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State of California • Department of Resources Recycling and Recovery (CalRecycle)

Final Closure & Postclosure Maintenance Plan:

Qualitative Review Checklist

CalRecycle 177 (Revised 11/16)

Reviewer:

Site:

Objective of Qualitative Review:

To determine if the work elements specified in the Final Closure and Postclosure Maintenance Plans meet California Code of Regulations Title 27, Division 2, Chapter 3, Subchapter 5, Article 2 content requirements and determine if plans are of adequate detail to produce a detailed cost estimate for disbursement of financial assurance funds.

QUALITATIVE REVIEW CHECKLIST

Final Closure Plan Contents §21800

Check to ensure adequacy.

- ☐ **Dated and signed professional certification:**
  - ☐ Civil Engineer registered with the State of California
  - ☐ Certified Engineering Geologist registered with the State of California
- ☐ **Table of contents**
- ☐ **Site description**
  - ☐ Site acreage
    - ☐ Total area of landfill property:
    - ☐ Area of the limit of waste:
    - ☐ An estimate of the maximum extent of the landfill that will ever require closure at any given time during the life of the landfill [§21790(b)(6)]:
  - ☐ Closure date pursuant to §21790(b)(7):
    - ☐ Based on volumetric calculations, including supporting documentation
    - ☐ Accounts for the effects of settlement and for volume occupied by daily cover
  - ☐ Description of waste types:
  - ☐ Surrounding land uses:
- ☐ **Maps**
  - ☐ Maps pursuant to §21790(b)(2), indicating:
    - ☐ Property boundaries
    - ☐ Existing limits of waste placement
    - ☐ Permitted limits of waste placement

- [ ] Proposed final limits of waste placement
- [ ] Entry roads
- [ ] Structures outside the property boundary but within 1000 feet of the property boundary
- [ ] General location of the landfill

- [ ] Location map of the current monitoring and control systems [Pursuant to §21790(b)(4)] including:
  - [ ] Leachate, drainage, and/or erosion control systems as required
  - [ ] Landfill gas monitoring and control systems as required
- [ ] Topographic map, drawn at appropriate scale and contour interval, and drawn to an appropriate detail, [pursuant to §21769(c)(2)(D)] showing:
  - [ ] The boundaries of the Unit(s) to be closed and of the facility
  - [ ] The projected final contours of the Unit(s) and surrounding area(s)
  - [ ] Any changes in surface drainage patterns, as compared to the preexisting natural drainage patterns
  - [ ] The final limits of waste placement
- [ ] Map showing site security and structure removal to illustrate requirements of §21790(b)(8)(A)

- [ ] **Drawings**
  - [ ] Site aerial photographic survey (or topographic map), showing corresponding survey monuments.
  - [ ] Design cross-sections
  - [ ] Details

- [ ] **Final Cover**
  - [ ] Final cover design description
    - [ ] Prescriptive cover
      - [ ] Foundation layer – at least 2 ft thick
      - [ ] Low-hydraulic-conductivity layer – at least 1 ft thick with hydraulic conductivity less than or equal to 1 x 10^-6 cm/sec
      - [ ] Erosion-resistant layer – at least 1 ft thick
        - [ ] Via a vegetative cover
        - [ ] Via a mechanically erosion-resistant layer
    - [ ] Engineered alternative cover
      - [ ] Alternative Cover components:

    - [ ] Calculate the volume or amount needed of each type of material
      - [ ] On-site materials
        - [ ] Tests to confirm the suitability of the material
        - [ ] Estimate of materials available on-site
      - [ ] Off-site materials
        - [ ] Tests to confirm the suitability of the material
        - [ ] Estimate of materials available off-site
  - [ ] Cover functions with minimum maintenance and provides waste containment to protect public health and safety by controlling at a minimum, vectors, fire, odor, litter, and landfill gas migration
  - [ ] Slope Stability and Seismic Analyses
    - [ ] Slope stability discussion under both static and dynamic conditions

- [ ] Slope stability report
- [ ] Seismic analysis report
  - [ ] Class II MSW Landfills – withstand the maximum credible earthquake
  - [ ] Class III MSW Landfills – withstand at least the maximum probable earthquake

- [ ] Final Grading
  - [ ] Final cover slopes no steeper than 1-3/4:1 (Horizontal: Vertical) unless approved by RWQCB
  - [ ] Have a minimum of one fifteen-foot wide bench for every fifty feet of vertical height unless approved by RWQCB
  - [ ] All portions of the landfill cover shall have a slope of at least 3% unless approved by RWQCB
  - [ ] Discussion of how the grading is designed to prevent ponding and to prevent soil erosion due to high run-off Velocities
  - [ ] Designed to reduce the impacts to health and safety and take into consideration any postclosure land use
  - [ ] Check all faces of the fill and decks for:
    - [ ] Potential slip surfaces – review geology and soil data
    - [ ] Grade of slopes – review final grading plan
      - [ ] If slopes are steeper than 3:1, review slope stability report

        In slope stability report:
        - [ ] Check to see if proper sections are analyzed (slopes > 3:1)
        - [ ] Check investigation boring locations, logging data, soil testing results
        - [ ] Review input parameters to stability analysis software
        - [ ] Review output surfaces in order to determine if the surface makes sense given the section profile
        - [ ] Check factors of safety for appropriate slopes (F.S. > 1.5 for pseudostatic)

- [ ] Drainage Plan
  - [ ] Hydrology and hydraulic calculations
    - [ ] Class II MSW Landfills – design storm is the 1000-yr, 24-hr precipitation event (use for sizing storage capacity)
    - [ ] Class III MWS Landfills – design storm is the 100-yr, 24-hr precipitation event (used for sizing storage capacity)
    - [ ] Local hydrology data for 100-yr, 1-hr precipitation event (used for sizing conveyances)
  - [ ] Check design location of run off storage basins
    - [ ] Make sure flow is directed away from the trash
    - [ ] If basins are near trash, an impermeable barrier needs to be in the design.

- [ ] Project-specific Construction Quality Assurance (CQA) Plan should include:
  - [ ] A delineation of the CQA management organization, including a chain of command
  - [ ] A detailed description of the level of experience and training of the contractor, work crew, and CQA inspectors.

- [ ] Description of the CQA testing protocols including:
  - [ ] Sampling location maps
  - [ ] Frequency of inspections by operator, CQA officer, or design professional
  - [ ] Frequency of performance audits
  - [ ] Sampling and field testing procedures and equipment to be utilized
  - [ ] Size, method, location, and frequency of sampling
  - [ ] Pass/fail criteria for sampling and testing methods
  - [ ] Description of corrective procedures in the event of a test failure

- [ ] CQA manufacturer or third party data on all geosynthetics utilized

- [ ] CQA documentation in the report should include:
  - [ ] Daily summary reports (daily record keeping)
  - [ ] Acceptance reports (verify that all materials and construction procedures meet the specifications)
  - [ ] Final documentation (all reports providing evidence that CQA plan was implemented)
- [ ] Check types, frequencies, and cost rate of tests to be performed
  - [ ] For consistency, at least two placement tests should be performed on the barrier layer
  - [ ] Frequency range:

    Barrier layer: 1 test per 200 yd^3 – 1 test per 1000yd^3

    Subgrade: 1 test per acre – 1 test per 5 acres
- [ ] Review soil **laboratory tests** required for specified cover materials for adequacy and completeness of test selection.
  - [ ] For all cover material the following tests should be performed:
    - [ ] Particle size analysis (ASTM D 422-93)
    - [ ] Compaction characterization (ASTM D 1557-91)
    - [ ] Classification of Soils (ASTM D 2487-93)
  - [ ] For low-hydraulic-conductivity layer the following tests should be performed:
    - [ ] Particle size analysis (ASTM D 422-93)
    - [ ] Compaction characterization (ASTM D 1557-91)
    - [ ] Classification of Soils (ASTM D 2487-93)
    - [ ] Liquid limit, plastic limit, plasticity index (ASTM D 4318-93)
    - [ ] Triaxial-cell method with back pressure (a.k.a. falling or constant head permeability tests) (USEPA Test Method 9100)
    - [ ] From these tests, a moisture-density curve for the low-hydraulic-conductivity layer should be developed
- [ ] Review required earth material/geosynthetic **placement tests** for adequacy and completeness
  - [ ] All earth materials:
    - [ ] Laboratory soil characterization tests as above (particle size analysis, compaction characterization, classification of soils, liquid limit, plastic limit, plasticity index, triaxial-cell method with back pressure)
    - [ ] Description and Identification of Soils (ASTM 2488-93)
    - [ ] Test fill pad - Double Ring Infiltrometer (vertical hydraulic conductivity test – ASTM 3385-94)

      Purpose: Determine if the specified density/moisture/hydraulic conductivity relationships determined in the laboratory can be achieved in the field with the compaction equipment to be used and at the specified lift thickness.
    - [ ] Four field density tests performed for each 1000 cubic yards of material placed or a minimum of 4 tests per day.
      - [ ] Nuclear density gauge
      - [ ] Cone test
    - [ ] Compaction curve data (ASTM D 1557-91) represented graphically once a week or every 5000 cubic yards of material placed
    - [ ] Atterburg limits (ASTM D 4318-93) represented graphically once a week or every 5000 cubic yards of material placed
    - [ ] Hydraulic conductivity tests must be performed on the barrier layer
    - [ ] Flexible Membrane Liner (FML):
      - [ ] Preconstruction quality control program
      - [ ] Tensile strength
      - [ ] Layer thickness strength

- [ ] Peel test for the seaming of the material
- [ ] Inspection of placement
- [ ] Inspections of installation of anchors and seals

- [ ] Water and Wind Erosion Analyses Report
  - [ ] Hydrological information
  - [ ] Annual soil loss calculations using the United States Department of Agriculture's (USDA) Universal Soil Loss Equation (USLE) or equivalent. The USLE estimates average annual soil loss from sheet and rill erosion. The equation is: A=RKLSCP, where A is the computed soil loss per unit area, R is a rainfall factor, K is a soil erodibility factor, L is a slope length factor, S is a slope degree factor, C is a crop practice factor, and P is a conservation practice factor.
  - [ ] Annual soil loss calculations using the USDA Wind Erosion Equation (WEQ) or equivalent. The WEQ is designed to predict long-term average annual soil losses from a field having specific characteristics. The equation is E=f(I,K,C,L,V), where E is the estimated average annual soil loss, I is the soil erodibility, K is the ridge roughness factor, C is the climatic factor, L is the equivalent unsheltered distance across the field along the prevailing wind erosion direction, and V is the equivalent vegetative cover

- [ ] **Gas monitoring and control** [ ] Exempt
  - [ ] Gas monitoring system description
    - [ ] Review Air SWAT report to determine if gas generation/migration is a problem
      - [ ] On-site structure should have less than 1.25% methane by volume
      - [ ] The site perimeter should have less than 5% methane by volume
      - [ ] Check N, H_2S, O_2, CO_2, and CO levels
      - [ ] Check for non-methane organic compounds (NMOC)
      - [ ] Check integrated surface sample (ISS) data
    - [ ] Check site geology

      Gravel and sand promote gas migration and provide preferential flow paths Silt and clay may confine landfill gas to a specific location in the subsurface
    - [ ] Review land development within 1000 feet of the fill area
      - [ ] Check zoning maps
      - [ ] Check land use

      Check for the following structures:
        - [ ] Concrete slab-on-grade
        - [ ] Raised foundation
        - [ ] Piling foundation
        - [ ] Basement/cellar
        - [ ] Water wells
        - [ ] Underground vaults/tanks
        - [ ] Utility lines/trenches
        - [ ] Parking lots
        - [ ] Road

      Note: the presence of any of these features could be potential receptors for landfill gas
    - [ ] Review site map showing gas monitoring probe placement
    - [ ] Determine if placement and number of probes is adequate for gas detection
      - [ ] Placed in locations that will detect all off-site migration
      - [ ] Common lateral spacing is 100 - 500 feet although Title 27 specifies spacing less than 1000 feet

- [ ] Probes should be installed around the perimeter of the fill at the property boundary in native soil (ideally there should be a buffer zone between the refuse fill boundary and the property boundary of 100 ft or greater, especially where native soils are permeable, e.g. sand and gravel)
  - [ ] Review monitoring probe construction detail for adequacy
    - [ ] A Licensed Engineer or Registered Geologist stamp
    - [ ] Well logs should be taken
      - [ ] Well description and location map should be recorded
- [ ] Gas control system description
  - [ ] Review gas control system plans and specifications
    - [ ] Compute cost of gas control system
      Consider:
      - [ ] Extraction wells
      - [ ] Conveyance system
      - [ ] Flare and blower station
      - [ ] Condensate management system

- [ ] **Leachate monitoring and collection system description** [ ] N/A
  - [ ] Determine if the site has liner and leachate collection system

    Note: if site does not have a liner, site has limited leachate collection ability
  - [ ] Review history of site leachate flows, quality of leachate produced, and time frames for dispersion
  - [ ] Review costs for operating and maintaining leachate collection system (including off-site disposal costs)

- [ ] **Closure procedures and tentative schedule**
  - [ ] Estimated closure commencement date based on volumetric calculations:

    - [ ] Estimate accounts for the effects of settlement
    - [ ] Estimate accounts for the volume occupied by daily cover material
  - [ ] On site structures removal procedures description
  - [ ] Sign installation indicating closure
  - [ ] Detailed description of the sequence of closure stages (including incremental closure, where appropriate), giving tentative implementation dates pursuant to §21800(c)

- [ ] **Financial assurance and closure funding section**
  - [ ] Demonstration of financial responsibility to CalRecycle for closure in at least the amount of the current closure cost estimate (determined by CalRecycle Financial Assurances Section)
  - [ ] Detailed schedule for disbursement of funds for closure activities from a trust fund, or enterprise fund if applicable, pursuant to §21800(d)

- [ ] **Final closure cost estimate**
  - [ ] Cost estimate in current year dollars
  - [ ] Cost estimates need to meet the following itemized criteria at a minimum:
    - [ ] Developed for the activities anticipated for scheduled closure;
    - [ ] Closure design;
    - [ ] Closure materials;
    - [ ] Transportation and hauling;
    - [ ] Equipment;
    - [ ] Labor;

- ☐ Administration;
- ☐ Quality assurance;
- ☐ Install/upgrade site security;
- ☐ Structural removal;
- ☐ Install/upgrade landfill gas monitoring and/or control systems;
- ☐ 20% contingency

☐ **Construction health and safety plan**

- ☐ Emergency notification list

☐ **CEQA Compliance (CEQA standards)**

☐ **Reference materials**

FINAL POSTCLOSURE MAINTENANCE PLAN CONTENTS §21830

☐ **Description of the planned uses of the property during the postclosure maintenance period**

☐ **As-builts**

- ☐ Current as-built (pre-construction) drawing
- ☐ As-built description of the current monitoring and control systems at the landfill including a detailed description of any proposed changes to be implemented as part of closure

☐ **Emergency Response Plan**

- ☐ List of the persons or companies responsible for each aspect of the postclosure maintenance, and their addresses and telephone numbers

☐ **Revegetation Plan**

- ☐ Plant species list
- ☐ Vegetation maintenance procedure description
- ☐ Irrigation plan (if applicable)

☐ **Final Cover Maintenance Plan**

- ☐ Inspection procedures
- ☐ Inspection frequency
- ☐ Notification procedures
- ☐ Repair procedures
- ☐ Final cover repair procedures
- ☐ Drainage collection system maintenance and repair procedures
- ☐ Settlement monitoring plan
- ☐ Surveying monument locations
- ☐ Surveying frequency

☐ **Landfill Gas Monitoring Plan** ☐ N/A

- ☐ Parameter list
- ☐ Monitoring frequency
- ☐ Monitoring equipment and procedures description (operations and maintenance plan)

- [ ] **Groundwater Monitoring Plan** [ ] N/A
  - [ ] Parameter list
  - [ ] Monitoring procedures description
  - [ ] Monitoring frequency
- [ ] **Leachate Monitoring Plan** [ ] N/A
  - [ ] Parameter List
  - [ ] Monitoring procedures description
  - [ ] Monitoring Frequency
- [ ] **Postclosure maintenance funding section**
- [ ] **Final postclosure maintenance cost estimate**
  - [ ] Cost estimate in current year dollars
  - [ ] Calculated as an annual cost of postclosure maintenance
  - [ ] Total postclosure cost is the annual cost estimate multiplied by thirty (30) years
  - [ ] Cost estimates need to meet the following itemized criteria at a minimum:
    - [ ] Site security pursuant to §21135;
    - [ ] Maintenance and integrity of the final cover including material acquisition, labor, and placement for repair of the final cover as required due to the effects of settlement, slope failure, or erosion;
    - [ ] Maintenance of vegetation (erosion resistance) including fertilization, irrigation and irrigation system maintenance;
    - [ ] Monitoring, operation, and maintenance of landfill gas monitoring and control systems;
    - [ ] Monitoring, operation, and maintenance of leachate monitoring and control systems;
    - [ ] Maintenance of drainage and erosion control systems including clearing materials, blocking drainage conveyances and repairing drains, levees, dikes, and protective berms.