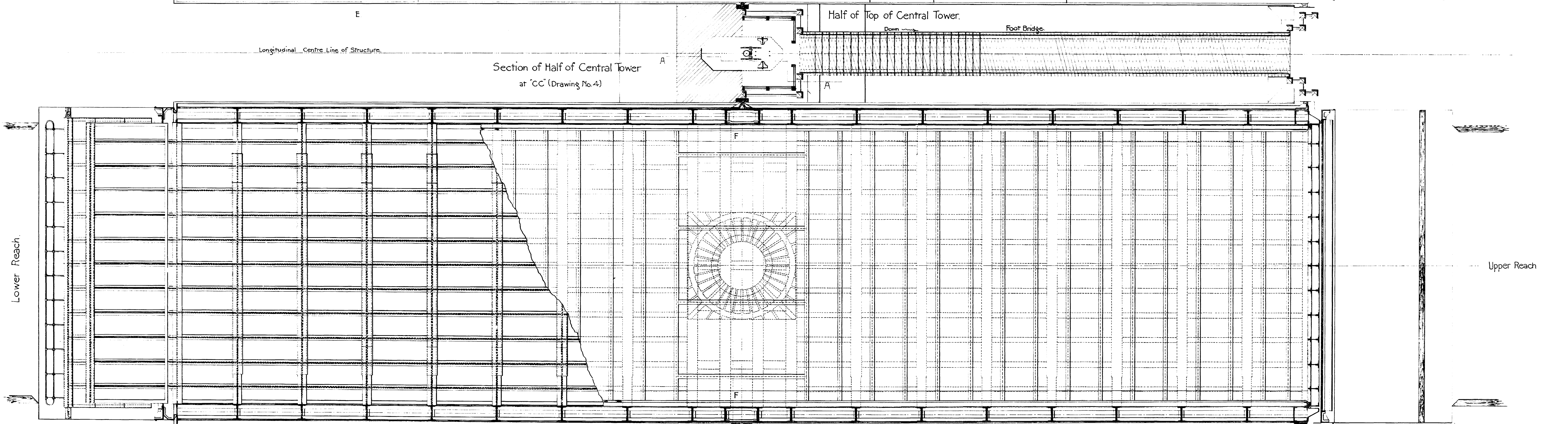
Section of
West Tower
at "DD" (Drawing No. 4)



Section of Half of Central Tower
at "CC" (Drawing No. 4)

Half of Top of Central Tower.

Foot Bridge.



TRENT CANAL
HYDRAULIC LIFT LOCK No.1
PETERBOROUGH
FLOOR PLAN

Scale $\frac{1}{5}$ inch to 1 foot.

Section of East Tower at "BB" (Drawing No. 4)
showing half top plan and half section of Accumulator.

Sectional Plan of East Lock Chamber
through "GG" (Drawing No. 3)

Richard Rogers
SUPERINTENDING ENGINEER.

Peterborough, Ont., April 2, 1898.

TRENT CANAL
HYDRAULIC LIFT LOCK No. 1
PETERBOROUGH
LONGITUDINAL SECTION

Scale $\frac{1}{5}$ inch to 1 foot.

Section thro Central Tower
at "AA" (Drawing No.2)

Roadway

ump Room

Operator's Cabin →

115-50

101.502

er-Reach

203-

-16-3-

.....

[illegible]

NOTE - East Lock chamber is shown 4" above the lower limit of stroke, that is, the top of flooring corresponds with top of Sill in the lower reach.

West Lock-chamber is shewn 8" below the upper limit of stroke, or in a position to contain a surcharge one foot in depth.

Richard E. Rogers

SUPERINTENDING ENGINEER.

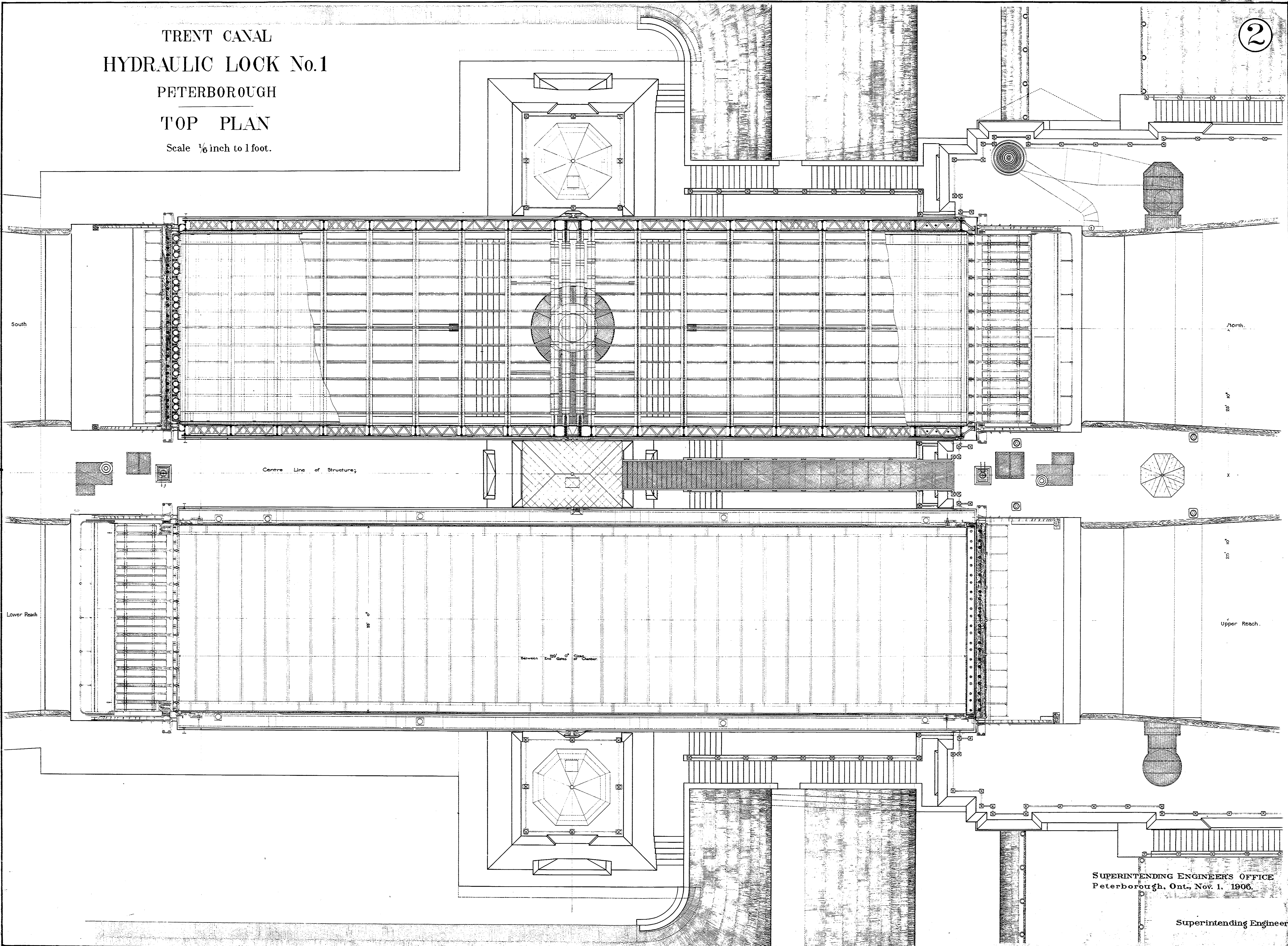
Peterborough, Ont., April 2, 1898.

A-13-1043

T-20-195.124 A-13-1043

TRENT CANAL
HYDRAULIC LOCK No.1
PETERBOROUGH
TOP PLAN
Scale $\frac{1}{6}$ inch to 1 foot.

2

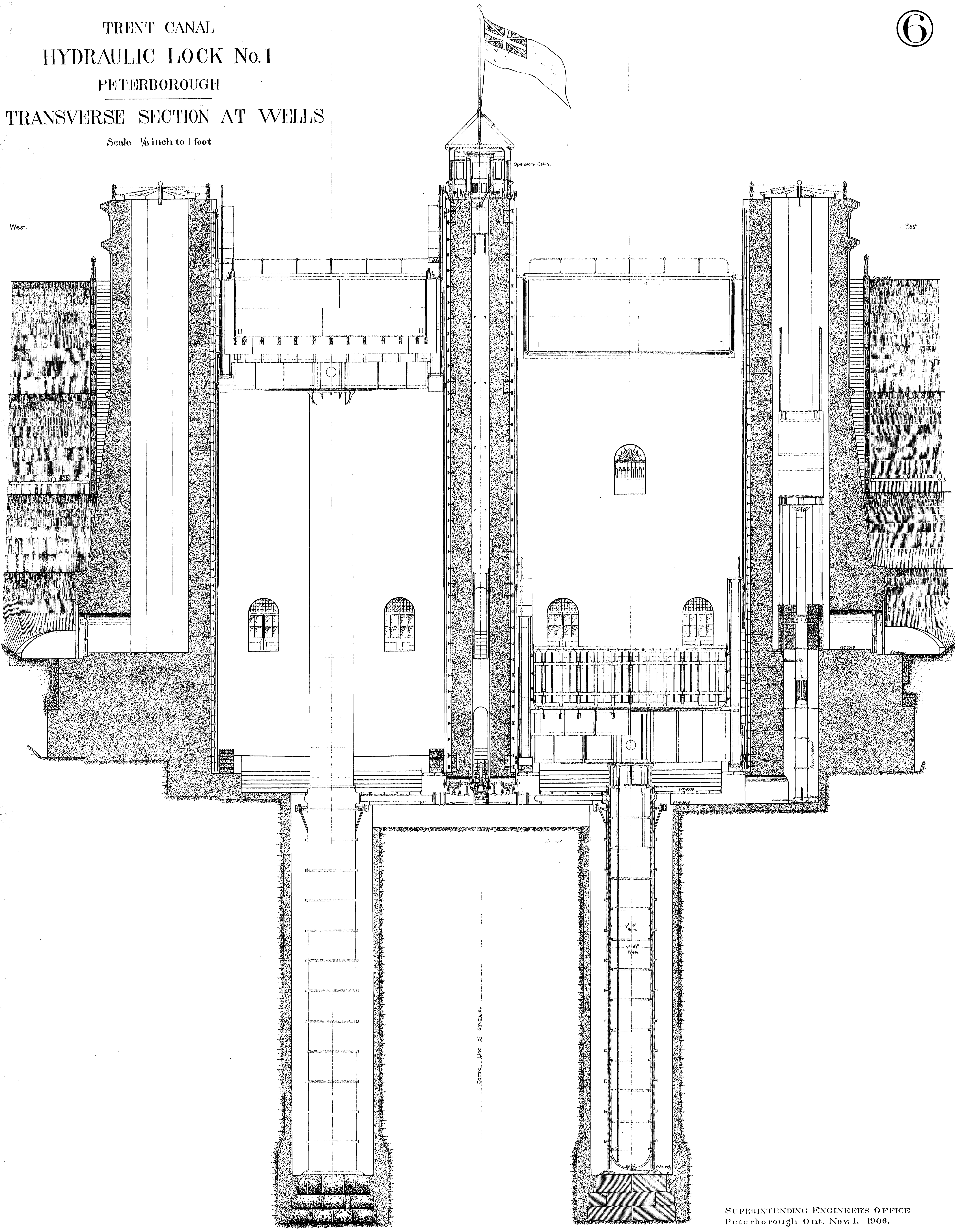


SUPERINTENDING ENGINEER'S OFFICE
Peterborough, Ont., Nov. 1, 1906.

Superintending Engineer

A-13-1050
T-20-195.131 1050 A-13-105

TRENT CANAL
HYDRAULIC LOCK No.1
PETERBOROUGH
TRANSVERSE SECTION AT WELLS
Scale 1/8 inch to 1 foot



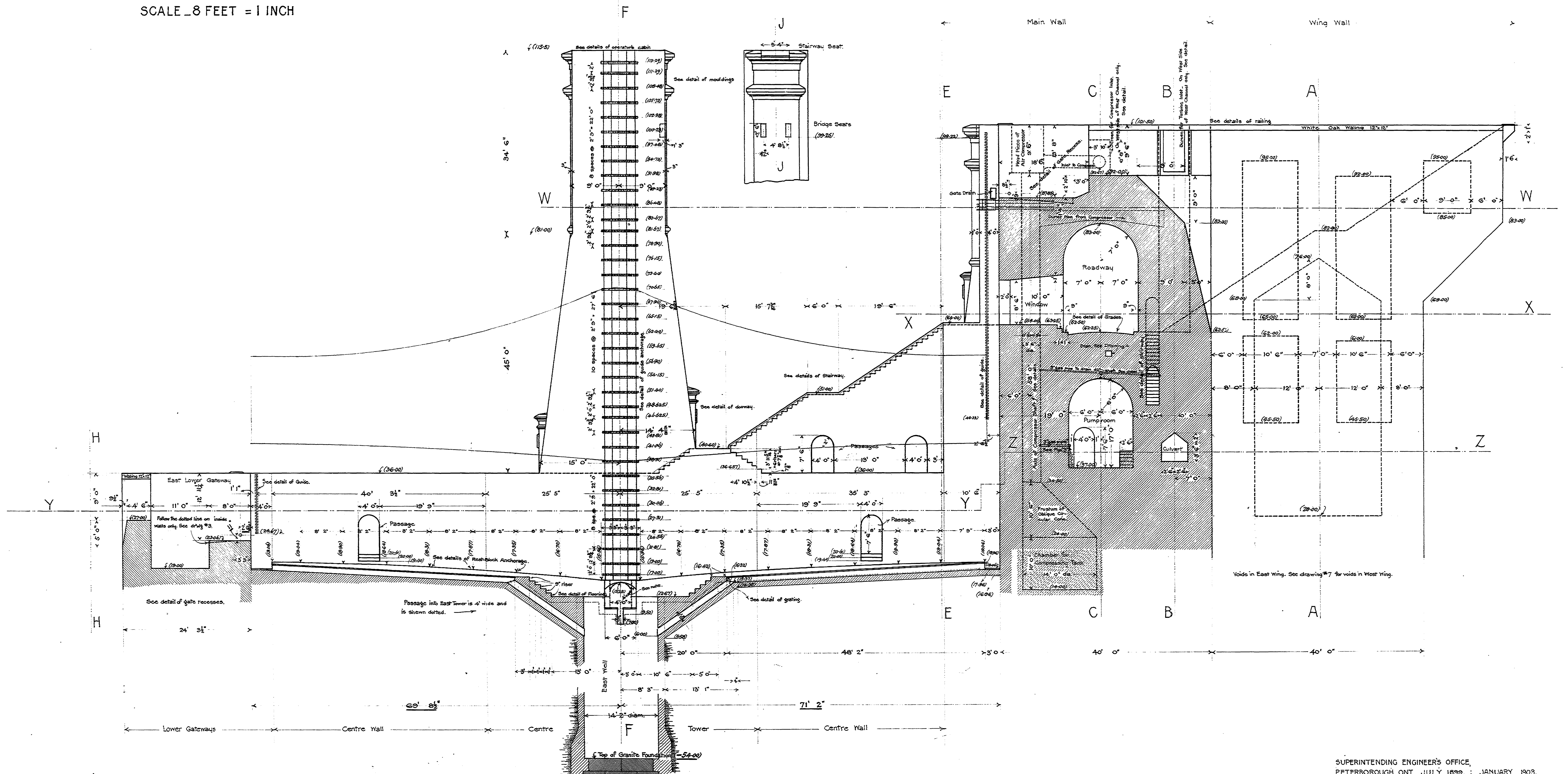
SUPERINTENDING ENGINEER'S OFFICE
Peterborough Ont, Nov. 1, 1906.

SuperIntending Engineer.

2052

TRENT CANAL
HYDRAULIC LIFT LOCK NO 1
PETERBOROUGH
MASONRY

SCALE 8 FEET = 1 INCH



LONGITUDINAL SECTION AT "KK"

SUPERINTENDING ENGINEER'S OFFICE,
PETERBOROUGH, ONT., JULY, 1899. : JANUARY 1903.

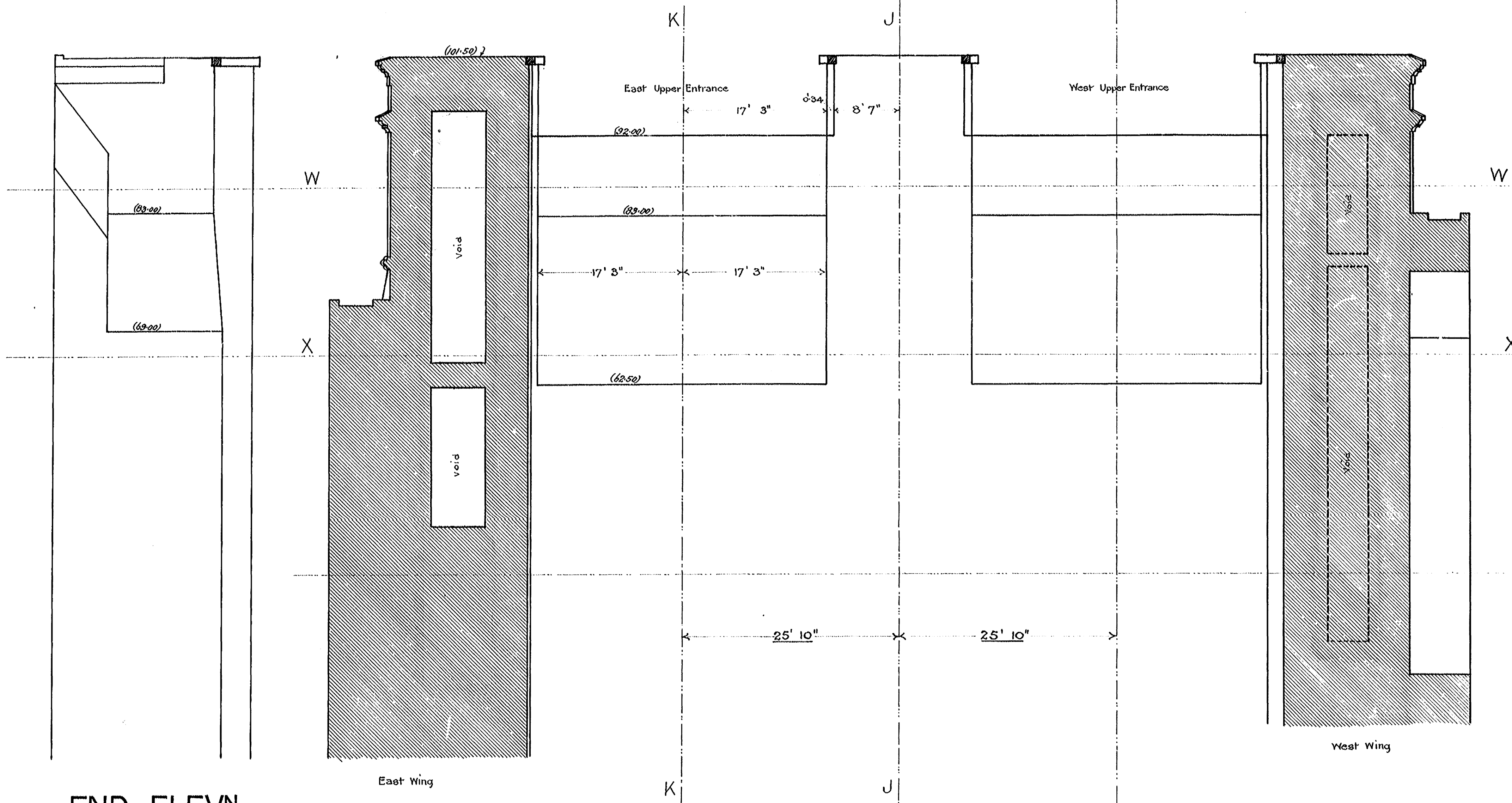
Robert R. Rogers
SUPERINTENDING ENGINEER.

A-13-960

10

TRANSVERSE SECTION AT "AA"

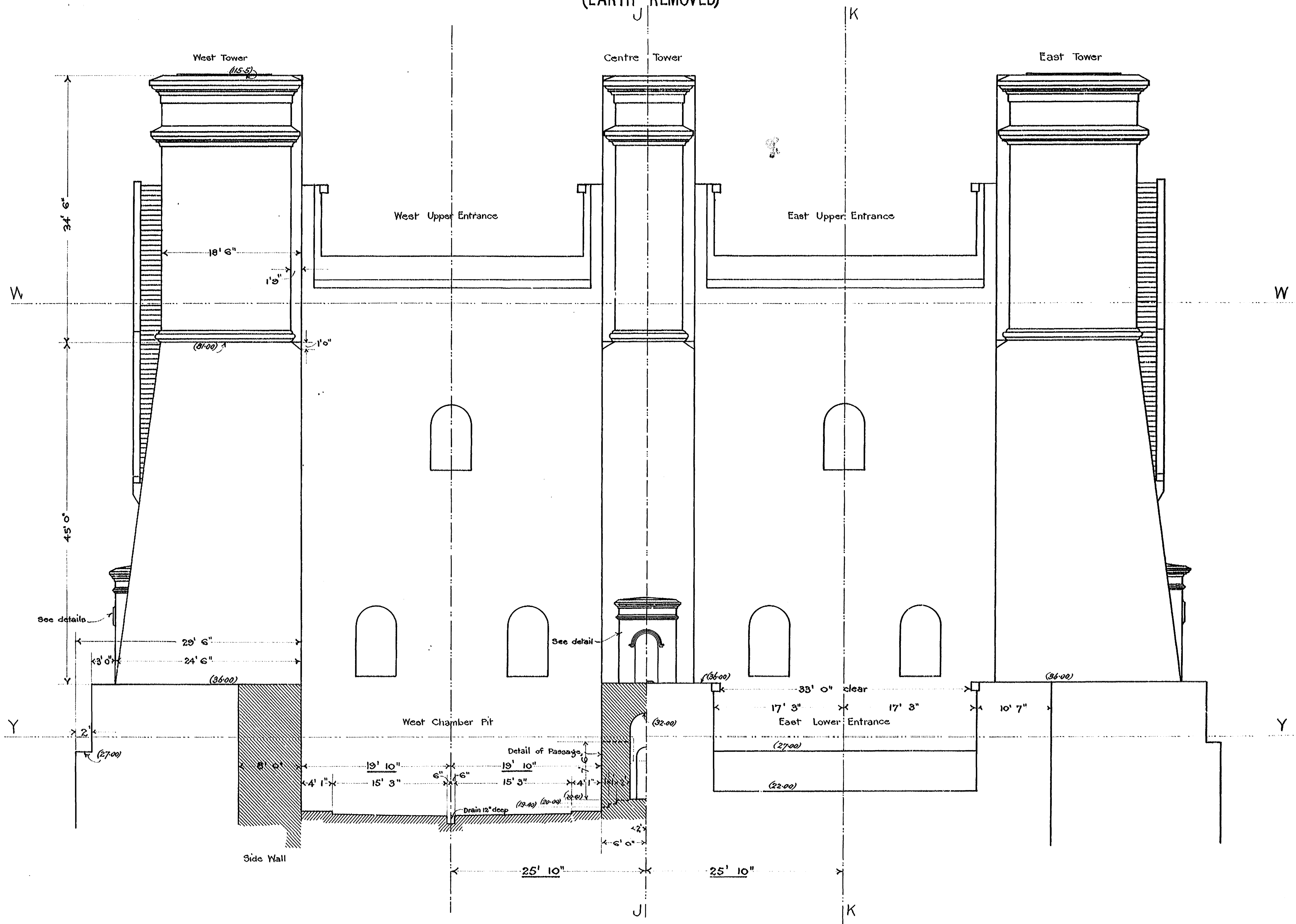
(EARTH REMOVED)



END ELEV

TRANSVERSE SECTION AT "CGHH"

(EARTH REMOVED)



TRENT CANAL HYDRAULIC LIFT LOCK NO 1 PETERBOROUGH

MASONRY

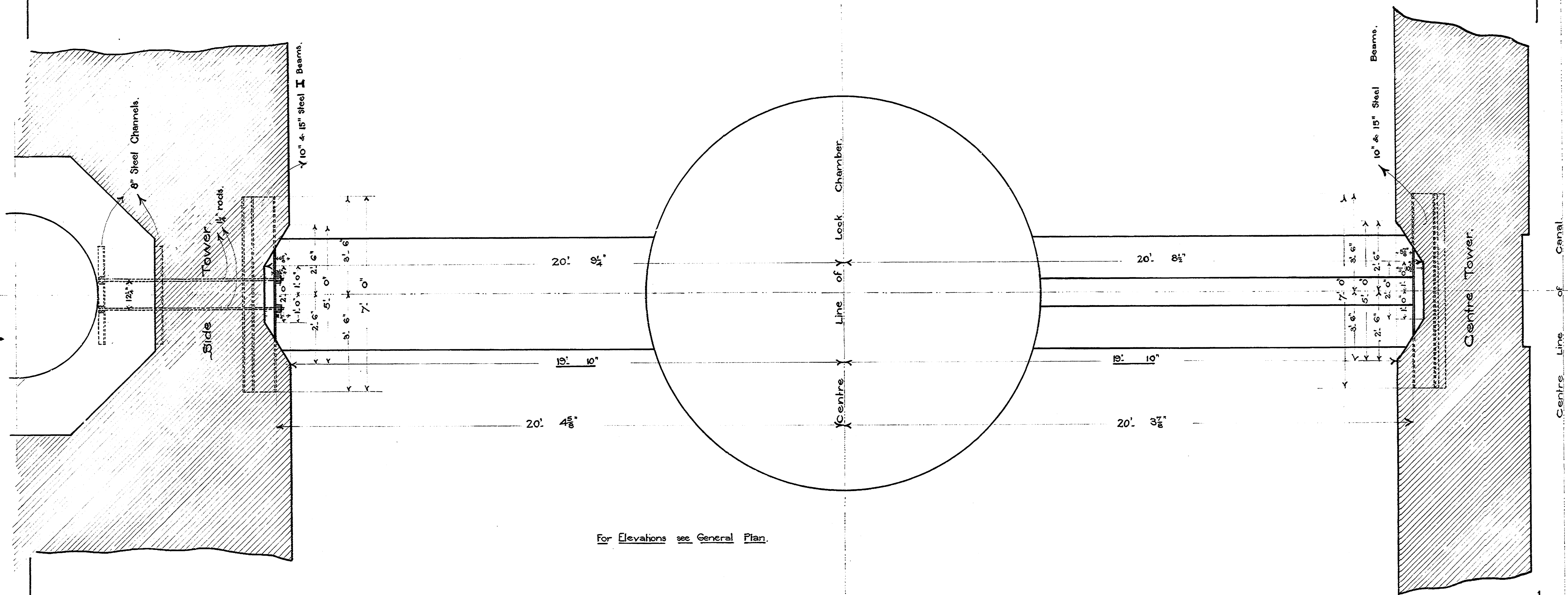
SCALE - 8 FEET TO 1 INCH

Richard Rogers
SUPERINTENDING ENGINEER

SUPERINTENDING ENGINEER'S OFFICE,
PETERBOROUGH, ONT., JULY 1899. : JANUARY 1903.

T-20-195-41

A-13-960



For Elevations see General Plan.

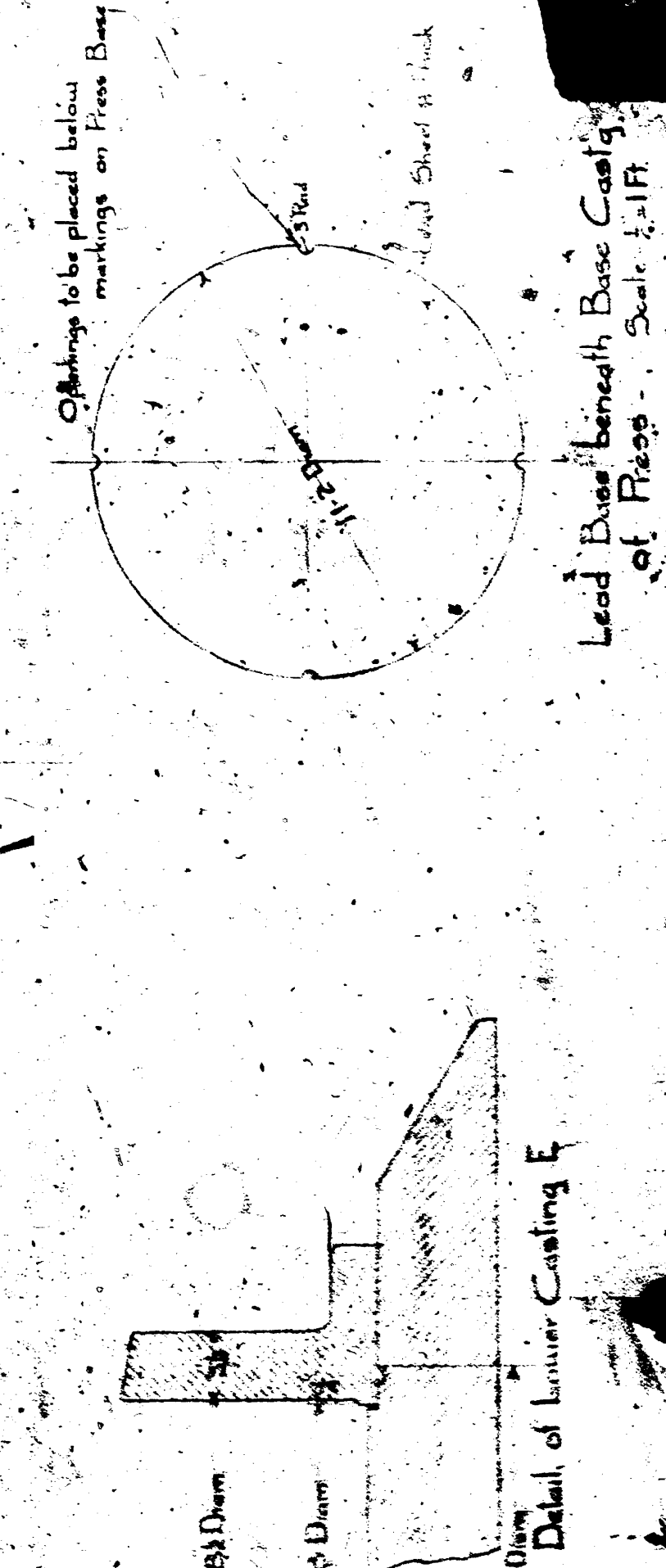
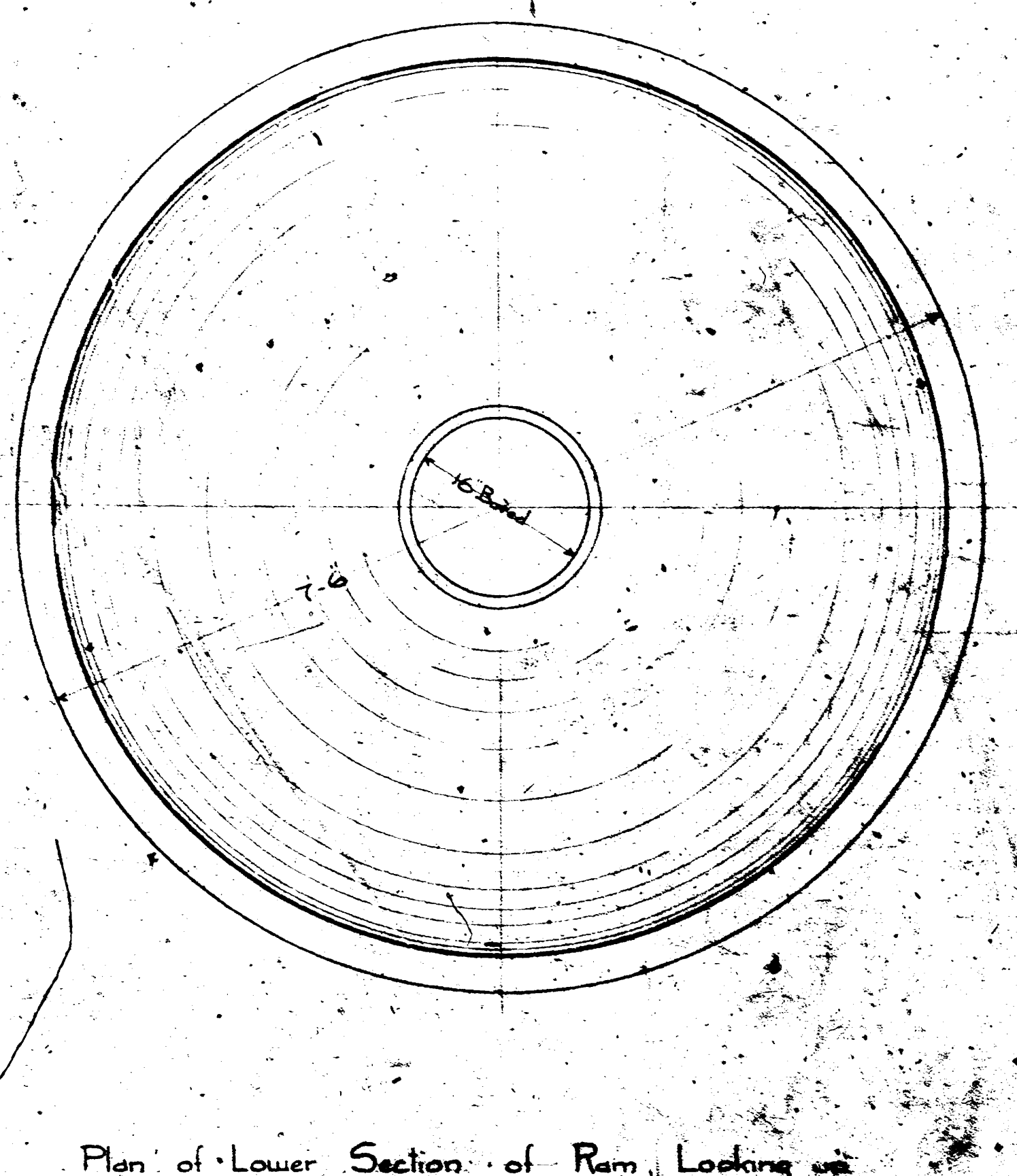
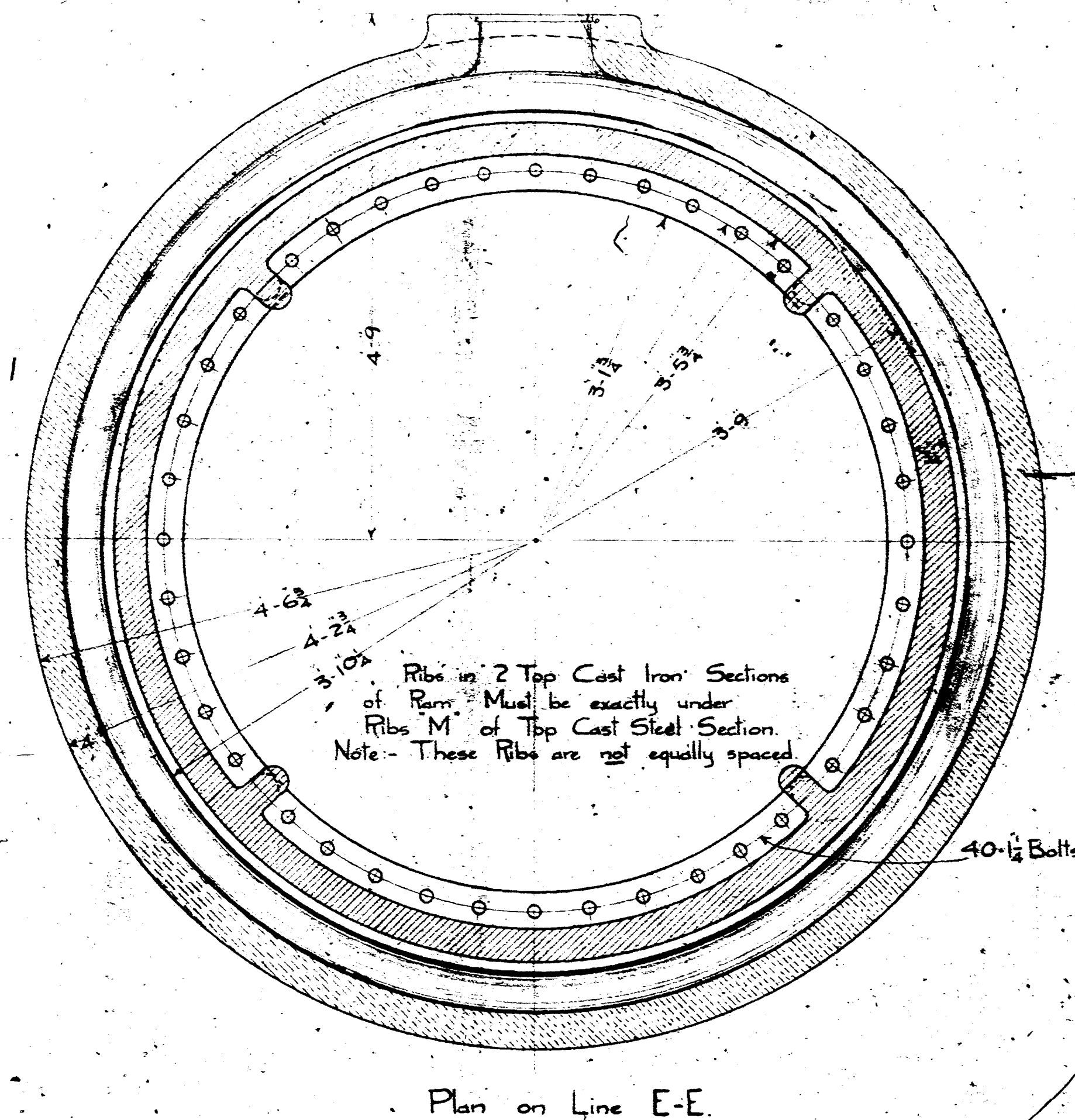
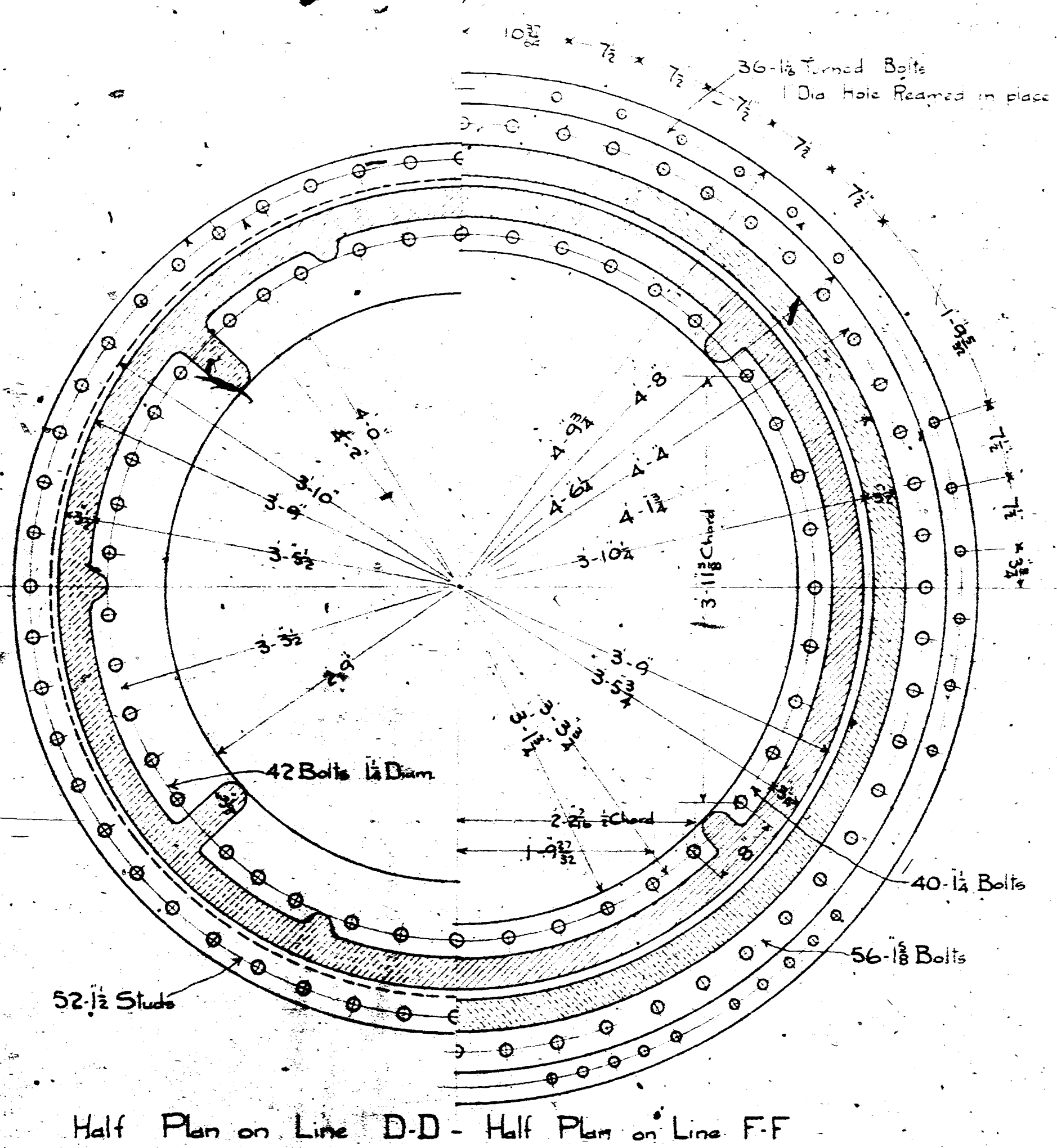
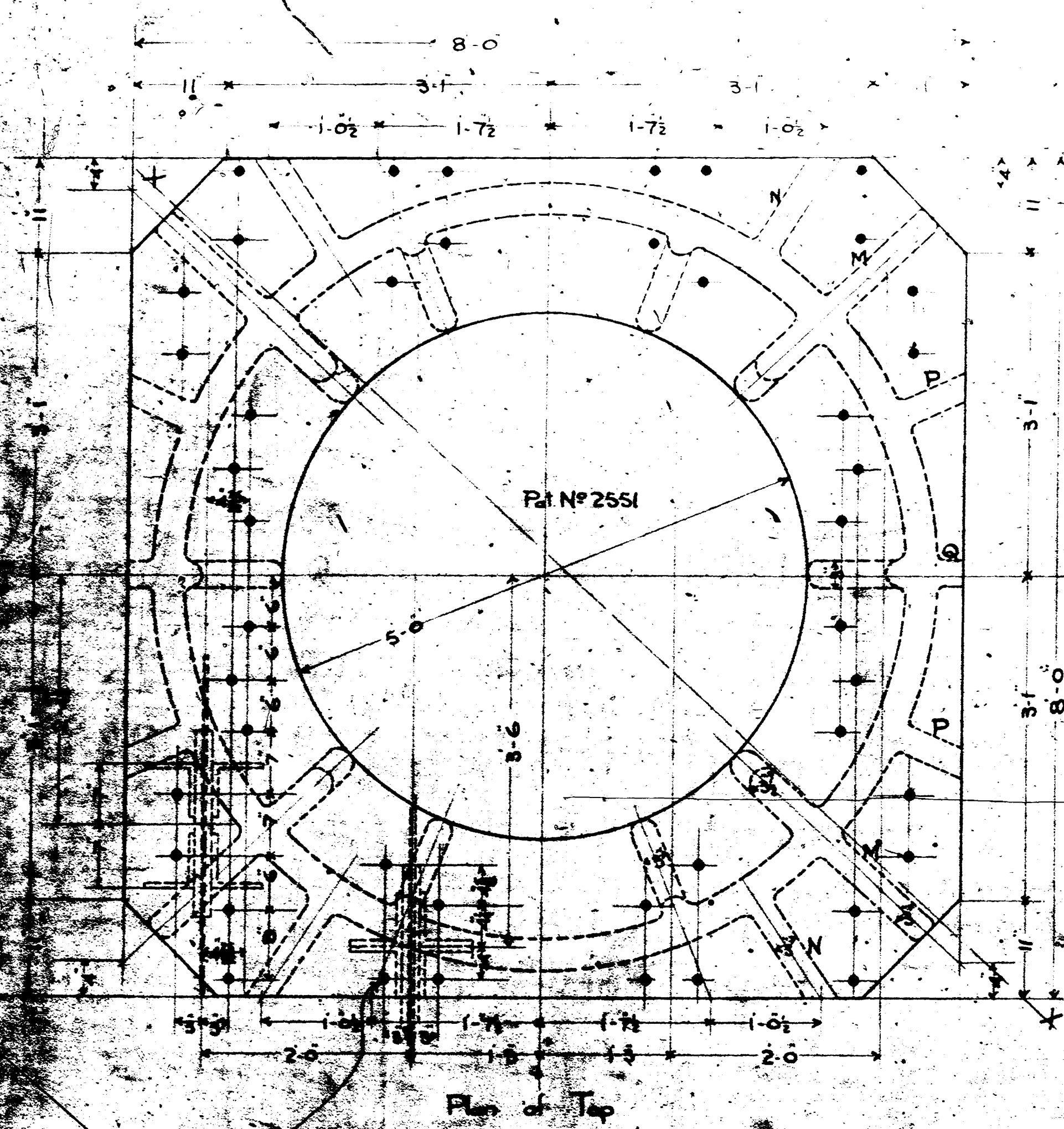
Drawing No 24.
Trent Canal—Hydraulic Lift Lock No 1
Details of Guide Anchorage.
Scale $\frac{1}{2}$ in = 1 ft.

Peterborough Dec 30 1900

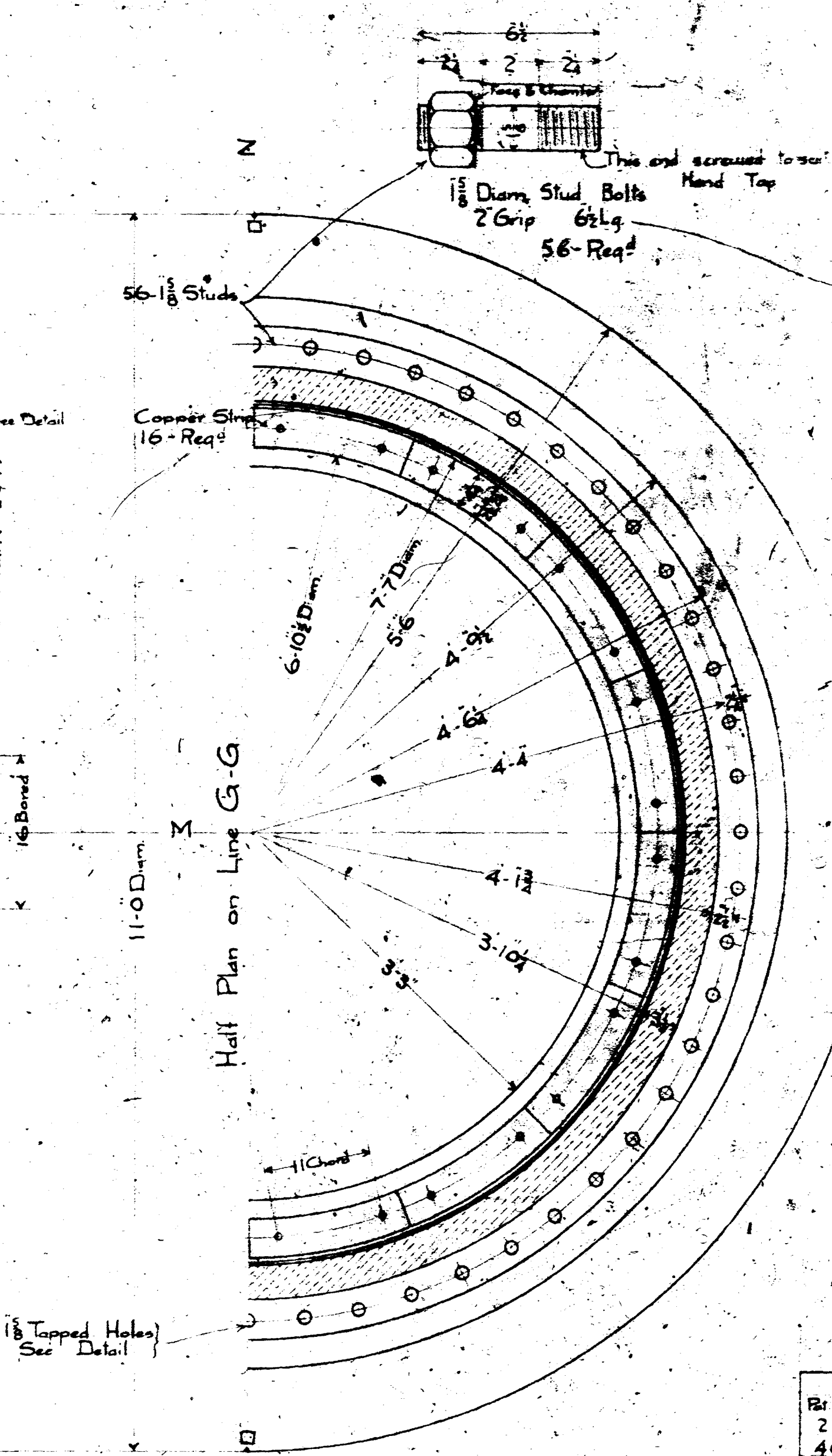
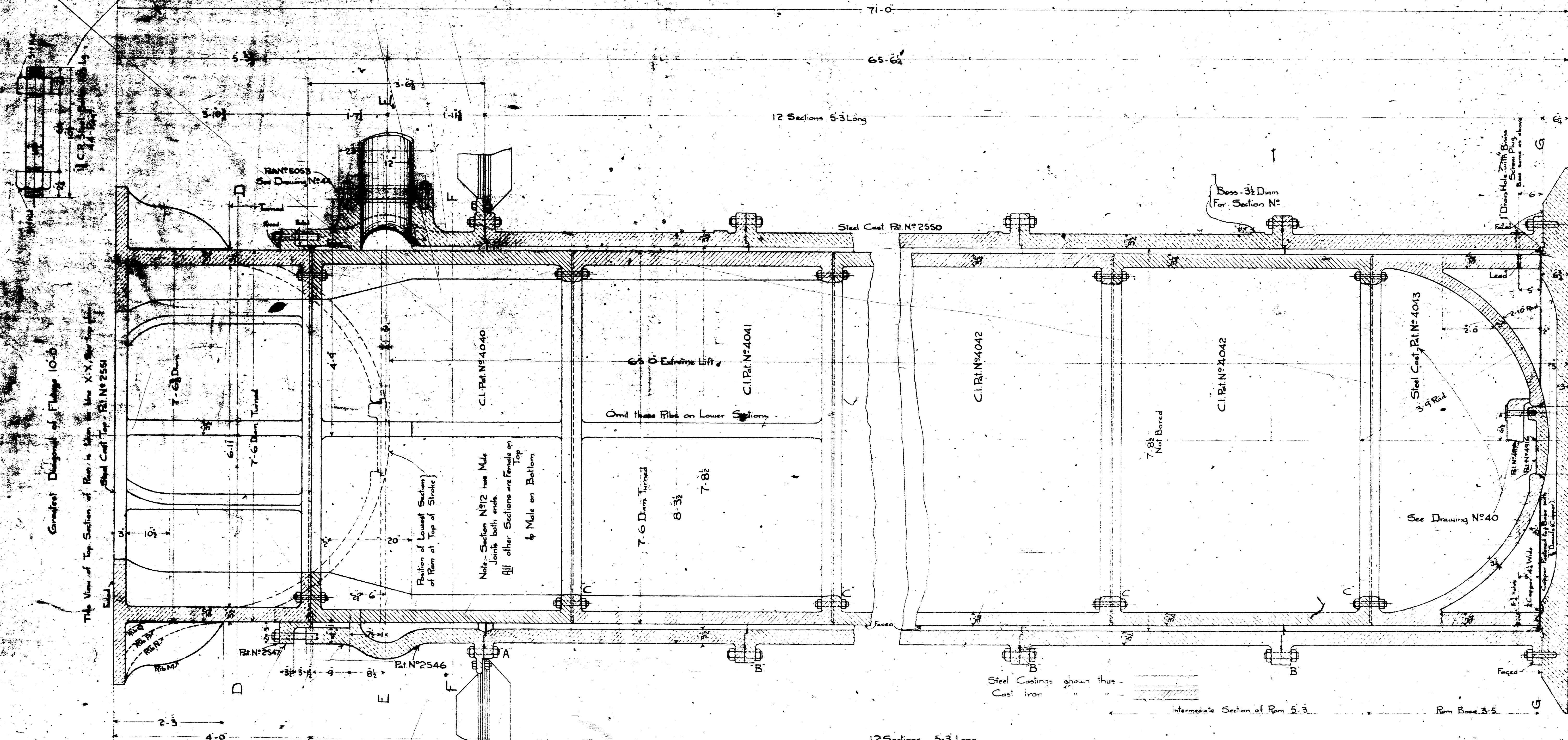
Richd. A. Rogers
Supts Engineer

A-13-973

T-20-195.54 A-13-973



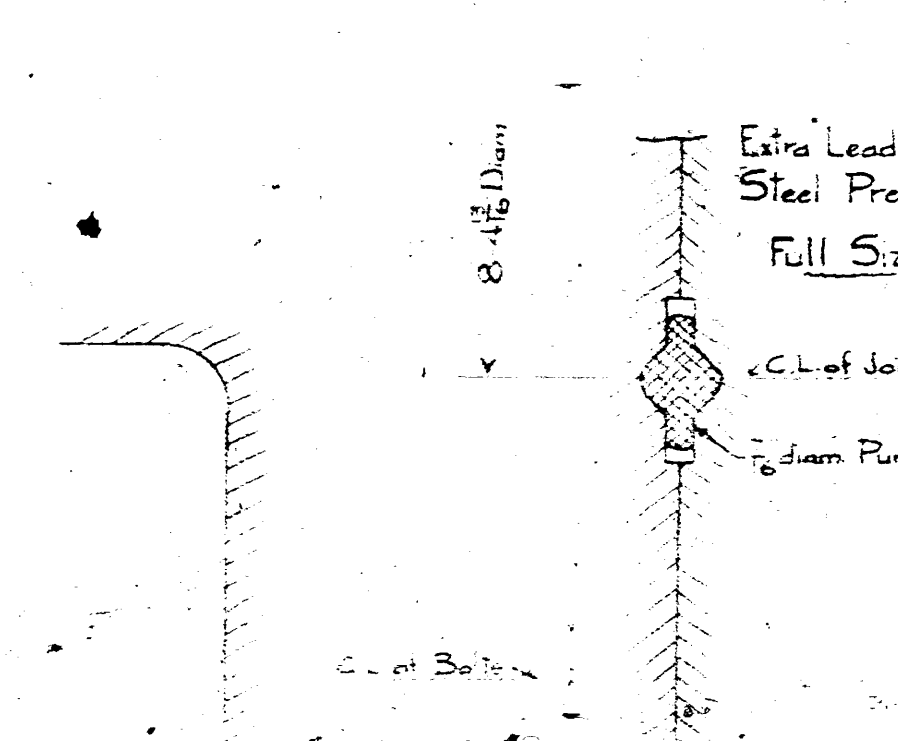
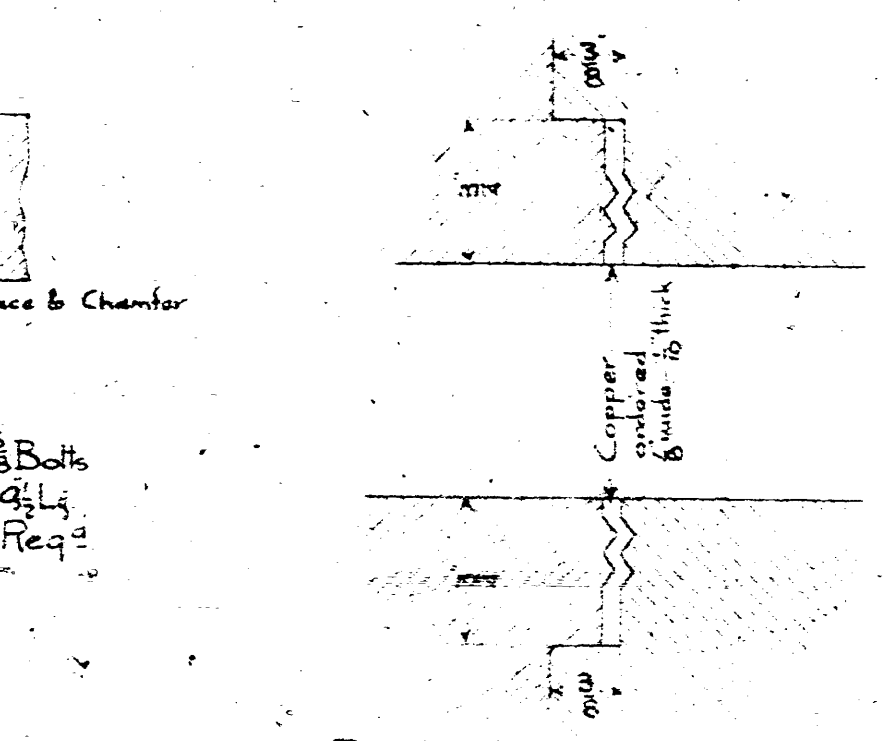
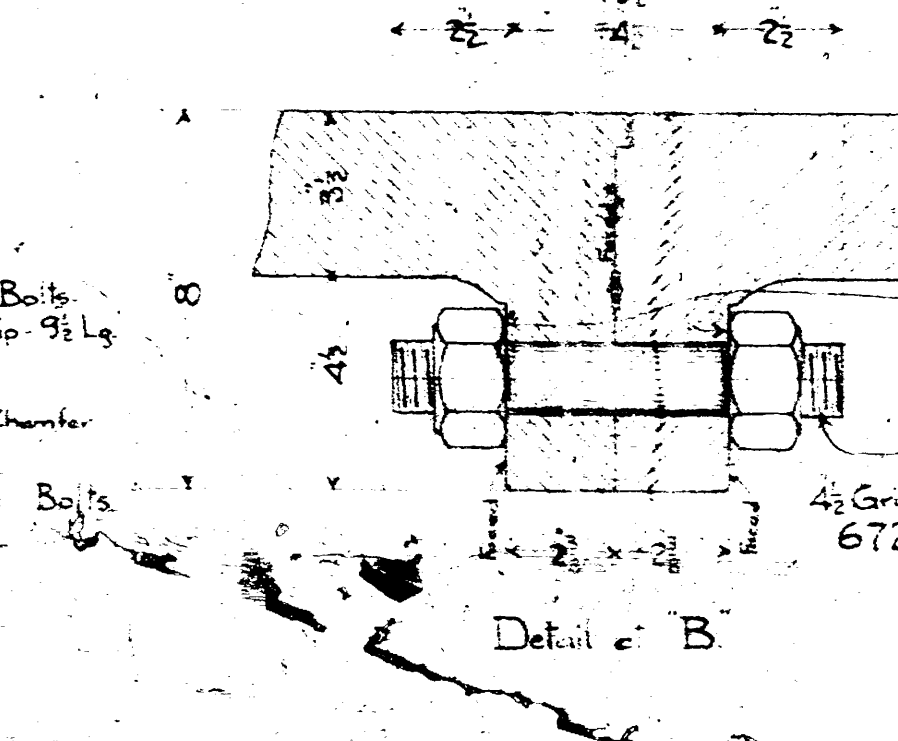
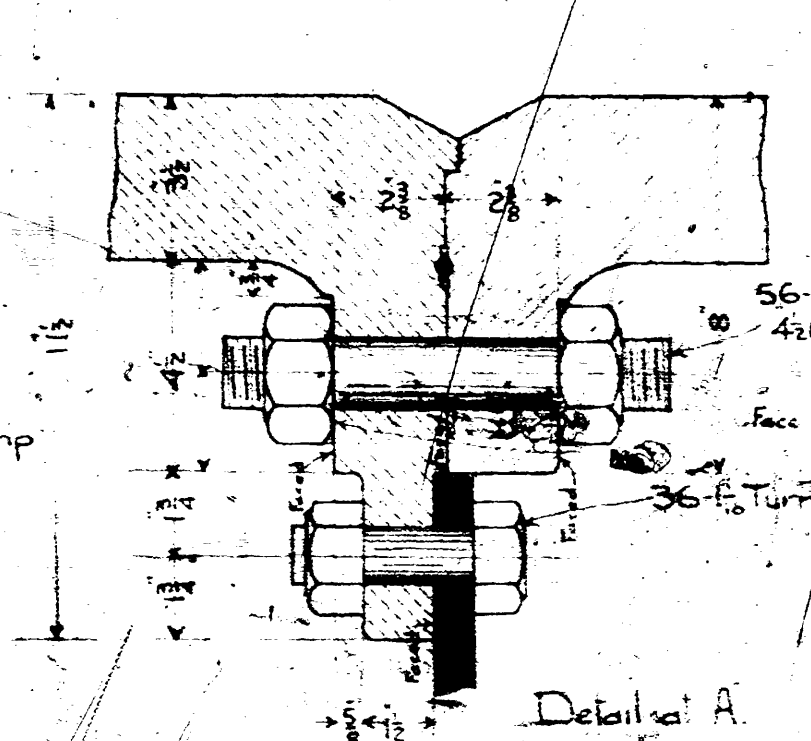
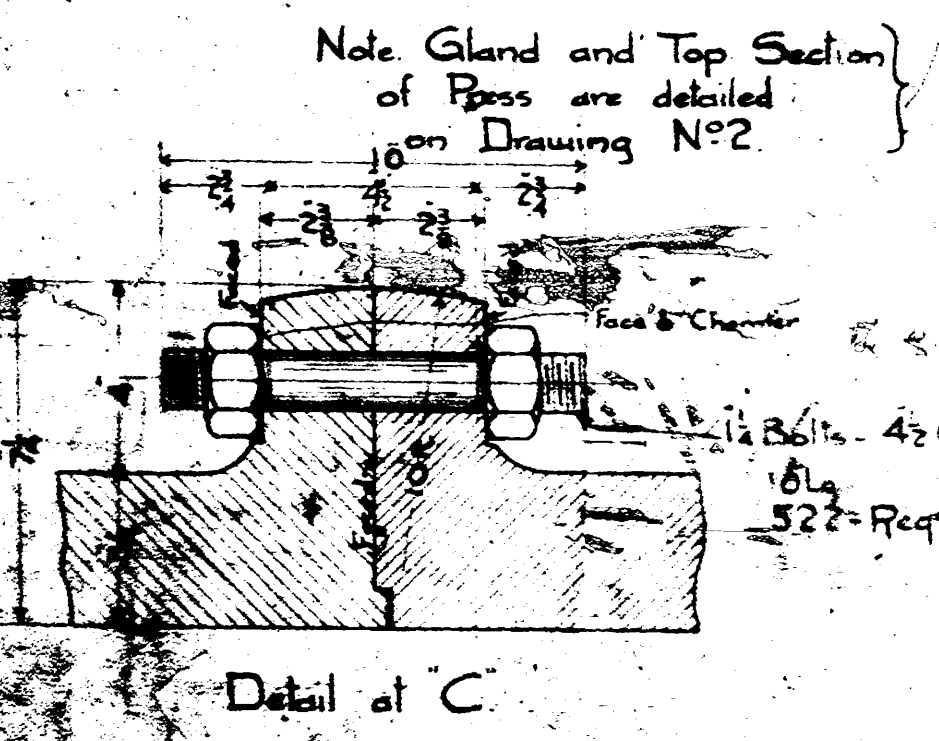
NOTE - ALL DIMENSIONS GIVEN ARE FINISHED



LIST OF CASTINGS

Ref No	Material	Description
2251	Steel Cast	Top Section of Ram
4040	C	Ram Section
4041	C	Ram Section
4042	C	Ram Section
2549	Steel Cast	Base of Press
2550	Steel Cast	Press Section

2-REQ^d COMPLETE



LIST OF BOLTS for 2 Lifts

No	Ref	Material	Length	Grip	Location
1344	1	C	5	4 1/2	Press Sections
1044	1	C	10	4 1/2	Ram Sections
88	1	Anchor	10 1/2	4 1/2	Top of Ram
112	1	Stud	6 1/2	2	Base of Press

CONTRACTS 1251-1252
HYDRAULIC LIFT LOCK NO 1
TRENT CANAL, PETERBOROUGH
DETAILS OF PRESS AND RAM
Dominion Bridge Co Ltd, Montreal
Scale
Drawing N

Diagonals are fastened to Posts with $\frac{3}{4}$ Bolts, not rivets, ordered on Dwg No. 87

7-I Beams 8" etc. are fastened to Posts with $\frac{3}{4}$ Bolts, ordered on Dwg No. 87

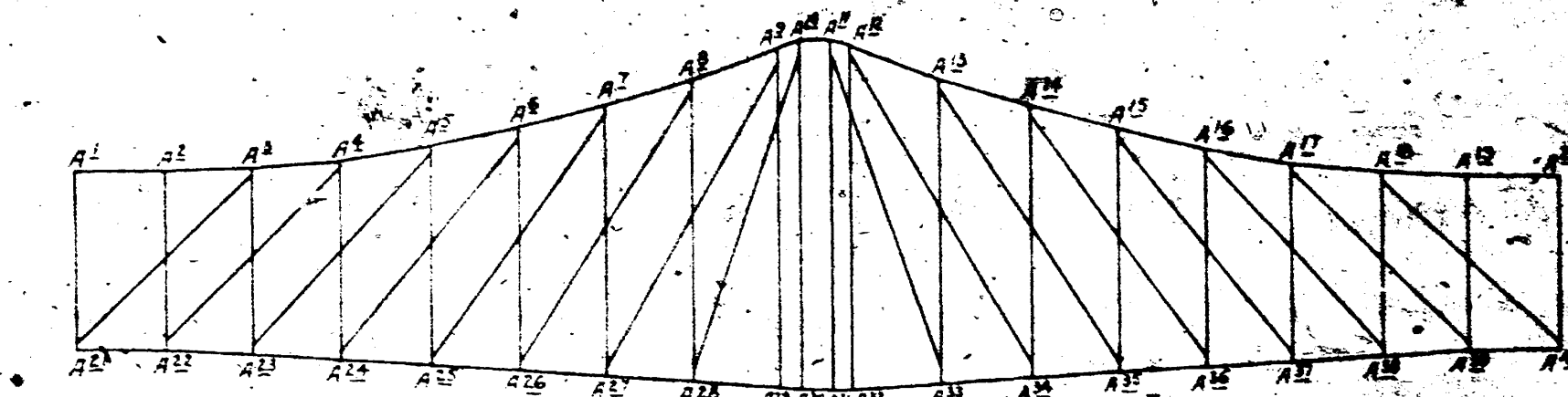
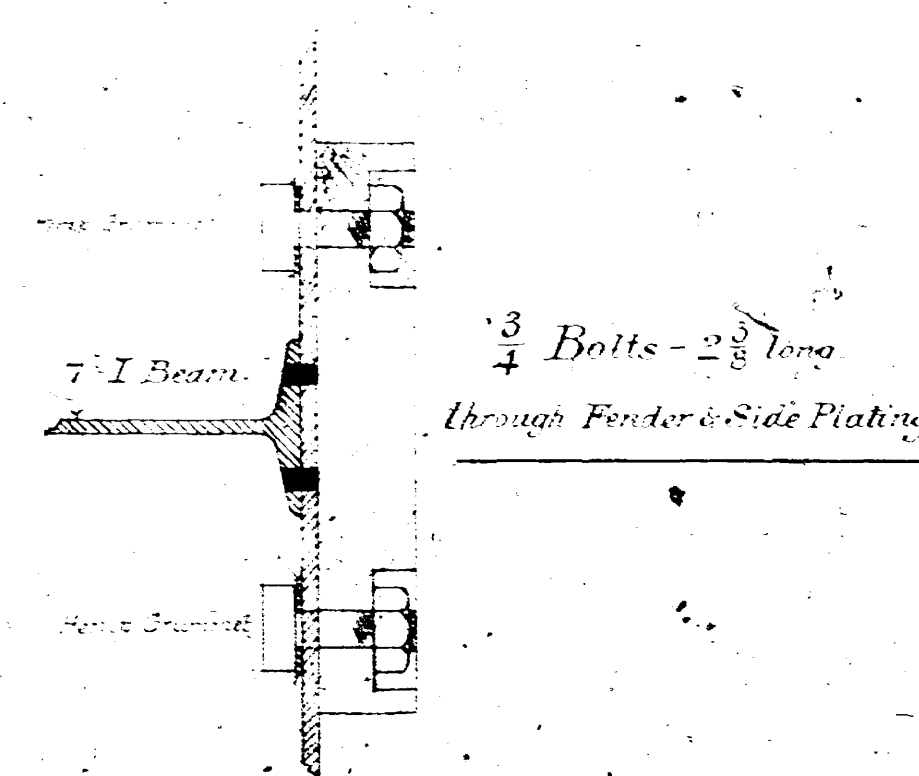
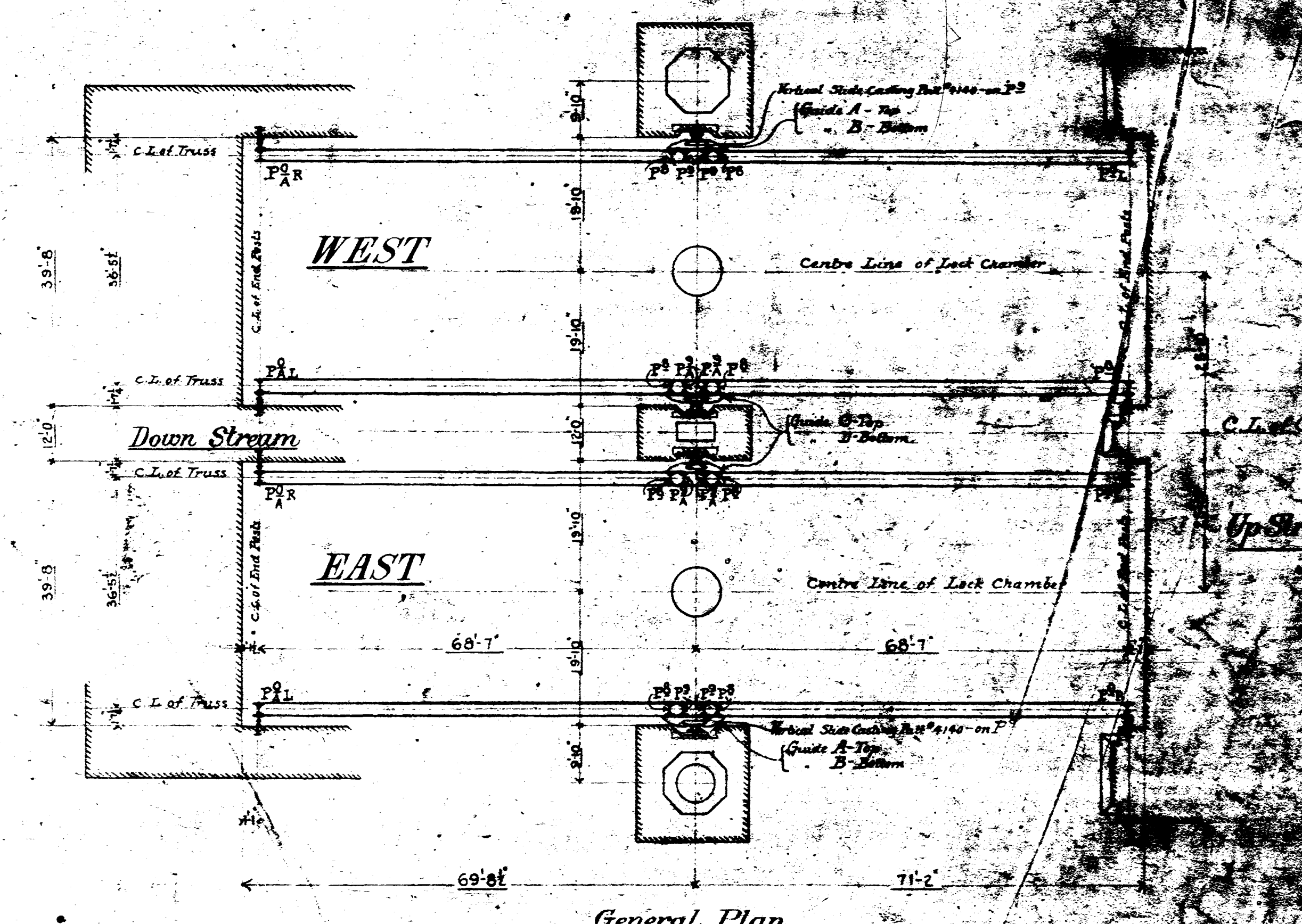
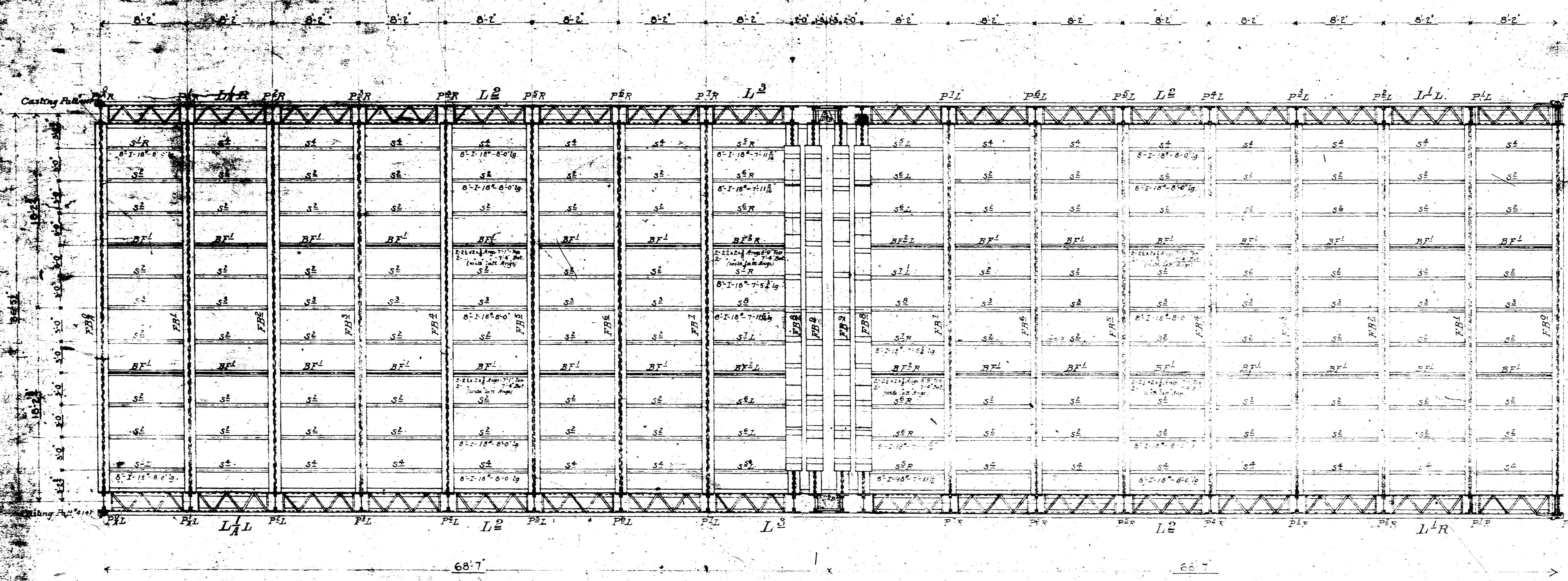
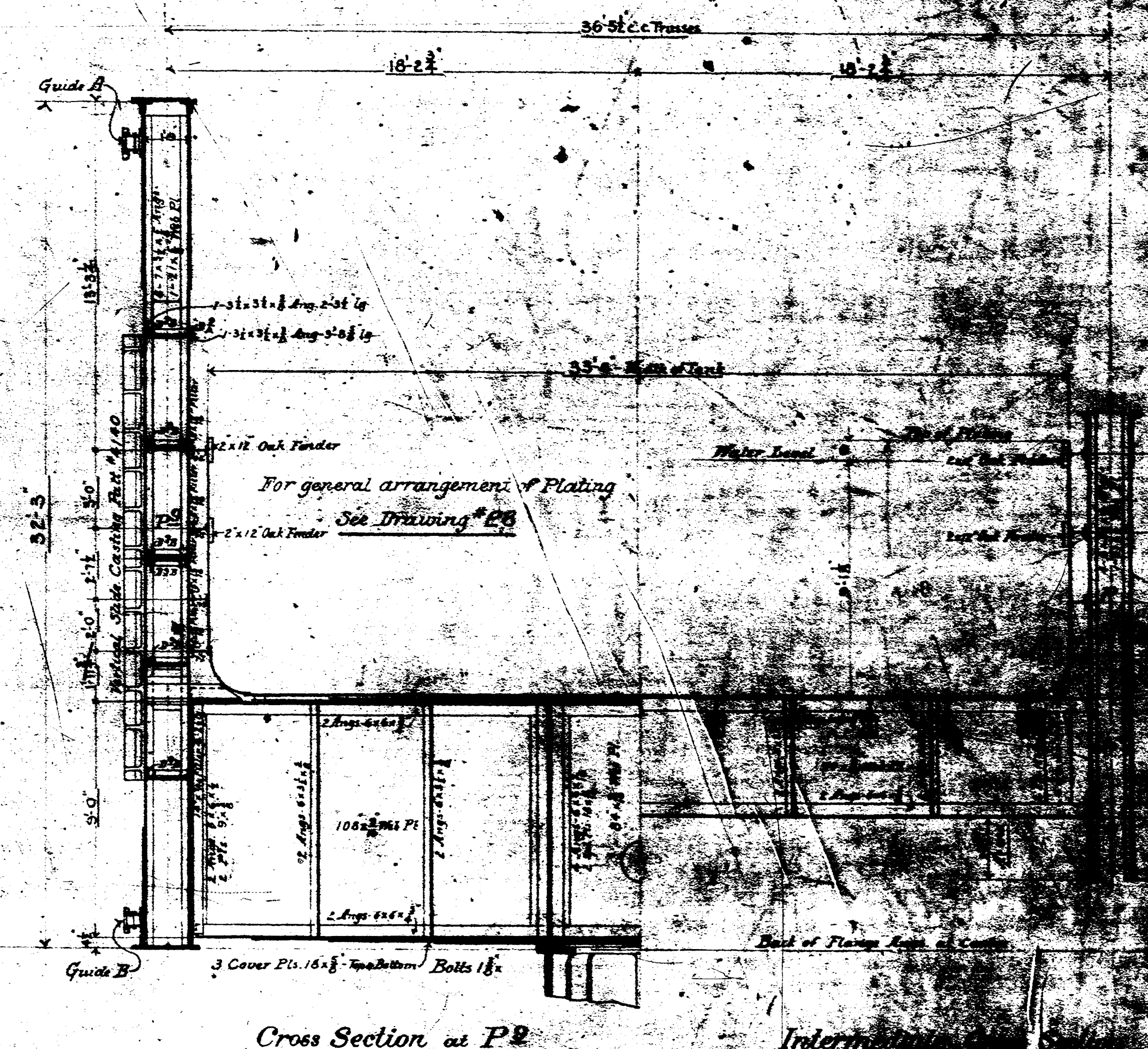
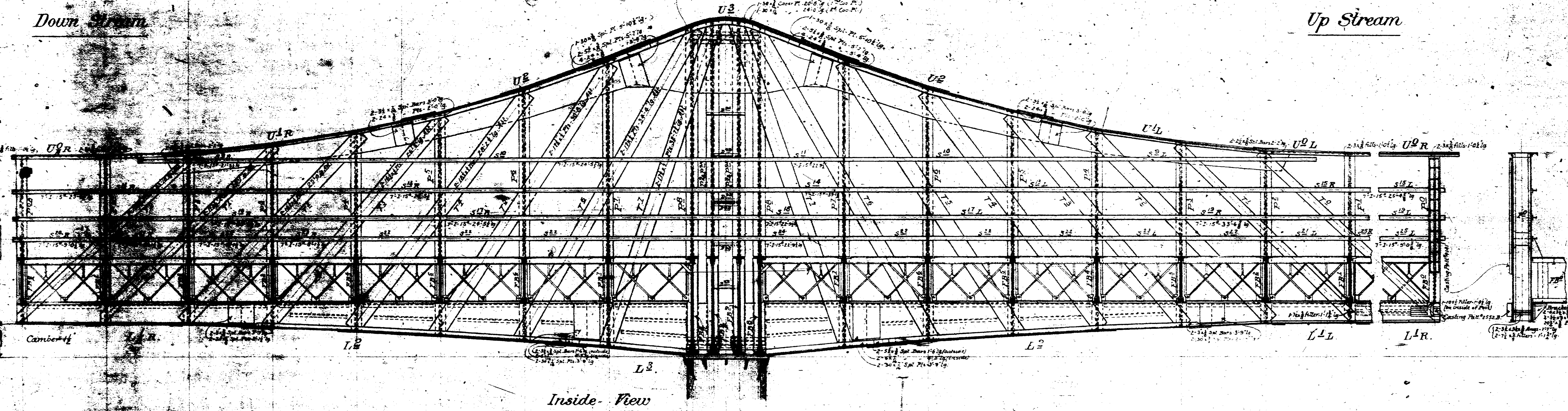
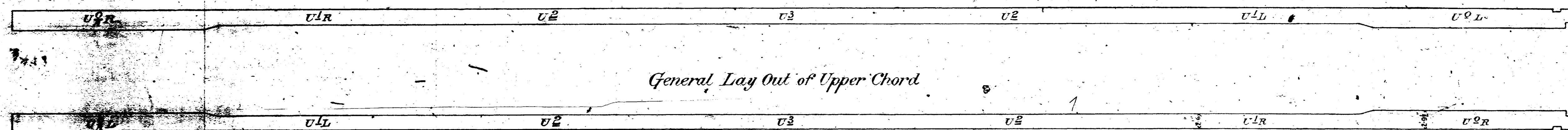
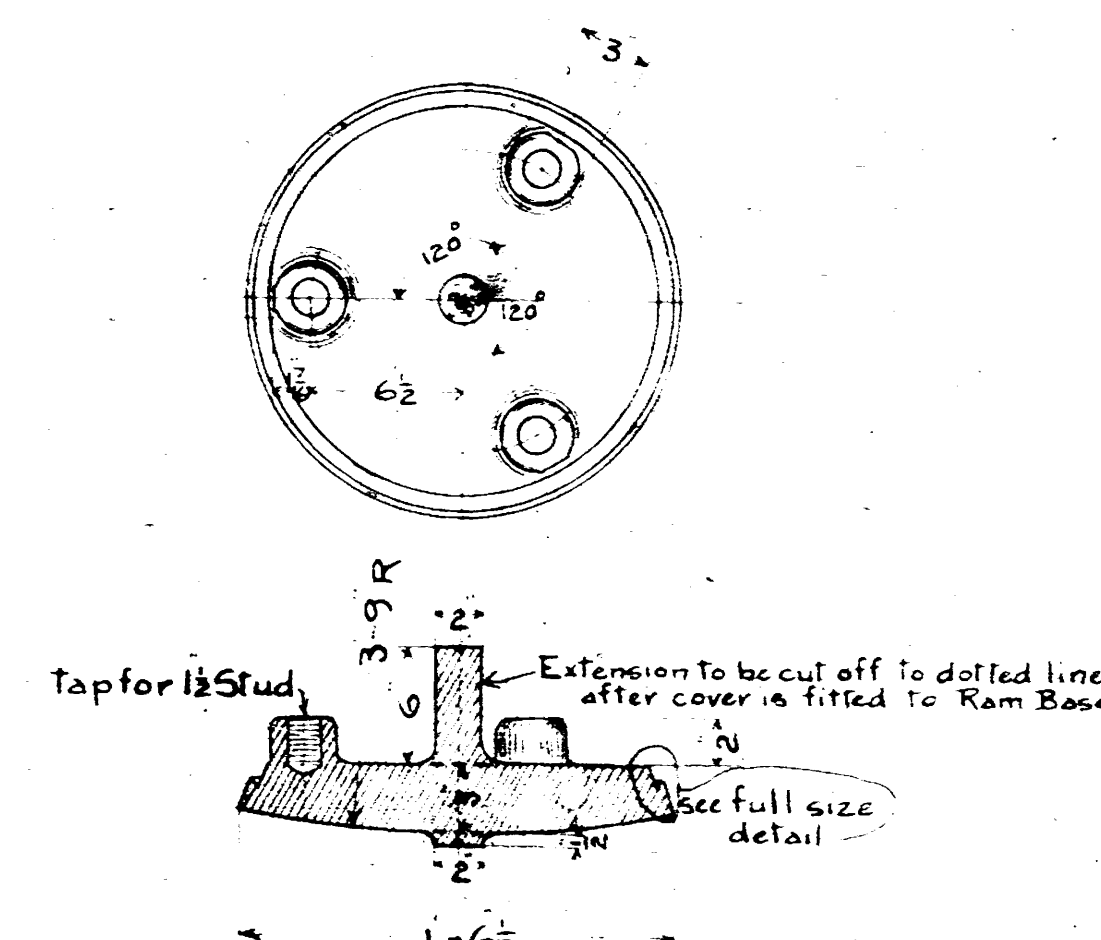
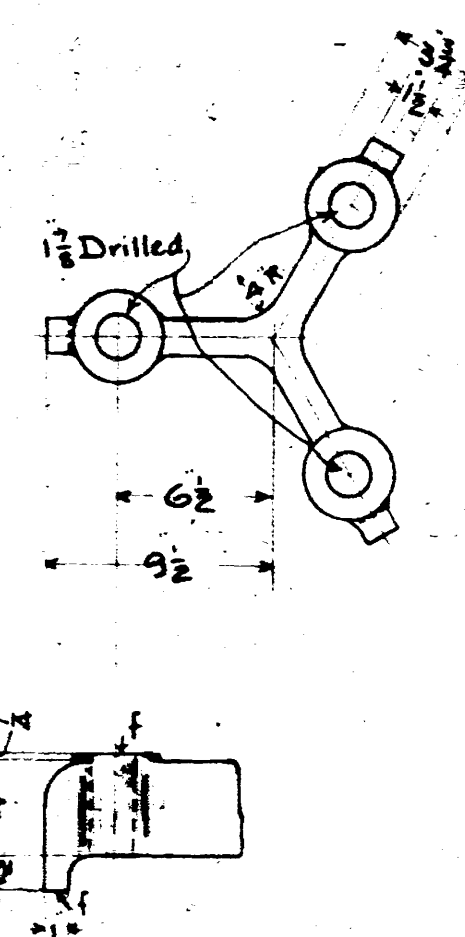
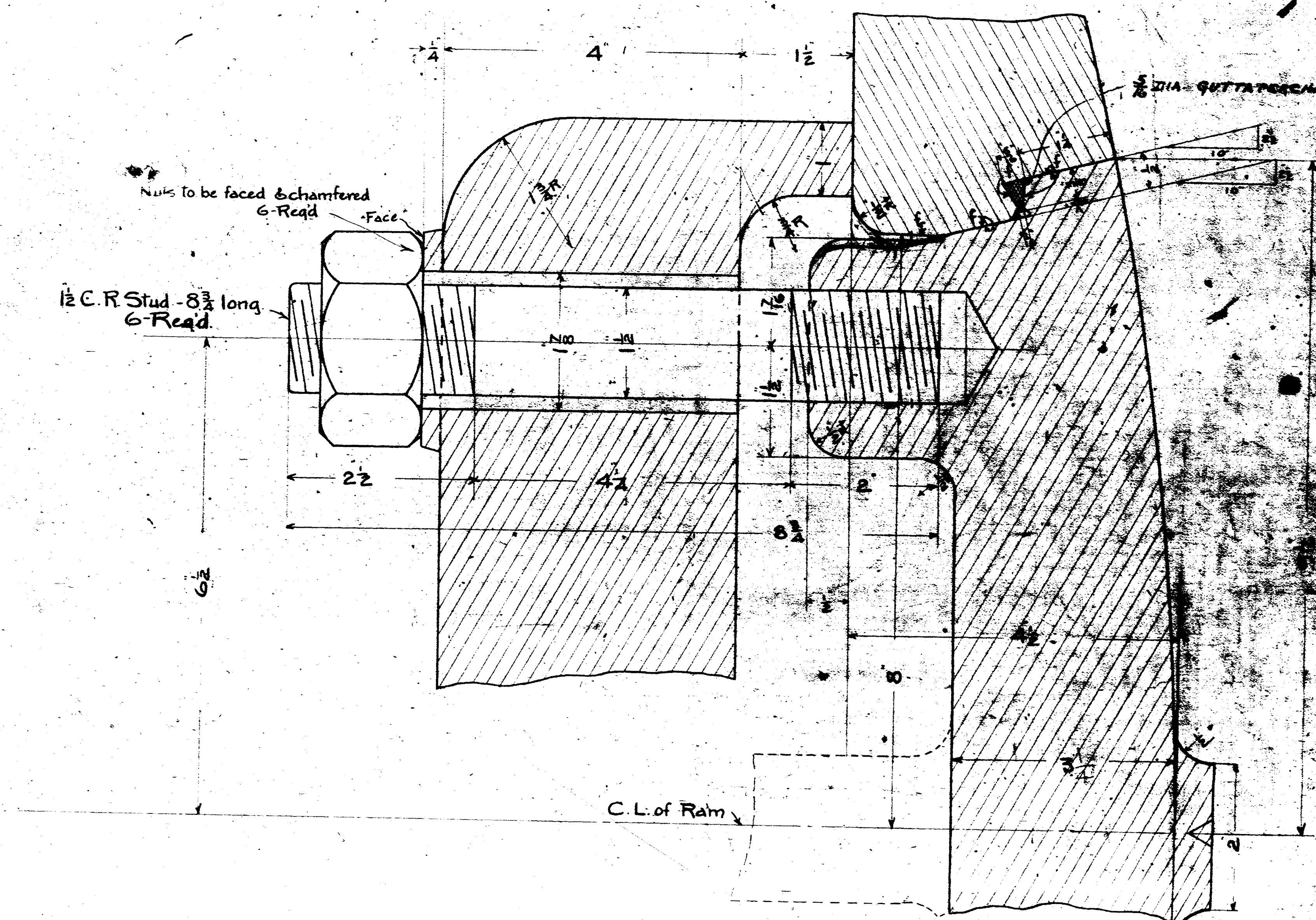
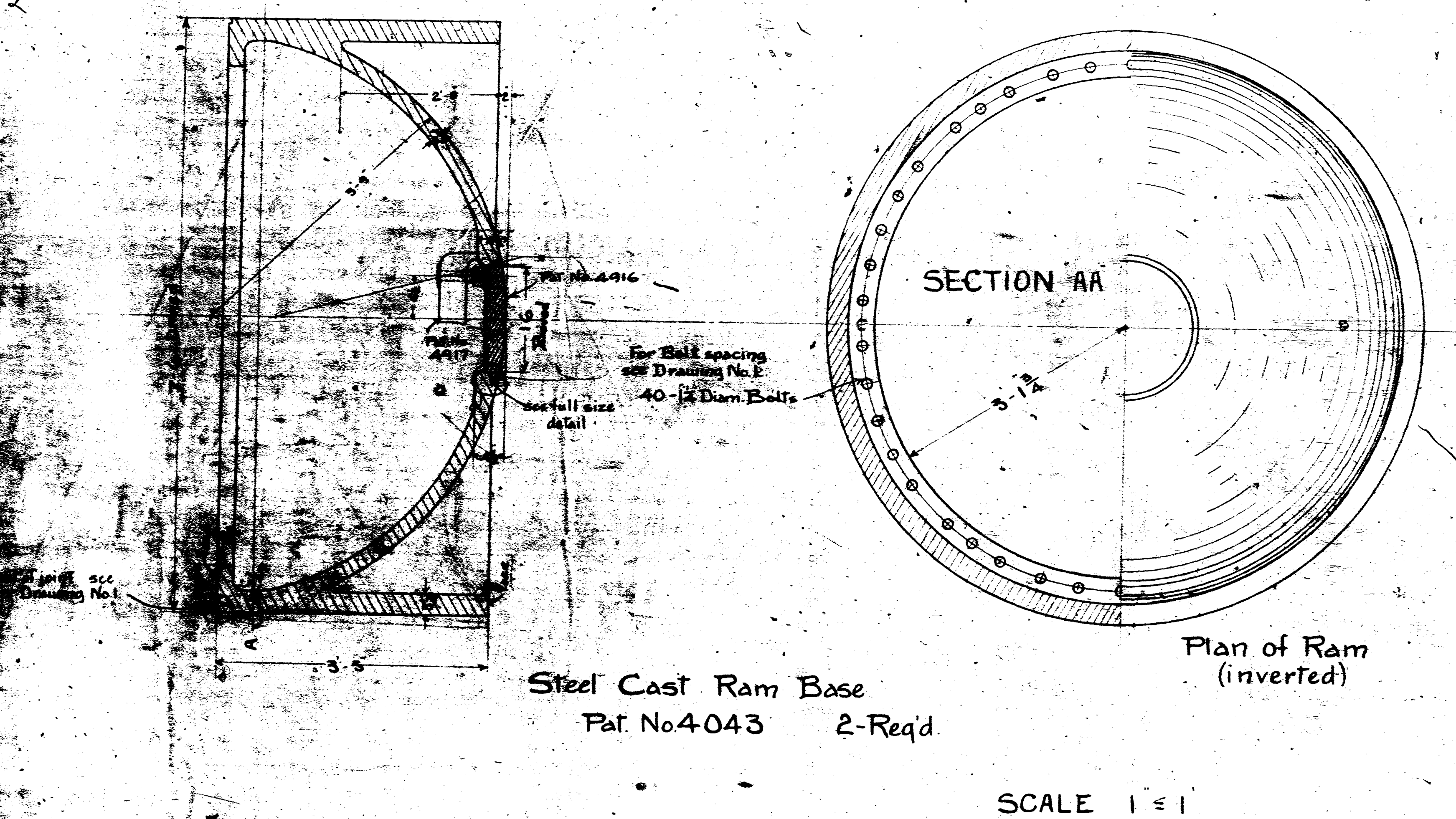


Diagram of Match Marks



CONTRACT 1253

Hydraulic 100' 100'



DETAILS OF MANHOLE YOKE
Steel Casting.
Pat. No. 4917.
2-Req'd.

DETAILS OF MANHOLE COVER
Steel Casting
Pat. No. 4916
2-Req'd.

SCALE $1\frac{1}{2} = 1$

FULL SIZE SECTION
SHOWING JOINT IN MANHOLE

CONTRACT 1252
HYDRAULIC LIFT LOCK NO.1
TRENT CANAL, PETERBOROUGH
STEEL CAST RAM BASE & DETAILS
Dominion Bridge Co Ltd April 3, 1962

DRAWING NO. 40.

	LIFT LOCK AT LA LOUVIERE, BELGIUM	LIFT LOCK N°1 TRENT CANAL.		
	Tests specified for Presses with sections of Cast Iron banded with Steel	Tests specified by Dominion Govt for Presses with sections of Cast Iron banded with steel for which specification was drawn.	Tests proposed by Dominion Bridge Co. Ltd. for presses with Sections made of Steel Castings.	Tests asked for by Sup ⁹ Engineer for Presses with Sections made of Steel Castings.
Proof test on every section	Before banding, each Cast Iron lining to be tested for 1 hour at a pressure = working pressure x 1-16	Before banding, each Cast Iron lining to be tested for 1 hour at a pressure = working pressure x 1-5	Every section to be tested after finishing at a pressure = working load x 2-5	Every section to be tested after finishing at a pressure = working load x 2-5
Ultimate tests	One Cast lining, tested to destruction before banding, shall not fail at a pressure less than working pressure x 2-34	One Cast Iron lining tested to destruction, before banding shall not fail at a pressure less than working pressure. 30	D.B.Co. believe it impracticable to burst the sections: or, granting that means could be devised for bursting them that this test would not in any way indicate the fitness of the material.	2 finished sections, tested to destruction, shall not fail at a pressure less than working pressure x 7-45
	One banded section to be tested without failure to a pressure = working pressure x 4-55	One banded section to be tested without failure to a pressure = working pressure x 50		
Proof tests. Upper Sections, with packing and portion of Ram assembled	Working pressure x 2-28	Working pressure x 2-0	Working pressure x 2-0	Working pressure x 2-0
Proof test of each Cylinder and Ram after completion.	Working pressure x 1-17	Working pressure x 2-0	The most severe test practicable to obtain say 1-5	Working pressure x 1-5
Specification for Steel Castings		Ultimate Strength, at least 60,000 Elastic Limit, per cent of Ult ^s 50% Elongation 13% Reduction of Area 17%	Ultimate Strength, at least 65,000 Elastic Limit, per cent. of Ult ^s 50% Elongation 15% Reduction of Area 17%	



Experience in Action