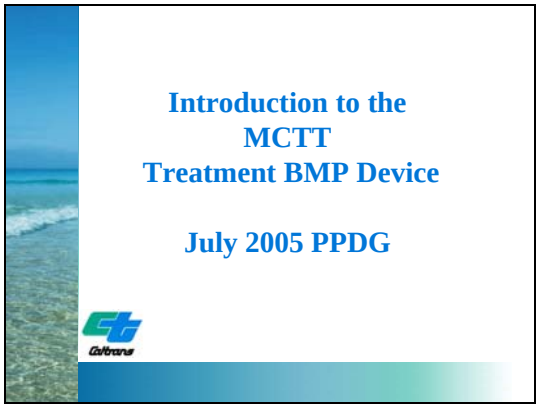
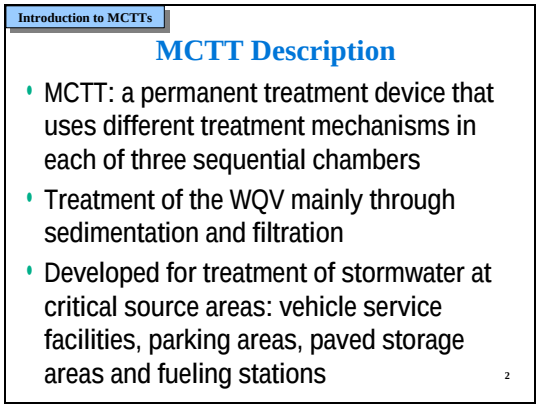
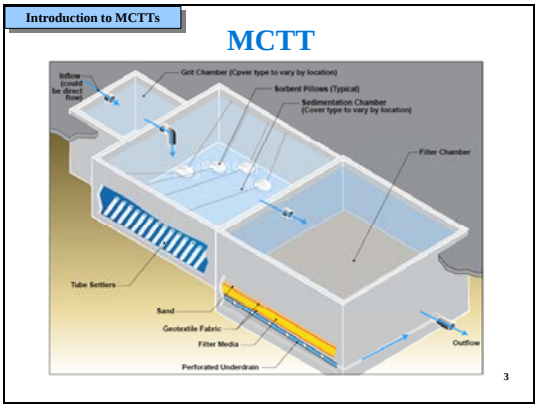


Slide 1: The MCTT, Multi-Chamber Treatment Train, is one of several recently approved Caltrans Treatment BMPs that can be employed on a project. In addition to the information presented today, Appendix B of the PPDG (Project Planning and Design Guide) has a 7-page section on the MCTT. Please check with the upcoming revision of the PPDG to determine if there are any changes to the material we will review today.
Please contact your NPDES coordinator if, later in the design process, you have questions that were not answered today, or call the Headquarters Design Office of Storm Water Management.



Slide 2: MCTTs were approved by Caltrans as a permanent Treatment Best Management Practice in March 2005, and incorporated into Section 2 of the PPDG in July 2005.

MCTTs were 'piloted' and Districts 7 and 11, and were described in a report entitled BMP Retrofit Pilot Program Final Report, Report ID CTSW - RT - 01 – 050, January 2004, by California Department of Transportation, from two sites in District 7: the Via Verde and Lakewood Park & Rides.
The design of this device should be coordinated through the Headquarters Office of Storm Water Management – Design, as structural plans are under development for the MCTT.



Slide 3: MCTTs are a permanent treatment system comprised of three separate units:
•The 1st chamber, also called a 'grit' chamber, captures the larger sized sediments; this may be configured as a catch basin with a sump. Some variations are employed in this chamber, such as including a trash rack.
•The 2nd chamber, also called the main settling chamber, is designed to capture finer sediments; this chamber may also be configured with sorbent pads or plates designed to capture hydrocarbons, and some designs employ aeration in this chamber (forcing air into the ponded water from approximately mid-elevation in the chamber) to lift floatables and litter not captured in the initial chamber.

•The 3rd chamber, also called the filtering chamber, employs a media filter often configured as a combination of sand and peat moss; it removes even finer sized particles than were captured in the previous chambers, and acts as a sorption area for some dissolved constituents. Other media can be placed in certain circumstances if unusual constituents are present in the runoff (but consult with District NPDES and the Office of Storm Water Management – Design in that situation).

All or most of the MCTT is placed below ground, with flow entering through culverts or sheet flow, and leaving as confined open channel flow, usually in culverts. The MCTT will be placed as a vault structure.

Introduction to MCTTs

MCTT

District 7 - Lakewood Park and Ride 4

Slide 4: Here is one view of an MCTT placed in District 7.

Introduction to MCTTs

MCTT

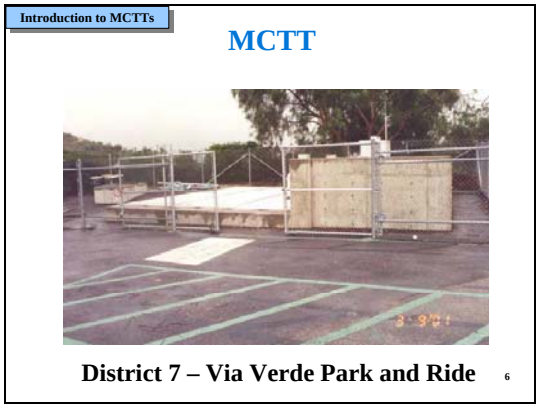
District 7 – Via Verde Park and Ride 5

Slide 5: This is another MCTT.

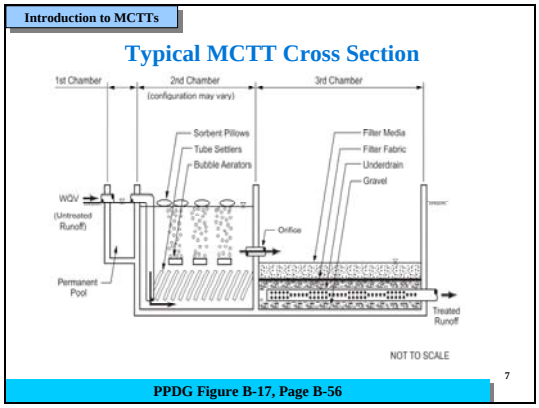
Shown in the background of this photograph is a parking lot, which serves also maintenance access to the MCTT; maintenance access should be provided to every treatment BMP device.

MCTTs will require periodic maintenance, but if otherwise properly designed should have a reasonable in-service life before heavy maintenance is needed. Routine annual maintenance would include removal of the litter and the upper few inches of the media filter material in the 3rd chamber. After several such 'cleanings', the media is replenished to its original elevation.

As the MCTT has permanent pool in the 1st chamber and in the 2nd chamber, be sure to discuss the design and proposed location with the local Vector Control agency; however, at this time plans are being developed for covers to be used above the 1st and 2nd chambers.



Slide 6: Surface view of the Via Verde Park and Ride.



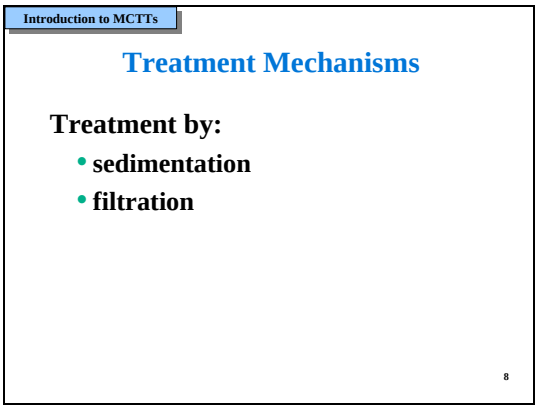
Slide 7: Inflow into the MCTT is via: a) a culvert, b) by overland flow into the 1st chamber configured as a drop inlet, or c) both.

After water enters into the 1st chamber (the grit chamber), it is held briefly for large settleable solids to fall out; this chamber will have a permanent pool of water. The runoff then leaves the 1st chamber and flows into the 2nd chamber (the settling chamber).

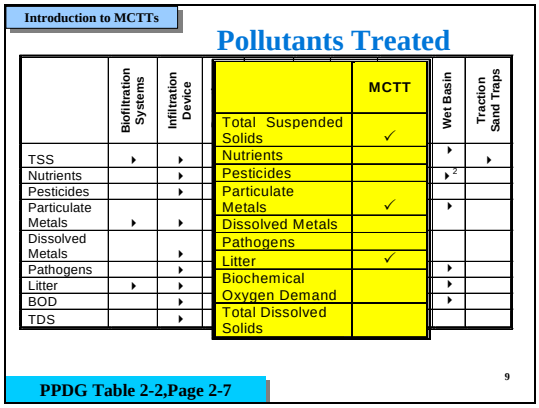
The 2nd chamber has as design options: sorbent pillows to capture floating hydrocarbon capture; settling tubes for stilling of the water, allowing finer sediments to drop out, and bubble aerators to drive over volatile organics (however, these were not incorporated in the pilot study sites, because the concentration of volatile organics was expected to be low in runoff from a park-and-ride; it is considered an option at this time).

Water flows from the 2nd to 3rd chamber (the filtering chamber) via either an orifice or a weir; if a weir used, the 2nd chamber also would have a permanent pool of water. Upon entering the 3rd chamber, the runoff is filtered through a media bed, consisting of sand mixed with peat. After being filtered, the effluent leaves the 3rd chamber via an underdrain system (perforated pipes placed in a gravel bed) located on the invert of this chamber.

Bypass overflow: off-line placement of MCTT is preferred, but the 1st chamber and/or the 2nd chamber will have as overflow release for events larger than the WQV, even if upstream diversion is provided.

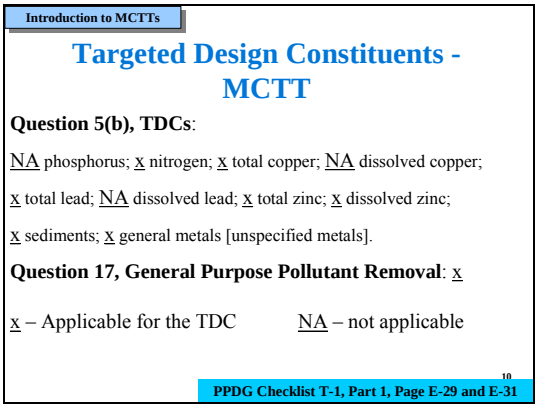


Slide 8: These are the treatment mechanisms: sedimentation and filtration.



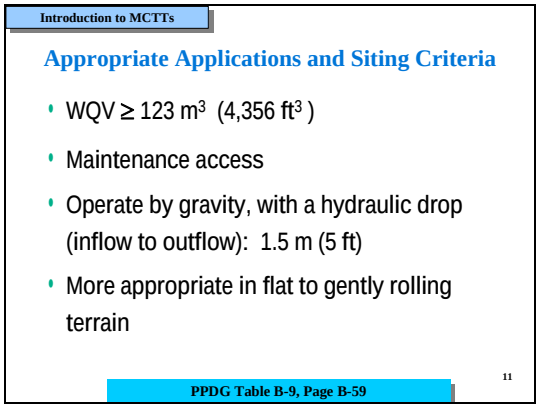
Slide 9: Pollutants primarily removed: Medium to fine sediments, Particulate metals, and Litter. Other pollutants may be captured depending upon design of the second and third chambers. Treatment Mechanisms: Sedimentation, Filtration, Adsorption and ion exchange (depending upon filtering media employed).

In the pilot studies, MCTTs were installed at park-and-ride sites where the runoff contained relatively low levels of pollutants. Consequently, the extra pretreatment capabilities (i.e., the second chamber) were not utilized. In addition, the performance evaluation of MCTTs was based on the removal of a number of conventional stormwater constituents, rather than on toxicity or PAH reduction. Using this measures of performance as discussed in the BMP Retrofit Pilot Program Final Report, the MCTTs provided approximately the same pollutant removal as Media Filters. This is not surprising given that the device, in essence, is an enhanced Media Filter, and given the comparable performance, for many situations within the context of Caltrans operations Media Filters are expected to be placed more often, as they are expected to have a smaller footprint.



Slide 10: Consideration of a MCTT should be done as part of the "TDC process" ("Targeted Design Constituent" process) discussed in Appendix E of the PPDG, this process is not further discussed in this presentation. As you can see, the MCTT is toward the lower end of efficiency of all the Caltrans-approved Treatment BMP. This is also shown on the TDC sheet, pages E-29 through E-31 of the PPDG, where the MCTT is listed at or near the bottom grouping of every specific TDC listed.

This table shows the target pollutants that MCTTs are effective in removing. They include totals suspended solids, particulate metals, and litter, although litter may be trapped in the bioswales and strips, litter removal is not a primary function of biofiltration. MCTTs are included in the TDC process for these constituents. These represent Steps 8, 9, 11, 13, 14, 15, 16 for specific pollutants, and 17 for general pollutants, on the checklist.



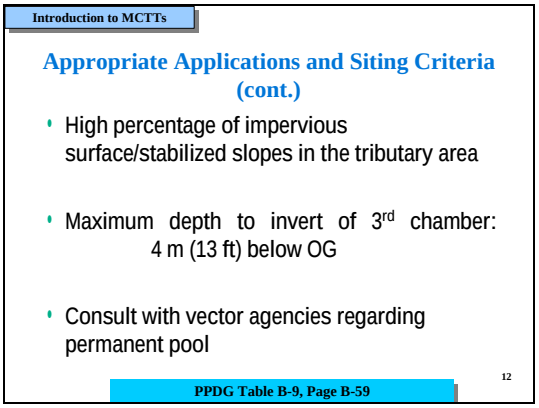
Slide 11: Some of the appropriate applications and siting criteria shown here; consult Table B-9 for a complete list.

•Minimum WQV = 123 m3 (4,356 ft3): MCTTs, as with the other Treatment BMPs that are based on volume, should be considered wherever site conditions allow and the design WQV exceeds 123 cubic meters (0.1 acre-foot), although even if only 80% of the WQV can be captured in a location, consideration should be given for its placement.

•Maintenance access

•Operate by gravity, with a hydraulic drop (inflow to outflow): 1.5 m (5 ft) The hydraulic drop is measured at the invert of the 1st chamber to the outflow invert of the 3rd chamber.

•More appropriate in flat to gently rolling terrain: Because of this hydraulic drop requirement, placement would be ideal at the toe of slopes or embankments, or in gently rolling terrain.

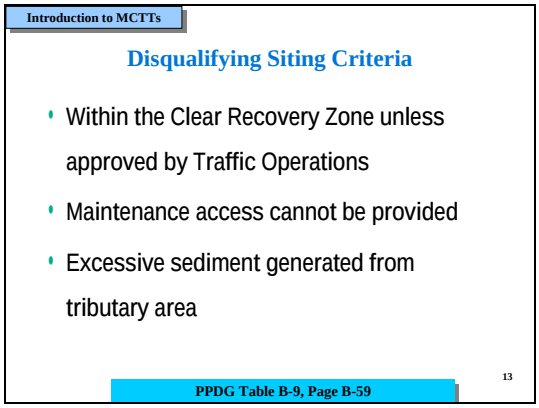


Slide 12: Some of the appropriate applications and siting criteria shown here; consult Table B-9 for a complete list.

•High percentage of impervious surface/stabilized slopes in the tributary area: To maintain longevity and performance, the tributary area should ideally have a relatively high percentage of impervious area and/or a low sediment loading (to minimize the fine sediment entering into the 3rd chamber especially).

•Maximum depth to invert of 3rd chamber: 4 m (13 ft) below OG: The maximum depth to invert of second chamber of 4 m (13 ft) below the ground surface, and Maintenance must be able to access invert at this depth. This depth meets maintenance purposes, as cleanout is usually by a vacuum truck, while being consistent with reasonable construction costs.

•Consult with vector agencies regarding permanent pool: Vector issues will be discussed in more detail an upcoming slide.

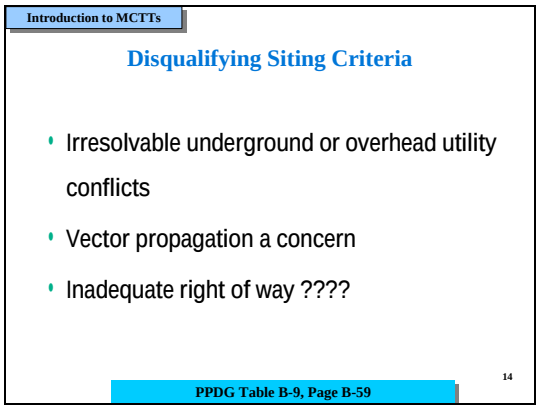


Slide 13: Some potentially disqualifying siting criteria are:

•Within the Clear Recovery Zone unless approved by Traffic Operations: When located with the Clear Recovery Zone, a traffic barrier may be required. It has not been approved for design with a traffic-rated top so it should not be considered in the traveled way.

•Maintenance access cannot be provided: Since yearly maintenance is required, safe access is mandatory.

•Excessive sediment generated from tributary area: Excessive sediments will increase annual maintenance and may ultimately decrease the effectiveness of the MCTT.

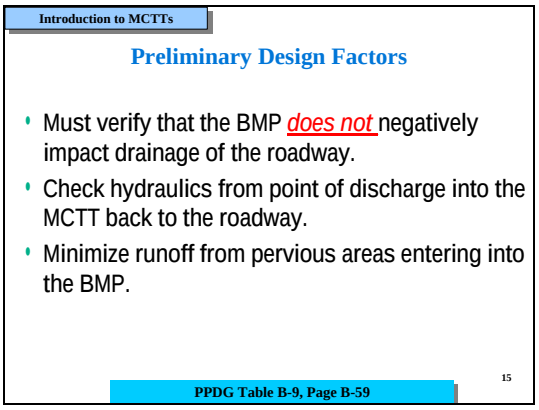


Slide 14: Some potentially disqualifying siting criteria are:

•Irresolvable underground or overhead utility conflicts: Utility relocation for the construction and operation may not prove possible.

•Vector propagation a concern: If an agreement or sign-off cannot be reached with the local vector agency, placement would not be appropriate. Consideration should also be given to the land use surrounding the proposed placement; for example, a school playground might be a disqualifying criteria due to vector concerns. Note also: plans are being developed for a covered MCTT, so this issue may not apply when those plans are available.

•Inadequate right of way???? Right of way: Recall that purchase of additional right of way must be considered for placement of all Treatment BMPs if the existing R/W is insufficient. Also recall that a cooperative agreement with a Local Agency (for joint use) might also include joint building and operation of the device (with both agencies sending runoff to the device).



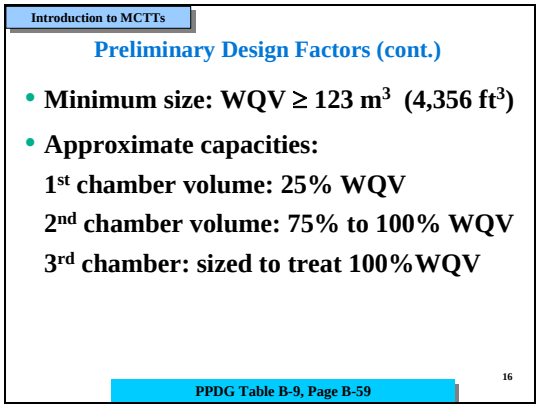
Slide 15: Some of the Preliminary Design Factors are shown here; consult Table B-9 for a complete list.

•Must verify that the BMP *does not* negatively impact drainage of the roadway: Consult with District Hydraulics to ensure that the design will not compromise the roadway drainage.

•Check hydraulics from point of discharge into the MCTT back to the roadway: this is related to the 1st bullet.

•Minimize runoff from pervious areas entering into the BMP. It is the goal to treat *only* runoff from impervious areas; minimize commingling of runoff from pervious areas into the Treatment BMP: the goal is to treat runoff from the impervious areas (i. e., the roadway surface), and runoff from pervious areas should bypass the MCTT if possible. However, if the runoff pervious surfaces cannot be routed around the treatment device, then this additional volume should be considered for the MCTT.

Note that 'flood routing' is not considered in the design process for water quality purposes; if the MCTT is placed for purposes of complying with local agency requirements about detaining/minimizing runoff into the downstream body, an inflow/outflow hydrograph must be developed; this would usually be done by District Hydraulics, and is beyond the scope of this presentation.



Slide 16: The 1st and 2nd chambers should have a combined capacity ≥ 100% WQV, with the initial chamber usually having a minimum capacity of 25% WQV.

Inflow the 1st chamber may be by sheet flow, or by a surface or buried concentrated flow conveyance system, by any combination of these.

The forebay will help capture sediment that could reduce the volume of the permanent pool, and therefore the effectiveness of treatment, of the MCTT.

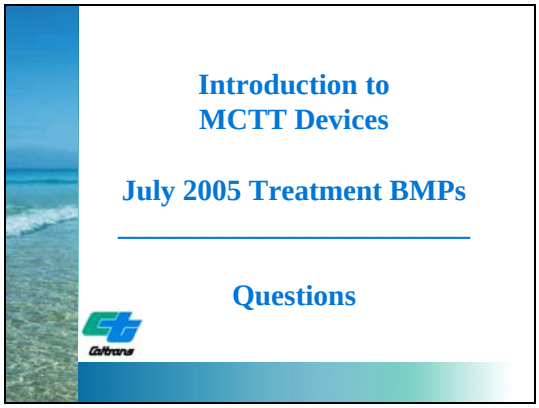
A permanent pool of water exists in the 1st chamber and in the 2nd chamber.

Some designs for the 2nd chamber employ an overflow weir, in which case there is also a permanent pool in this chamber. If a weir is not used, an outlet orifice is used to meter the flow out, usually over a 24-hour period.

Recall: the Water Quality Volume (WQV) is discussed in PPDG Section 2 as the: "maximized detention volume determined by the 85th percentile runoff capture ratio." This method is described in Chapter 5 of the *Urban Runoff Management WEF Manual of Practice No. 23*, 1998, published jointly by the Water Environment Federation (WEF) and the American Society of Civil Engineers (ASCE).

It can be considered for discussion purposes as similar to a frequently occurring storm, such as a 2-yr storm. It has been found that storm of this size contribute about 80 to 85% of the runoff, and the economics of capturing for treatment volumes of this size are favorable, relative to larger volumes.

Incorporation of the MCTT into project plans: It is expected that plan sheets will be available as 'insertable' sheets for the project when an MCTT is to be included in a project PS&E package; contact HQ Office of Storm Water Management and the District Design NPDES Coordinator if you have questions.



Slide 17: Please contact your NPDES coordinator if, later in the design process, you have questions that were not answered today, or call the Headquarters Design Office of Storm Water Management.

If no more questions, we will begin some design examples.