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IMPERIAL METALS CORP.
MT. POLLEY PROJECT

TAILINGS STORAGE FACILITY
SITE INSPECTION MANUAL
(REF. NO. 1625/2)

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GRIT 2198

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CONSULTING ENGINEERS

IMPERIAL METALS CORP.
MT. POLLEY PROJECT

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(REF. NO. 1625/2)

Association of Consulting Engineers of Canada
Association des Ingénieurs-Conseils du Canada

Knight Piésold Ltd.
CONSULTING ENGINEERS

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TAILINGS STORAGE FACILITY

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IMPERIAL METALS CORPORATION
MOUNT POLLEY PROJECT
TAILINGS STORAGE FACILITY

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SECTION 1.0 - INTRODUCTION

This manual outlines the Construction Quality Assurance (CQA) program for the construction of Stage Ib of the Tailings Storage Facility and ancillary structures for the Mt. Polley Project. The work will be carried out under a Construction Contract between a Contractor and Imperial Metals Corporation.

Subsequent raises of the embankments will be constructed in accordance with detailed drawings developed for each embankment raise. The appropriate sections of the Technical Specifications and of this Site Inspection Manual will be excerpted and updated as appropriate to form a complete construction package for each raise.

Knight Piésold Ltd., as the Engineer, will have responsibility for the CQA program and for technical direction of the work to ensure conformity with the design intent. Imperial Metals Corp. will provide Construction Management services and contract administration.

The Technical Specifications for the construction of the tailings storage facility have been written as a method specification in which the Contractor is directed how to carry out the work and the requirements of the end product are defined. It is the Contractor's responsibility to supply materials which meet the specified requirements and it is the Engineer's responsibility to ensure that the Contractor uses these materials to construct the work as defined in the Specifications. The Engineer retains the right to vary the critical parameters that control the end product, such as placement moisture content and number of compaction passes for earthworks.

SECTION 2.0 - INSPECTION AND TESTING REQUIREMENTS

2.1 ORGANIZATION AND RESPONSIBILITIES

The Owner, Imperial Metals Corporation, have appointed a Construction Manager as its representative on site. The Engineer is Knight Piésold Ltd., who has appointed a Resident Engineer as its representative on site. The Contractor has not yet been appointed.

Knight Piésold Ltd., as Engineer, will administer all CQA and technical aspects for the tailings storage facility as set out in the Technical Specifications. The Engineer's staff on site comprises a Resident Engineer and a Senior Technician, with part time presence of the Project Manager. The Construction Manager employs inspectors, check surveyors, material men and laboratory technicians as required to round out the inspection and testing personnel and to administer the Contract. A Site staff organization chart is shown in Figure 1.

The Resident Engineer is responsible for all technical direction, inspection and testing activities, and interpretation of test results. He reports on site to the Construction Manager or his designated representative. The Senior Technician is responsible for the regular performance of the CQA program and reports to the Resident Engineer. Inspectors and technicians are responsible for carrying out specific tasks as directed, and for on-site laboratory and field testing. They report on administrative aspects to the Construction Manager and on technical aspects to the Engineer. For example, inspections to verify the quantities and amounts for payment under the Contract would be reported to the Construction Manager since these are separate from quality control inspections. However, observations of unacceptable construction procedures would be reported to the Engineer for remedial action.

The designation of tests to be carried out, CQA inspections to be performed and interpretation of test results is the sole responsibility of the Engineer or his designated representative. Notwithstanding that the Engineer is responsible for ensuring that all work carried out by the Contractor meets the requirements of the

Technical Specifications the Contractor will not be relieved of liability for substandard work.

The Owner will establish reference monuments and benchmarks for survey control on the site. The Contractor will be responsible for using these control points to set out the work to the correct lines and grades and for ensuring that the work is constructed to them. Third party surveyors will check lines and grades and check quantity measurements and calculations as and when directed by the Construction Manager.

2.2 STANDARD PROCEDURES

2.2.1 Sampling

2.2.1.1 Sample Identification

A sample identification scheme will be established by the Resident Engineer. The scheme will use a unique and systematic system such that each sample has an identification code number which contains the following information.

1. Project name identifier
2. Sample site identifier
3. Sample episode or sequence identifier
4. Modifier if necessary
5. Sample type
6. Sampler identifier
7. Date

At the time each sample is taken, the sampler must record the date, time, identification code and location of the sample, and any other relevant information in his field book and in the lab records book.

The sample identification code is to be marked on the container or attached tag in indelible ink.

2.2.1.2 Sample Procedure

The following general procedure will be used, modified as appropriate for the sample type and purpose.

- Collect an adequate and representative sample
- Handle it as little as possible
- Transfer or dispatch it properly and promptly
- Accept samples only after checking for identification and integrity
- Store in correct area avoiding contamination
- Retain or dispose of samples as directed by the Resident Engineer

2.2.1.3 Sample Custody

It is not anticipated that custody and chain of custody procedures will be necessary. If required, the Resident Engineer will develop a custody procedure.

2.2.2 Documentation

2.2.2.1 Test Records

Records of all samples taken will be kept in an up to date lab records book. Individual test data and results will be recorded on standard forms applicable to the test being performed (see Appendix A). The results will then be entered onto Summary Sheets for each type of material. These sheets will be kept up to date at all times. The location of all tests will be determined and recorded in a system appropriate to the test being performed.

The Resident Engineer will provide the Construction Manager with one copy of all test records.

2.2.2.2 Inspection Records

The Resident Engineer will maintain records of all inspections carried out. Inspectors Daily Report forms and the specific Inspection Record forms for pipework, concrete, etc., must be completed on a daily basis and returned to the Resident Engineer. These forms and the Engineers observations will form the basis for the Daily Report. A copy of the Daily Report will be provided to the Construction Manager each day.

2.2.2.3 Field Books

The Resident Engineer will issue all inspection and testing staff with permanently bound field books. The field books remain the property of Knight Piésold Ltd. and must only be used for project work. Pages must not be torn or removed from the book.

Each user may make entries in their individual style. All entries must be legible and in indelible ink. While individual preferences are acceptable, notes should follow usual professional practice.

2.2.2.4 Corrections to Documentation

All entries on all documents are to be indelible ink. If an error is made on a document assigned to one individual, that individual may make corrections by crossing a single line through the error and entering the correct information. The erroneous information must not be obliterated. The individual must date and initial the correction.

If an error is made on a general document or a change is made in a document assigned to another, the above procedure is used and the entry is dated and initialled by the person making the correction or entry.

No documents are to be destroyed or thrown away, even if they are illegible, contain inaccuracies, or are replaced by another document.

2.2.3 Acceptance and Approvals

In certain circumstances, it is necessary that the Engineer accept or approve the quality and/or condition of part of the work or approve the Contractor's proposed construction methods before subsequent work can take place. These occur at designated Construction Hold Points as set out in the Technical Specifications. Examples of Construction Hold Points include:

1) Approval of the Basin Liner Subgrade.

2) Approval of completed Basin Liner, including verification of thickness and review of testing results.

3) Approval of embankment foundation(s).

4) Approval of Toe Drain construction methods.

The following general procedures will be used for Construction Hold Points:

- The Contractor will notify the Resident Engineer of the area, type, and extent of acceptance approval required.

- The Resident Engineer will arrange for all necessary inspections and tests, so that the least delay is caused to the work.

- The Resident Engineer will issue a written approval or rejection to the Contractor. The written approval will contain a clear description and plan of the work approved. If the work is rejected, the reasons for so doing will be clearly set out. The Resident Engineer at his sole discretion may make a partial approval. A copy of the request and response will be forwarded to the Construction Manager.

2.2.4 Material Pre-Approval

All "or equal/equivalent" materials must be approved by the Engineer. Requests for use of equivalent materials are submitted through the Construction Manger. The Resident Engineer will review each request in view of the requirements of the Technical Specifications and the intentions of the design.

As soon as reasonably possible, the Resident Engineer will inform the Construction Manager in writing of the acceptance or rejection of the proposed equivalent material. In the case of rejections, the reasons will be clearly stated. The Resident Engineer at his sole discretion may authorize restricted use of the proposed equivalent material.

2.3 AS-BUILT DOCUMENTATION

The Engineer will maintain one complete set of the Drawings for the express purpose of compiling the final locations, elevations, lines, grades and dimensions of the components of the work on an on-going basis during construction. Information required for this purpose will be obtained in large measure from drawings submitted by the Contractor in support of measured quantities for payment and as required by the provisions of Clauses 1.15 and 1.16 of the Technical Specifications.

Additional information required for as-built documentation will include:

- The Engineers observations, calculations, design changes and detailing sketches.
- Inspection report forms (included in Appendix A).
- Testing results from the site laboratory records.

- Test certificates for pipework, valves, etc. submitted by the Contractor in support of requests for acceptance of materials.

- Manufacturer's and supplier's product documentation (provided in accordance with Clause 1.6.b), operation and maintenance manuals and warranty documentation.

- Instrumentation records obtained during construction.

SECTION 3.0 - INSPECTION OF THE WORK

3.1 GENERAL TECHNICAL REQUIREMENTS (GTR's)

The provisions of Section 1 of the Technical Specifications, the General Technical Requirements (GTR's), apply to each of the subsequent sections as though they were repeated in full for each item of work. The various notice periods, submittals for approval and qualifications of materials, methods, equipment and components that are required in the GTR's are summarized on Table 1 in the Technical Specifications.

Detailed inspection and documentation of items of completed work, as measured for payment, will be carried out in accordance with the provisions of the GTR's under the specifications and payment items included in Sections 2 to 7 of the Technical Specifications, according to the inspection and documentation requirements set out herein.

3.2 MOBILIZATION AND DEMOBILIZATION

Section 2 of the Technical Specifications provides the detailed requirements for mobilization and demobilization.

Inspection requirements during mobilization consist of confirming that the Contractor's site facilities and equipment fleet conform to those proposed in the Contractor's proposal and that they meet the requirements of the Specifications.

The Contractor's site arrangement plans (Clause 1.9.b.) and construction schedule will be reviewed for completeness and adequacy. Notifications required by provisions of the General Technical Requirements will be reviewed and approved or returned for revision.

The site testing laboratory and the Engineer's office must be set up and all of the testing, inspection and documentation procedures set out herein must be initiated. In large measure this will be a matter of familiarizing the site staff with the design and with the contents of this Site Inspection Manual as they apply to the duties and responsibilities of the inspectors and technicians.

Inspection and documentation requirements during demobilization will comprise checking of completed items of work for acceptance and for completeness of documentation. This includes checking that the site is left in a clean and tidy condition.

3.3 TAILINGS BASIN

Section 3 of the Technical Specifications provides the detailed requirements for Work in the Tailings Basin.

Inspections for the Tailings Basin comprise verification of clearing and stripping limits; inspections of areas of prepared subgrade submitted for approval by the Contractor; inspection of exploration trenches to determine the limits of the basin liner; inspection of the installation of the basin groundwater drains; inspection and testing of the basin liner; inspection and testing of the borrow areas and final inspection of the completed basin liner.

The as-built documentation will comprise compilation of plans showing areas cleared, stripped, grubbed and topsoil removed and locations and arrangements of spoil piles and stockpiles; a survey of the prepared subgrade prior to installation of the basin liner and the final locations and grades of the exploration trenches and basin groundwater drains and pipeworks. Test results on basin liner materials and borrow materials along with inspectors reports and photographs will complete the documentation for this work.

Instrumentation and flow monitoring records will be maintained as per Section 3.7.

3.4 EMBANKMENTS AND SEEPAGE COLLECTION PONDS

Section 4 of the Technical Specifications. provides the detailed requirements for Work in the Embankments and Seepage Collection Ponds.

Inspections for the Embankments and Seepage Collection Ponds comprise inspection of setting out criteria; inspections and testing of embankment foundations submitted for approval by the Contractor; inspection of the installation of the foundation drains and pipeworks; inspection and installation of the foundation instrumentation; inspection and testing of the borrow and fill materials; inspection of the toe drain and pipework installations; inspection and testing of pond foundations and berm fill materials and inspection of the installation of the drain monitoring sump.

The as-built documentation will comprise compilation of plans showing additional areas cleared, stripped, grubbed and topsoil removed and locations and arrangements of spoil piles and stockpiles; a survey of the prepared subgrade prior to placement of fill at the embankments or construction of the seepage collection ponds; a survey of the completed embankments, ponds and berms in sufficient detail such that all zone boundaries are easily distinguished; the final locations and grades of the toe drains, CPT riser pipes and conveyance pipework; the final locations and grades of all remaining drain pipework and details of the drain monitoring sump, and the final locations of the remaining instrumentation. Test results on foundation, borrow and fill materials along with instrumentation records, inspectors reports and photographs will complete the documentation for this work.

3.5 SITE ROADS AND DIVERSION DITCHES

Section 5 of the Technical Specifications provides the detailed requirements for Work in the Site Roads and Diversion Ditches.

Inspections for the Site Roads and Diversion Ditches comprise verification of alignments for grade and location criteria; verification of clearing and stripping limits; inspections of areas for field optimization of the locations of culverts, flow control structures, the Bootjack Creek pipe crossing, etc.; inspection of the installation of the culverts, flow control structures, Bootjack Creek pipe crossing etc.; inspection and testing of the road fills; inspection and testing of the ditch subgrade and final inspection of the completed alignments.

The as-built documentation will comprise compilation of plans showing areas cleared, stripped, grubbed and topsoil removed and locations and arrangements of spoil piles and stockpiles; detailed cross-sections of the various road and diversion ditch alignments; the final locations and grades of the culverts, flow control structures, the Bootjack Creek pipe crossing, etc. Test results on road fills and ditch subgrades along with inspectors reports and photographs will complete the documentation for this work.

3.6 PIPEWORKS

Section 6 of the Technical Specifications provides the detailed requirements for the Pipeworks.

Inspections for the Pipeworks comprise verification of supplied materials meeting specification, storage and handling procedures, butt fusion welding procedures including cool-down times, pipe bedding and backfill materials and procedures, bend radius, use of correct stub ends for pipe rating, flange alignment, bolt torque, installation of correct pipe in each location and final inspection of completed alignment. Pressure testing will be carried out as outlined in the Technical Specifications or as required by Engineer.

As-built documentation will comprise surveyed location and elevations of all flanges, bends, changes in grade, sleeve pipes, etc., noting the pressure rating (SDR number) of each pipe run. Manufacturer's literature will be collected as supplied with the materials by the Contractor. Photographs and test records on pipe backfill will complete the documentation for this work.

3.7 INSTRUMENTATION AND FLOW MONITORING

Section 7 of the Technical Specifications provides the detailed requirements for the Instrumentation and flow monitoring.

Inspections for the Instrumentation and flow monitoring comprise verification of acceptable materials and supplies; verification of location criteria; verification of areas for field optimization of the locations of the drain monitoring sump and the instrumentation monitoring hut; inspection and testing of the installation of all instrumentation, including the Parshall Flume; and final inspection of the completed instrumentation work.

The as-built documentation will comprise compilation of plans showing the final locations of all instrumentation, including details of the Parshall Flume; monitoring results along with inspectors reports and photographs will complete the documentation for this work.

SECTION 4.0 - TEST PROCEDURES

4.1 STANDARD TESTS

The following standard laboratory and field tests will be used for quality control of construction:

4.1.1 Earthworks

Test	**Standard**
Field density	See Section 4.2.1 (ASTM D2167)
Atterberg limits	ASTM D4318 - 84
Moisture content	ASTM D2216 - 92
Moisture content using Microwave Oven	ASTM D4643 - 93
Particle size analysis	ASTM D422 - 63
Laboratory compaction	ASTM D1557 - 91
Specific gravity	ASTM D854 - 92
Laboratory Air Entry Permeameter (LAEP)	See Section 4.2.2
Field Air Entry Permeameter (FAEP)	See Section 4.2.3

Testing carried out on earthworks will include Control and Record tests comprising all or some of the above sub-tests. Control tests will typically be carried out on materials in borrow pits or from source locations to determine their suitability for use in the work. Further control tests will be done on materials after spreading in the fill zones but prior to compaction to determine the acceptability of gradation and moisture content. Record tests will typically be carried out on materials after placement and compaction in the work to document the level of workmanship achieved and to ensure that the design objectives shown on the Drawings are met. Both Control and Record tests will be used as a basis for modifying the construction procedures as and when necessary.

The tests described above and the frequency at which test work will be carried out is summarized on Table 4.1.

4.1.2 Concrete

(i) Prequalification of Materials

The mix design and batching plant will be the responsibility of Others. Results of all tests shall be supplied to the Engineer for review. The Engineer reserves the right to order additional confirmatory testing. The tests may include but are not be limited to all those covered by items (ii) and (iii). In addition, results from the following tests may be reviewed by the Engineer:

Test	Standard	Frequency
Water soluble chlorides	ASTM D1411	1
Reactivity of aggregate	ASTM C227, C289, C342	1
Total chlorides in water	ASTM D512	1
Potable water	(Local health standards)	1

(ii) Concrete Testing at Placement

Test	Standard	Frequency
Concrete sampling	ASTM C172	As needed for tests
Test specimens	ASTM C31	Four from each sample
Slump	ASTM C143	1 per day or 100 m^3
Ambient air temperature		
Concrete temperature	ASTM C1064	

The above tests shall be made at least once per 100 cubic yards, or fraction thereof, of each mixture class of concrete placed in any one day or as directed by the Engineer.

In addition, the first truck load of concrete each day should be tested for slump and air content so that appropriate adjustments can be made at the batch plant.

(iii) Concrete Testing of Hardened Concrete

Testing of hardened concrete will be carried out by a commercial laboratory. Tests will include the following:

Test	**Standard**	**Frequency**
Compressive strength	ASTM C39	Two from each sample at 7 days and two at 28 days

4.2 ADDITIONAL TESTS

4.2.1 Field Density Tests

The field density test is carried out using a 350 mm diameter density ring or similar apparatus (D2167). The water replacement method to determine the volume of a test hole using the density ring is as follows:

- Sweep the surface of the compacted material at the test location with a soft broom to remove any loose material.

- Place the density ring on the swept surface and adjust until it rests firmly. Fix the ring in position using sand bags or steel pins.

- Determine the volume between the compacted surface and the reference mark on the ring by lining the ring and surface with polyethylene sheeting and then filling with water from the reservoir up to the reference mark.

- Return water to reservoir, remove sheeting and excavate the test hole to between 200 and 300 mm deep with approximately vertical sides projected downward from the inside of the density ring. Retain all excavated material in sealed containers for weighing and for laboratory compaction, particle size distribution, laboratory permeability testing, Atterberg limits, specific gravity and moisture content tests, as appropriate.

- The volume of the test hole will be determined by lining the density ring and test hole with the plastic sheeting and filling with water to the reference mark. The volume of the test hole is the difference between the two measured volumes.

4.2.2 Laboratory Permeability Tests

The laboratory air-entry permeameter method for determining the coefficient of permeability on unsaturated samples is carried out in a Proctor compaction mould with an air tight cap which has fittings for tubes from a water supply reservoir, vacuum source and vacuum gauge. The air-entry permeameter apparatus is shown schematically on Figure 2.

A step by step procedure for the air-entry permeameter test is given below:

- Material is compacted in the mold at the natural moisture content to a density simulating the field density.

- The compacted sample in the mold is then placed on a porous base and the air tight cap is attached.

- Water is introduced from the reservoir into the mold to fill the void between cap and soil.

- Once the surface void is filled the vacuum gauge valve on the mold cap is opened to allow de-aired water to flow through the bleed valve adjacent to the vacuum gauge to remove any air from the system.

- The bleed valve on the vacuum gauge is then closed and the 3-way valve is adjusted to allow de-aired water to fill the burette.

- Once the burette is filled the 3-way valve is again adjusted to block off the supply reservoir while allowing flow from the burette into the soil sample.

- The infiltration rate of water into the soil is measured by recording the drawdown in the burette for several time increments until the rate becomes constant (dV/dt). The burette is then shut off and the total volume of water that has flowed into the sample is recorded. This is used to calculate the depth, L_f, to which the wetting front has penetrated.

- A vacuum is then applied to the sample through the cap of the permeameter using a syringe connected to the bleed valve at the vacuum gauge. The maximum negative pressure achieved at the point at which air percolates through the soil into the surface water is recorded (P_{min}).

- The coefficient of permeability is calculated using the equation shown on Figure 2 (Bouwer H., (1978) Groundwater Hydrology, McGraw-Hill).

During the initial stages of work a series of compaction tests using the mold should be carried out over the range of expected moisture contents of each material. The tests should be carried out at various compactive efforts to develop characteristic dry density versus moisture content curves for the materials. This will enable prediction of the appropriate compactive effort to be applied to the samples during the testing program.

During construction, the material characteristics may change and the characteristic curves for required compactive effort may require periodic updating.

4.2.3 Field Permeability Tests

The field air-entry permeability test is similar to the laboratory test except that it is larger, with a 24 inch internal diameter, and is carried out on a ring which is set into the seal material to be tested. The larger size is to ensure that macro-permeability is measured and that any structures which could have an effect on permeability are included in the test areas.

The test is initiated by the excavation of a narrow annular channel 4 inches deep in which the test ring will fit. The channel is partially filled with a bentonite paste and the test ring is inserted. The ring is left until the bentonite grout has cured completely sealing the ring soil interface. The test apparatus is then fitted to the ring and the test proceeds in the same manner as the laboratory air-entry permeability test.

SECTION 5.0 - REPORTING

5.1 MONTHLY PROGRESS REPORTS

The Engineer will prepare monthly progress reports throughout the period of construction. These reports will summarize all construction activities and results of testing during the month as well as highlight any difficulties encountered, potential difficulties and an assessment of the progress of the work in relation to the construction schedule.

The monthly progress reports will be issued to the Owner through the Construction Manager and will be made available to regulatory agencies.

5.2 CONSTRUCTION REPORT

On completion of the work and prior to discharge of any tailings into the facility, or retention of any runoff or process waters in the facility, the Engineer will prepare a comprehensive Construction Report which will include results from all tests carried out as part of the quality assurance program, and as-built drawings. The Construction Report will be filed with the British Columbia Ministry of Energy, Mines and Petroleum Resources and other appropriate agencies.

Similar construction reports will be prepared after all subsequent construction stages.

Knight Piésold Ltd.
CONSULTING ENGINEERS

TABLE 4.1

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TAILINGS DISPOSAL FACILITY
STAGE Ib 1995 CONSTRUCTION

QUALITY CONTROL TESTING SCHEDULE

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ZONE (Material)	QUANTITY (m^3)	CONTROL TESTS REQUIRED					RECORD TESTS REQUIRED						
		C2	C3	C4	C6	C8	R1	R2	R3	R4	R7	R8a	R8b
Zone S - Main Embankment (Glacial Till)	175,000	25,000/7	25,000/7	25,000/7	60,000/3	25,000/7	10,000/18	10,000/18	10,000/18	10,000/18	10,000/18	20,000/9	--
Zone S - Perimeter Embankment (Glacial Till)	25,000	20,000/1	20,000/1	20,000/1	20,000/1	20,000/1	5,000/5	5,000/5	5,000/5	5,000/5	5,000/5	20,000/1	--
Zone B - Main Embankment (Glacial Till)	75,000	20,000/4	20,000/4	20,000/4	40,000/2	20,000/4	10,000/7	10,000/7	10,000/7	10,000/7	10,000/7	20,000/4	--
Zone B - Perimeter Embankment (Glacial Till)	10,000	20,000/1	20,000/1	20,000/1	20,000/1	20,000/1	10,000/1	10,000/1	10,000/1	10,000/1	10,000/1	10,000/1	--
Toe Drain - Main Embankment (Filter Sand)	20,000	--	2,000/10	--	--	--	--	--	1,500/10	--	--	10,000/2	--
Toe Drain - Perimeter Embankment (Filter Sand)	5,000	--	2,000/3	--	--	--	--	--	1,500/10	--	--	--	--
Basin Liner (Glacial Till)	70,000	20,000/4	20,000/4	20,000/4	40,000/2	20,000/4	10,000/7	10,000/7	10,000/7	10,000/7	10,000/7	10,000/7	15,000/5
Pipe Surround (Drain Gravel)	5,000	--	1,000/5	--	--	--	--	--	1,000/5	--	--	--	--
Ditch Erosion Protection (Riprap)	5,000	--	1,000/5	--	--	--	--	--	1,000/5	--	--	--	--
Road Surfacing (Wearing Course)	10,000	--	2,000/5	--	--	--	--	--	2,000/5	--	--	--	--
Perimeter Embankment Seepage Pond (Glacial Till Foundation)		--	--	--	--	--	--	--	--	--	--	2	2
Bootjack - Morehead Connector (Road Fill)		--	--	--	--	--	--	--	--	--	3	--	--
Tailings Line Access Road (Road Fill)		--	--	--	--	--	--	--	--	--	3	--	--
Area B&C Runoff Collection Ditch (Ditch Foundation)		--	--	--	--	--	--	--	5	--	--	--	--
Totals	400,000	17	42	17	9	17	38	38	78	38	44	26	7
						102							269

Legend: 10,000/4 means one test to be completed for every 10,000 cubic metres of material placed with a minimum of 4 tests over the duration of the testwork.

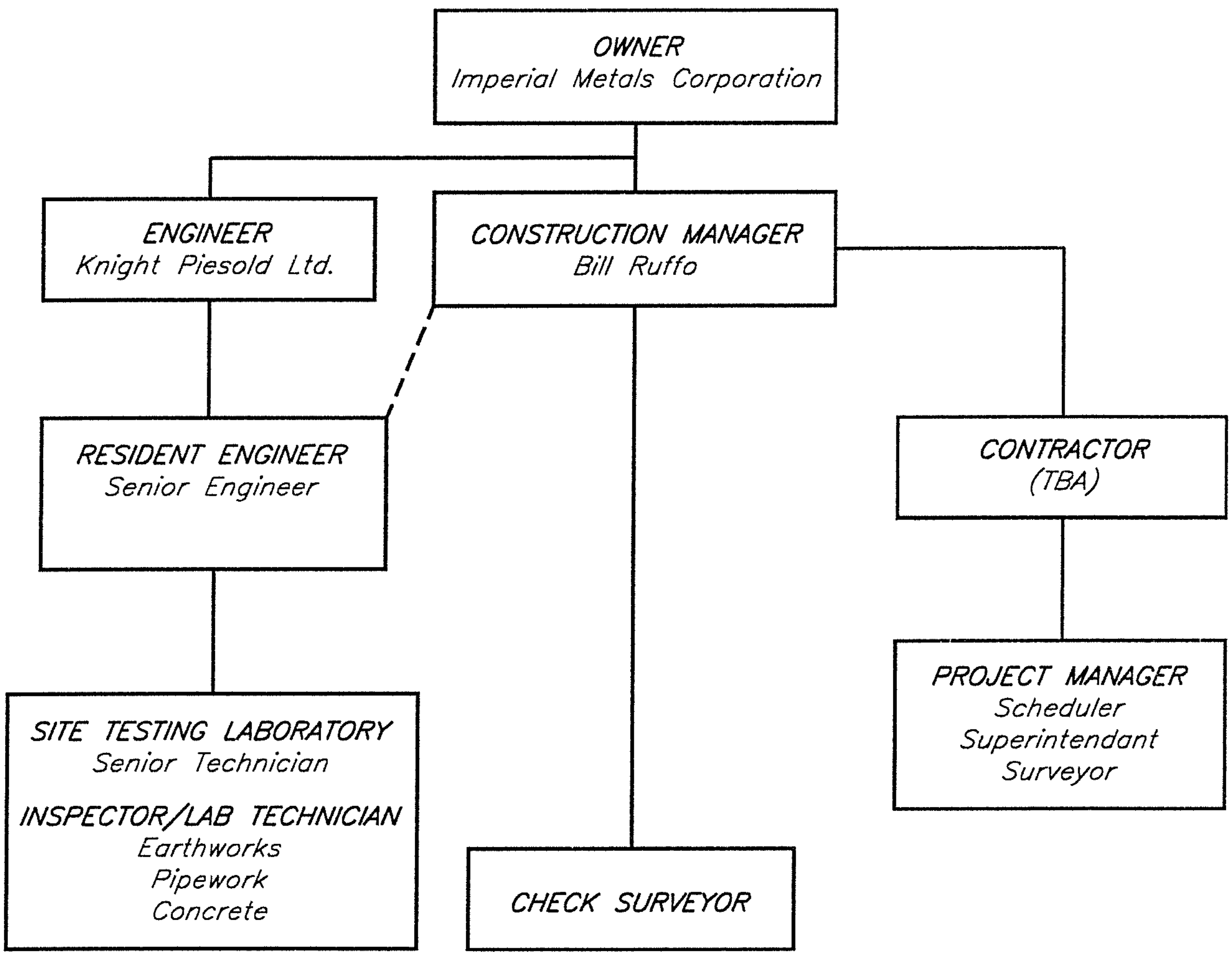
Control Tests:

C2	Moisture Content (ASTM D2216)
C3	Particle Size Distribution (ASTM D422)
C4	Laboratory Compaction (ASTM D1557)
C6	Specific Gravity (ASTM D854)
C8	Lab Air Entry Permeameter (LAEP)

Record Tests:

R1	Atterberg Limits (ASTM D4318)
R2	Moisture Content (ASTM D2216)
R3	Particle Size Distribution (ASTM D422)
R4	Laboratory Compaction (ASTM D1557)
R7	Field Density (ASTM D2167)
R8a	Lab Air Entry Permeameter (LAEP)
R8b	Field Air Entry Permeameter (FAEP)

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TAILINGS STORAGE FACILITY
SITE INSPECTION MANUAL
ORGANIZATION CHART



May 10, 1995

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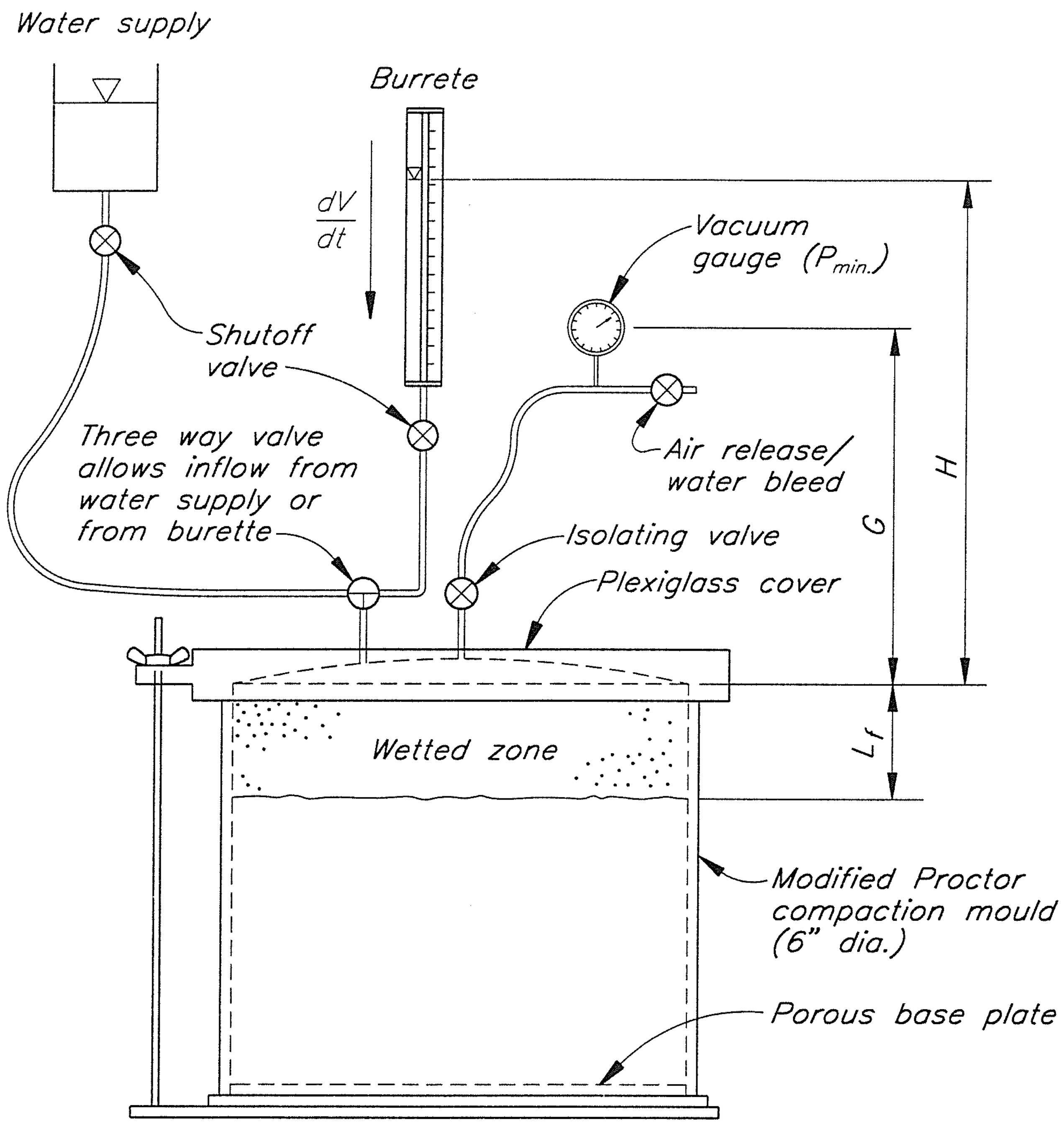
FIGURE 1

CAD FILE: \PROJECT\1625\FIG\A15 Plot 1=1

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

AIR ENTRY PERMEAMETER

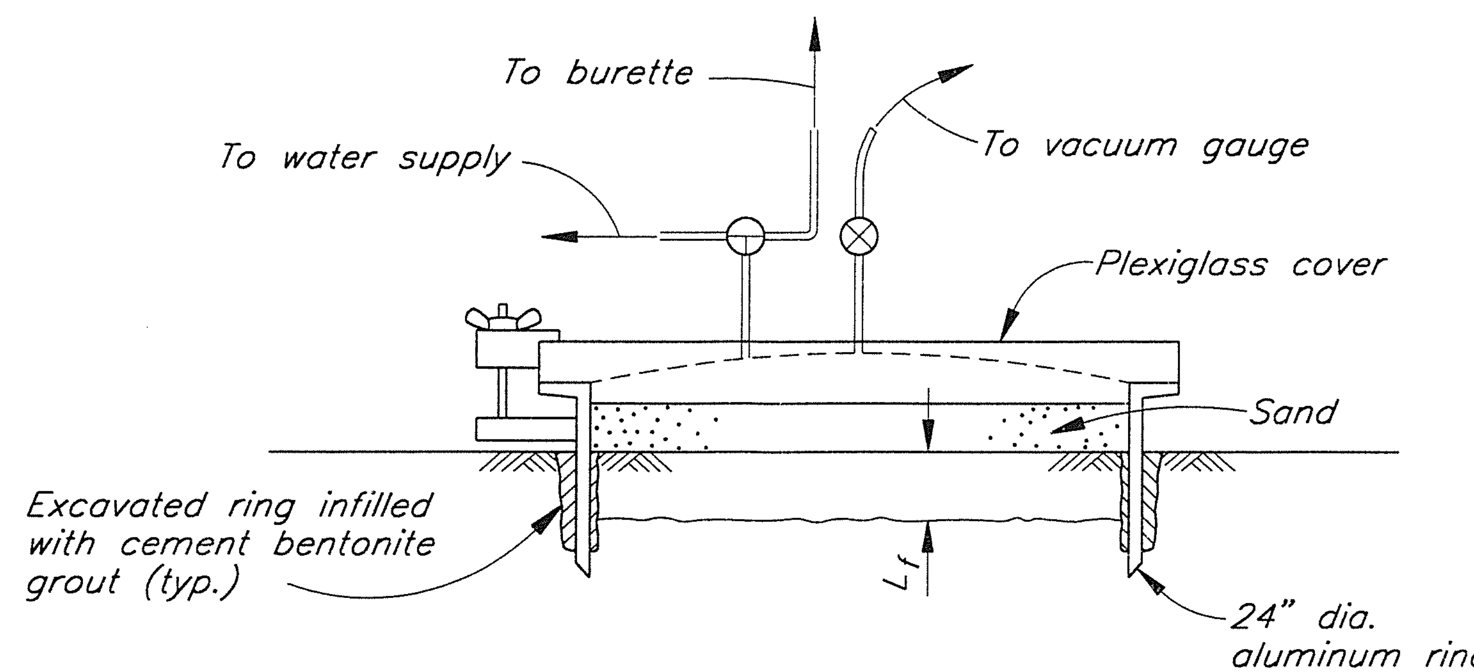


LABORATORY AIR–ENTRY PERMEAMETER

Permeability Calculations:

$$k = \frac{(dV/dt) \cdot L_f \cdot 100}{A \cdot (H + L_f - 0.5\,P_a)} \text{ (cm/sec)}$$

$$P_a = P_{min.} + G + L_f$$



FIELD AIR–ENTRY PERMEAMETER

May 10, 1995
KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

FIGURE 2

CAD FILE: \PROJECT\1625\FIG\B11 Plot 1=1

APPENDIX A

INSPECTION FORMS

- inspectors daily report
- pipework inspection checklist
- concrete placement inspection checklist
- foundation inspection checklist

Seq. No. ____ cc CM

Date: ____________

PIPEWORK INSPECTION CHECKLIST

Name of Project Component: _________________________ Weather: __________________________ Inspector: _________________

Inspections: from Sta. ____ to Sta. ____ from El. ____ to El. ____

Pipe Diameter and material: ____________ Ref. Drawing No. ____________

ITEM	DETAILED REQUIREMENTS	CHECKED	REMARKS
Trench Line and Grade	As per drawings		
Soil Materials	Describe soils exposed in trench walls and invert, attach sketch if necessary.		
Trench Spoil	Suitable for backfill		
	Use in other fills		
	Waste in place		
	Sample Nos. (for testing)		
Trench Floor	Free of sharp protrusions		
	Soft areas or sloughs		
	Compacted? (state how)		
Pipe Bedding	Material type.		
	Lift thickness/No. of compaction passes.		
Pipe Joints	Type/No./Pass-fail.		
	Pressure test record No.		
As-built Line and Grade	Survey done		
Backfill	Material type.		
	Lift thickness/No. of compaction passes.		
	Sample Nos. for testing.		
Photos	Photo Nos.		
Equipment	Equipment nos., note any problems or unusual conditions.		

Seq. No. ____ cc CM

Date: ____________

CONCRETE PLACEMENT INSPECTION CHECKLIST

Name of Project Component: __________________ **Weather:** __________________ **Inspector:** ______________

Inspections: from Sta. ____ to Sta. ____ from El. ____ to El. ____

Type of Concrete: ____________ **Ref. Drawing No.** ____________

ITEM	DETAILED REQUIREMENTS	CHECKED	REMARKS
Lines and Grade	Location		
	Elevation		
	Dimensions		
	Drainage		
	Preparation of surface		
Formwork	Dimensions/Tolerances		
	Alignment		
	Plumb		
	Stability (bearing, shores, tees)		
	Penetrations/Blockouts/Chamfer strips		
	Forms oiled		
	Cleanliness		
	Waterstops/shear bars		
Reinforcing Steel	Location (No. of bars, spacing, cover)		
	Size (diameter, length, bends and anchorage)		
	Splices		
	Blocking		
	Stability (wiring, chairs, spacers)		
	Cleanness (no rust, oil, paint mortar, salt, etc.)		
Concrete	Delivery ticket nos. attached		

Seq. No. ____ cc CM

Date: ______________

CONCRETE PLACEMENT INSPECTION CHECKLIST

Name of Project Component: ____________________________ Weather: ______________________________ Inspector: ____________________

Inspections: from Sta. _____ to Sta. _____ from El. ____ to El. ____

Type of Concrete: ______________ Ref. Drawing No. ______________

Ticket No.	Batched	Time Poured	Interval	Accept/Reject	Slump Test	Cylinder Nos.	Remarks

Seq. No. ____ cc CM

Date: ____________

FOUNDATION INSPECTION CHECKLIST

Name of Project Component Zone: ________________________ **Weather:** ____________________ **Inspector:** ________________

Inspections: from Sta. ____ to Sta. ____ from El. ____ to El. ____

Ref. Drawing No. ____________

ITEM	DETAILED REQUIREMENTS	CHECKED	REMARKS
Material Type	Soil or rock description		
Compaction	Number of passes specified/done		
Lines and Grades	Check against drawings		
Photo Record	Photo Numbers		
Foundation Approval	Signature/Date		

Sketch:

Scale:

APPENDIX B

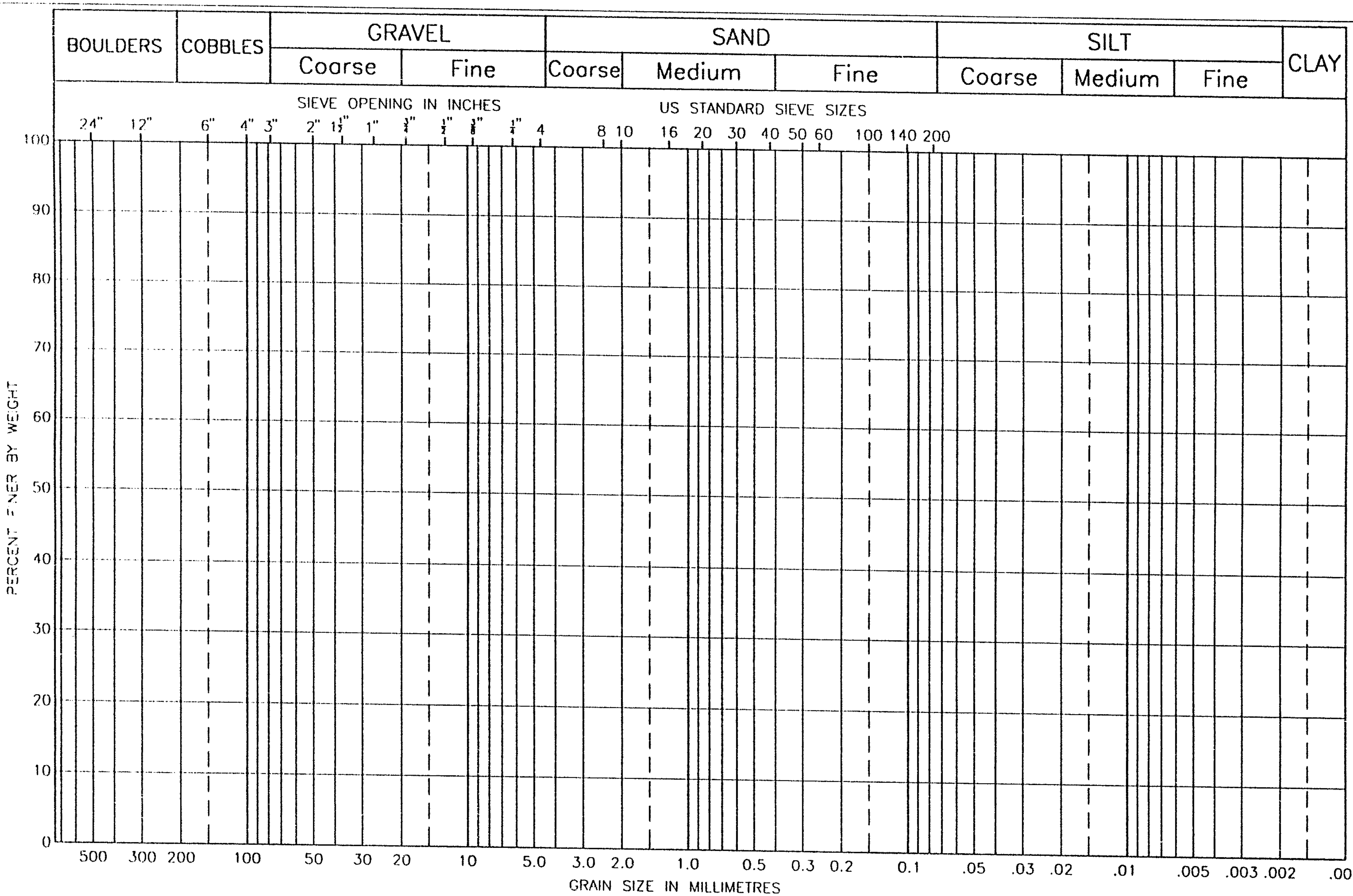
STANDARD TEST FORMS

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

UNIFIED SOIL CLASSIFICATION SYSTEM

PROJECT No. ____________
SAMPLE No. ____________
DATE ____________

PROJECT: —
—



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CONSULTING ENGINEERS

MOISTURE CONTENT DETERMINATION ASTM D2216

Project ______________________ Date of Test ______________________

Sample No. ______________________ Tested By ______________________

Location ______________________ Checked By ______________________

Chainage or Grid Ref. ______________________ Elevation ______________________

Trial No.							
Tare No.							
Weight in Grams	Tare + Wet Soil						
	Tare + Dry Soil						
	Water, W_w						
	Tare						
	Dry Soil, W_s						
Moisture Content (%)							
Av. Moisture Content							

Trial No.							
Tare No.							
Weight in Grams	Tare + Wet Soil						
	Tare + Dry Soil						
	Water, W_w						
	Tare						
	Dry Soil, W_s						
Moisture Content (%)							
Av. Moisture Content							

Remarks: ____

KNIGHT PIESOLD LTD. CONSULTING ENGINEERS	GRAIN SIZE ANALYSIS – ASTM D422

roject ______________________ Date of Test ______________________

Sample No. ______________________ Tested By ______________________

Location ______________________ Checked By ______________________

Chainage or Grid Ref. ______________________ Elevation ______________________

Dry Wt. of Coarse Sample =				HYDROMETER TEST Dry Wt. of Sample =					
Screen	Wt. Ret.	% Ret.	% Pass.	Time Interval	Clock Reading	Hyd'mtr Reading	Temp. °F.	Grain Size mm	% Passing
2-1/2"									
2"									
1-1/2"									
1"									
3/4"									
1/2"									
3/8"									
1/4"									
4									
#10									
Pass #10									
TOTALS									

Dry Wt. of 1/4'd Sample Passing No. = g				SPECIFIC GRAVITY TEST			
Screen	Wt. Ret.	% Ret.	% Pass.	(1) Wt. of Flask + Soil			
#8				(2) Wt. of Flask			
#16				(3) Wt. of Soil = (1) – (2)			
#30				(4) Wt. of Flask + Water			
#50				(5) (3) + (4)			
#100				(6) Wt. of Flask + Water + Soil			
#200				(7) Vol. of Soil = (5) – (6)			
Pan				(8) Temp. & Corr. (Tc)			
TOTALS				Specific Gravity = (3) x Tc/(7)			

Classificaton: ____

____

Remarks: ____

____

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

ATTERBERG LIMITS – ASTM D4318

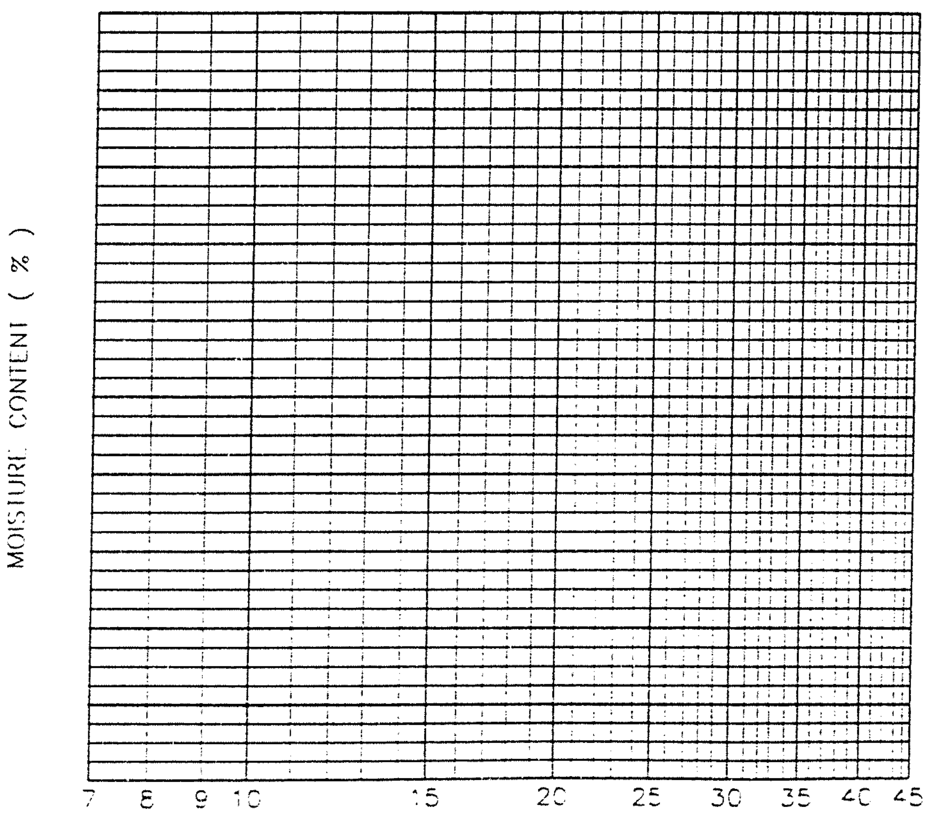
roject ______________________ Date of Test ______________________
Sample No. ______________________ Tested By ______________________
Location ______________________ Checked By ______________________
Chainage or Grid Ref. ______________ Elevation ______________________

LIQUID LIMIT

Trial No.								
No. of Blows								
Container No.								
Wt. of Wet Soil + Container								
Wt. of Dry Soil + Container								
Wt. of Container								
Wt. of Moisture								
Wt. of Dry Soil								
Moisture Content								

PLASTIC LIMIT

Trial No.								
Container No.								
Wt. of Wet Soil + Container								
.. of Dry Soil + Container								
Wt. of Container								
Wt. of Moisture								
Wt. of Dry Soil								
Moisture Content								



SUMMARY
Liquid Limit ____________
Plastic Limit ____________
Plastic Index ____________

KNIGHT PIESOLD LTD. CONSULTING ENGINEERS	SPECIFIC GRAVITY TEST – ASTM D854

Project ______________________ Date of Test ______________________

Sample No. ______________________ Tested By ______________________

Location ______________________ Checked By ______________________

Chainage or Grid Ref. ____________ Elevation ______________________

Test No. ____________

Flask No.			
Temperature (°C)	(T)		
Wt. of Flask and Water (g) (from Curve, at T)	(Wa)		
Temperature Correction Factor	(K)		
Wt. of Dry Soil and Tare (g)			
Wt. of Tare (g)			
Wt. of Dry Soil (g)	(W_o)		
Wt. of Flask, Water and Soil (g)	(W_b)		
Specific Gravity (T,T)	$W_o/(W_o + (W_a - W_b))$		
Corrected Specific Gravity (T,20°C)	$K.G_s(T,T)$		

Specific Gravity at _____ °C relative to water at 20°C = _____.

Remarks: ____

____

____

____

____

KNIGHT PIESOLD LTD. CONSULTING ENGINEERS	COMPACTION TEST – ASTM D1557	METHOD A B C D (circle one)

Project ______________________ Date of Test ______________________

Sample No. ______________________ Tested By ______________________

Location ______________________ Checked By ______________________

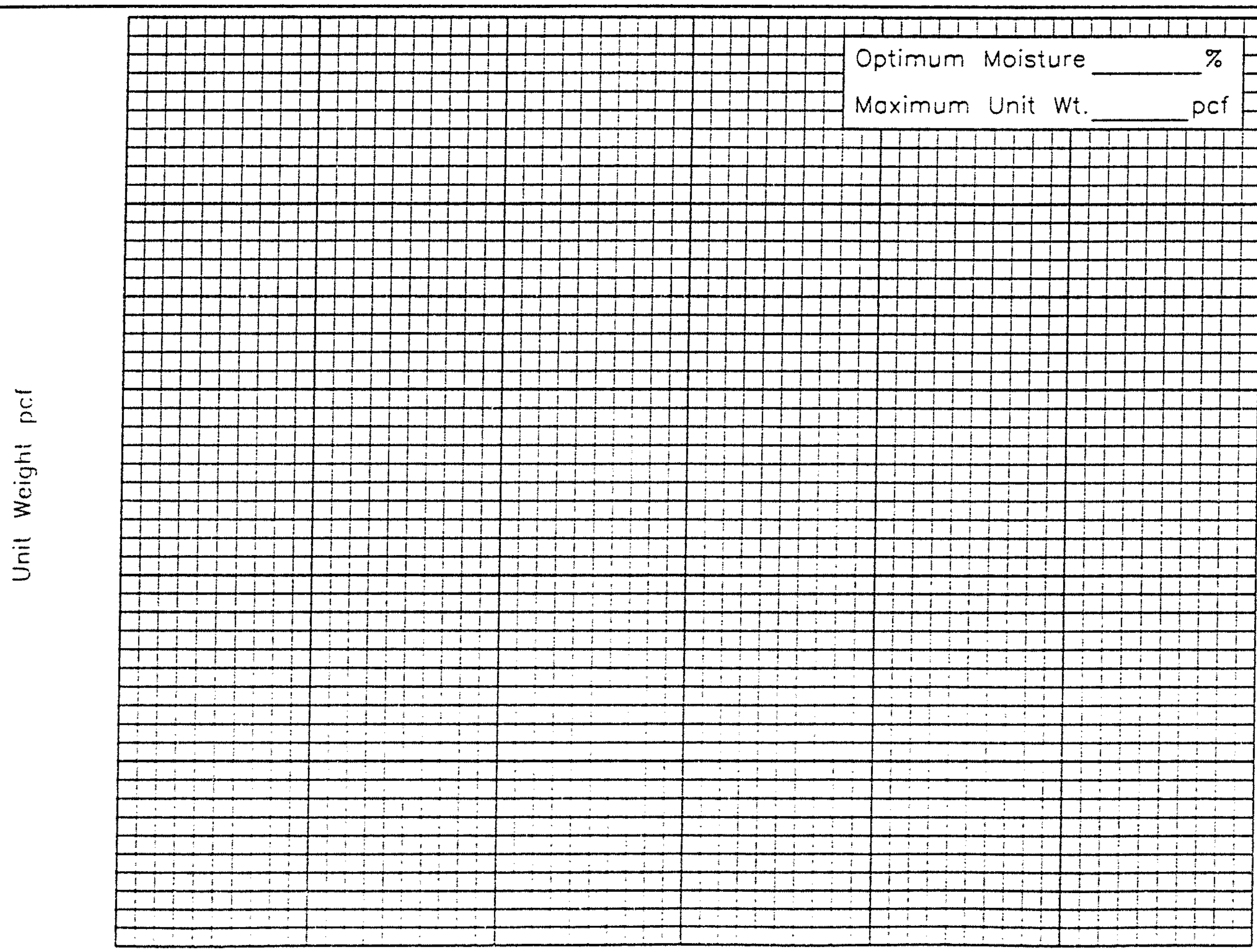
Chainage or Grid Ref. ______________________ Elevation ______________________

Unit Weight	Trial No.							
	Wt. of Sample Wet + Mold							
	Wt. of Mold							
	Wt. of Sample Wet							
	Wet Density pcf							
	DRY DENSITY pcf							

Moisture Content	MOISTURE ADDED							
	Container No.							
	Wt. of Sample Wet + Tare							
	Wt. of Sample Dry + Tare							
	Tare of Container							
	Wt. of Water							
	Wt. of Dry Soil							
	MOISTURE CONTENT							

Type of Mold ______________ Volume ______________ Weight ______________

Soil Descriptions ____



Moisture Content %

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

FIELD DENSITY TEST – ASTM D2167

Project ______________________ Date of Test ______________________

Sample No. ______________________ Tested By ______________________

Location ______________________ Checked By ______________________

Chainage or Grid Ref. ______________ Elevation ______________________

A. FIELD DRY DENSITY – WATER VOLUME REPLACEMENT METHOD			
	INITIAL	FINAL	
Reading with ring full			
Reading with ring and pit full			
a. Volume of pit (.134 ft^3/ US gal)			ft^3
Number of barrel			
Total weight of wet sample and container			lbs
Weight of container			lbs
b. Wet weight of sample			lbs
c. Field total sample wet density (b/a)			pcf
d. Field minus 3/4 inch moisture content (From C2 or R2 Test)			%
e. Percent finer than 3/4 inch in total sample (From C3 or R3 Test)			%
f. Field total sample moisture (From C2 or R2 Test)			%
g. Field total sample dry density (c/(1 + f))			pcf
h. Field minus 3/4 inch dry density			pcf
B. PERCENT COMPACTION			
j. Optimum moisture (Test C4 or R4)			%
k. Laboratory maximum dry density (Test C4 or R4)			pcf
m. Percent compaction (c/k) x 100			%

marks: ____

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AIR ENTRY PERMEAMETER TEST

Project ______________________ Test no. ______________ Date of Test ______________

Project No. ______________________ Soil Type ______________ Tested by ______________

Location of Test of Sample ______________________ Checked by ______________

Time		dt	Burette readings		dV	ΣdV	dV/dt	$\overline{H}$	L_f	P_a	k	Remarks
Start	End	(min.)	Start	End	(ml)	(ml)	(m^3/sec)	(m)	(m)	(mH_2O)	(cm/sec)	

Soil Data

γ_b ______________

w ______________

$\gamma_d = \gamma_b/(1+w)$ ______________

G_s ______________

$n = 1 - \gamma_d / G_s \gamma_w$ ______________

$S_r = w\gamma_d / n\gamma_w$ ______________

Test Data

Burette Ht. H(m) ______________

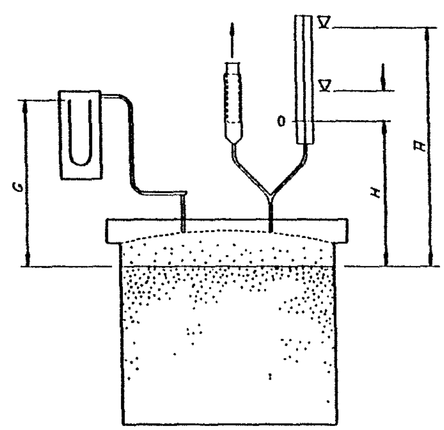
Gauge Ht. G(m) ______________

Sample Area A(m) ______________

Min. Pressure (mH_2O) = P_m

a) assumed P ______________

b) measured P ______________



Permeability Calculations:

$$P_a\ (mH_2O) = P_m + G + L_f \quad (-ve)$$

$$L_f\ (m) = \Sigma dV / A \cdot a$$

$$k = \frac{(dV/dt) \cdot L_f \cdot 100}{A \cdot (H + L_f - 0.5\,P_a)} \ (cm/sec)$$

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CONTROL TEST SUMMARY SHEET

SHEET ______ OF ______
PERIOD ______________
TO ______________

Project ______________________________ Project No. ______________
Material ______________________________ Area ______________

Date	Sample Number	Location			M.C. %	Gradation – Percent Passing										Lab Density		S.G.	
		Station	Offset	Elev.												γ_d max pcf	opt. M.C. %	+ $\frac{3}{4}$"	− $\frac{3}{4}$"
Specified Gradation Limits			Maximum																
			Minimum																

Comments ______________________________

CAD FILE. \CAD\FIG\A23 scale 1=1

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

RECORD TEST SUMMARY SHEET

SHEET ________ OF ________
PERIOD ________
TO ________

Project ____________________ Project No. ____________
Material ____________________ Area ____________

Date	Sample No. & Location	R1			R2	R3										R4		R5	R7				Percent Compaction
		Atterberg Limits			M.C. %	Gradation – Percent Passing										Lab Density		k cm/s	Field Density				
																			TOTAL		−3/4"		
		L.L. %	P.L. %	P.I. %												γ_d max pcf	Opt. m/c %		γ_d pcf	m/c %	Var. from Des. m/c	Material Type	
Specified Gradation Limits					Max.																		
					Min.																		

Comments ____________________

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

QUALITY CONTROL RECORDS

Project ______________________ Project No. ______________________

Location ______________________ Type of Test ______________________

From Test No. ______________ To Test No. ______________

Date ______________ Date ______________

scale 1=1 STD.1

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COMMENTS