NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES®
A division of the National Society of Professional Engineers

Building Construction Engineering Technology

WATER/WASTEWATER PLANTS

PROGRAM DETAIL MANUAL

Please check NICET's website (www.nicet.org) to make sure you have the most recent edition of this document.

Effective upon issuing a new edition of any program detail manual, all previous editions of that program detail manual become obsolete.

Field Code: 024
Subfield Code: 02

Second Edition
November 2012

IMPORTANT INFORMATION

KEEP YOUR MANUALS CURRENT

The Institute occasionally makes changes in its certification programs which will significantly affect the currency of individual program detail manuals. These changes could include any or all of the following:

- o deletion, modification, or addition of work elements
- o modification to the Examination Requirements Chart
- o modification to crossover work element credit
- o changes to the work experience requirement
- o changes to the verification requirement

Such changes could affect the requirements for certification. Therefore, if this manual is more than a year old, NICET highly recommends that you check www.nicet.org (or, if you don't have access to the Internet, call NICET at 888-476-4238) to make sure that you have the current edition of the Program Detail Manual before applying for an examination. The date of publication of this manual is March 1993.

It is the responsibility of all applicants to make sure they are using a current manual.

CHANGES TO THIS MANUAL

This second edition of the Water/Wastewater Plants program detail manual contains the following substantive change from the first edition:

- o Work element #21011, "Basic Metric Units and Conversions," is no longer mandatory for certification at Levels II, III, and IV.

PAYMENT OF ANNUAL RENEWAL BILL

Once certified, each certificant will be mailed an annual renewal bill. If the yearly payment is not made for three consecutive calendar years, the certification "EXPIRES" (all certification records as well as all testing records will be deleted) and certification can be regained only by reapplying as a new applicant and meeting the current criteria.

Payment of an exam fee does not substitute for payment of the annual renewal fee.

RECERTIFICATION POLICY

All certificants need to be aware of Policy #30, "Continuing Professional Development." This Policy can be found on the NICET website (www.nicet.org).

DELETION OF TEST RECORDS

All test records for an individual certification area will be purged from the database after 5 years if no further testing is done in that certification area and you are not certified in that certification area. See Policy #26 on the NICET website (www.nicet.org).

FIELD OF BUILDING CONSTRUCTION ENGINEERING TECHNOLOGY

SUBFIELD OF WATER/WASTEWATER PLANTS

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GENERAL INFORMATION

This Program Detail Manual contains the information needed to apply for a NICET certification examination in the Water/Wastewater Plants subfield of Building Construction Engineering Technology.

This manual does not contain all of the rules and procedures for obtaining certification. For this, you must refer to the website (www.nicet.org).

National Institute for Certification
in Engineering Technologies (NICET)
1420 King Street, Alexandria, Virginia 22314-2794
1-888-476-4238 (staff response – 8:30am to 5pm Eastern Time)
(voice mail system at all other times)
1-703-548-1518 (local number)
www.nicet.org

PROGRAM DESCRIPTION

This certification program is for engineering technicians performing the inspection during construction of water/ wastewater treatment plants, pumping stations and related buildings and structures. Areas covered include reading and interpreting of plans, specifications and shop drawings; on-site inspection; testing procedures; construction techniques and equipment; and recordkeeping and reporting.

This program became operational in 1993. Development of this program was initiated in 1988 with technical guidance from the Washington Suburban Sanitary Commission (Laurel, Maryland).

WORK ELEMENT DESCRIPTION

The typical job duties and associated responsibilities of engineering technicians who inspect construction of water/ wastewater plants have been broken down into discrete work elements which form the basis for an evaluation of the candidate's knowledge. Each work element is written in sufficient detail to permit candidates to make reasonable assumptions about the types of questions likely to be asked.

In addition, the supervisor verifying the experience of the candidate should be able to interpret the scope of the activities associated with each work element.

FIELD CODE AND WORK ELEMENT IDENTIFICATION NUMBERS

In order for NICET to prepare individualized examinations for each applicant, identification numbers have been assigned to each technical field and to each work element. Each technical field is represented by a 3-digit number. The technical field code number for Building Construction is **024**.

The identification number assigned to each work element is 5 digits long. The first digit identifies the technical subfield within the field of Building Construction:

(1) —
(2) Water/Wastewater Plants

The second digit identifies the level (Levels I through IV) and the work element type (General or Special):

GENERAL WORK ELEMENTS	SPECIAL WORK ELEMENTS
(1) Level I General	(2) Level I Special
(3) Level II General	(4) Level II Special
(5) Level III General	(6) Level III Special
(7) Level IV General	(8) Level IV Special

The third, fourth and fifth digits identify the individual work element within each category. A sample of this numbering system is illustrated below for work element number 024/23008:

Technical Field Code:	024	(Building Construction)
Subfield:	2	(Water/Wastewater Plants)
Level/Type:	3	(Level II General)
Work Element Number:	024/23008	(Field Code Number/ 5-Digit Work Element ID Number)

This eight-digit identification number is needed when using the application form to request an examination or provide work element verification.

REQUIREMENTS FOR CERTIFICATION AT LEVELS I THROUGH IV

Level I is designed for entry-level technicians with very limited relevant work experience in this technical subfield. The Institute recommends that persons with eighteen or more months of relevant work experience set their initial certification goal at Level II. Certification at a particular level does **NOT** require prior certification at a lower level. The Examination Requirements Chart lists the actual examination requirements for certification at Levels I, II, III, and IV in the subfield of Water/Wastewater Plants.

WORK ELEMENT SELECTION FOR AN INITIAL EXAM

1. Refer to the Examination Requirements Chart on page 5.

2. Select the appropriate box for the level of certification desired.

3. Note the number of work elements required for certification, by category, as shown in the selected box.

4. Turn to the Work Element Listing section and carefully select work elements from the required categories, paying attention at each level to whether they are classified as General, Special or Core work elements. Select first those work elements most likely to be passed. (We suggest that all examinees sign up for the Level I General Core work element on their first exam.)

5. When possible, select a few extra in each category so that failing one or more work elements leaves enough passed work elements to satisfy the examination requirement. (Alternatives are not available in the case of Core work elements.)

6. If the requirement for the desired level is more than 34, it is advisable to examine first all lower level work elements needed to achieve certification. Save the upper level work elements for a subsequent examination.

7. It is strongly recommended that the maximum number of work elements (34) be selected for each examination taken. Selection of 34 work elements provides the greatest opportunity for successful completion of the examination requirement with the smallest number of subsequent examinations. Recognize, however, that all elements selected on an exam application WILL BE SCORED, even if no attempt is made to answer the questions. That is, a score of "0" will be assigned to the work element even if the questions are not answered and the work element will have one failure marked against it.

8. It is suggested that all examination candidates keep a copy of their filled out applications. This will assist in resolving questions over the telephone.

CROSSOVER WORK ELEMENTS

Individuals who have tested in other NICET subfields may be eligible to receive crossover credit towards the examination requirement. NICET's Personal Records Order Form, available on the NICET website (www.nicet.org) may be used to order a crossover listing free of charge.

NICET "Crossover" work elements are identified as identical or nearly identical in topic coverage and test questions to work elements in other selected fields/subfields. Almost all NICET certification programs have "generic" crossover work elements covering communication skills, mathematics, physical science and other basic areas of knowledge. Once a crossover work element is passed on an examination, it does not normally have to be taken again on any other examinations. Crossover credit for the passed elements will be assigned to an examinee's record as follows:

- **First Time Testing in New Subfield:** When you test work elements in a new subfield (at least one element), any crossover credit from previously tested subfields will automatically be assigned to the new subfield. At the same time, any crossover credit from the new subfield will automatically be assigned to previously tested subfields. This assignment of crossover credit will occur every time a new subfield is tested.

- **Additional Testing in Previously Tested Subfield:** When you test new work elements or retest failed work elements from a previously-tested subfield, any crossover credit from the newly-passed work elements will automatically be assigned to all previously-tested subfields.

- No crossover credit will be assigned to a subfield until you **test at least one work element** from that subfield.

- Crossover credit will not be assigned to or from work elements if the certification is in Delinquent or Expired Status.

- The three-month waiting period policy, which applies to failed work elements, also applies to all work elements that have crossover credit to that work element (see Policy #20).

- The following documents are available. Use the Decal and Personal Records Order Form on our website.

    - **Personal Crossover Evaluation** lists your "potential" crossover credit to a designated **untested s**ubfield.

    - **Crossover Listing** lists all current crossovers between three specified subfields.

    - **Official Personal Transcript** lists all work elements presently credited to the examinee's testing record (including those passed on an exam and those achieved through crossover) for a designated subfield.

WARNING

Revisions to certification programs can occasionally eliminate previous crossovers relationships or create new ones. Thus, crossover credit shown on the "Personal Crossover Evaluation" and on any "Crossover Listing" cannot be assumed to be permanent.

The Personal Crossover Evaluation is a "potential" list. Only when a new subfield is tested and the crossover credit is posted to the test record does it become permanent. The Official Personal Transcript shows the crossover credit actually awarded.

EXAMINATION REQUIREMENTS CHART

Subfield: Water/Wastewater Plants

You must pass the number of work elements shown in each box to complete the exam requirement for certification at that level.

Level I

Level I – General –	6
Level I – Special –	4
TOTAL	10

You must pass this many work elements to complete the **Level I** exam requirement.

Level II

Level I – General –	10
Level I – Special –	4
Level II – General –	8
Level II – Special –	3
TOTAL	25

You must pass this many work elements to complete the **Level II** exam requirement**.**

Level III

Level I – General –	10a
Level I – Special –	8
Level II – General –	11
Level II – Special –	11
Level III – General –	6
Level III – Special –	4
TOTAL	50

You must pass this many work elements to complete the **Level III** exam requirement. Read Note (a) below.

Level IV

Level I – General –	10b
Level I – Special –	10
Level II – General –	11
Level II – Special –	13
Level III – General –	6
Level III – Special –	8
Level IV – General –	8
Level IV – Special –	5
TOTAL	71

You must pass this many work elements to complete the **Level IV** exam requirement. Read Note (b) below.

NOTES:

(a) Time restrictions dictate that no more than 34 work elements can be scheduled for any single examination sitting. Therefore, at least two examination sittings will be needed in order to complete this requirement.

(b) Read very carefully the two sections applicable to Level IV certification in this manual before seeking Level IV certification.

GENERAL NOTES:

(1) Work elements passed which are in excess of the requirement at a particular level and which can be used to meet the requirement at the next higher level are automatically applied to that higher level requirement.

(2) Use the Personal Tally Worksheet in this manual to keep track of the number of work elements you have successfully passed.

WORK ELEMENT SELECTION FOR ALL SUBSEQUENT EXAMS

All the items listed on page 3 for the initial examination apply to subsequent exams. In addition, the following should be understood:

1. It is not necessary to retest failed work elements if there are other work elements, in the appropriate categories, which can be selected. If you need to retest a failed work element, you must wait three months from the last time you failed it before you will be permitted to test that element again. In addition, you will be blocked from signing up for a work element a fourth time **if it has been previously failed four times within a two-year span.** For further information, read Policy #20, "Retesting of Failed Work Elements," available on our website (www.nicet.org).

2. If an adequate number of work elements has been selected to meet the certification requirement (with a few extra selected to provide a cushion), and there is room on the exam application to add more elements, it is appropriate to include work elements that will satisfy the examination requirement of the next level of certification or to include work elements from another subfield or another field.

VERIFICATION OF WORK ELEMENTS

Verification should be provided by the applicant's immediate supervisor. The verifier, by signing his or her initials, is signifying that the applicant has actually performed at least the operations indicated in the work element description and that the verifier is confident that the applicant has performed the specific job tasks **repeatedly and satisfactorily**. Exposure to a job task through demonstrations by others or through partial involvement by the applicant should not be a basis for a supervisor to verify that the task can be performed correctly by the candidate under a variety of conditions.

WARNING

NICET takes very seriously the role of the verifier. All certification candidates and their verifiers must understand that verification is an important component of the certification process.

NICET's Policy #2, "Handling of Certification Process Irregularities" says, in part, that if NICET determines that any verification was obtained from a non-qualified verifier or was given for tasks not actually performed, the NICET action against the candidate can be to permanently deny the certification sought or revoke the certification(s) held. The NICET action against the verifier can be to terminate the privilege of serving as a verifier. If the verifier is NICET-certified, the certification(s) could be revoked.

Lack of verification on any (or all) work elements does not prevent an applicant from testing those work elements. Certification, however, will not be awarded until all work elements counted toward certification are verified.

WORK EXPERIENCE REQUIREMENT

A preponderance of the work experience must be acquired while residing in the United States and its territories, employing U.S. standards and practices.

LEVEL IV WORK EXPERIENCE REQUIREMENT

In addition to the normal work experience information requested on the technician application form, all candidates for certification at Level IV, Senior Engineering Technician, in Building Construction, technical subfield of Water/Wastewater Plants, must establish, in writing, that they have occupied a senior position of responsibility throughout the duration of one or more major water/wastewater plant construction projects. It must be remembered that ten years or more of employment in the technical area, by itself, is not sufficient for the granting of a Level IV certification.

The write-up sent to NICET must provide detailed, concise descriptions of projects which show the candidate's involvement in a majority of the various aspects of the construction process. The pertinent work experience must be described in depth by the candidate personally -- official job descriptions or testimonials from others will not be evaluated.

The write-up on each project should include such information as:

1. **type of project (water or wastewater, pumping station capacity);**
2. **scope of project (project time period, time spent on the job);**
3. **your supervisory responsibilities and/or on-site authority on each project; and**
4. **the range of your experiences on the project as related to such various components as recordkeeping, testing, inspection, observation, quality control, etc. If all of these components cannot be documented for a single project, they may be accumulated via several narrowly-focused projects.**

   If you have been assigned to projects which result in narrowly focused experiences, you should describe several assignments which collectively can be used to meet the experience requirement.

Your write-up must address the Level IV requirement that your level of responsibility demonstrates independent engineering technician work, including delegated responsibilities and duties for which engineering precedent exists.

In order to avoid lengthy delays in processing your Level IV certification, this write-up should be sent with the Level IV examination application.

EARLY TESTING OF LEVEL IV WORK ELEMENTS

Although NICET does permit testing of Level IV work elements prior to satisfying the work experience requirement, the Institute reserves the right to question the validity of Level IV work elements passed by, and verified for, persons with little work experience. If, for example, a technician with a total of 3 years of experience passes Level IV work elements, NICET may require documentation of how this higher level knowledge was obtained without accumulating the requisite work experience. NICET may require specific work elements to be tested and passed again, at the candidate's expense, prior to the Level IV certification decision.

In addition, NICET reserves the right to require reverification of work elements designated for meeting the Level IV examination requirement if the verifications were signed more than three years prior to the time of the Level IV certification decision.

PREPARATION FOR TESTING

The NICET written examinations are designed by the individual who has performed the work elements associated with the program. Preparation for this examination should be minimal.

When appropriate, the work element description specifies the applicable standards or procedures. The standards and other references cited in the work element descriptions are permitted (and encouraged) at the test site.

TRAINING COURSES

NICET does not endorse, certify, or accredit training programs; any claims to that effect should be viewed with caution. NICET does, however, provide information on its certification procedures and objectives so that training courses can be developed specifically to help persons planning to take a NICET certification exam.

WORK ELEMENT LISTING

Water/Wastewater Plants

LEVEL I - GENERAL WORK ELEMENTS

(Work at Level I Is Performed Under Direct Supervision)

ID# **Work Element Title and Description**

21001 SIMPLE PLANS AND SPECIFICATIONS
Use simple plans and specifications to determine basic dimensions, types and specifications of component materials (steel, concrete, masonry, mortar, grout, etc.), and component locations, etc.

21002 BASIC MATHEMATICS (^)
Solve mathematical problems requiring simple addition, subtraction, multiplication, division, and raising numbers to exponential powers. Round to the correct number of significant figures, calculate percentages, read graphs, and use simple geometric definitions and formulas. (See general mathematic textbooks.)

21003 CODE-REFERENCED SPECIFICATIONS
Know basic code requirements (tolerances, clearances, maximum/minimum limitations) as specified for various construction areas and features, both interior and exterior, such as stairs, slabs, foundation details, structural details.

21004 TOPOGRAPHIC MAPS AND SITE PLANS
Use topographic maps and site plans to determine ground distances, areas, elevations, and differences in elevations and slopes. Determine direction of drainage, recognize drainage features.

21005 BASIC COMMUNICATION SKILLS (^)
Use proper punctuation, vocabulary, spelling, and sentence structure. Follow written instructions. (See basic grammar references.)

21006 TERMS AND DEFINITIONS
Know the standard terms and definitions applicable to the various aspects of building construction and inspection. (General building construction textbooks)

21007 BASIC PHYSICAL SCIENCE (^)
Apply terms, definitions, and concepts from mechanics, electricity, heat and chemistry. (Solutions may involve simple formulas found in basic physic textbooks, but will not involve algebraic manipulation or trigonometry.)

21008 INDIVIDUAL SAFETY REQUIREMENTS (^)
Know safety practices as they apply to tasks performed. Recognize improper safety practices on work site. (Construction Industry Standards - OSHA 2202)

21009 CLEARING AND GRUBBING
Observe clearing and grubbing work to be sure that "save" items are not disturbed, that removals are complete, and that work is accomplished within specific limits. Record findings.

21010 SHOP DRAWINGS
Understand and be familiar with approved shop drawings to assure compliance with contractual requirements.

21011 BASIC METRIC UNITS AND CONVERSIONS (^)
Perform conversions to and from metric units. (E 380)

21012 BASIC BUILDING COMPONENTS
Recognize and identify basic building components, structural members, and structural materials.

LEVEL I - SPECIAL WORK ELEMENTS

22001 SOILS CLASSIFICATION
Classify soils in accordance with the Unified Soil Classification System. (D 2487, D 2488, M 145)

22002 BASIC EROSION CONTROLS
Understand the basis of accepted practices and procedures for controlling erosion, and protecting slopes and landscaping during construction.

22003 FENCING
Perform inspection to assure placement as staked out. Check type of fencing used, compliance with specs for setting of posts, corners, gates, and bracing. Check alignment and work to assure quality.

22004 SAMPLING SOIL
Be familiar with soil sampling practices and techniques including adequate sample size, classification, and moisture conditioning. (D 421, D 1586, D 2217, D 2487)

22005 FIRST AID PROCEDURES (^)
Understand the basic rules and procedures of first aid. (See general handbooks on first aid.)

22006 SAMPLING FRESH CONCRETE
Obtain representative samples of fresh concrete as delivered to a project site for testing. (C 172)

22007 SAMPLING BITUMINOUS MATERIALS
Be familiar with the sampling liquid, semi-solid, and solid bituminous materials for testing at the point of manufacture, supply terminal, or at the point of shipment delivery. (D 140, D 979)

22008 BASE AND SUBBASE MATERIALS
Determine quantities of base and subbase materials delivered to site. Assure placement as required by specifications, and compact in manner specified.

22009 SAMPLING/AGGREGATES
Have a knowledge of field sampling procedures and preparation of samples for testing. (D 75, C 702)

22010 BACKFILLING
Observe backfilling to assure use of proper materials, moisture content, lift depths and compaction methods. Assure compliance with final grade requirements. Report on quantities of materials and equipment used; assure protection of buried pipes, tanks, etc.

22011 BORING LOGS AND LOCATION PLANS
Read and interpret boring log symbols, descriptions, and location plans.

22012 SAMPLING GROUT AND MORTAR
Obtain representative sample of fresh grout and mortar for testing. (C 943, C 780, C 1019)

22013 EXCAVATION AND TRENCHING
Observe excavation to required cut and fill requirements. Observe trenching for proper width, depth, underlayment preparation, and shoring (if required). Report any unusual or unsafe conditions to project engineer.

LEVEL II - GENERAL WORK ELEMENTS

(Work at Level II Is Performed Under General Supervision)

23001 STANDARD PLANS AND SPECS
Use standard plans and specs (contract and as-built) to determine dimensions, types of materials, elevations, slopes, component (structural members, piping systems, electrical systems, mechanical systems) sizes, shapes, and locations, etc.

23002 WRITTEN DOCUMENTATION
Write an accurate, comprehensive written report on conditions observed when participating in the inspection of a project. Maintain supporting record drawings and records of quantities for payments.

23003 OSHA AND OTHER SAFETY REGULATIONS
Identify and apply OSHA, EPA, and other applicable safety regulations and procedures. Recognize proper and improper safety practices on the job.

23004 MATERIAL PROPERTIES
Know the physical properties of concrete, steel, timber, masonry, and other building construction materials.

23005 BASIC DRAFTING (^)
Know elementary drafting techniques. Familiar with architectural and engineering drawings including structural, mechanical and electrical drawings.

23006 BASIC SURVEYING
Use engineer's transit and level to conduct simple surveying operations such as measuring horizontal angles and distances; determining the elevation of object or points; making field notes in the field book.

23007 INTERMEDIATE MATHEMATICS (^)
Perform mathematical calculations utilizing basic algebra (fundamental laws, algebraic expressions), geometry, and the trigonometric functions of right triangles. (See basic textbooks on algebra and trigonometry.)

23008 PRECONSTRUCTION INSPECTION
Inspect job-site for variances against plans and specs, including location of existing utilities, structures, and all other features and site conditions.

23009 PROCESS INSPECTION INFORMATION
Compute, record, handle and file inspection information in accordance with good standard procedures.

23010 CONCRETE STRUCTURE INSPECTION
Know the performance characteristics of plain, reinforced, and prestressed concrete. Be aware of forming, placement, curing and finishing procedures for concrete members. Recognize the significance of damaged or deteriorated concrete, rebars, and prestressed tendons on the overall structure. Be familiar with ACI standards.

23011 STEEL STRUCTURE INSPECTION
Know the performance characteristics of structural steel and steel wire and cable. Be aware of handling and erection procedures for steel members. Recognize the significance of damaged or deteriorated members on the overall structure, and the effects of load repetitions, fire and heat. Be familiar with AISC Manual of Steel Construction.

23012 TIMBER STRUCTURE INSPECTION
Know the performance characteristics of timber and laminated wood. Know the types, grades and preservatives. Recognize the significance of damaged or deteriorated members on the overall structure, including the effects of decay and insect damage. Be familiar with the major building code used in your region to regulate construction or installation practice. (UBC, SBC, or BBC)

23013 MASONRY STRUCTURE INSPECTION
Know the performance characteristics of masonry in structures. Know masonry types, sizes, mortar constituents, erection techniques. Recognize the significance of damaged or deteriorated masonry on the overall structure. Be familiar with the major building code used in your region to regulate construction or installation practice. (UBC, SBC or BBC)

23014 EARTH-MOVING OPERATIONS
Be familiar with equipment used for trenching, backfilling, removal, placement, and compaction. Be familiar with stockpiling of select materials and balancing of cuts and fills.

23015 WATER RETENTION STRUCTURES
Be familiar with the basic principles for the construction of water retention structures. Apply these principles to common applications such as dams, levees, water retention ponds, diversions, cofferdams, etc.

23016 TUNNELING METHODS
Know the common methods of construction for small diameter and large diameter tunnels and their adaptability to different soil, rock and underwater conditions.

23017 FOUNDATION CONSTRUCTION
Be familiar with various facets of foundation construction including spread footings, pressure-injected footings, grade beams, mud mats, pilings, caissons, etc.

LEVEL II - SPECIAL WORK ELEMENTS

24001 REINFORCING STEEL
Know the requirements for handling and placement of reinforcing steel for reinforced concrete. (ACI 301 & 318)

24002 PLACEMENT AND CURING OF CONCRETE
Know the requirements for placement, consolidation, and curing of concrete. (ACI 301)

24003 DEWATERING SYSTEMS
Know the various types and applications of dewatering systems and be familiar with the equipment and theories used in their installation.

24004 FORMWORK AND SHORING
Know the basic requirements for the placement of formwork and shoring for concrete. (ACI 301 & 318)

24005 BLASTING
Understand the practices and principles of blasting operations, including safety measures, as they apply to underground structures.

24006 COMPUTERS
Know the functions and uses of computers and their potential use in the field of engineering construction.

24007 QUANTITY TAKEOFFS
Perform simple quantity takeoffs and calculations; prepare materials lists.

24008 PILE DRIVING
Be familiar with types of piling and pile driving procedures and precautions.

24009 STRUCTURAL MATERIALS AND MEMBERS
Perform inspection to assure compliance with plans, specs, and ASTM standards for materials and structural members. Determine adequacy and completeness of shop inspection reports and certificates. Cross reference standards as required and utilize certificates in project files.

24010 RECORD PLANS
Verify completion and adequacy of "as-built" inspection and posting. Confirm dimensions, workmanship, material and conformance to standards or acceptability of modifications to original plans.

24011 STRUCTURAL STEEL ERECTION
Understand structural steel erection processes, including handling, placement, use of structural steel drawings in compliance with AISC Specification and Codes.

24012 FIELD TESTING CONCRETE
Perform slump and air content tests on fresh concrete. Cast and begin curing cylinders and beams for subsequent testing. (C 31, C 143, C 173, C 231 and T 119)

24013 FIELD MOISTURE AND DENSITY DETERMINATION
Know the various methods for determining the in-place moisture content of soils.

24014 READY-MIXED CONCRETE
Be familiar with specifications for manufacture and delivery of ready-mixed concrete. (C 94)

24015 SEDIMENT CONTROL PLANS
Know the general requirements of the sediment control plan. Know its effect on subsequent landscaping, drainage, final grades, etc.

24016 SLUDGE COMPOSTING
Know the fundamental processes involved in sludge composting operations, fermentation, aeration, and separation of components.

24017 WATER/WASTEWATER TREATMENT
Know the types of water and wastewater filtration and treatment processes and their purposes, including primary, secondary, and tertiary processes.

24018 WATER/WASTEWATER PUMPING STATIONS
Know the major components of water and wastewater pumping stations including generators, pumps, motors, shafting, flushing water systems, etc. Be familiar with the installation and operation of equipment.

24019 PIPE INSULATION AND COATING REQUIREMENTS
Be familiar with various pipe insulation and coating specifications and design characteristics. Understand line lists and specifications where applicable. Make provision for insulation clearances on all piping drawings. Make proper notes and details on drawings.

24020 PIPING SYMBOLOGY
Have a thorough knowledge of all piping, valves, fittings and other related components. Determine from piping specification sheets which of the components are to be used for a particular service. Be familiar with procedures and techniques applied in the use of each piping component. Be thoroughly familiar with pressure ratings, materials, component variations, and applications of each item in a piping system.

24021 SIMPLE PIPING DRAWINGS
Read, interpret and understand simple piping drawings. Use simple piping arrangement drawings to inspect the assembly of piping systems.

24022 UNDERGROUND PIPING
Be familiar with special requirements for types, arrangements, connections, and anchorage of underground pipings.

24023 STRUCTURAL PAINTING
Assure compliance with plans and specifications of materials used; condition of surfaces painted; temperature of air and surfaces when surfaces are primed and painted; adequacy of drying time, and adequacy of paint coverage. Record findings.

24024 CHEMICALS AND FILTRATION MEDIA
Know the purposes and uses of common types of chemicals and filter media used in graduated filters and in secondary and tertiary treatment processes.

24025 TESTING OF PIPING SYSTEMS
Understand basic treatment process and flow diagrams. Know the piping specifications as applied to hydrostatic and non-hydrostatic testing of specific piping systems. Show knowledge of construction capabilities and equipment required for specified tests. Know the test procedures and code and safety standards applicable when conducting tests.

LEVEL III - GENERAL WORK ELEMENTS

25001 COMPLEX PLANS AND SPECIFICATIONS
Read and interpret plans and drawings depicting various systems required for water/wastewater processing including pumping stations.

25002 BUSINESS COMMUNICATIONS (^)
Use the rules of syntax and style to write clear sentences and paragraphs in preparing routine correspondence and reports. Follow standard business communications procedures. (See basic grammar and writing handbooks.)

25003 INTERMEDIATE PHYSICAL SCIENCE (^)
Solve problems in mechanics, electricity, heat, and inorganic chemistry. (Solution may involve algebra and trigonometry.)

25004 COMPLIANCE WITH GOVERNMENTAL REGULATIONS
Be familiar with the requirements of government regulations at all levels (EEOC, OJT, Davis-Bacon, environmental, etc.) and assure compliance on the job by scheduled and nonscheduled inspections. Work with contractors, municipalities, and other agencies to set up a workable system of inspection and verification.

25005 EXTERNAL WORKING RELATIONS
Establish effective working relations with contractors, subcontractors, suppliers, consultants, utility companies, government agencies, municipalities, property owners, design personnel and

the public.

25006 LOADS AND FORCES ON BUILDINGS
Be familiar with the internal and external primary and secondary forces acting upon and within buildings. Understand deadloads, live loads, wind pressure, thermal stresses, seismic effects, etc.

25007 ROOFING SYSTEMS
Interpret detailed drawings of roofing systems, including metal, shingle, membrane, and built-up-roofs; and gutters and flashing.

25008 COMPACTION DATA ANALYSES
Assimilate and interpret the results of soil compaction and density tests conducted by the various methods such as sand cone, nuclear, etc.

25009 SOIL BORING REPORTS
Read and interpret boring logs. Recognize how to locate additional borings.

25010 STATICS
Solve simple problems involving equilibrium and Newton's laws, torque, friction, addition of forces/torques, and/or systems of forces and loads in two dimensions.

25011 MECHANICS OF MATERIALS
Solve simple problems involving normal and shear stress and strain, Hooke's law, Poisson's ratio, shear and moment diagrams, the flexure formula, and torsional stress and strain involving circular members. Locate simple centroids.

25012 FOUNDATION INSPECTION
Perform field inspections of deep and shallow excavations for foundation construction, caissons, and bored friction piles. Monitor installation and stressing procedures for tied-back shoring systems.

25013 LARGE VALVES
Perform inspections of complex installations of large valves commonly associated with pipe systems and insure compliance with specifications and manufacturer's recommendations. Report findings.

25014 PLANT OPERATION
Understand the basic function and operation of water/wastewater treatment plant systems.

LEVEL III - SPECIAL WORK ELEMENTS

26001 PRECAST AND PRESTRESSED CONCRETE STRUCTURES
Be familiar with approved repair and installation practices for precast and prestressed concrete structures, including handling, substructure preparation, and coatings.

26002 EXCAVATION PROBLEMS
Recognize the various potential construction problems that may occur during excavation operations, including the effect of unusual soil and/or groundwater conditions, existing underground structures, utility lines, etc.

26003 MECHANICAL SYSTEMS PLANS
Understand drawings of mechanical systems. Inspect mechanical systems (heating and air conditioning, plumbing, hydraulic, compressed air, etc.).

26004 WATER FILTRATION
Observe the proper installation and operation of all elements commonly used in water filtration plants and systems including tube setters, troughs, scrubbers, piping, pumps, etc.

26005 ELECTRICAL SYSTEMS
Understand drawings of electrical systems. Inspect electrical systems, including lighting, power supply and distribution, alarms, etc.

26006 WELDS, BOLTS, AND FASTENERS
Recognize and document deficiencies found in riveted and bolted connections.

26007 POST-TENSIONED CONCRETE INSPECTION
Inspect post-tensioned concrete. Have knowledge of materials, forms, tensioning procedures, etc. (Prestressed Concrete Institute, MNL 116)

26008 ENGINEERING OFFICE WORKS
Perform all duties associated with Clerk-of-the-Works and engineering aide positions.

26009 ELEMENTARY STRUCTURAL ANALYSIS
Solve elementary problems involving stress in the analysis of simple beams, tension and compression members. Recognize overloading and deformation of structures. Record findings.

26010 PROTECTIVE COATINGS
Be familiar with protective coatings on building structures and elements, including paints, sealants, and preservatives, etc.

26011 STRESS AND TORQUE TESTS
Perform stress and torque tests on nuts, fittings, and welds in conjunction with proper installation techniques of structural steel systems.

26012 STORAGE TANK CONSTRUCTION
Inspect the foundation preparation and construction of water, fuel, and chemical storage tanks, including steel and fiberglass types.

26013 SEDIMENT CONTROL DEVICES
Know the materials, methods of operation and installation practices for sediment control devices.

26014 STRUCTURAL STEEL SHOP INSPECTION
Assure compliance with plans and specifications by reviewing certificates from manufacturers, fabricators, and private laboratories. Verify size, type of steel, weld quality, fastening data, etc.

26015 FLOCCULATION SYSTEMS
Inspect flocculation systems and flocculent material delivery systems for conformance with specification requirements. Document observations and make recommendations.

26016 SLUDGE MANAGEMENT SYSTEMS
Know basic sludge management system components and processes, including conveyor systems, shakers and screens, bottom hoppers, settlement ponds, weigh scales, and blower systems. Inspect for contract compliance.

26017 ODOR CONTROL SYSTEMS
Know the materials, component parts, and methods of operation for odor control systems. Inspect for conformance with contract documents.

26018 ARCHITECTURAL (FINISH) FEATURES
Know specification requirements for quality, grade, and application of architectural features such as paint, carpets, wall coverings, etc.

26019 HVAC SYSTEMS
Know the basic components of HVAC systems. Be familiar with HVAC equipment, specifications, symbols, operation, etc.

LEVEL IV - GENERAL WORK ELEMENTS

NOTE: Certification at Level IV requires that the candidate must have occupied a senior position of responsibility throughout the duration of one major water/wastewater plant construction inspection project. There are no exceptions to this requirement and documentation must be present in the work history listed on the application form.

27001 DISPUTE AND CONFLICT MANAGEMENT
Be involved in the management of disputes, including arbitration, litigation, mediations, and claims. Handle grievances and complaints and refer matters beyond delegated authority to proper supervisor.

27002 MAJOR CONSTRUCTION PROJECT
Act as Chief Inspector or assistant to Project Engineer on all aspects of a major construction project. Supervise inspectors, material samplers and testers, other technicians and workers on the job. Assure full compliance with plans, specifications and contract provisions. Supervise and coordinate safety provisions. Supervise submittal of required reports, certificates, payrolls, etc., and maintain project files in good order. Keep current records of work to permit ready preparation of record plans. Have all data in compliance for acceptance of job by a designated authority.

27003 BUILDING CODES
Understand building codes and their enforcement. Know the relationship between building codes and installation standards.

27004 ALTERATIONS TO DESIGN
Review plans and specifications to determine applicability to specific jobs. Recognize design deficiencies and/or mistakes or changed conditions in plans and specifications; analyze needs of job to determine appropriate corrective action and prepare detailed recommendations for delivery to appropriate authority.

27005 CHANGE ORDERS
Gather information from subordinates or from personal inspection and review. Prepare complete contract change order in final format with clear justifications and cost estimates for approval of contracting officer.

27006 TECHNICAL LIBRARIES
Perform research to keep abreast of state-of-the-art accomplishments of authoritative organizations regarding physical properties of materials, testing methods and acceptable standards. Extract and utilize applicable information, recommend rechecks to substantiate usage.

27007 TRAINING NEEDS

Use experience and knowledge of performance factors to determine performance of subordinates. Evaluate need for training programs to increase the skills of workers performing special duties. If program is needed, get approval, select subject matter, recruit and supervise instructors and work with instructors on course program. Evaluate OJT and other training programs.

27008 APPLIED STATISTICS

Apply basic statistical concepts to the sampling and evaluation of materials or component batches. Utilize established standards or develop limits of acceptance which consider the practical variability of sampling procedures. (ASTM E 105, E 22, E 141, D 3665. See textbooks on statistics)

27009 TECHNICAL PRESENTATIONS AND REPORTS (^)

Organize and deliver oral presentations and prepare technical reports and correspondence.

27010 PUBLIC RELATIONS

Assure dissemination of pertinent information to appropriate groups (utilities, local government agencies, and citizen interest groups). Establish effective working relations with contractors, subcontractors, suppliers, consultants, utility companies, government agencies, municipalities, property owners, design personnel, and the public.

27011 SCHEDULING AND COORDINATION

Understand and interpret the Critical Path Method (CPM) diagrams for construction event scheduling. Establish communication channels with other operations in accordance with coordination responsibility.

LEVEL IV - SPECIAL WORK ELEMENTS

28001 STRUCTURAL STEEL SYSTEMS
Understand the structural steel systems and related erection procedures including complex steel connections.

28002 REINFORCED CONCRETE STRUCTURAL SYSTEMS
Understand the basics of reinforced concrete structural systems and related erection and installation procedures.

28003 TIMBER STRUCTURAL SYSTEMS
Understand the basics of timber structural systems, including related erection procedures and timber connections.

28004 COMPOSITE STRUCTURAL SYSTEMS
Understand the basics of composite structural systems and related erection and installation procedures.

28005 CONSTRUCTION DEFICIENCIES
Recognize construction deficiencies, take proper corrective action to alleviate problems immediately. Recognize safety implications and overall structural effects. Document and report to proper authority.

28006 TUNNELING PRACTICES
Know the routine tunneling practices associated with utility systems. Be familiar with rock tunneling and other non-routine applications.

28007 WATER/WASTEWATER TREATMENT CONTROL SYSTEMS
Be familiar with electro-mechanical control systems for water and wastewater treatment. Inspect construction and installation.

PERSONAL TALLY WORKSHEET

Passed Work Elements in Water/Wastewater Plants

- Put a checkmark next to the appropriate work element number when you receive a passing score on your Examination Score Report.
- Put a "C" next to the appropriate work element number if you have crossover credit from another field. Read page 4 in this manual concerning crossover credit.
- Refer to the Examination Requirements Chart on page 5 to determine whether you have passed an exam requirement.

Level I
General
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Level I
Special
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_22013

Level II
General
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Level II
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Level III
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Level III
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Level IV
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Level IV
Special
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_28006
_28007

SELECTED GENERAL REFERENCES

ACI Manual of Concrete Inspection (SP-2), 8th edition. American Concrete Institute. Detroit, MI.

Ambrose, James and Harry Parker. Simplified Mechanics and Strength of Materials, 4th edition. John Wiley & Sons. New York, NY.

Annual Book of ASTM Standards. American Society for Testing and Materials. Philadelphia, PA.

Basic Building Code. Building Officials and Code Administrators International Inc. (BOCA). Country Club Hills, IL.

Construction Industry - OSHA Safety and Health Standards Digest (OSHA 2202). U.S. Department of Labor. Washington, D.C. (Available from U.S. Government Printing Office)

O'Brien, James J. Construction Inspection Handbook, 2nd edition. Van Nostrand Reinhold Company, Inc. New York. NY.

Putnam, Robert E. The Builder's Comprehensive Dictionary. Craftsman Book Company. Carlsbad, CA.

Standard Building Code. Southern Building Code Congress International, Inc. (SBCCI). Birmingham, AL.

Standard First Aid and Personal Safety. American Red Cross. Washington D.C.

Uniform Building Code. International Conference of Building Officials (ICBO). Whittier, CA.

WARNING

On its website, NICET maintains a complete listing of references that are allowed in the paper-and-pencil testing centers. Please view the document "Reference Material Allowed in NICET Paper and Pencil Test Centers" at www.nicet.org/candidates/allowable_reference_material.pdf.

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- **We suggest in all cases that the most current edition of the publication be used.**

SAMPLE SCORE REPORT

Exam No. 000100
Examinee: JOHN EXAMINE

Test Date: 10/01/92
Report Date: 11/01/92

Work Element Number and Title | Score (%) | Pass/Fail

WATER/WASTEWATER PLANTS

		SCORE	PASS/FAIL
21001	Simple Plans and Specifications	55.00	F**
21002	Basic Mathematics	100.00	P
21003	Code-Referenced Specifications	80.25	P
21004	Topographic Maps and Site Plans	40.00	F*
21005	Basic Communication Skills	100.00	P
21006	Terms and Definitions	59.75	F*
21007	Basic Physical Science	75.00	P
21008	Individual Safety Requirements	87.50	P
21009	Clearing and Grubbing	93.00	P

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Asterisks (*,**,***,****) indicate the number of times a work element has been failed. Additional information can be found on our website: http://www.nicet.org/about/policies.cfm#policy20.

JOHN EXAMINE
1420 King Street
Alexandria, Virginia 22314-271