

Exam Blueprint

Collection System Maintenance Certification

Exam Blueprint & Suggested References



Collection System Maintenance Grade 1

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Effective April 2019

CWEA's Technical Certification Program Collection System Maintenance Grade 1 exam is based on an exam blueprint that outlines the exam content and is periodically reviewed by CWEA Subject Matter Experts. This exam blueprint is based on a job task analysis that includes research of the essential duties of a Collection System Maintenance worker at a representative cross-section of systems and facilities in California. The Collection System Maintenance Grade 1 exam was last reviewed by Subject Matter Experts in 2019.

The exam content outline that follows presents content covered on the Collection System Maintenance Grade 1 exam and shows the amount of the exam devoted to each Domain in the column labeled weighting. Following the outline, you will find a list of suggested references and a link to a free self-evaluation you can take to help you identify your strengths and areas to work on as a candidate. You will also find an Equivalents & Formula Sheet which will be available on screen during the exam.

Please be sure to review CWEA's *Technical Certification Program Candidate Handbook*, which contains CWEA's certification procedures and policies. Applicants and certification holders are responsible for understanding all certification policies. The *TCP Candidate Handbook* can be downloaded for free in our [Online Store](#).

Content Domain	Weighting
Domain 1 – Systems Operations, Inspections and Maintenance	36%
Domain 2 – Records, Documentation, and Mapping	17%
Domain 3 – Safety and Customer Service	23%
Domain 4 – Vehicles, Equipment, and Grounds	16%
Domain 5 – Math for Collections Systems	8%
Total	100%

Domain 1 – Systems Operations, Inspections and Maintenance

Sub-Domain 1.1 – Inspection, cleaning and maintenance of wastewater collection systems utilizing equipment.

1. Choose the most effective way to remove root systems, sand, and grit from sewer systems.
2. Identify parts of a standard sewer and their functions.
3. Understand methods and procedures of preventative maintenance.
4. Understand mechanical cleaning systems.
5. Understand the use of high-velocity sewer cleaners, mechanical rodding machines and hydraulic winches.
6. Understand CCTV inspection equipment.
7. Understand the necessity of sewer cleaning.
8. Analyze situations and choose the most effective cleaning method.
9. Understand how to make observations and problem solve during manhole cover inspections.
10. Understand self-cleaning sewers and the appropriate wastewater velocity.
11. Understand the concepts of preventive, predictive and reactive maintenance.
12. Understand the type of sewer cleaning that calls for a trap.
13. Understand the basic use of sewer chemicals for controlling grease, odor, roots, etc.

Sub-Domain 1.2 – Performing and giving assistance with pump station inspections, maintenance and repair and recording instrument readings.

1. Understand Lockout/Tagout procedures.
2. Define important terms needed to properly execute an inspection.
3. Read and analyze gauges, meters, and pumps.
4. Understand warning labels.
5. Recognize the basic components of a pump.
6. Understand the basic functions of pump controls tag.

Sub-Domain 1.3 – Inspection and maintenance of easements, some of which may be remote or difficult to access.

1. Describe what easement road maintenance includes.
2. Describe how to exercise caution to prevent injuries, damage to private property or environmentally sensitive areas.
3. Understand the need for easement maintenance.

Sub-Domain 1.4 – Participation in the construction and repair of the wastewater collection system.

1. Understand how to mark sewer pipe locations in accordance with Underground Service Alert guidelines.
2. Identify hazardous gases.
3. Understand construction practices and principles including excavation and shoring.
4. Demonstrate how to calculate the volume of a sewer trench.
5. Describe how to employ safe strategies when excavating trenches.
6. Identify the correct tools to use for installation and repairs.
7. Describe how to replace and repair damaged pipes or maintenance structures.
8. Understand the purpose of raising maintenance structures to grade after paving activities.
9. Understand sewer flow in an excavation.

10. Recognize good safety practices when working in a manhole.
11. Identify preparation steps to take before driving to a repair job and solving issues that may arise.
12. Describe how to protect oneself and other employees during trench excavations.
13. Identify a manhole cover and valve parts and functions.
14. Identify information that is needed before one can execute a proper sewer repair.
15. Understand the role of the Competent Person on the job.
16. Identify the correct reasons for utilizing various repair methods such as excavation repair and trenchless repair.
17. Understand the appropriate PPE (Personal Protective Equipment) related to construction and repair.

Sub-Domain 1.5 – Participation in the containment and cleanup of sanitary sewer overflows (SSOs).

1. Calculate spill volume of a sanitary sewer overflow.
2. Understand the State of California Waste Discharge Requirements.
3. Identify spills and overflow and containment/cleanup procedures.

Sub-Domain 1.6 – Participation in the safe removal and restoration of concrete and paved surfaces using a wide variety of construction equipment, hand and power tools.

1. Solve problems that arise with asphalt and concrete removal.
2. Understand the use of jack hammers and surface cutting tools.
3. Identify the correct tools used to complete a job.
4. Identify when to use different backfill materials.
5. Understand the importance of proper compaction.

Domain 2 – Records, Documentation, and Mapping

Sub-Domain 2.1 – Completion and maintenance of accurate, legible, and timely records of work performed.

1. Recognize work-related terms and acronyms and their meanings.
2. Understand how to document activities and complete forms.
3. Understand the need for accuracy and the consequence for inaccurate or incomplete (or non-existent) documentation.

Sub-Domain 2.2 – Reading and interpreting collection system maps for operations and maintenance.

1. Comprehend improvement plans to system maps.
2. Read and interpret system maps to report to field locations.
3. Identify basic structures (manholes, mains, laterals, siphons, etc.) and flow direction on a map.

Domain 3 – Safety and Customer Service

Sub-Domain 3.1 – Participation in establishing proper traffic control measures at work sites to protect workers and the public.

1. Define a clear work space to inform both workers and the public.
2. Understand personal safety and health during traffic control.
3. Implement proper traffic control measures.
4. Identify traffic control measures that need to be taken at night.
5. Identify various traffic control devices (advance warning signs, stop/slow paddles, flags, barricades, delineators, cones, drums, etc.) and when to use them.
6. Identify the different types of temporary traffic control zones and how to correctly set up a temporary traffic zone with regard for public safety.
7. Identify the correct safety equipment for self and others.
8. Understand the appropriate PPE related to traffic control.

Sub-Domain 3.2 – Knowledge of all applicable regulations, policies, and procedures.

1. Understand the protocol for reporting overflows and spills.
2. Understand when high-visibility clothing or devices are required.
3. Recognize safety and indicator markings related to sanitary sewers.
4. Understand the Injury and Illness Prevention Program (IIPP) required by Cal OSHA and how it protects workers.
5. Understand the purpose of the agency safety policy statement.
6. Knowledge of the components of a Safety Data Sheet (SDS).
7. Knowledge of First Aid and CPR.
8. Understand basic elements of “Worker Right-To-Know” laws.

Sub-Domain 3.3 – Application of safety-related tasks related to excavation and trenching.

1. Recognize the color codes used for marking underground utilities.
2. Identify the conditions when shoring is required.
3. Understand how soil conditions affect trench stability.
4. Know the minimum distance that the spoil must be kept from the edge of an excavation.
5. Understand when, where, and how ladder(s) should be placed in a trench.
6. Identify the different types of shoring equipment – e.g., hydraulic shores, screw jacks, pneumatic shores, solid sheeting, etc.

Sub-Domain 3.4 – Participation in confined space entries.

1. Remove access covers safely.
2. Identify confined space roles (entrant, attendant, supervisor, rescue) and associated responsibilities.
3. Identify gas types to be monitored when entering a confined space.
4. Define a Permit Required Confined Space and understand how to complete a confined space permit.
5. Identify how to assess and safely handle atmospheric hazards while inspecting confined spaces.
6. Understand how to secure safe working spaces and conditions in confined spaces.
7. Understand how to use a self-contained breathing apparatus.
8. Understand the operation of a retrieval device for rescue purposes.

9. Understand the appropriate PPE related to confined space.
10. Understand the procedures for proper inspection of confined space equipment.

Sub-Domain 3.5 – Adhering to safe work practices to mitigate risk related to jobsite hazards.

1. Understand how to read monitoring equipment accurately and respond to unsafe conditions.
2. Recognize personal safety and health measures.
3. Identify unsafe equipment.
4. Understand how to employ safe practices in a wet well.
5. Understand how to operate a high velocity cleaning machine safely.
6. Identify the correct PPE that is needed to reduce safety risks.
7. Identify potential problems and hazards that arise from poor design velocity.
8. Identify proper lifting techniques.
9. Identify the proper sequence for Lockout/Tagout procedures.
10. Recognize what type of fire each fire extinguisher should be used for – i.e., Class A, Class B, Class C, Class D.

Sub-Domain 3.6 – Responding to public inquiries and service requests in a courteous manner and providing information appropriate to the area of assignment.

1. Understand how to communicate effectively with members of the public.
2. Understand how to respond to service calls and questions professionally.
3. Demonstrate public professionalism and courtesy.
4. Understand collection system operation and maintenance issues that may arise.
5. Understand how to respond to requests according to professional work standards.

Domain 4 – Vehicles, Equipment, and Grounds

Sub-Domain 4.1 – Conducting pre/post trip inspections of vehicles and equipment (including ensuring that hand and power tools are in proper operating condition), and arranging for maintenance when required.

1. Describe what constitutes a pre- and post- trip inspection on commercial vehicles.
2. Recognize who is responsible for different safety checks.
3. Describe operator-related maintenance.
4. Understand how to effectively avoid vehicle accidents.
5. Identify vehicle types and when they are used.
6. Identify and solve problems that may arise during a trip inspection.
7. Understand how to inspect tires in an efficient and safe manner.
8. Recognize when equipment poses a safety hazard.
9. Identify and solve problems that arise with faulty equipment.

Sub-Domain 4.2 – Performing basic building and grounds maintenance at collection systems facilities.

1. Understand the scope of building and grounds maintenance.
2. Identify Inspection and operation of equipment found at collection systems facilities.
3. Understand how the facility supports the maintenance of the collection system.

Domain 5 – Math for Collections Systems

Sub-Domain 5.1 – Selecting the appropriate formula and completing basic calculations needed for collections systems maintenance.

1. Use formula to calculate distance.
2. Use formula to calculate velocity and flow rate.
3. Use formula to calculate volume of basic shapes such as cylinder, rectangle and square.
4. Use formula to calculate surface area of a basic shapes such as square, circle, and rectangle.
5. Use formula to calculate slope.
6. Understand how to execute basic unit conversions in calculations.
7. Understand how to calculate trench depth and width, benching, flow rates, and pipe slope.

Suggested References

CWEA’s exam is based on a job task analysis that includes research of the essential duties of a Collection System Maintenance worker at a representative cross-section of systems and facilities in California. CWEA’s exams do **not** correspond directly to any specific textbook, educational course, or program; instead, the exams are based on an analysis of the duties commonly performed in actual practice. In developing the exam, CWEA Subject Matter Experts used their years of experience in the field along with the key textbooks and reference materials listed below. Candidates should understand that the references listed do not necessarily cover all exam content. Candidates who meet the minimum qualifications for this exam may find these suggested references useful when preparing for this exam; however, these suggested references are not required reading and should not be interpreted as constituting the sole source of all exam questions.

This list does **not** include all the available textbooks and materials for studying for this exam. Candidates are strongly encouraged to seek additional material, training, and experience, especially in content areas for which the candidate is not adequately prepared. Candidates are encouraged to prepare for CWEA certification exams using as many different study materials as possible plus education events and on-the-job training. Candidates are encouraged to develop their own personal study plan based on individual needs and knowledge. Taking our free self-evaluation can help identify strengths and areas to work on; the link to that self-evaluation tool follows at the end of this document.

Domain 1 – Systems Operations, Inspections and Maintenance	
Sub-Domain 1.1	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 2, 9-10, 33, 49-55, 278-305, 315-319, 323-402, 452-468
Sub-Domain 1.2	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 142-165, 190-204, 370-382, 468-491 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 14-27, 32-80, 83-93
Sub-Domain 1.3	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 419-472, Glossary • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 520-522
Sub-Domain 1.4	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 89-189, 162-165, 177-181, 412-491, 518-521 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 14-27, 261-330, 357-376, 617 • Title 29 CFR 1926.21 • Title 29 CFR 1926.650 • Title 29 CFR 1926 Subpart P App A • California Code of Regulations, Title 8, Section 1541

	<ul style="list-style-type: none"> California Code of Regulations, Title 8, Section 1541.1 California Government Code 4216 California Government Code 4216.2
Sub-Domain 1.5	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 9-16, 226, 518-521 Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 624-628 State Water Resources Control Board Order No. 2006-0003-DWQ State Water Resources Control Board Order No. WQ 2013-0058-EXEC
Sub-Domain 1.6	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 119-134, 177-189, 430-437 Title 29 CFR 1926.1204
Domain 2 – Records, Documentation, and Mapping	
Sub-Domain 2.1	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 23-33, 263-268, 308, 371-376, 488-491 Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 94-101, 483-484, 624-628 California Code of Regulations, Title 8, Section 5157
Sub-Domain 2.2	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 22-77, 412-462 Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 11-79, 461-469, 617-618
Domain 3 – Safety and Customer Service	
Sub-Domain 3.1	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 94-134, 177-189 Watchbook: Work Area Traffic Control Handbook, 2019, 14th Edition
Sub-Domain 3.2	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 9-16, 94-204, 303-491 Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 342-349, 623-631 State Water Resources Control Board Order No. 2006-0003-DWQ State Water Resources Control Board Order No. WQ 2013-0058-EXEC Safety, Health, and Security in Wastewater Systems, 6th Edition The Worker Occupational Safety and Health Training and Education Program – IIPP information page
Sub-Domain 3.3	<ul style="list-style-type: none"> Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 177-191

	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 342-347 • Title 29 CFR 1910.146
Sub-Domain 3.4	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 134-146 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 358-361
Sub-Domain 3.5	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 146-165, 203-204 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 347 • Safety, Health, and Security in Wastewater Systems, 6th Edition
Sub-Domain 3.6	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 72-75 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 519-522, 632-637
Domain 4 – Vehicles, Equipment, and Grounds	
Sub-Domain 4.1	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 89-102, 224-233 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 148-247 • California Commercial Driver Handbook, State of California, Department of Motor Vehicles
Sub-Domain 4.2	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 224-233, 303-309, 332-347, 422-426, 439-441 • Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition. Pages 445-460
Domain 5 – Math for Collections Systems	
Sub-Domain 5.1	<ul style="list-style-type: none"> • Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition. Pages 27, 56, 426, 501-557

Publications in the Suggested Reference list

- [Operation and Maintenance of Wastewater Collection Systems, Volume 1, 8th Edition, Office of Water Programs](#)
- [Operation and Maintenance of Wastewater Collection Systems, Volume 2, 7th Edition, Office of Water Programs](#)
- Title 29 CFR
 - [1910.146](#)
 - [1926.21](#)
 - [1926.1204](#)
 - [1926.650](#)
 - [Subpart P App A](#)
- California Code of Regulations Title 8
 - [Section 1541](#)
 - [Section 1541.1](#)
 - [Section 5157](#)
- California Government Code
 - [4216](#)
 - [4216.2](#)
- [State Water Resources Control Board Order No. 2006-0003-DWQ](#)
- [State Water Resources Control Board Order No. WQ 2013-0058-EXEC](#)
- [Watchbook: Work Area Traffic Control Handbook, 2019, 14th Edition, Bni Building News](#)
- [Safety, Health, and Security in Wastewater Systems, 6th Edition, Water Environment Federation](#)
- [The Worker Occupational Safety and Health Training and Education Program – IIPP information page](#)
- [California Commercial Driver Handbook, State of California, Department of Motor Vehicles](#)

Gauge your readiness with this self-evaluation Gap Analysis Tool

Help identify the knowledge, skills, and abilities you are confident in and those you might need to spend more time on by using this self-evaluation tool. http://www.cwea.org/tcp/pdf/CSM_1-Gap-Tool.pdf

Equivalents & Formula Sheet

Familiarity with the following formula sheet is important. There is no need to memorize it, as it can be accessed on screen during the exam.

Collection System Maintenance Grade 1 Equivalents & Formulas

Conversions	
12 inches = 1 foot 36 inches = 3 feet = 1 yard 5,280 feet = 1 mile 1,440 minutes = 1 day = 24 hours. 144 square inches = 1 square foot 9 square feet = 1 square yard 43,560 square feet = 1 acre 1,728 cubic inches = 1 cubic foot	27 cubic feet = 1 cubic yard 1 cubic foot of water contains 7.48 gallons 1 cubic foot of water weighs 62.4 pounds 1 gallon of water weighs 8.34 pounds 1 million gallons per day (mgd) = 694 gallons per minute (gpm) 1 million gallons per day (mgd) = 1.55 cubic feet per second (cfs) 1 horse power = 0.746 kilowatts (kw) 1 kilowatt = 1,000 watts

Formulas	
Flow $Q = AV$	Q = Flow A = Area V = Velocity
Area Rectangle: $A = LW$ Circle: $A = 0.785D^2$	L = Length W = Width D = Diameter A = Area
Circumference of a circle $C = 3.14D$	C = Circumference D = Diameter
Volume Rectangle Solid: $Vol = LWd$ Cylinder: $Vol = 0.785D^2L$ OR $3.14R^2L$	Vol = Volume d = Depth D = Diameter W = Width L = Length
Slope	$\frac{\text{Rise}}{\text{Run}} = \text{Slope}$

*** Assume 100 gallons per capita (person) per day (gpcd) for average daily water flow for all problems**