Evaluating the Feasibility of Infiltration and Rainwater Harvesting and Use

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Presentation Overview

- Bay Area Municipal Regional Permit (MRP) Requirements for Feasibility/Infeasibility Evaluation
- Technical Studies
- Key Factors Affecting Feasibility
- Feasibility Evaluation Process
- Resources for Evaluation
MRP Provision C.3.c

100% LID Treatment required:

– “LID Treatment” = harvesting/reuse, infiltration, evapotranspiration, or biotreatment
– “A properly engineered and maintained biotreatment system” is only allowed if other options are infeasible
– Permit provides list of potential infeasibility criteria
– Report on criteria and procedures for determining feasibility/infeasibility submitted May 1, 2011
– Report on experience applying the criteria and procedures due December 1, 2013.
Technical Studies

- “Harvest and Use, Infiltration and Evapotranspiration Feasibility/Infeasibility Criteria Report” (Geosyntec, 2011)
  - Literature Review
  - Mapping of Soil Types and Saturated Hydraulic Conductivity (Ksat)
  - Continuous Simulation Modeling
    - Bioinfiltration system performance for various soil types
    - Cistern sizing for various drawdown times (i.e. demands)
    - Landscape dispersion simulation to develop effective impervious to pervious area ratios
  - Process flow chart
  - Reference tables for applying criteria
Key Factors Affecting Feasibility

- **Amount of Stormwater Runoff**
  - LID measures must treat 100% of C.3.d water quality design storm runoff
    - Volume based – 80% of annual runoff
    - Flow based – runoff from 2 X 85th percentile rainfall intensity or 0.2 in/hr
Key Factors Affecting Feasibility

- Feasibility of Infiltration
  - **Soil Characteristics**
    - “C” and “D” soils have low to very low infiltration rates compared to “A” and “B” soils
  - **Site Characteristics**
    - High groundwater table (< 10’ below base)
    - Groundwater production wells within 100’
    - Septic systems, underground tanks within 100’
    - Pollutants in soil or groundwater
    - Geotechnical hazards
    - Industrial or high traffic areas
    - Underground utilities/trenches
Key Factors Affecting Feasibility

- Feasibility of Rainwater Harvest/Use
  - Supply and Demand
    - Need reliable demand to draw down tank such that C.3.d volume requirement is met
    - Strongly affected by California rainfall pattern
  - Other Factors
    - Recycled water use conflicts
    - Municipal building & plumbing codes
    - Reliability of water quality
    - Operational & treatment challenges
    - Site constraints, utility proximity
    - Geotechnical/structural stability
Feasibility Process Flow Chart

- Regulated Projects: Evaluate Feasibility at Drainage Management Area (DMA) or Project Scale
  - Step 1: Consider site design measures, self-treating, and self-retaining areas
  - Decision: is project still a Regulated Project?
- Step 2: Evaluate Infiltration and Rainwater Harvesting
  - Infiltration and Rainwater Harvest Equal – must look at both
  - Evaluate soil type, infiltration rates, harvested rainwater use demand and other factors
- Step 3: Implement Biotreatment
Feasibility Process Flow Chart

Regulated Projects
Evaluate at Project or DMA Scale

Step 1.
1a. Consider Site Design Measures (C.3.c.i.(2)(a))
1b. Consider Self-Retaining and Self-Treating Areas:
   • Landscape Dispersion
   • Green Roofs
   • Pervious Pavement
   • Interceptor Tree Retention

Is project still a Regulated Project (more than 10,000/5,000 sf of impervious surface)?

Yes

No
Feasibility Evaluation Process

- **Step 1.a. - Consider Site Design Measures**
  - Limit disturbance of natural drainage systems
  - Conserve natural areas
  - Minimize impervious surface
  - Minimize disturbance to natural drainages
  - Direct runoff to landscaping or permeable paving
Feasibility Evaluation Process

- **Step 1.b. – Consider Self-Retaining and Self-Treating Areas**
  - Self-Treating Area = pervious area that treats rain falling on itself only, via ponding, infiltration and ET
    - Interceptor trees
    - Green roofs
    - Pervious paving
Feasibility Evaluation Process

- **Step 1.b. – Consider Self-Retaining and Self-Treating Areas**
  - Self-Retaining Area = pervious area that retains first 1” of rainfall on itself and the contributing impervious area, up to a 2:1 ratio (impervious:pervious)
    - Roof runoff dispersion to landscaping
    - partial green roofs
    - pervious paving
Feasibility Process Flow Chart

Step 2a.
Feasible to Fully Treat via Infiltration Measures or Devices?

No

Step 2b.
Feasible to Fully Treat via Rainwater Harvesting?

No

Infeasible to Fully Treat using either Rainwater Harvesting or Infiltration Measures/Devices

Step 3. Implement Biotreatment

Yes

Yes
Feasibility Evaluation Process

- **Step 2.a. – Infiltration Feasibility**
  - **Soil Characteristics**
    - Volume based sized criteria in C.3.d is 80% capture of the annual runoff
    - Modeling studies indicated that “bioinfiltration” areas (bioretention with open bottom) in soils with Ksat < 0.4 in/hr (all “C” and “D” soils) cannot meet the 80% capture requirement
    - Increase in drain rock depth provided only marginal improvement, for Ksat = 0.4 -1.6 in/hr
    - For Ksat > 1.6 in/hr, infiltration of C.3.d runoff is feasible
  - **Site Conditions**
    - Evaluate other factors to see if infiltration allowed
Feasibility Evaluation Process

- Step 2.b. – Rainwater Harvesting and Use

  - **Types of Demands**
    - Irrigation
    - Toilet flushing
    - Other non-potable (e.g., commercial/industrial)

  - Volume based sized criteria in C.3.d is 80% capture of the annual runoff
  - Key concept is drawdown time
  - Barriers: lack of plumbing codes, treatment, recycled water preference
Figure G-9: Percent Capture Achieved by BMP Storage Volume for Various Drawdown Times - San Jose
Feasibility Evaluation Process

Rainwater Harvesting and Use

- Modeling analyses for San Jose:
  - To meet 80% capture for non-potable (per acre of impervious area):
    - 15,000 gal. tank, 7,500 gpd (48 hr drawdown)
    - 48,000 gal. tank, 2,400 gpd (480 hr drawdown)
    - 2,400 gpd = 280 toilet users @ 8.6 gpd (under Green Building Code)
  - To meet 80% capture for irrigation (per acre of impervious area):
    - 2,400 gpd = 2.5 to 5 acres of landscaping
Feasibility Evaluation

- **Important Tables from the BASMAA “LID Feasibility Report”**:  
  - **Table 8**: Required Cistern Volume & Demand per Acre of Impervious Area (48-hr drawdown time)  
  - **Table 9**: Required Cistern Volume & Demand per Acre of IA (longer drawdown time, minimum demand)  
  - **Table 10**: Toilet Users per Impervious Acre (TUTIA) Ratios for Meeting Required Demand  
  - **Table 11**: Effective Irrigated Area to Impervious Area (EIATIA) Ratios for Meeting Required Demand
Evaluate Feasibility at DMA or Project Scale

Step 1: Consider site design, self-treating, self-retaining areas

Step 2: Evaluate Infiltration and Rainwater Harvesting

Step 3: Implement Biotreatment
- Maximize infiltration
- Low tech, low maintenance
- Known standards and specs
- Institutional capacity and experience
- Excellent treatment!
Resources for Evaluation

• Screening Checklist
• Detailed Infiltration Feasibility Checklist
• Detailed Rainwater Harvest and Use Checklist
Next Steps

- MRP Amendment did not address infiltration/harvest and use feasibility
- Water Board staff have provided verbal authorization to proceed with evaluation process as submitted
- Feasibility analyses on projects must be tracked (using checklists)
- MRP requires status report on application of feasibility criteria by 12/1/2013