RIVERSIDE COUNTY
WATERSHED PROTECTION

rcwatershed.org

Transportation Project Guidance and Workshop

Riverside County Flood Control and Water Conservation District

Santa Ana Region TPG Training

Updated April 15, 2019

Introductions

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- Speaker Introductions:
  - Michael J. Gentile, PE, QSD
- Audience Introductions:
  - Agencies
  - Departments
  - Other

Training Agenda

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- Transportation Project Guidance
  - Purpose & Applicability
  - LID Principles and BMPs
  - Project Evaluation and Use of Template
  - Project Documentation
- Project Demonstration – Limonite Widening Project
- Questions

Acronyms and Permits

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- BMP - Best Management Practice
- HCOC - Hydrologic Conditions of Concern
- LID - Low Impact Development
- MEP - Maximum Extent Practicable
- MSHCP - Multiple Species Habitat Conservation Plan
- MS4 – Municipal Separate Storm Sewer System
- SAR – Santa Ana River Region/Watershed
- TPG – Transportation Project Guidance
- WQMP – Water Quality Management Plan
- 401 – CWA §401 (Dredge/Fill) Water Quality Certification
- 404 – CWA §404 Permit (Discharge of Dredged/Fill Material)
- 1602 – CDFWC §1602 Permit (Lake and Streambed Alteration)

Transportation Project Guidance

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Purpose & Applicability

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- In accordance with the Riverside County Santa Ana Region MS4 Permit, a Project-Specific Water Quality Management Plan (WQMP) is not required for Co-Permittee street, road, and highway projects.
- Instead, Co-Permittees are required to develop and implement a "*standardized design and post-construction BMP guidance to reduce the discharge of pollutants from such projects to the maximum extent practicable.*"
- ***Low Impact Development: Guidance and Standards for Transportation Projects for Santa Ana Region*** was developed for the purposes of implementing this permit provision.
- Guidance is Exhibit D of the SAR WQMP Guidance Document.

Content and Organization of TPG Guidance

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- Section 1: Introduction – Purpose of the Guidance
- Section 2: Project Categories
- Section 3: Project Evaluation
- Section 4: Source Control BMPs
- Section 5: Project Implementation Requirements
- Section 6: Resources
  - A. Glossary
  - B. Transportation Project BMP Template
  - C. LID-based BMP Planning and Design Information

Project Evaluation Process Flow Chart

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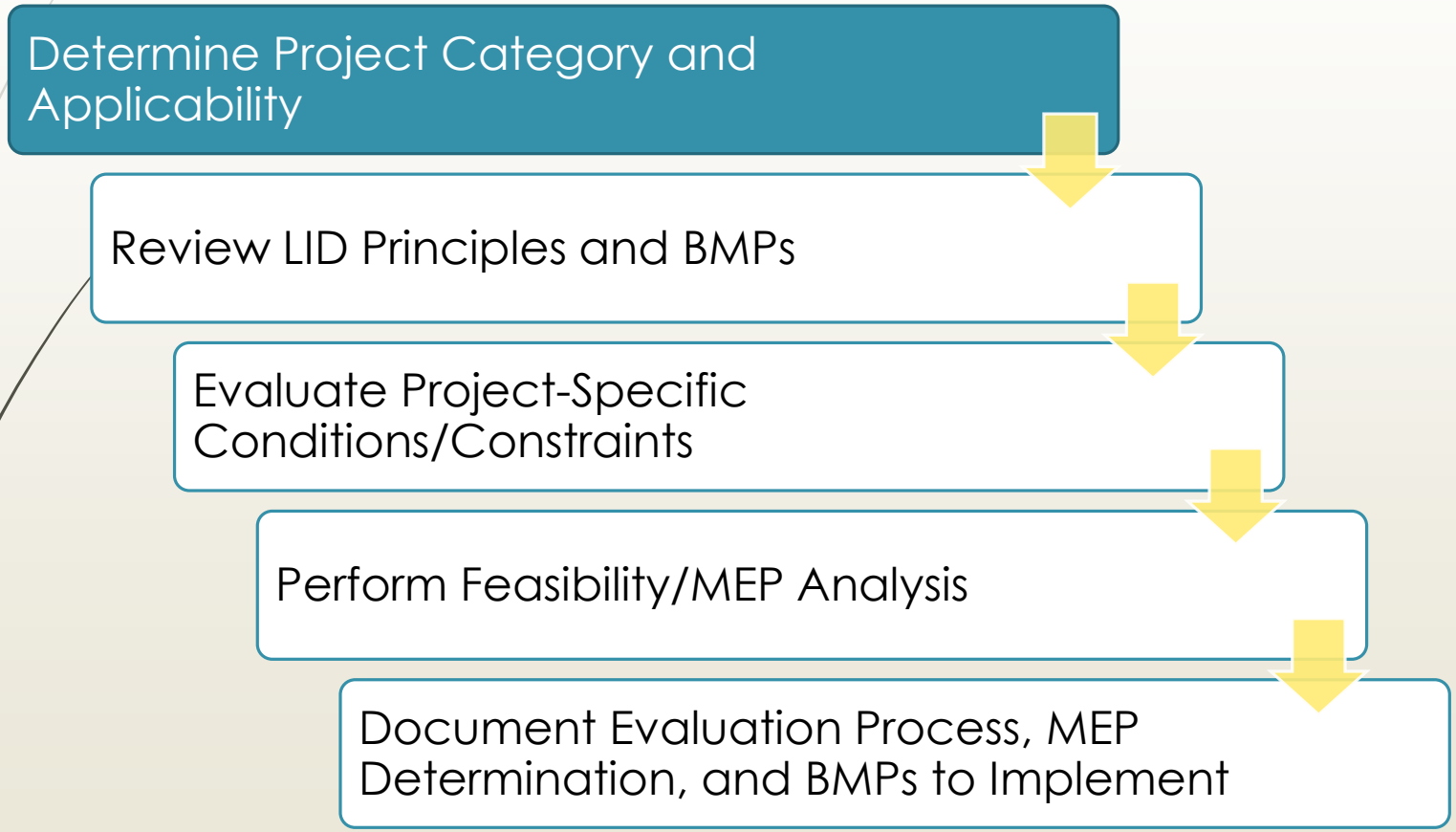

Purpose & Applicability

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Applicability	Projects Included
Guidance Applies	• Public Transportation Projects in the area covered by the Santa Ana Region MS4 Permit, which involve the construction of new transportation surfaces or the improvement of existing transportation surfaces (including Class I Bikeways and sidewalks).
Guidance Does Not Apply	• Transportation Projects that have received CEQA approval by the effective date of this Guidance (April 22, 2013) • Emergency Projects, as defined by Guidance • Maintenance Projects, as defined by Guidance • Dirt or gravel roads • Transportation Projects part of a private new development or significant redevelopment project and required to prepare a WQMP • Projects subject to other MS4 Permit requirements, e.g., Caltrans oversight projects, cooperative projects with adjoining County or agency outside Santa Ana Region MS4 Permit jurisdiction

Purpose & Applicability

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Purpose & Applicability

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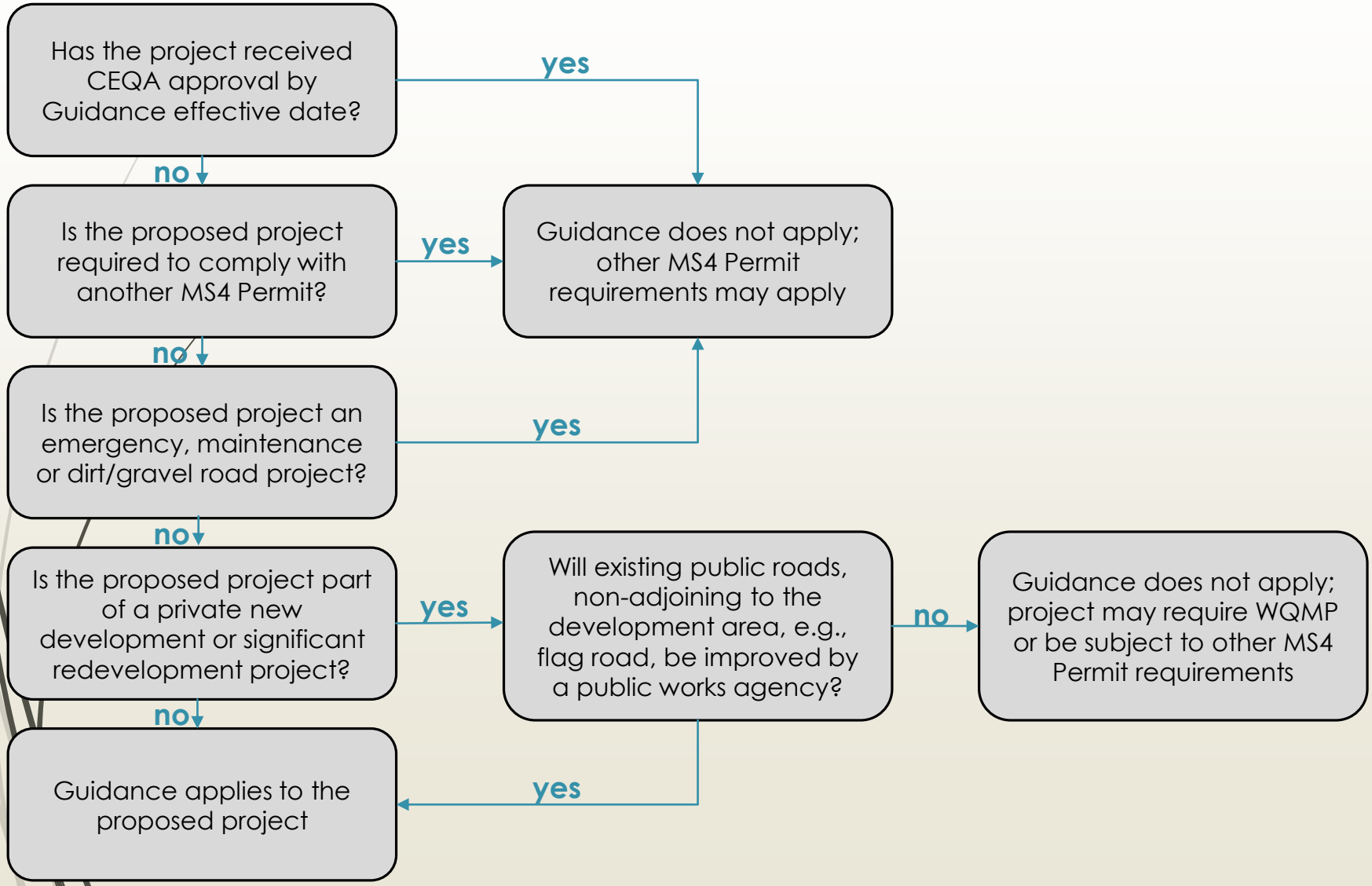

Applicability Project Categories

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Category	Project Type	Guidance Applicability
1	Emergency Projects	Exempt
2	Maintenance Projects	Exempt
3	Existing Transportation Projects	Non-Exempt
4	New Transportation Projects	Non-Exempt

Example Category 1 & 2 Projects

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Category	Project Examples
Category 1 – Emergency Projects	• Emergency road work of any nature that occurs outside the normal planning process
Category 2 – Maintenance Projects	• Routine, reactive, or preventive maintenance activities • Pavement preservation, preventive maintenance, pavement reconstruction, or pavement rehabilitation activities within the existing surface footprint • Traffic control device improvements to address safety concerns • Bridge rehabilitation within existing surface footprint (no traffic capacity change or modification of existing drainage) • Seismic enhancement / retrofit projects • Safety enhancement projects that result in the addition of no new transportation surfaces • Median improvement projects with no new road surface that does not increase the overall median imperviousness by more than 5% • Curb and gutter improvements • Utility cuts • Alteration of the existing road profile within the existing surface footprint

Example Category 3 Projects

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Category	Project Examples
Category 3 - Roadway Capacity Improvement	• Lane additions • Bridge capacity improvements • Grade separation projects, where capacity is increased
Category 3 - Non-Capacity Roadway Improvement	• Shoulder / parking lane improvements • Turn pocket additions • Signal project that adds a turn lane • Horizontal alignment correction to improve sight distance • Grade separation projects, where no change in capacity • Addition of passing lane • Addition of a turn out • Addition of a bike lane or sidewalk that adjoins an existing roadway
Category 3 - Class I Bikeway & Sidewalks	• Improvements to existing Class I Bikeway or sidewalk, not adjoining a roadway

Example Category 4 Projects

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Category	Project Examples
Category 4 - New Transportation Projects	• New road or bridge project • New Class I Bikeway or sidewalk project, not adjoining a roadway

Example Project

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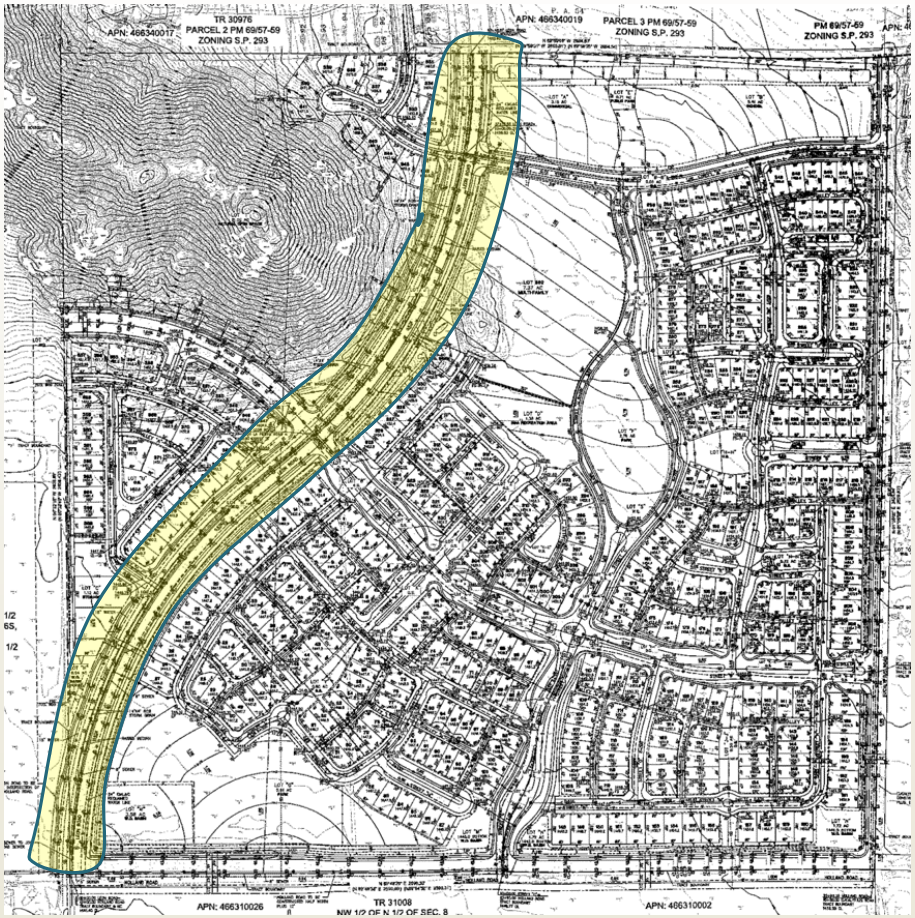
- Tract Development with a <u>new</u> major roadway
  - WQMP Project
- Does this area qualify as a TPG Project?
  - Why?
  - Why Not?



Project Evaluation Process Flow Chart

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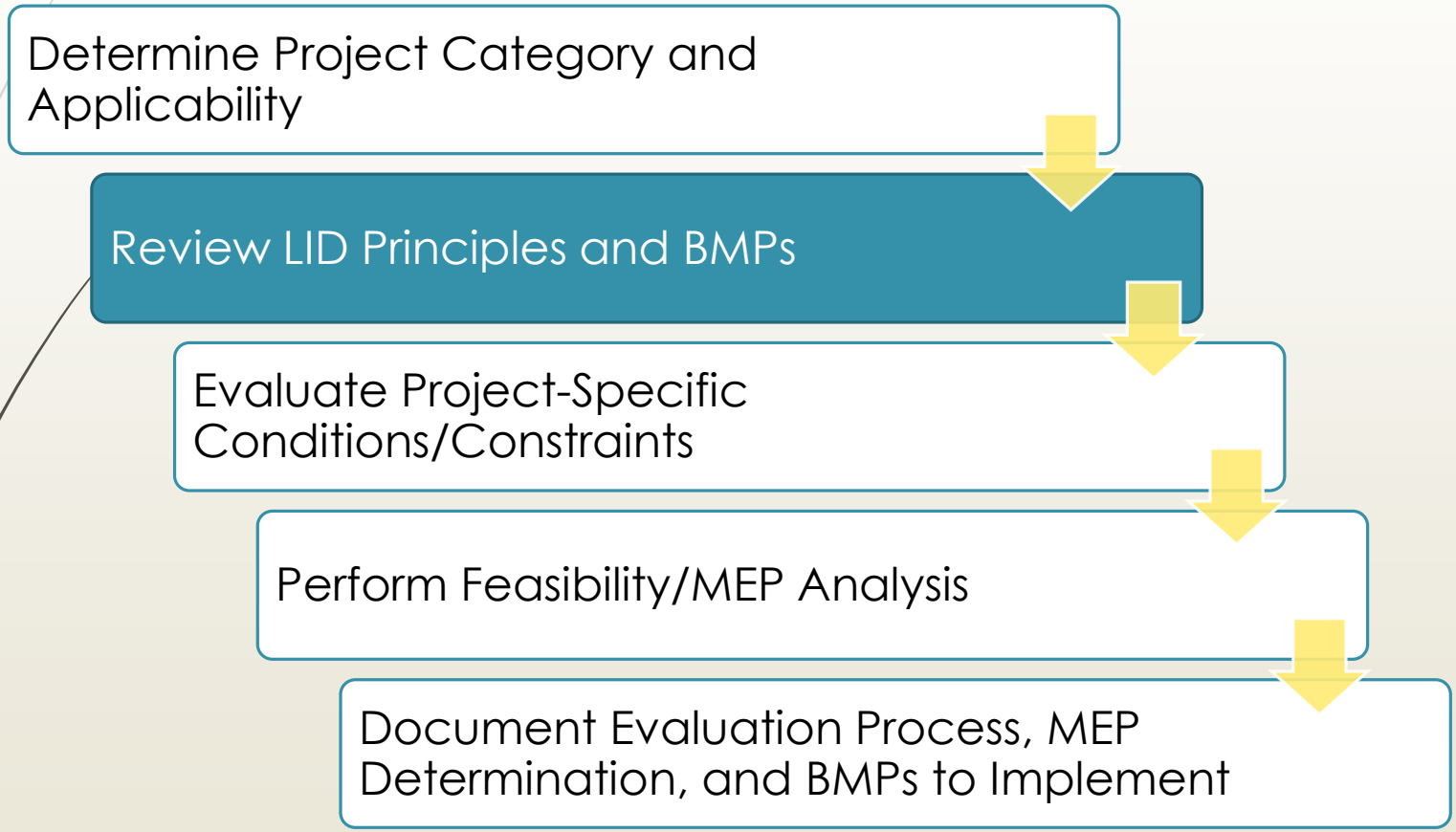

LID Principles and Use of LID-Based BMPs

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- Transportation Projects shall incorporate the following LID Principles and BMPs to the maximum extent practicable:
  - Conservation of natural areas to the extent feasible
  - Minimization of the impervious footprint
  - Minimization of disturbances to natural drainage
  - Design and construct pervious areas to receive runoff from impervious areas
  - Use of landscaping that minimizes irrigation and runoff, promotes surface infiltration, and minimizes the use of pesticides and fertilizers

LID-Based BMPs: Minimize Road Widths

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- Plan site layout and road network to respect the existing hydrologic functions of the land (preserve wetlands, buffers, high-permeability soils, etc.) and minimize the impervious area
- Minimize road widths while maintaining jurisdictional code requirements for emergency service vehicles and a free flow of traffic
- Look for opportunities to eliminate imperviousness within all areas of the proposed project site

LID-Based BMPs: Drainage Swales

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- Plan site drainage using vegetated swales (preferably without irrigation) to accept sheet flow runoff and convey it in broad shallow flow to:
  - Reduce stormwater volume through infiltration,
  - Improve water quality through vegetative and soil filtration, and
  - Reduce flow velocity by increasing channel roughness
- Consider use of vegetated or pervious material swales before considering use of hard-lined impervious channels

LID-Based BMPs: Drainage Swales

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- Swales traditionally have been planted with grasses, requiring regular irrigation. If planted with drought-tolerant vegetation, swales will require little to no water once established.
- Suggested criteria for Plants used in vegetated swales:
  - Native or well-adapted to local climate
  - Low water use
  - Low fertilizer requirements
  - Minimal maintenance
  - Attractive in all seasons

Bioswale Example, Low Impact Development Center, Inc.

LID-Based BMPs: Drainage Swales

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- Identify additional benefits that may be attained from swales through:
  - Amended soils
  - Bioretention soils
  - Gravel storage areas
  - Underdrains
  - Weirs
  - Thick diverse vegetation, including, where possible, use of native vegetation
- What areas would swales be feasible?

Green Streets: EPA-833-F-09-002, August 2009, www.epa.gov/greeninfrastructure

LID-Based BMPs: Drainage Swales

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Photo Credit: Jeff Potts, City of Corona

LID-Based BMPs: Bioretention

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- Evaluate road configurations, topography, soil conditions, and space availability for opportunities to incorporate bioretention features
- Plan site layout using bioretention features, e.g., curb extensions, sidewalk planters, and tree boxes, designed to take runoff from the road
- Look for opportunities to use the roadway median as a bioretention feature
- Evaluate/select plants with respect to maintenance requirements, irrigation requirements, and plant height considering traffic safety and security
  - If an approved plant list is available, plants should be selected from this list.

LID-Based BMPs: Bioretention

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Green Streets: EPA-833-F-09-002, August 2009, www.epa.gov/greeninfrastructure

Green Streets: EPA-833-F-08-009, December 2008, water.epa.gov/infrastructure/greeninfrastructure

LID-Based BMPs: Bioretention

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Photo Credit: Jeff Potts, City of Corona

LID-Based BMPs: Permeable Pavement

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- Plan low speed and parking areas within a site layout for incorporating permeable pavement
- Evaluate permeable gutters
- Evaluate permeable concrete, permeable asphalt, permeable interlocking concrete pavers, and grid pavers as alternatives to conventional, less pervious concrete and asphalt surfaces
- Incorporate an aggregate base to provide structural support, runoff storage, and pollutant removal through filtering and adsorption

Green Streets: EPA-833-F-09-002, August 2009, www.epa.gov/greeninfrastructure

LID-Based BMPs: Sidewalk Trees and Tree Boxes

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- Evaluate site opportunities to incorporate tree cover into site layout, e.g., using sidewalk tree features and tree boxes
- Provide sufficient uncompacted soil and space for proper tree health/growth via larger tree boxes, structural soils, root paths, or "silva cells" that allow sufficient tree root space

Green Streets: EPA-833-F-09-002, August 2009, www.epa.gov/greeninfrastructure

LID-Based BMPs: Sidewalk Trees and Tree Boxes

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- Consider sufficient tree space in the right-of-way while maintaining traffic and pedestrian safety
- Consider sufficient tree space for root growth to prevent road structural impacts
- Evaluate space for trees versus added construction costs
- Evaluate species water needs and availability of irrigation

Green Streets: EPA-833-F-09-002, August 2009, www.epa.gov/greeninfrastructure

LID-Based BMPs: Infiltration Basins

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- Infiltration basins can have high pollutant removal efficiency and can reduce flows to mimic pre-development hydrologic conditions
- Plan roadway drainage to be directed away from the road surface to infiltration basins
  - Typical detention or retention basins may be designed as infiltration facilities in some cases, with the ability to store runoff until it gradually exfiltrates through the soil
  - 72-hour drawn down is usually recommended
- Use of infiltration BMPs shall be consistent with the pretreatment of runoff prior to infiltration requirements established by the MS4 Permit for areas subject to high vehicular traffic (25,000 or more average daily traffic)

LID-Based BMPs: Infiltration Basins

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- Use of infiltration basins should consider:
  - Appropriate soil conditions for infiltration and potential site constraints
  - Groundwater separation should be at least 10 feet from the basin invert to the measured groundwater elevation
  - Traffic / pedestrian safety and site aesthetics

www.casqa.org – California BMP Handbooks

LID-Based BMPs: Infiltration Basins

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- Reference the County's design criteria for infiltration basins to be consistent with design requirements (note that Caltrans also has design requirements for basins in their right-of-way)

www.casqa.org – California BMP Handbooks

BMP Example: Curb Extensions

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STORMWATER CURB EXTENSIONS

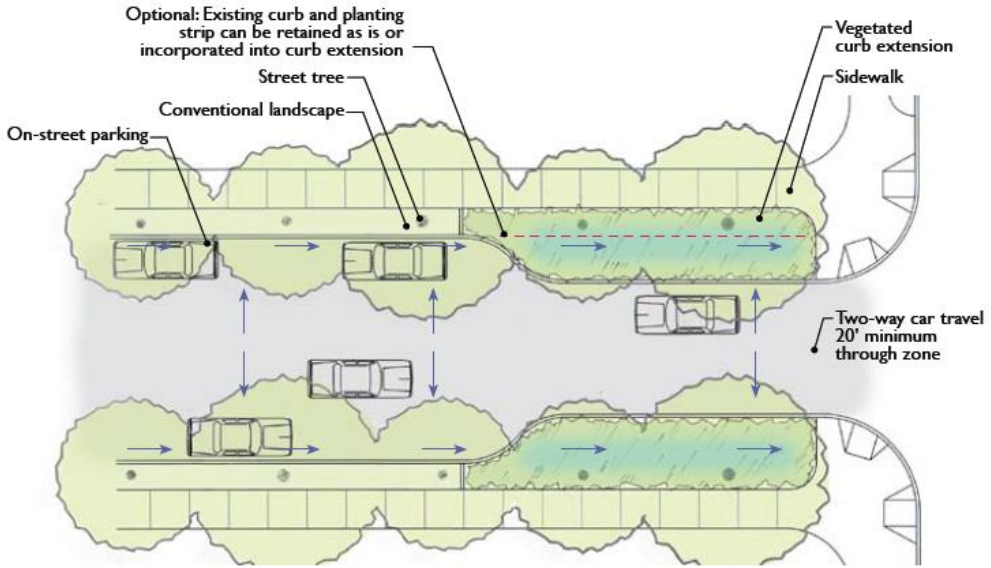
Conventional curb extensions (also known as curb bulb outs, chokers, or chicanes) have been used for decades to enhance pedestrian safety and help in traffic calming.

A stormwater curb extension simply incorporates a rain garden into which runoff flows.

TYPICAL STREET

OPPORTUNITY

IMPLEMENTATION



Source: Green Streets: EPA-833-F-09-002, August 2009, water.epa.gov/aboutow/eparecovery/upload/2009_09_10_eparecovery_EPA_ARRA_Green_Streets_FINAL.pdf

BMP Example: Curb Extensions

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STORMWATER CURB EXTENSIONS

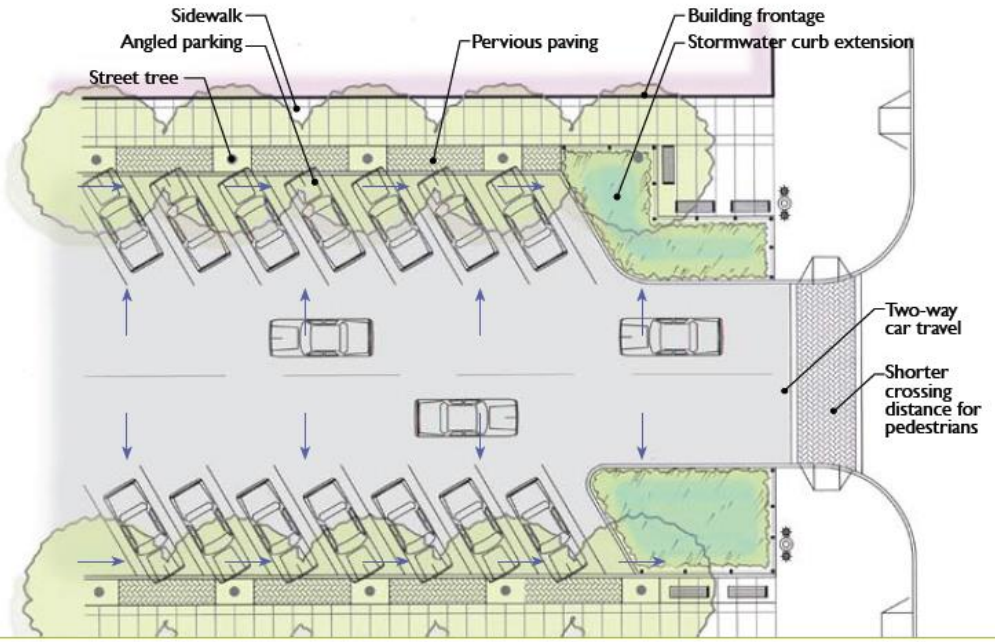
Stormwater curb extensions on commercial streets are similar to those on residential streets. They are rain gardens typically located near the corners that can also provide the pedestrian with a more comfortable crossing.

Curb extensions can also be located mid-block by converting one or more parking spaces.

EXISTING

OPPORTUNITY

IMPLEMENTATION



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BMP Example: Vegetated Swales

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VEGETATED SWALES

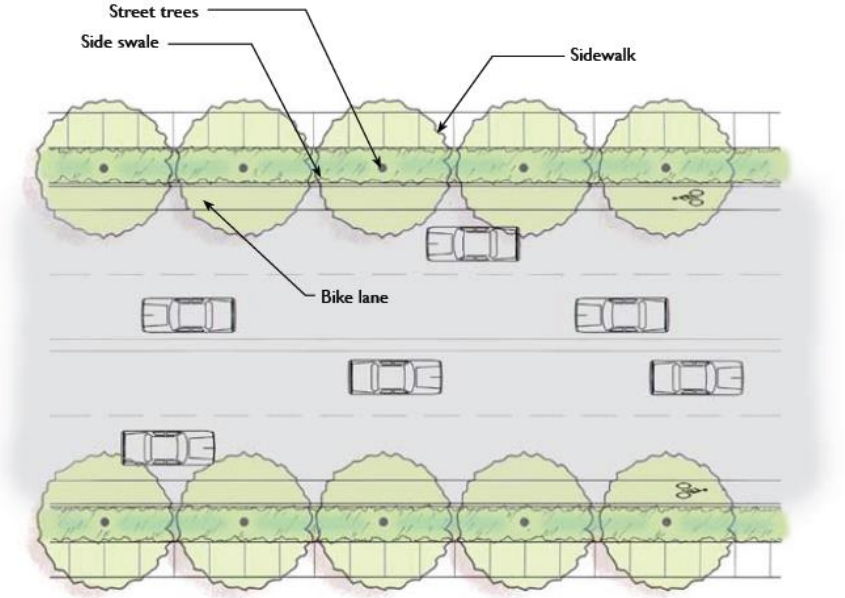
Like residential streets, arterial roadways are good street types for swales because they typically have long, linear stretches of uninterrupted space that can be used to manage stormwater.

Some arterials may not have landscape space in place but do have travel lanes or paved shoulders that can be narrowed to create space for swales.

TYPICAL STREET

OPPORTUNITY

IMPLEMENTATION



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BMP Example: Vegetated Swales

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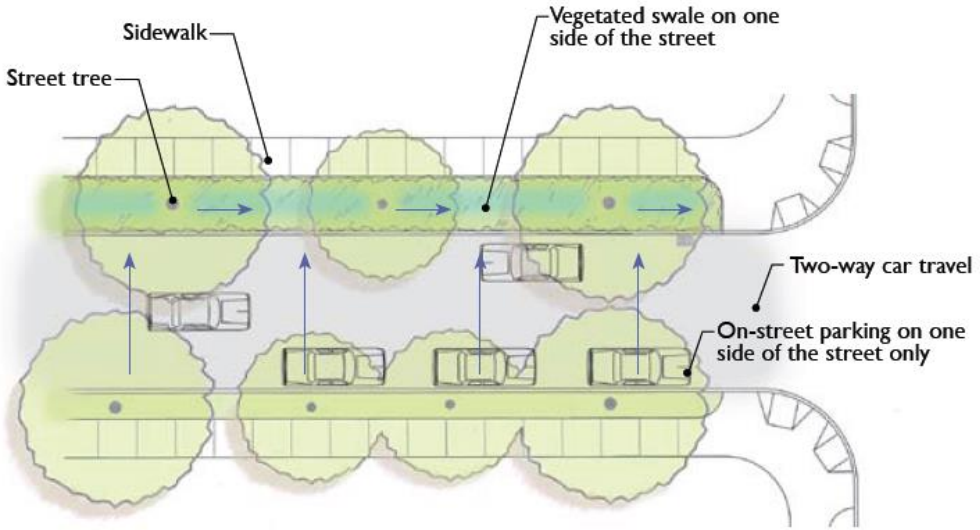
VEGETATED SWALES

Swales are long, shallow vegetated depressions, with a slight longitudinal slope. As water flows through the swale, it is slowed by the interaction with plants and soil, allowing sediments and pollutants to settle out. Water soaks into the soil and is taken up by plants, and may infiltrate further into the ground if the soil is well-drained.

EXISTING

OPPORTUNITY

IMPLEMENTATION



Source: Green Streets: EPA-833-F-09-002, August 2009, water.epa.gov/aboutow/eparecovery/upload/2009_09_10_eparecovery_EPA_ARRA_Green_Streets_FINAL.pdf

BMP Example: Permeable Pavement

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PERMEABLE PAVING

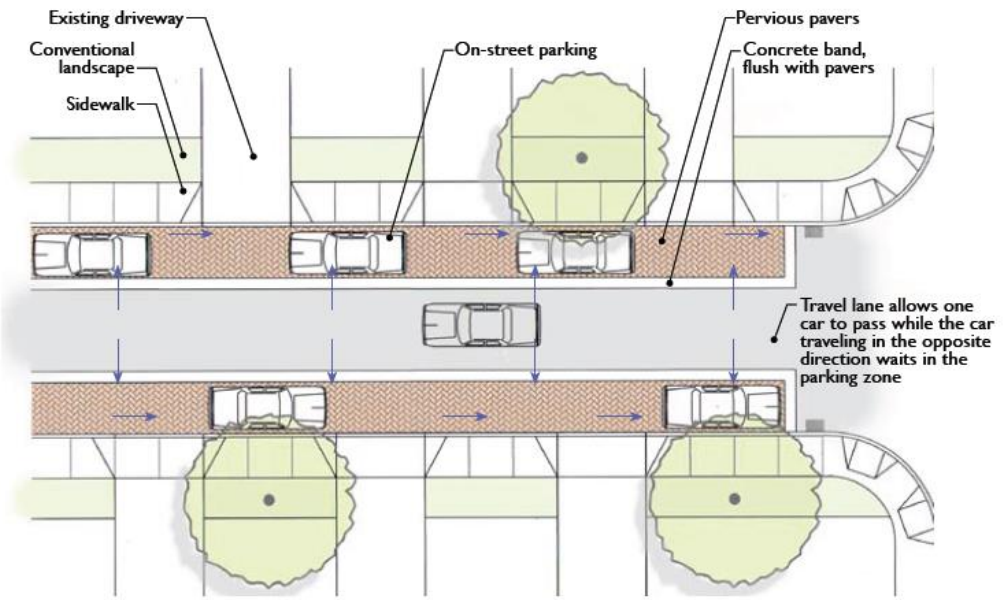
Permeable paving (pavers, or porous asphalt and pervious concrete) in the parking lane converts impervious surfaces to allow stormwater to absorb into the ground, which reduces the amount of runoff without any loss of parking on the street.

The aesthetics of permeable paving can also give the illusion of a narrower street and therefore help calm traffic.

EXISTING

OPPORTUNITY

IMPLEMENTATION



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BMP Example: Permeable Pavement

rcwatershed.org

PERMEABLE PAVING

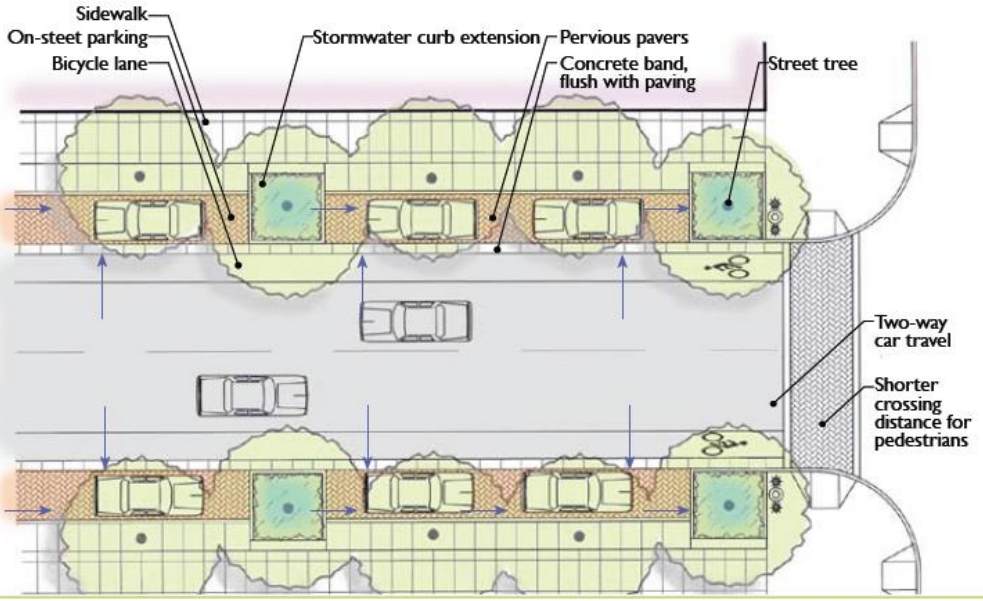
Permeable paving on commercial streets can be incorporated into sidewalks and parking lanes.

Recent advances in permeable paving technologies now make many appropriate for higher speeds or where large, heavy vehicles are expected to be parked—areas such as loading zones and bus stops.

EXISTING

OPPORTUNITY

IMPLEMENTATION



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BMP Example: Planters

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STORMWATER PLANTERS

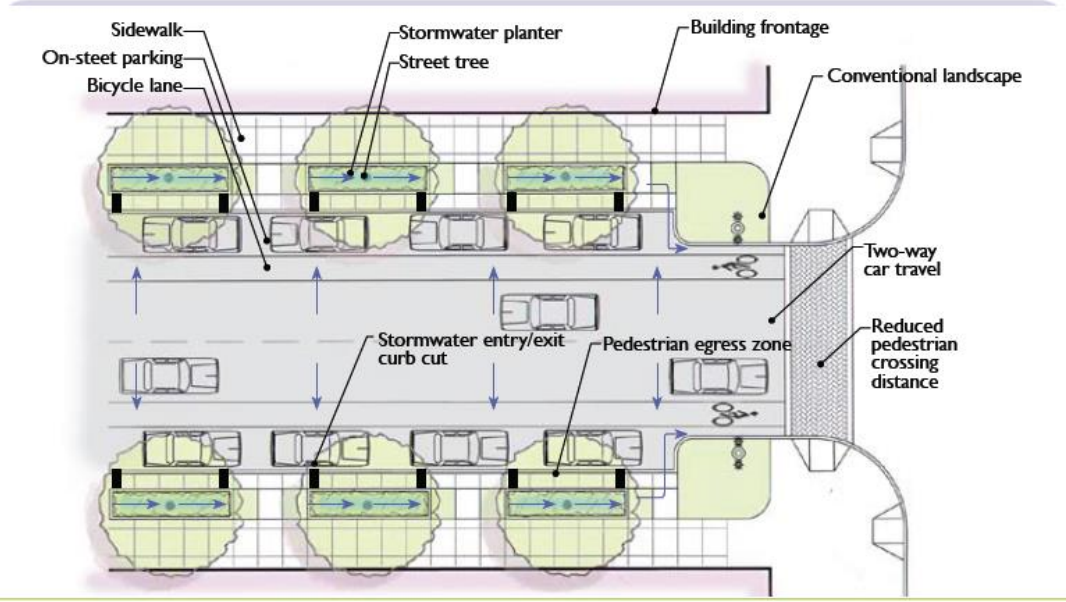
Planters are long, narrow landscaped areas with vertical walls and flat bottoms, typically open to the underlying soil. They allow for more storage volume than a swale in less space.

Water flows into the planter, absorbs into the plants and topsoil, fills to a predetermined level, and then, if necessary, overflows into a storm sewer system. If desired, planters can accommodate street trees.

TYPICAL STREET

OPPORTUNITY

IMPLEMENTATION



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water.epa.gov/aboutow/eparecovery/upload/2009_09_10_eparecovery_EPA_ARRA_Green_Streets_FINAL.pdf

Integrative Design: Complete Streets

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Streets for Mobility

Streets for the Environment

Streets for Community

Complete Streets are a natural complement to sustainability efforts, ensuring benefits for mobility, community, and the environment

Source: *Complete Streets are Green Streets http://anr.vermont.gov/sites/anr/files/specialtopics/muniday/documents/Complete-Streets-are-Green-Streets-Municipal-Day-Sept-2015.pdf*

Integrative Design: Complete Streets

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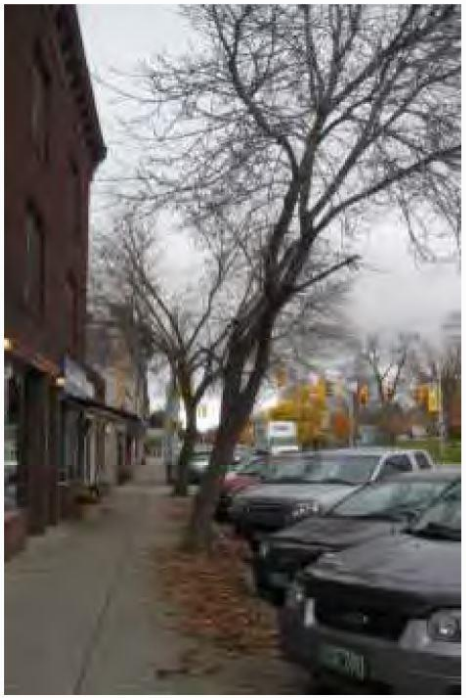
ST. ALBANS

Before



2015 Municipal Day

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Integrative Design: Complete Streets

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ST. ALBANS

After

Treatment Bays

2015 Municipal Day

Source: *Complete Streets are Green Streets http://anr.vermont.gov/sites/anr/files/specialtopics/muniday/documents/Complete-Streets-are-Green-Streets-Municipal-Day-Sept-2015.pdf*

Discussion: Complete Street Opportunities

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103RD STREET - EXISTING CONDITIONS

Source: *Watts Green Streets, p. 34*
http://wattsreimagined.org/wp-content/uploads/2015/04/Exhibit-3.1-Watts-Greenstreets.pdf

Discussion: Complete Street Opportunities

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(B) - 103RD STREET PROPOSED IMPROVEMENTS - STREET SECTIONS

SECTION D-D

Plant recommendations include drought tolerant and L.A. River Masterplan species

Source: *Watts Green Streets, p. 34*
http://wattsreimagined.org/wp-content/uploads/2015/04/Exhibit-3.1-Watts-Greenstreets.pdf

Integrative Design:
The Complete Street Advantage

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- Complete Streets are Green Streets!
- Multi-Perspective Approach
  - Safety, Accessibility, Mobility, Land Use, Community Needs
  - Create spaces for both vehicles and pedestrians; more choices for getting around
- Solve more than one problem at a time

Project Evaluation Process Flow Chart

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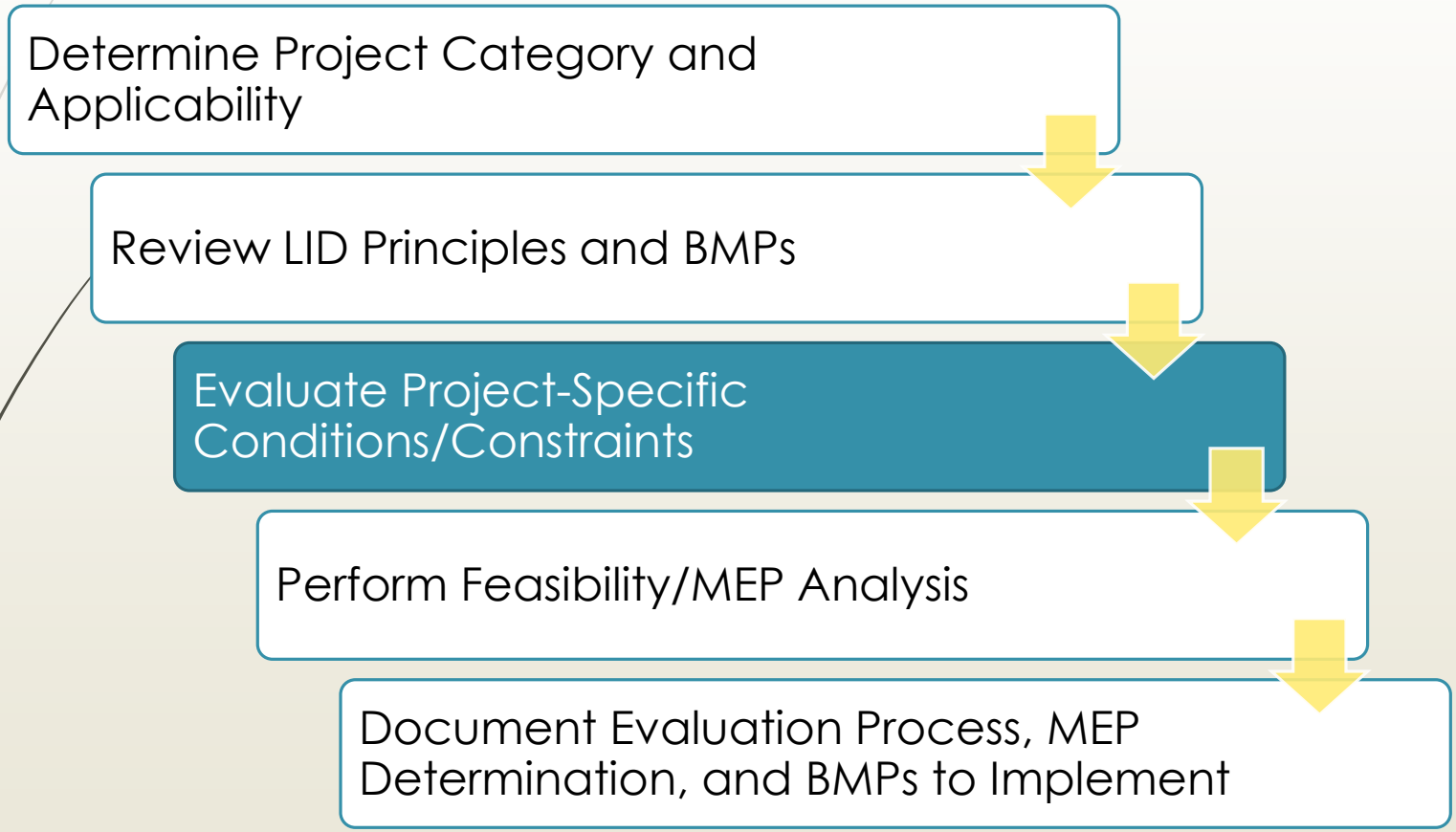

Potential Project Constraints

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- **Regulatory Requirements**
  - TMDL/Impaired Waters requirements
  - Environmentally sensitive areas
  - CEQA mitigation measures
  - 401 cert / 404 Permit, Section 1602
- **Site-specific Characteristics**
  - Drainage characteristics
  - Soil characteristics, geologic conditions
  - Elevated groundwater conditions
  - Groundwater protection areas
  - Natural sediment loads
- **Infrastructure & Project-specific Characteristics**
  - Programmatic or funding restrictions
  - Right-of-way constraints
  - Existing features (drainage, curb and gutter, grades, etc.)
  - Utility constraints (e.g., pipelines, cables)
  - Availability of irrigation water
  - Availability of power
  - Types of traffic loads
  - Maintenance resources and expertise

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  - Types of traffic loads
  - Maintenance resources and expertise

Transportation Project Elements

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Evaluated as Part of Project Analysis

- Program Requirements/Funding Restrictions
  - Restriction on use of funds; ADA requirements; relative costs
- Drainage Connectivity and Utilities
  - Run-on conditions; drainage patterns; existing utility placement
- Environmentally Sensitive Areas and Impaired Waterbodies
  - Site-specific regulatory compliance requirements
- Road Widths and Parking Requirements
  - Code requirements and road standards
- Applicability of LID-Based BMPs
  - Feasibility analysis using Guidance Template
- Maintenance Requirements
  - Ease of maintenance; expertise; cost considerations

Project Evaluation Process Flow Chart

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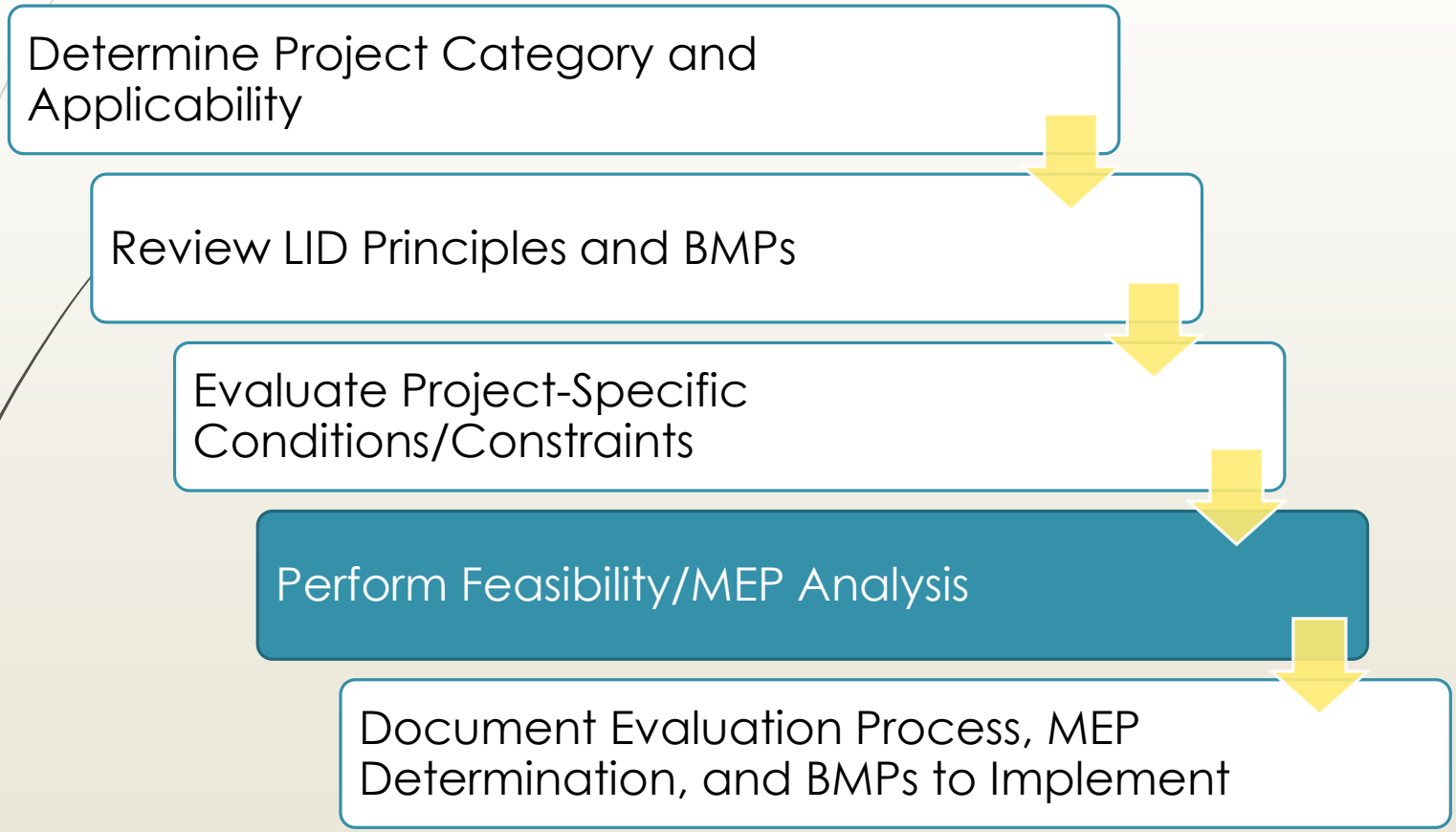

BMP Feasibility Analysis – Guidance Template

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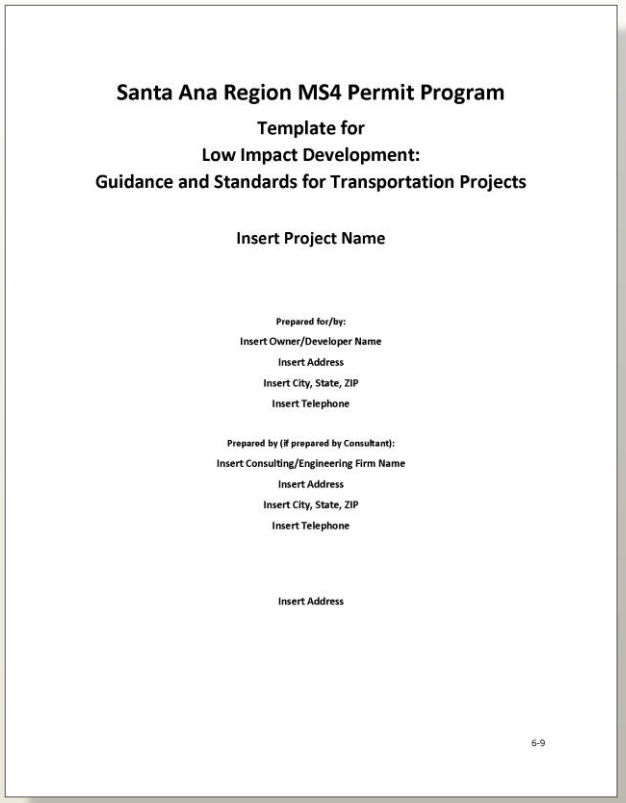
- Exhibit D of the WQMP (the TPG) includes information on conducting the feasibility analysis
  - TPG Section 3.B provides a general overview
  - TPG Section 6 includes a Template
- TPG Template
  - Table 5.1 BMPs to Evaluate
  - Table 5.2 BMP Design Information
  - Table 5.3 – LID BMP Feasibility Analysis for Trans. Projects
  - Table 5.4 – LID BMP Feasibility Analysis for Class I Bikeways and Sidewalks



Santa Ana Region MS4 Permit Program

Template for
Low Impact Development:
Guidance and Standards for Transportation Projects

Insert Project Name

Prepared for/by:
Insert Owner/Developer Name
Insert Address
Insert City, State, ZIP
Insert Telephone

Prepared by (if prepared by Consultant):
Insert Consulting/Engineering Firm Name
Insert Address
Insert City, State, ZIP
Insert Telephone

Insert Address

6-9

Source Control Considerations

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Project Type	Non-Structural BMPs	Structural BMPs
Category 3 or 4 Road Projects	• Irrigation System and Landscape Maintenance • Sweeping of Transportation Surfaces Adjoining Curb and Gutter • Drainage Facility Inspection and Maintenance	• MS4 Stenciling and Signage • Landscape and Irrigation System Design • Protection of Slopes and Channels
Class I Bikeway or Sidewalk Projects	• Public Education Program • Use of Signage • Installation and Maintenance of Trash Bins and Pet Waste Collection Bags	None identified in Guidance

Project Evaluation Process Flow Chart

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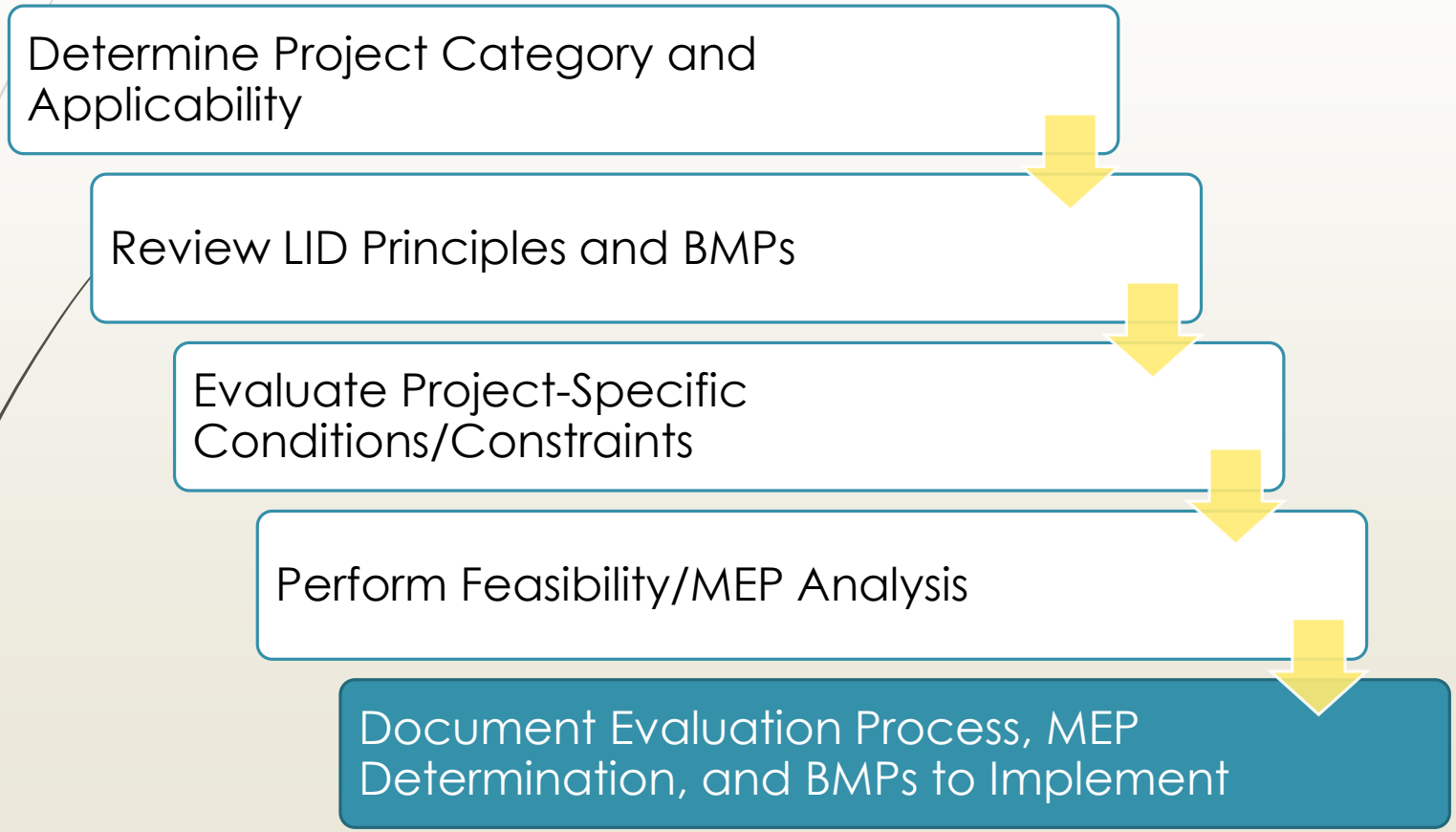

Project Documentation Requirements

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Category	Documentation Requirements	Additional Considerations
Category 1 & 2 Emergency and Maintenance Projects	Document that Guidance and the implementation of LID-based BMP practices did not apply to the proposed project	• Maintain this documentation along with all other information required for approval and permitting the proposed project within the project files
Category 3 & 4 Existing and New Transportation Projects	Incorporate following supplemental documentation in the project development file: • Project category and type • Site constraints • Feasibility analysis findings • LID-based BMPs incorporated into the project	• Document basis for funding restrictions limiting application of BMPs • BMPs documented via supplementary document to the proposed project plans, such as contract documents or specifications, or directly within the project plans as plan notes • Project plans and file documentation will show/describe the types, sizes, and locations of proposed BMP techniques -project BMP sizing documentation (Appendix A of Template must be included) • Maintain this documentation along with all other information required for approval and permitting the proposed project within the project files

Project Demonstration

Limonite Avenue Project Example

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- Project Description
- Project Information
- LID BMP Evaluation
- Source Control BMPs
- BMP Sizing
- Observations/learning experiences

Project Description

Limonite Avenue Project Description

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- Existing two-lane (one lane in each direction) roadway from Etiwanda to Downey Street
- City of Jurupa Valley General Plan, has Limonite Avenue as a six-lane Urban Arterial with 152' of ultimate right of way
- The City proposes interim improvements to a four-lane roadway with a center left turn or painted median from Etiwanda Avenue to Bain Street
- Interim project will address the immediate traffic needs and minimize traffic congestion in peak hour traffic
- Project is within the City jurisdiction; however, City has requested the County of Riverside to take lead to perform preliminary engineering and environmental clearance

Current Status

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- Project in preliminary design stage
  - Reviewed recent in-progress working drawings and compared with concept drawings used for prior training in Dec. 2012
  - No major changes in alignment or significant details
  - Previous drawings had areal map background so have continued to use these for training
  - Discussed several ideas with County design team and incorporated new info on county-owned property
- Project also undergoing environmental review

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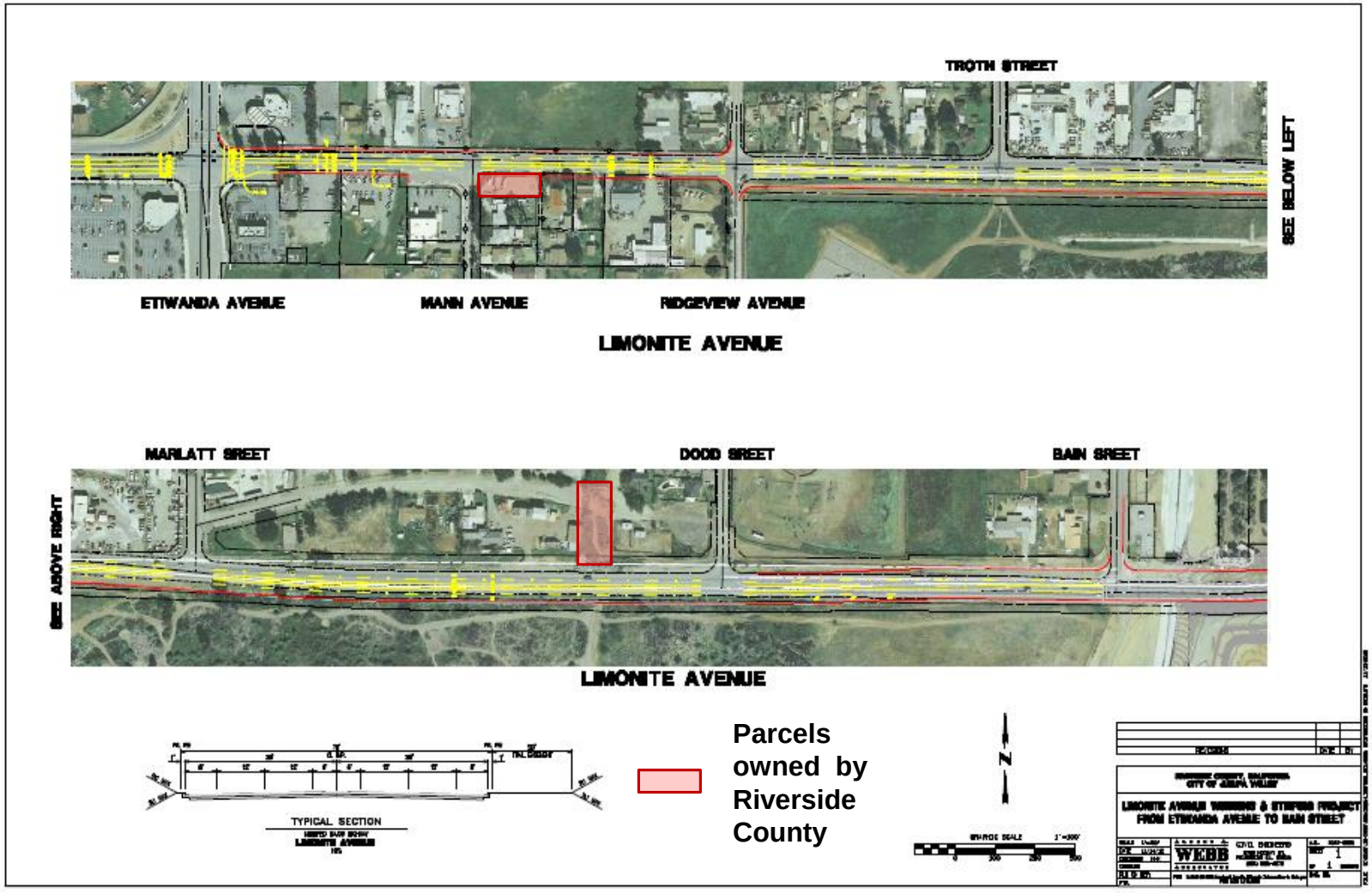

Typical Cross-Section
(varies depending upon available ROW)

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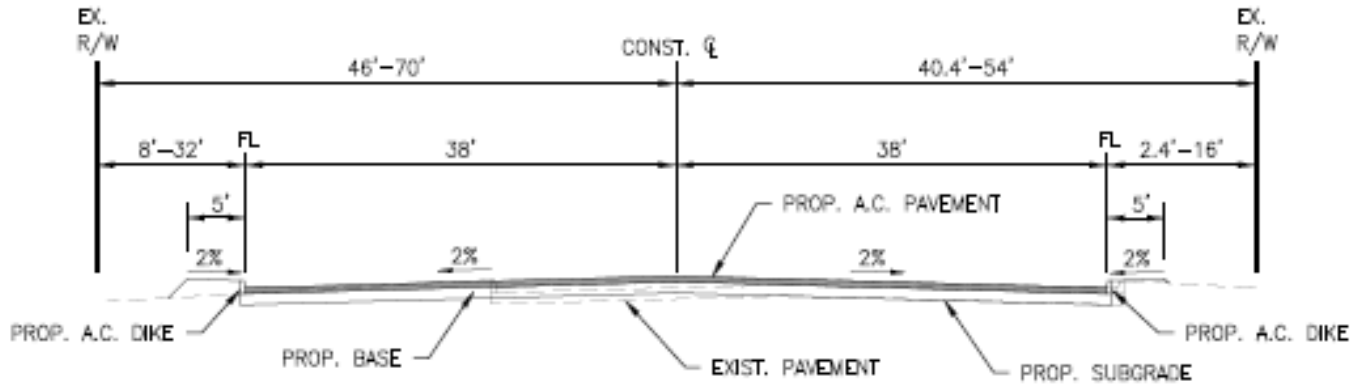

LIMONITE AVENUE
STA 39+97.63 TO STA 72+92.99
SECONDARY HIGHWAY STD. NO. 94 (MODIFIED)
A.C.=0.43', BASE=1.00'
T.I. = 8.5 , R = XX

Applicability of the Transportation Project Guidance to Proposed Project

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Table 1.1. Transportation Project Guidance Applicability

The Transportation Project Guidance applies to the following projects:

- Public Transportation Projects in the area covered by the Santa Ana Region MS4 Permit, which involve the construction of new transportation surfaces or the improvement of existing transportation surfaces (including Class I Bikeways and sidewalks)

The Transportation Project Guidance does not apply to the following projects that are either exempt or covered by other MS4 Permit requirements:

- Transportation Projects that have received CEQA approval by the effective date of this Guidance
- Emergency Projects, as defined by this Guidance (see Section 2 of the Guidance)
- Maintenance Projects, as defined by this Guidance (see Section 2 of the Guidance)
- Dirt or gravel roads
- Transportation Projects that are part of a private new development or significant redevelopment project and required to prepare a Water Quality Management Plan (WQMP)
- Transportation Projects subject to other MS4 Permit requirements, e.g., California Transportation Department (Caltrans) oversight projects, cooperative projects with an adjoining County or an agency outside the jurisdiction covered by the Santa Ana Region MS4 Permit.

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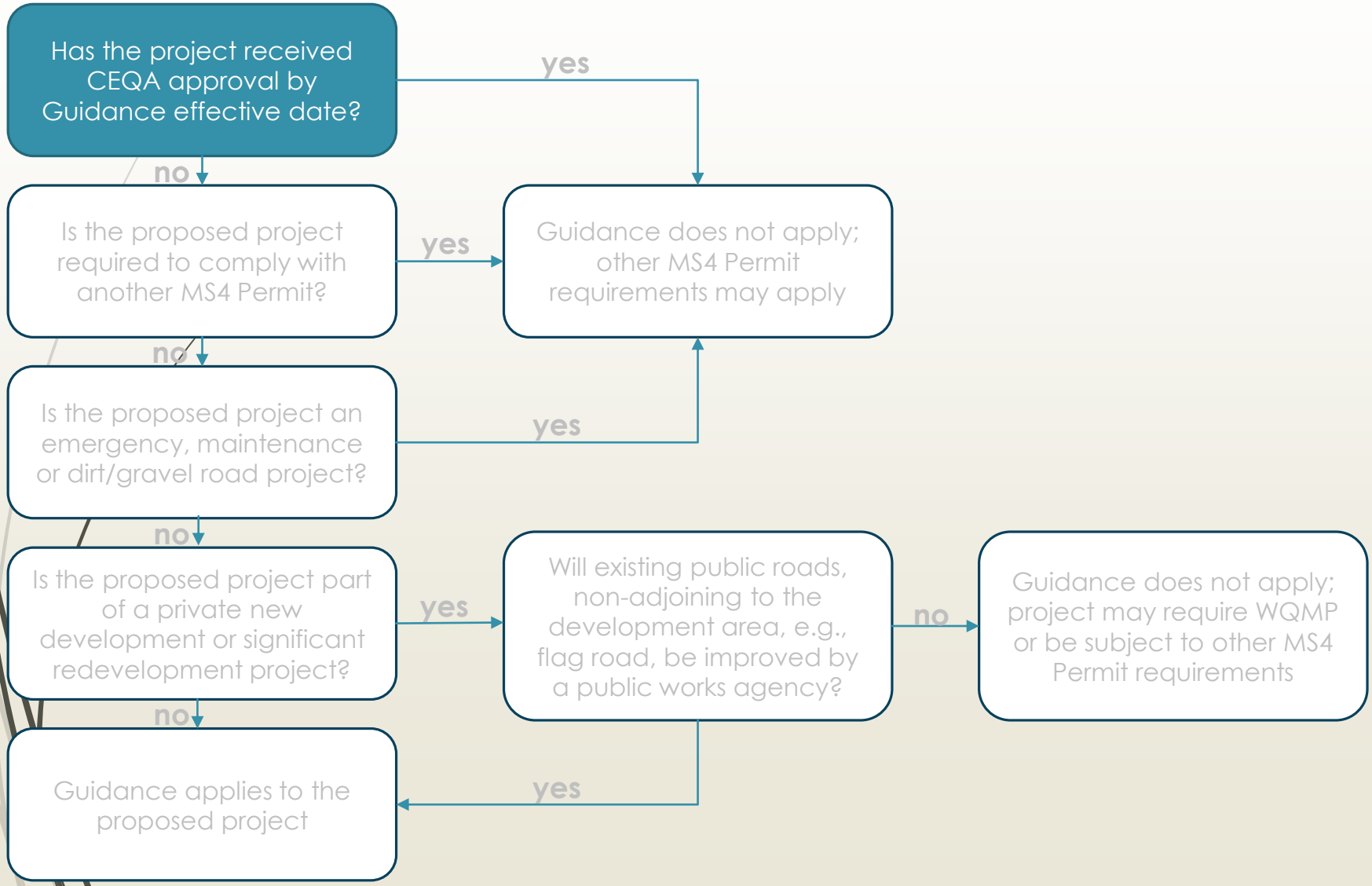

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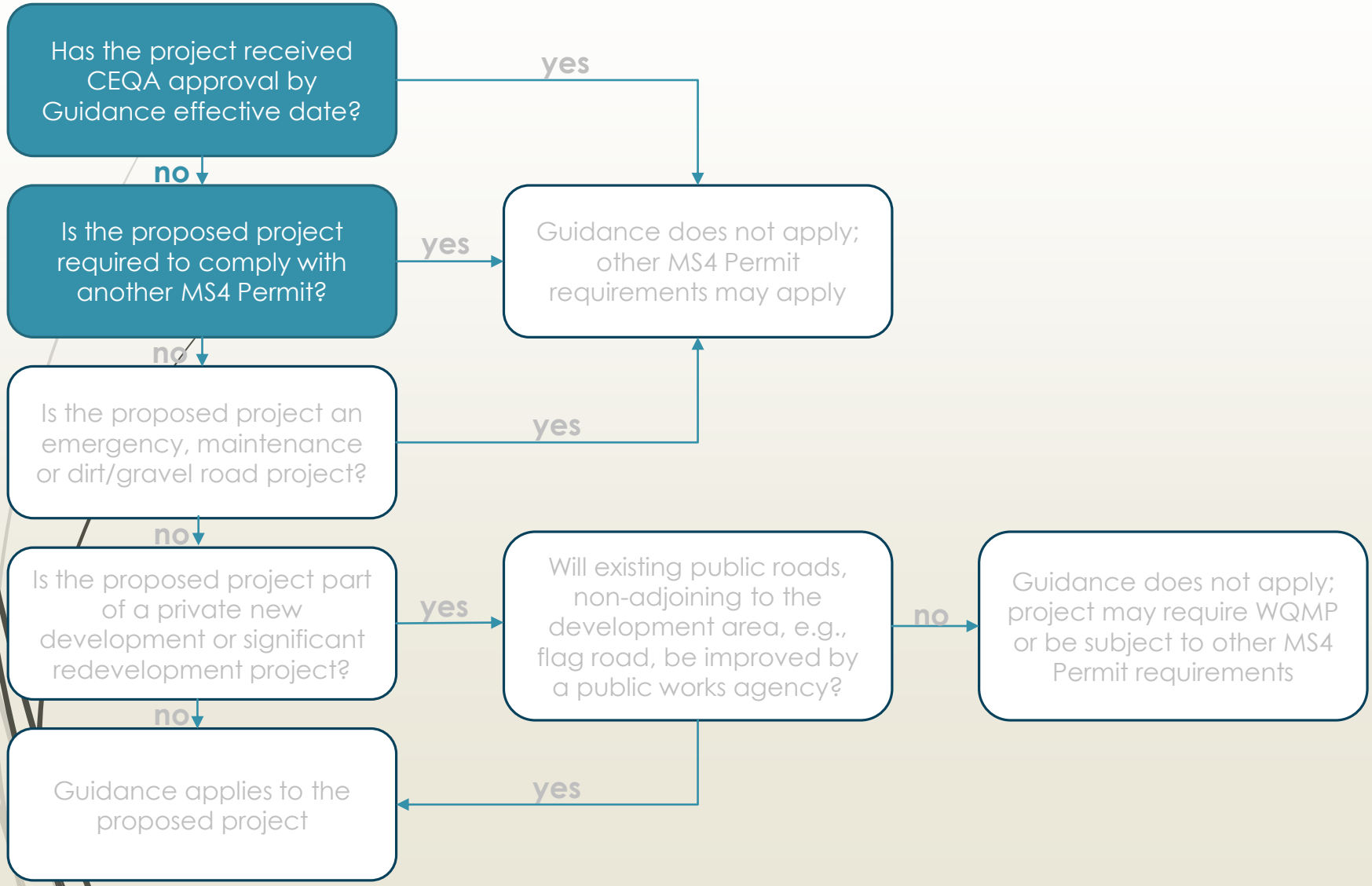

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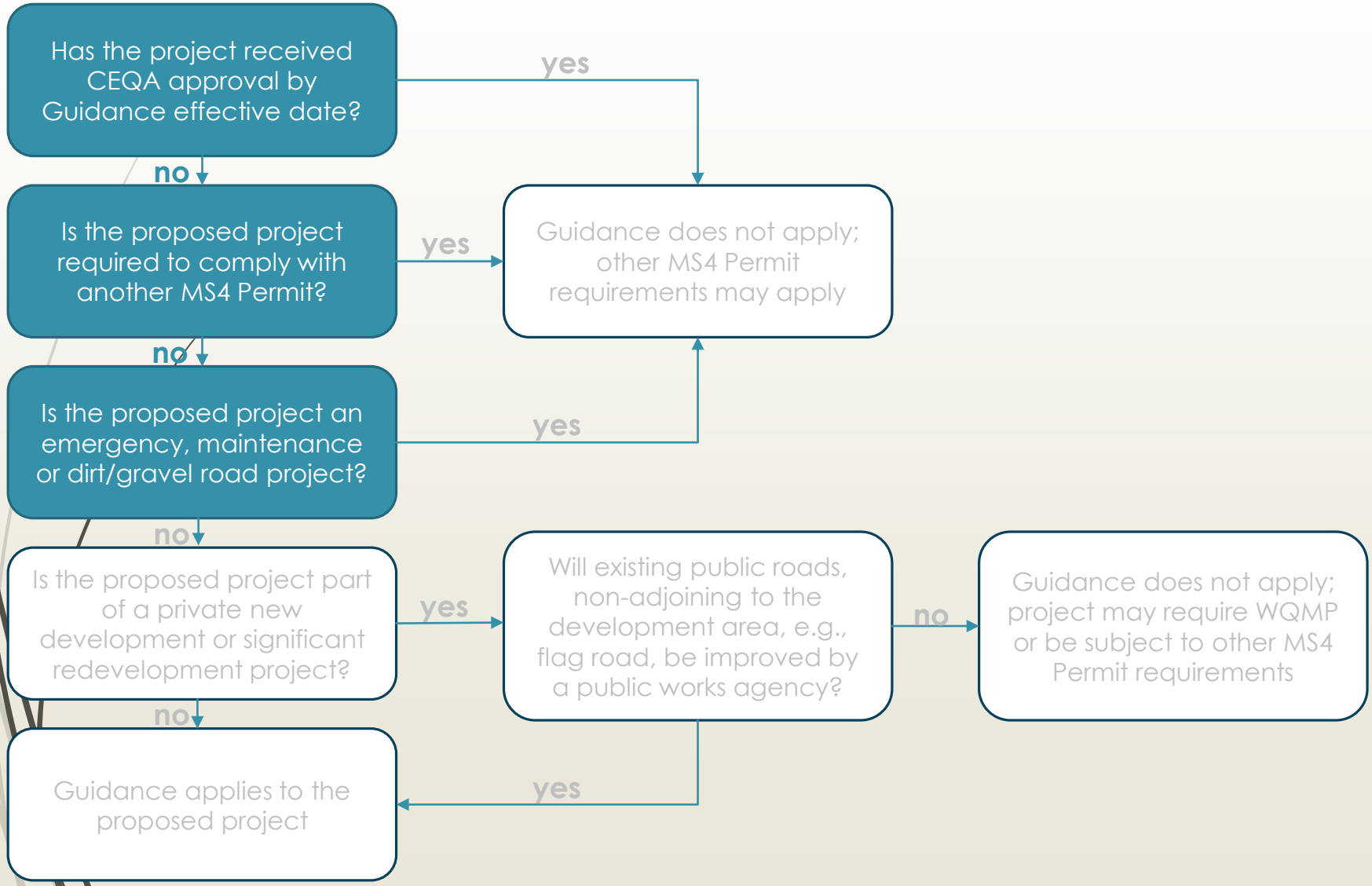

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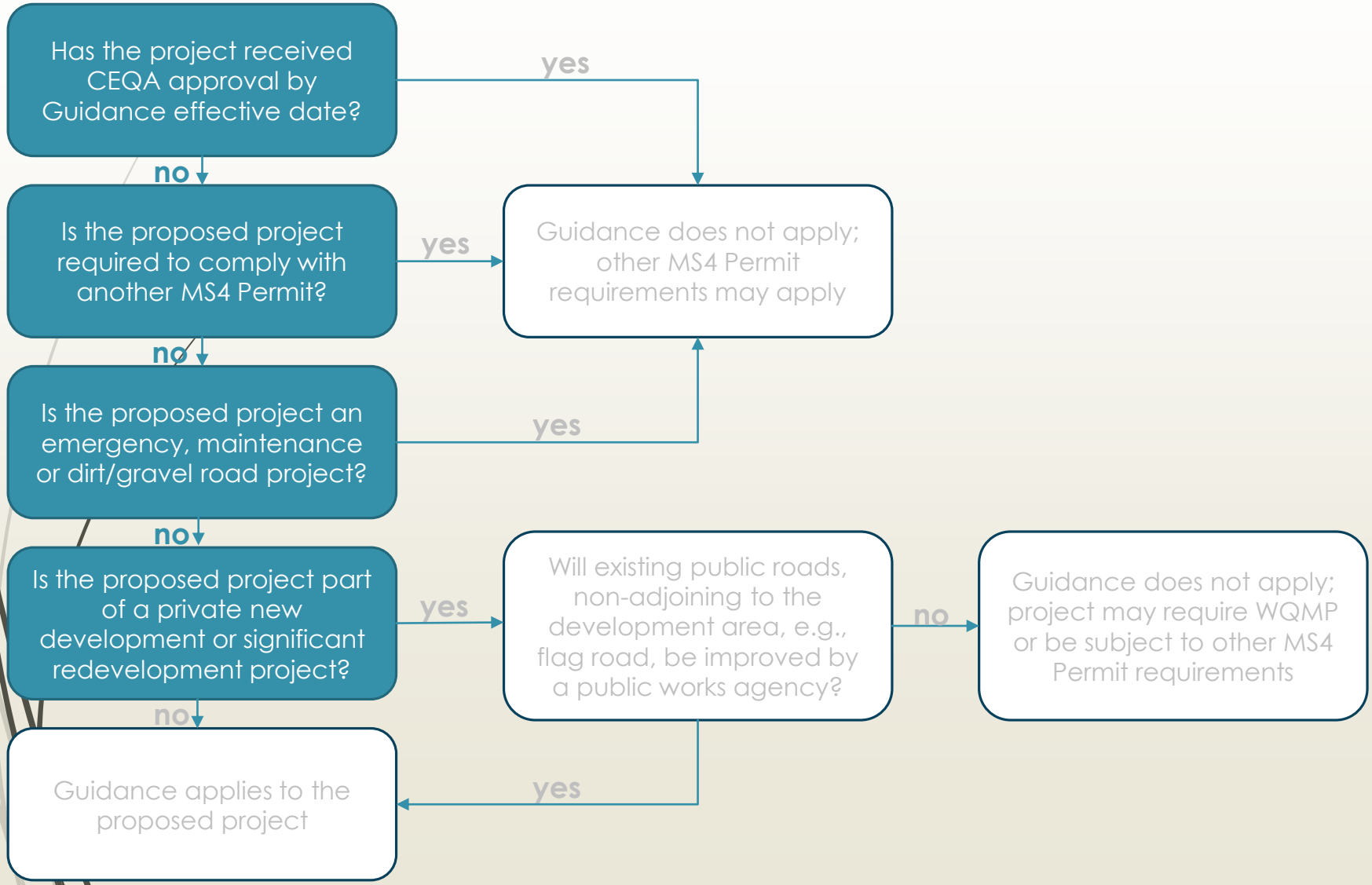

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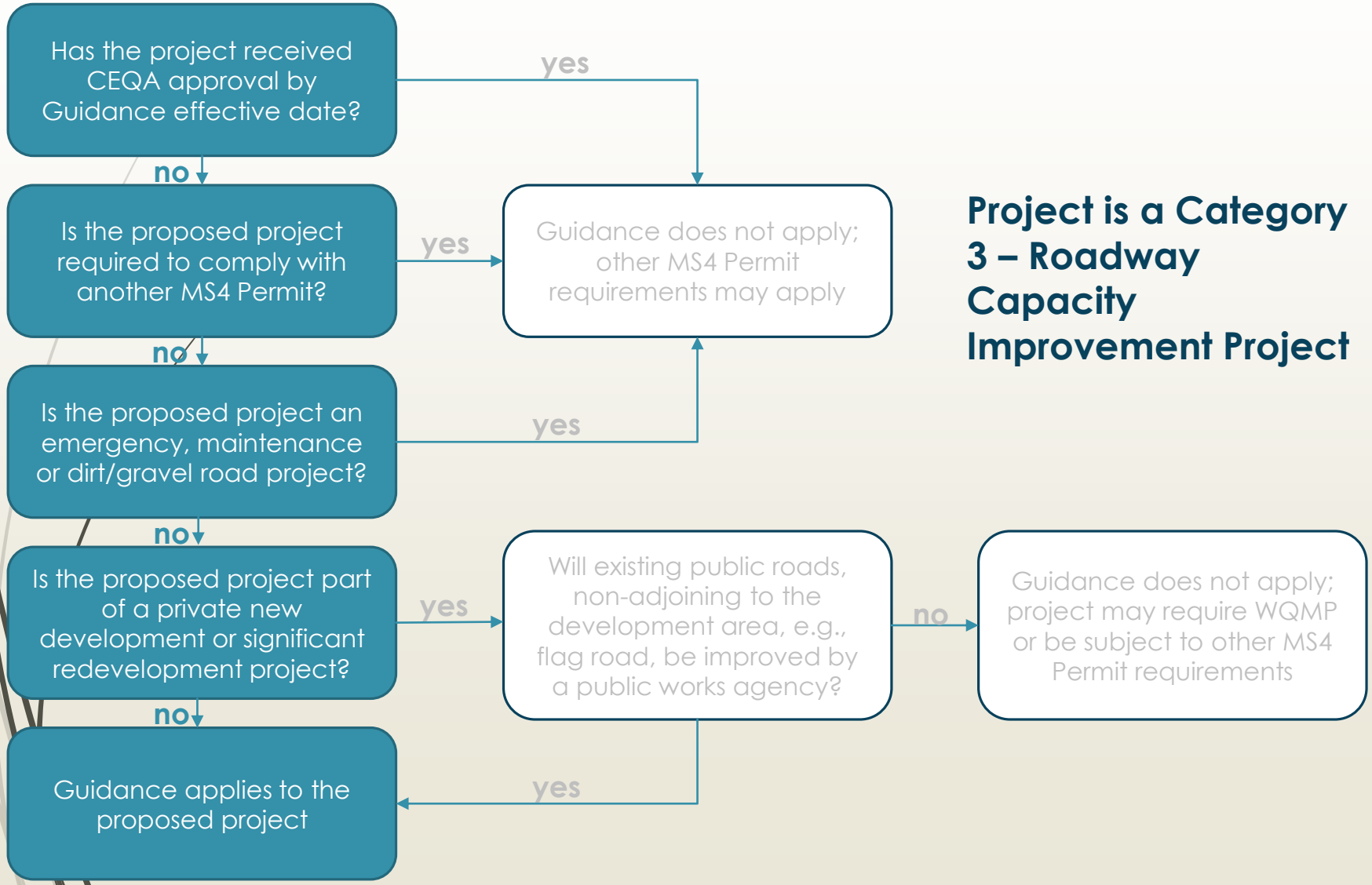
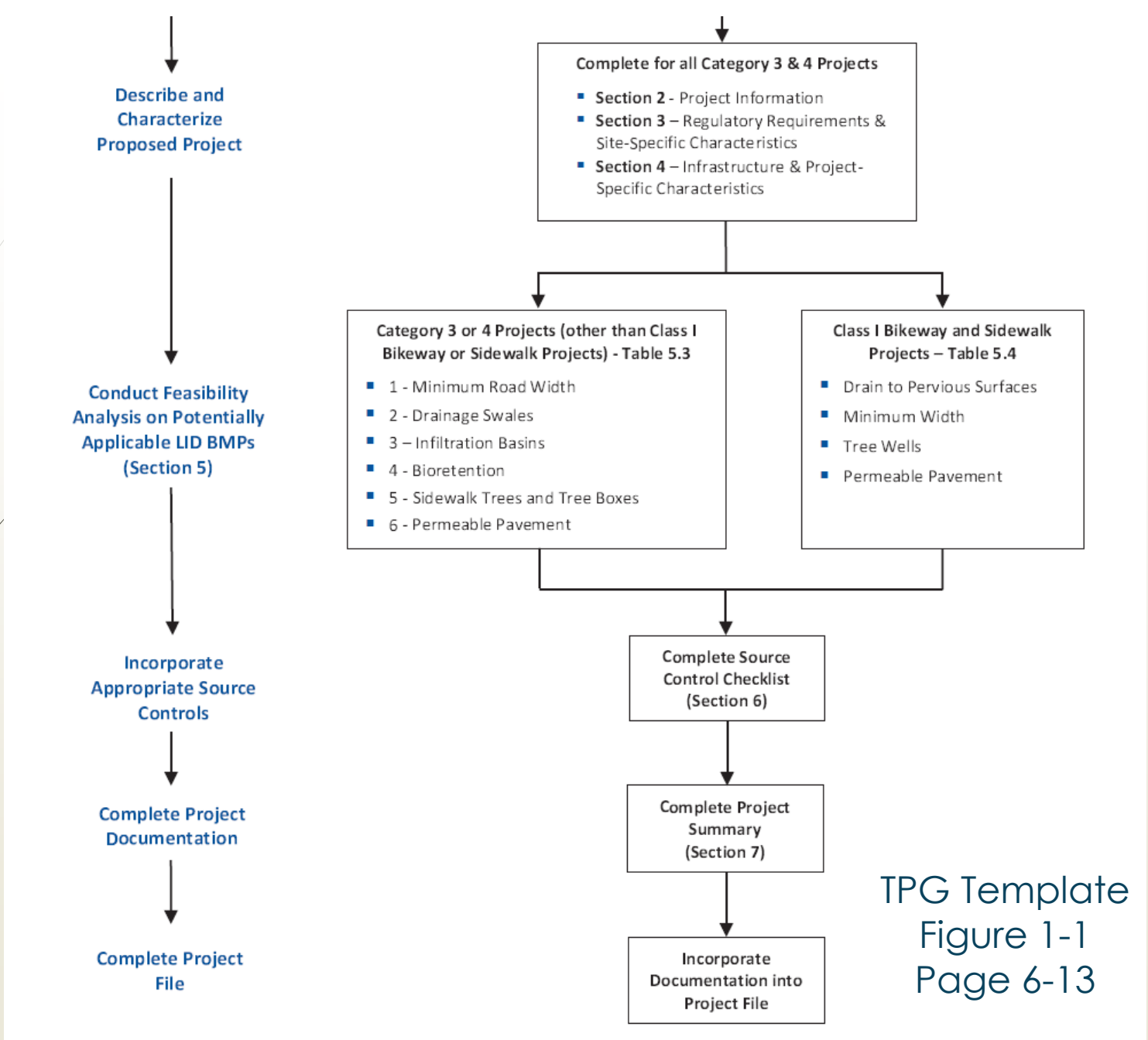
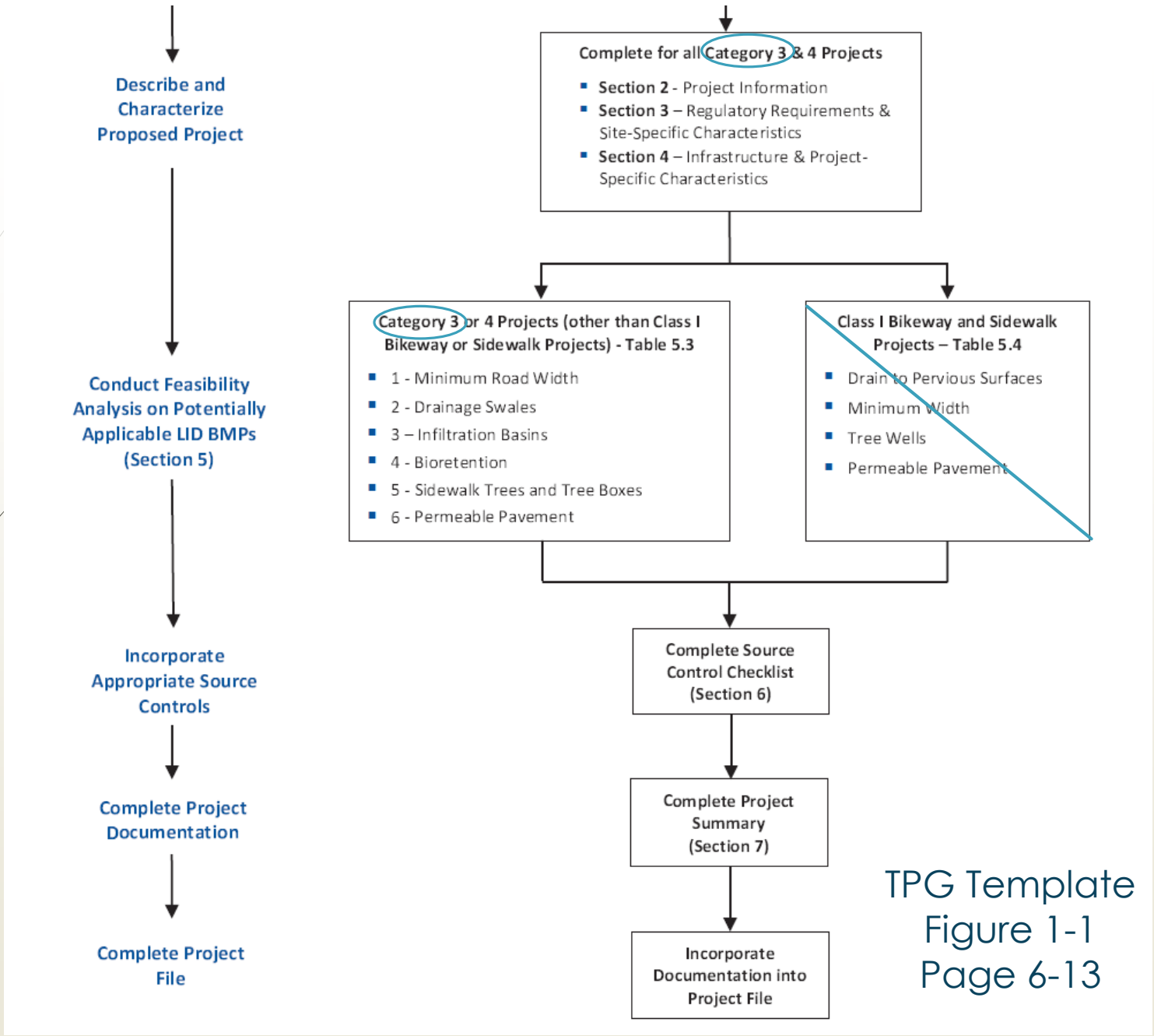


Project is a Category 3 – Roadway Capacity Improvement Project



TPG Template
Figure 1-1
Page 6-13



TPG Template
Figure 1-1
Page 6-13

Project Information

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Table 2.1 - Project Characteristics

Project Name					
Project Owner/Operator (Agency)					
Project Contact Name:					
Mailing Address:		E-mail Address:		Telephone:	

Project Category	Check the box for the applicable Project Category *(See Table 2-1 in Guidance* ☐ Category 3 – Existing Transportation Project ☐ Category 4 – New Transportation Project	
Check the appropriate boxes below, based on the Project Category checked above		
Category 3	☐ Roadway Capacity Improvement Project	☐ Lane additions ☐ Bridge project ☐ Grade separation project ☐ Other project type
	☐ Non-Capacity Roadway Improvement Project	☐ Shoulder improvements ☐ Parking lane improvements ☐ Turn pocket addition ☐ Signal project that adds a turn lane ☐ Horizontal alignment correction (improve sight distance) ☐ Grade separation project ☐ Passing lane addition ☐ Turn out addition ☐ Other project type
	☐ Class I Bikeway or sidewalk	☐ Improvement to existing Class I Bikeway or sidewalk ☐ Other project type
Category 4	☐ New road project ☐ New bridge project ☐ New Class I Bikeway or sidewalk project	
Project Schedule:		

Table 2.2 - Project Description

General Project Description:					
Project Area (ft^2):	15,000 (rough)	Project Length (ft):	5,280	Coordinates of the approximate center of the project:	Latitude: Longitude:
For Category 3 & 4 projects, complete the information below.					
Describe how the existing surface footprint will be modified, if applicable					
Describe how the capacity of the existing transportation surface (if any) will be improved					
For a Class I Bikeway or sidewalk project, describe how the existing surface will be improved	N/A				

Table 3.1 – Regulatory Requirements & Site-Specific Characteristics

Regulatory Requirements	
Consult Local Implementation Plan(s) to document pollutants of concern based on impaired waters listings or TMDL implementation requirements.	**Middle Santa Ana River Bacteria TMDL**
Document any known CEQA conditions, Multi-Species Habitat Conservation Plan, California Fish & Game Code Section 1600, CWA Section 401, or CWA Section 404 requirements	
Site-Specific Characteristics	
Drainage Area (ft^2)	
Existing Site Impervious Area (ft^2)	
Expected Post-Project Impervious Area (ft^2)	
Hydrologic Soil Group* *Describe hydrologic soil group and associated infiltration characteristics, if known*	
Expected Infiltration Characteristics *Describe known infiltration characteristics based on soil group or soil test data (attach if such data are available)*	
Natural Sediment Load Characteristics *Describe local sediment characteristics that could impact selection or functionality of BMPs*	
Depth to Groundwater *Determine depth to groundwater, if known (provide source of information)*	

* See soils section of the Flood Control District's Hydrology Manual
http://floodcontrol.co.riverside.ca.us/downloads/planning/Hydrology%20Manual%20-%20Complete.pdf

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Hydrologic Soil Groups

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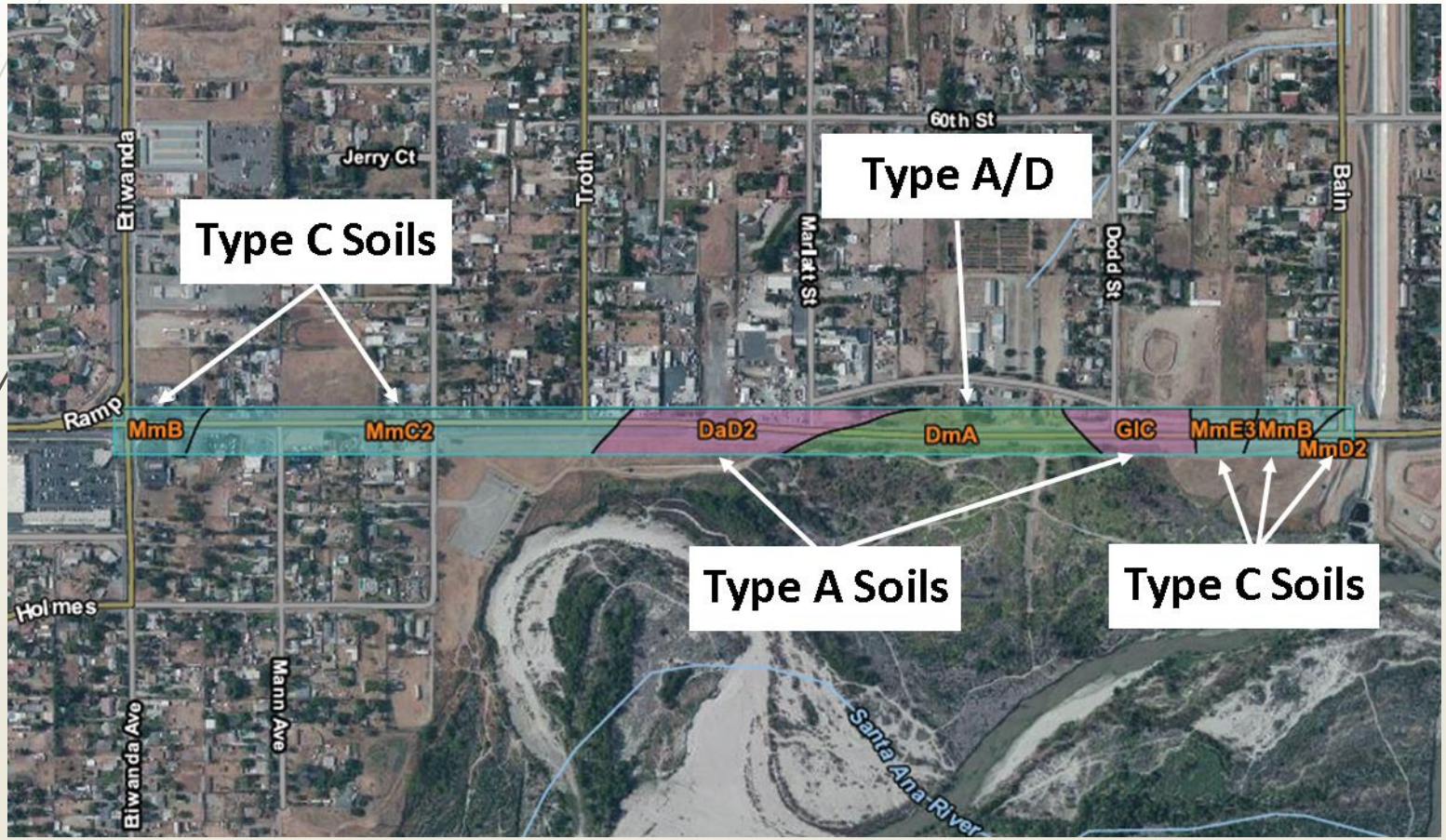
Mixture of soil types. Soils in middle of alignment are generally A soils – favorable for infiltration



Source: USDA NRCS Web Soil survey, Accessed 2014

Depth to Groundwater

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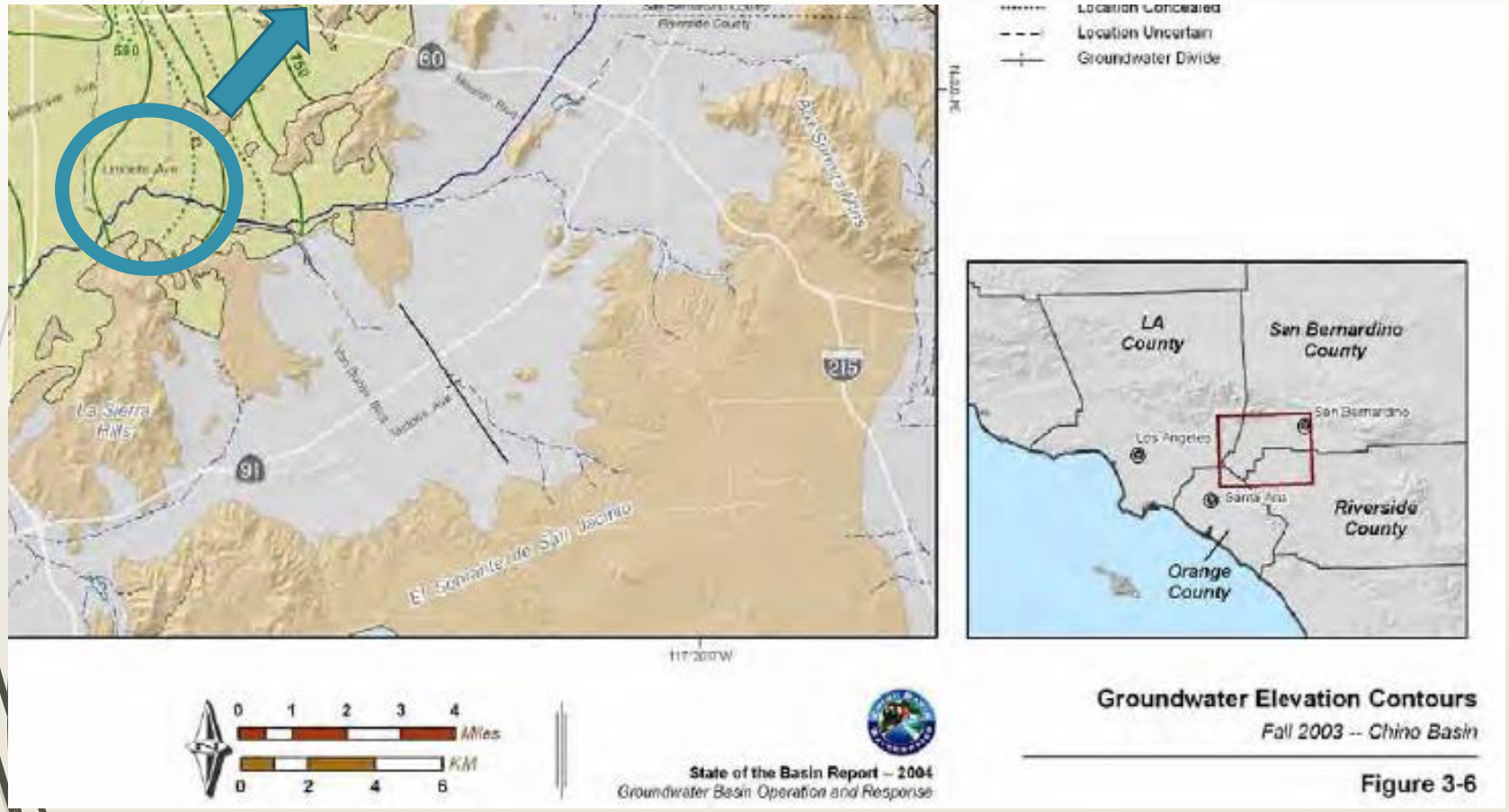
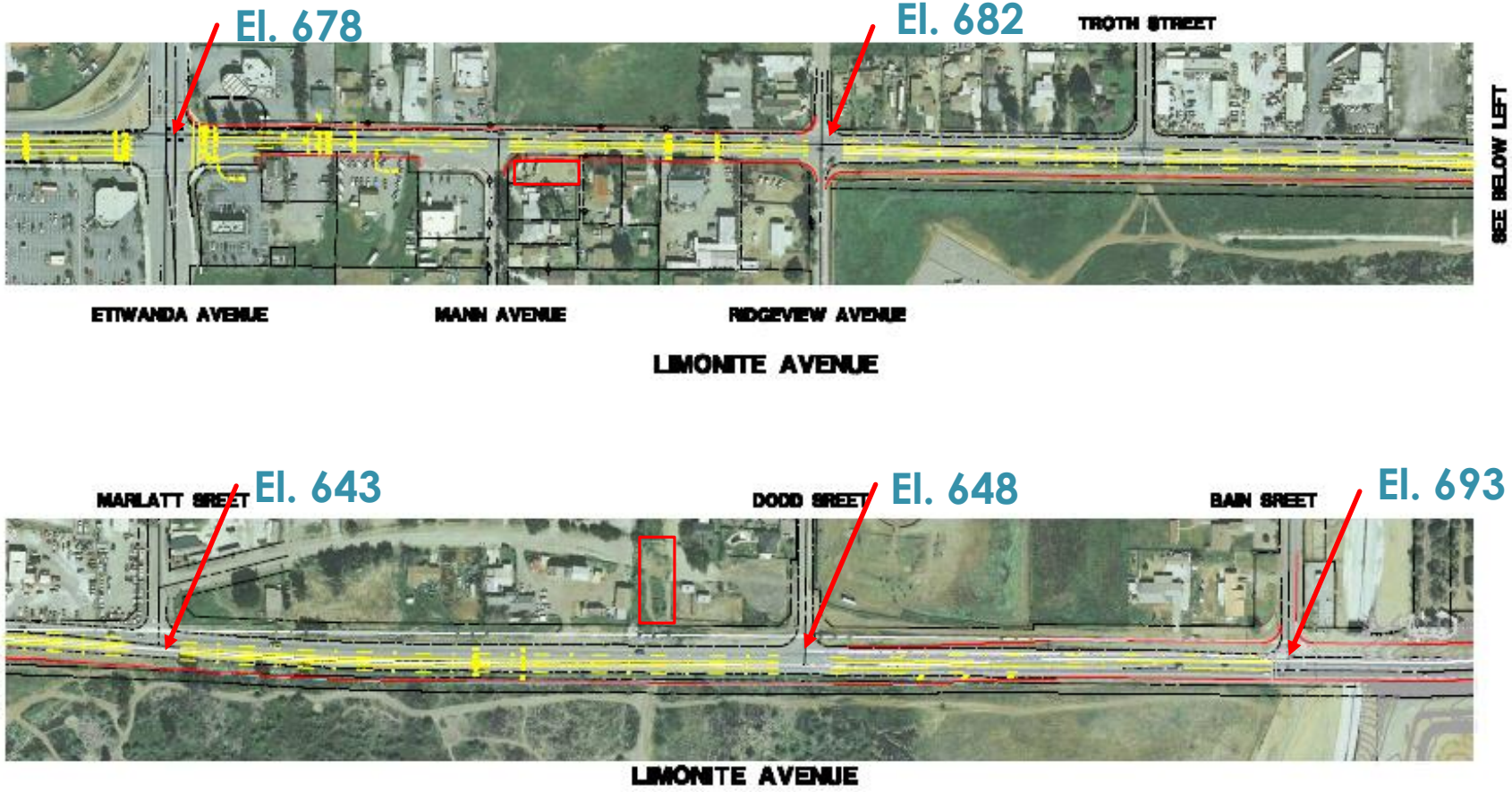
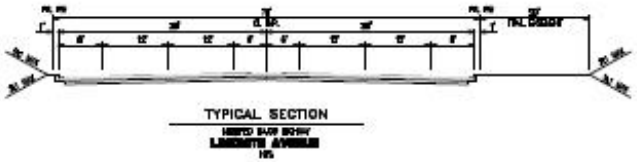
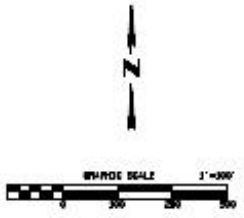
Approximate Groundwater Elevation 610-615 MSL







Depth to GW
> 10 ft



Existing Drainage Facilities

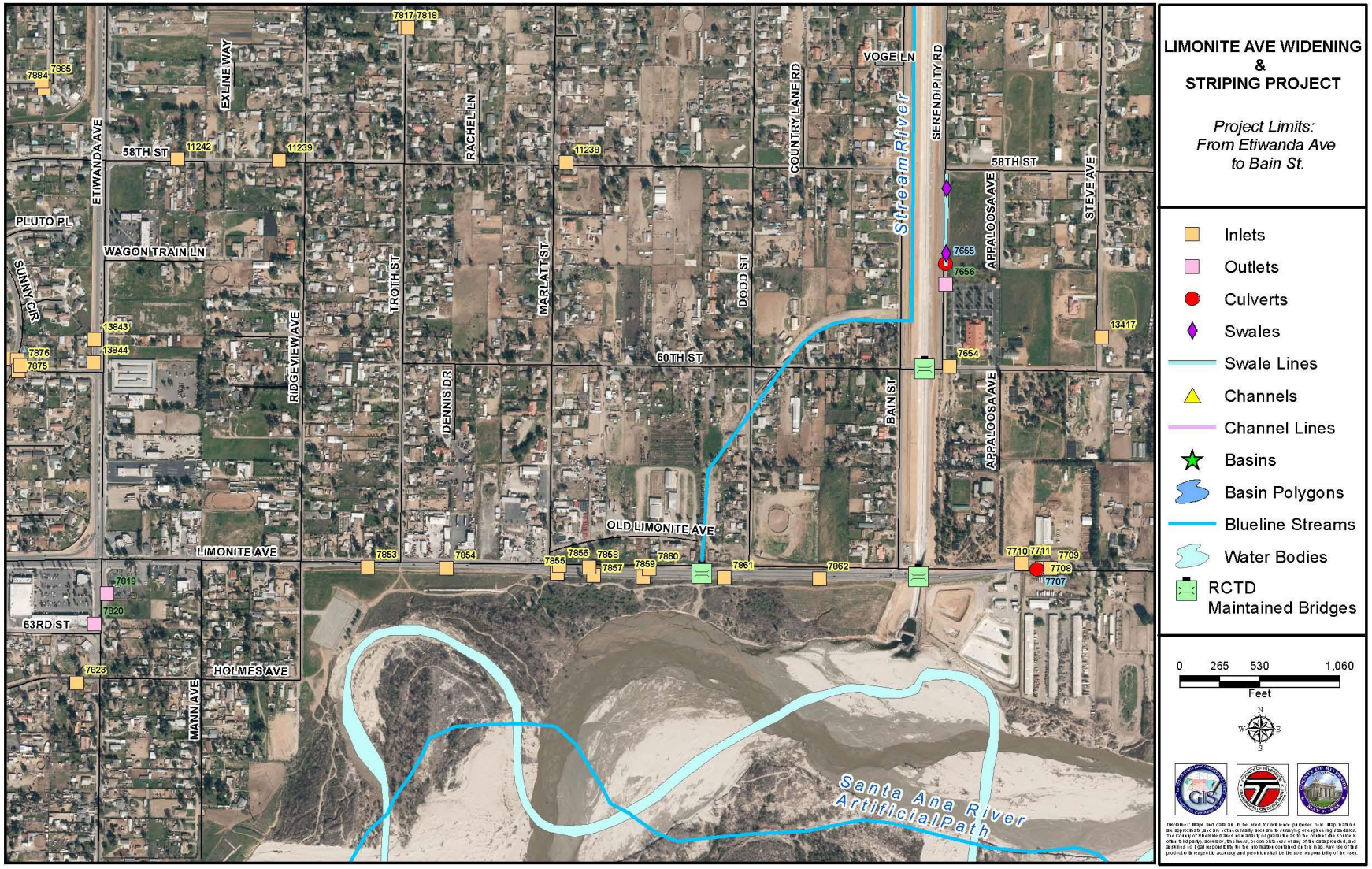


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Table 4.1 - Infrastructure & Project-Specific Characteristics

Programmatic & Funding Restrictions	
Project Funding *Provide information regarding project funding*	Project Budget: Funding Source: Are there any limitations or restrictions on the use of dedicated funds: ☐ Yes; if this box checked, explain limitations ☐ No
Programmatic Constraints *Identify any programmatic or regulatory constraints, e.g., Americans with Disabilities Act; need for emergency access, etc.*	Does the project require compliance with other programmatic, regulatory, or code requirements that may affect application of BMPs? ☐ Yes; if this box checked, explain limitations ☐ No
Impaired Waters & TMDL Requirements	
Regulatory Constraints *Describe applicable BMP specific requirements to address impaired water related concerns*	Identify the MS4 Local Implementation Plan(s) consulted: Does the applicable LIP(s) identify any BMP requirements that need to be implemented in the project area: ☐ Yes; describe the BMP requirements and how they have been addressed in the project design: ☐ No
Right-of-Way (ROW)	
ROW Constraints *Describe potential ROW constraints to BMP implementation*	
Drainage Connectivity	
Connectivity Constraints *Based on drainage features of the project site, describe potential constraints to BMP implementation*	

Table 4.1 - Infrastructure & Project-Specific Characteristics

Utilities	
Utility Constraints *Identify any utility-related constraints*	Does the project have any utility constraints that that may affect application of BMPs? ☐ Yes; if this box checked, explain constraints ☐ No
Resource Availability	
Irrigation Water *Describe availability of irrigation water to support BMPs that require establishment of landscaping*	
Power *Describe availability of power to support use of an irrigation system*	
Estimated Road Use	
Vehicle Load *Describe the expected vehicle loads, e.g., H-20 truck loads, that will use the transportation surface after project completion*	
Maximum Allowable Speed (MAS) *Describe expected speed of vehicles on completed transportation surface; if variable, provide the MAS for different project elements*	
Roadside Parking Requirements *Describe any minimum requirements associated with design of roadside parking areas*	
Capacity Design (Average Daily Traffic, ADT). Is the ADT ≥ 25,000?	☐ Yes ☐ No

LID BMP Evaluation

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Table 5.1 - LID BMP Evaluation Requirements

Check the appropriate box. The LID BMPs listed within each category must be included in the feasibility analysis

☐ **Category 3 or 4 (other than a Class I Bikeway or sidewalk project)**	☐ **Class I Bikeway or Sidewalk Project**
▪ 1 - Minimum Road Width ▪ 2 - Drainage Swales ▪ 3 – Infiltration Basins ▪ 4 - Bioretention ▪ 5 - Sidewalk Trees and Tree Boxes ▪ 6 - Permeable Pavement	▪ Drain to Pervious Surfaces ▪ Minimum Width ▪ Use of Tree Wells ▪ Permeable Pavement

- If the Category 3 or 4 box was checked above, complete the feasibility analysis for <u>each</u> of the LID BMPs in Table 5.3
- If the Class I Bikeway or Sidewalk project box was checked, complete Table 5.4

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Table 5.1 - LID BMP Evaluation Requirements

Check the appropriate box. The LID BMPs listed within each category must be included in the feasibility analysis

☐ **Category 3 or 4 (other than a Class I Bikeway or sidewalk project)**	☐ **Class I Bikeway or Sidewalk Project**
▪ 1 - Minimum Road Width ▪ 2 - Drainage Swales ▪ 3 – Infiltration Basins ▪ 4 - Bioretention ▪ 5 - Sidewalk Trees and Tree Boxes ▪ 6 - Permeable Pavement	▪ Drain to Pervious Surfaces ▪ Minimum Width ▪ Use of Tree Wells ▪ Permeable Pavement

- If the Category 3 or 4 box was checked above, complete the feasibility analysis for each of the LID BMPs in Table 5.3
- If the Class I Bikeway or Sidewalk project box was checked, complete Table 5.4

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Table 5.3 – LID BMP Feasibility Analysis 1 – Minimum Road Widths	
1.a - Does the project need to meet jurisdictional code or General Plan requirements for minimum road widths?	☐ Yes; if checked, describe requirements ☐ No
1.b – Based on the findings of 1.a., determine if this BMP can be applied to the project. If applicable, describe how it was incorporated into the project design.	☐ Applicable, describe design features incorporating this BMP; include in Table 7.1 ☐ Not Applicable, describe basis for decision (e.g., project requirements, traffic or pedestrian safety concerns)

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Table 5.3 – LID BMP Feasibility Analysis
2 – Drainage Swales

2.a – Are there any programmatic constraints that prevent the use of this BMP, *e.g., Americans with Disabilities Act; need for emergency access, funding restrictions, etc.? See Section 3.b of the Guidance.*	☐ Yes; if checked, provide basis for finding and STOP; this BMP is infeasible ☐ No; BMP is potentially feasible, continue to 2.b
2.b - Considering grade and need for drainage connectivity, is there sufficient ROW for proper swale installation?	☐ No; if checked, provide basis for finding ☐ Yes
2.c - Can drainage swales be sized large enough to capture site run-on and redirect it into the drainage system?	☐ No; if checked, provide basis for finding ☐ Yes
2.d - Are existing soil characteristics sufficient to support infiltration such that nuisance or vector conditions are not created by any ponded water that may occur?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 2.b, 2.c, or 2.d, then STOP - this BMP is infeasible; attach appropriate documentation support as needed • If "Yes" is checked for 2.b, 2.c, and 2.d, then this BMP is potentially feasible, continue on to 2.e and 2.f	
2.e - Are irrigation water and power available to support vegetation in swale during dry periods?	☐ No; if checked, provide basis for finding ☐ Yes
2.f - If irrigation water and power are not available, can the site support native vegetation that does not require irrigation?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 2.e and 2.f, this BMP is infeasible • If "Yes" is checked for 2.e or 2.f, then this BMP is potentially feasible; continue to 2.g	
2.g – Are there any special maintenance, equipment, or experience requirements associated with the implementation of this BMP?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
2.h – If this BMP is implemented, will there be any one-time capital costs incurred, e.g., for new equipment required to maintain the BMP, that impacts project funding?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
2.i – Is there long-term funding available to maintain this BMP?	☐ Yes ☐ No
• If any of the findings from 2.g, 2.h or 2.i prevent the use of this BMP, then this BMP is infeasible; attach appropriate documentation as needed • If the findings from 2.g., 2.h, and 2.i do not prevent implementation of this BMP, then the BMP is feasible; incorporate into Table 7.1	

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Table 5.3 – LID BMP Feasibility Analysis
3 – Infiltration Basins

3.a – Are there any programmatic constraints that prevent the use of this BMP, *e.g., Americans with Disabilities Act; need for emergency access, funding restrictions, etc.? See Section 3.b of the Guidance.*	☐ Yes; if checked, provide basis for finding and STOP; this BMP is infeasible ☐ No; BMP is potentially feasible, continue to 3.b
3.b - Do appropriate soil conditions exist at the project site to allow effective infiltration consistent with a drawdown period, not to exceed 72 hours?	☐ No; if checked, provide basis for finding ☐ Yes
3.c - Is there at least 10 feet separation between the planned basin invert and the measured groundwater elevation?	☐ No; if checked, provide basis for finding ☐ Yes
3.d- Is there at least 100 feet separation from the proposed basin(s) and any known water supply wells?	☐ No; if checked, provide basis for finding ☐ Yes
3.e - Is the underlying soil and/or groundwater free from any known contamination?	☐ No; if checked, provide basis for finding ☐ Yes
3.f - Is there sufficient space to size or place an infiltration basin that: • Has slopes that are no steeper than 4:1, and • Is located at least 100 feet from bridge structures?	☐ No; if checked, provide basis for finding ☐ Yes
3.g - For a project area that has high vehicular traffic (25,000 or more average daily traffic), can the planned infiltration basin meet the MS4 Permit's pretreatment of runoff requirements?	☐ No; if checked, provide basis for finding ☐ Yes
3.h - Can an infiltration basin be incorporated into the site plan in a manner that does not create traffic or pedestrian safety concerns?	☐ No; if checked, provide basis for finding ☐ Yes
3.i - Does inclusion of an infiltration basin detract from the aesthetics of the roadway or project area that cannot be mitigated?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for any of the above questions (3.b – 3.i), this BMP is infeasible • If "Yes" is checked for all of the above (3.b - 3.i), then this BMP is potentially feasible; continue to 3.j	
3.j – Are there any special maintenance, equipment, or experience requirements associated with the implementation of this BMP?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
3.k – If this BMP is implemented, will there be any one-time capital costs incurred, e.g., for new equipment required to maintain the BMP, that impacts project funding?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
3.l – Is there long-term funding available to maintain this BMP?	☐ Yes ☐ No
• If any of the findings from 3.j, 3.k or 3.l prevent the use of this BMP, then this BMP is infeasible; attach appropriate documentation as needed • If the findings from 3.j., 3.k, and 3.l do not prevent implementation of this BMP, then the BMP is feasible; incorporate into Table 7.1	

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Table 5.3 – LID BMP Feasibility Analysis
4 – Bioretention

4.a – Are there any programmatic constraints that prevent the use of this BMP, *e.g., Americans with Disabilities Act; need for emergency access, funding restrictions, etc.? See Section 3.b of the Guidance.*	☐ Yes; if checked, provide basis for finding and STOP; this BMP is infeasible ☐ No; BMP is potentially feasible, continue to 4.b
4.b - Is there sufficient ROW to consider curb extensions?	☐ No; if checked, provide basis for finding ☐ Yes
4.c - Is there sufficient ROW to consider sidewalk planters?	☐ No; if checked, provide basis for finding ☐ Yes
4.d – Is there sufficient space to consider using the road median for bioretention?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 4.b, 4.c and 4.d, then STOP - this BMP is infeasible; attach appropriate documentation support as needed • If "Yes" is checked for 4.b, 4.c or 4.d, then this BMP is potentially feasible, continue on to 4.e	
4.e – Can the site be designed so that median, curb extensions or sidewalk planters tie into the existing drainage at the project site?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 4.e, then STOP - this BMP is infeasible; attach appropriate documentation support as needed • If "Yes" is checked for 4.e, then this BMP is potentially feasible, continue on to 4.f and 4.g	
4.f - Are irrigation water and power available to support bioretention area or sidewalk planters?	☐ No; if checked, provide basis for finding ☐ Yes
4.g - If irrigation water and power are not available, can the site support native vegetation that does not require irrigation?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 4.f and 4.g, then STOP - this BMP is infeasible • If "Yes" is checked for 4.f or 4.g, then this BMP is potentially feasible; continue on to 4.h	
4.h – Based on anticipated traffic capacity and MAS applicable to the project site, are there any traffic or pedestrian safety concerns that prevent application of this BMP?	☐ Yes; if checked, provide basis for finding ☐ No
• If "Yes" is checked for 4.h this BMP is infeasible • If "No" is checked for 4.h, then this BMP is potentially feasible; continue to 4.i.	
4.i – Are there any special maintenance, equipment, or experience requirements associated with the implementation of this BMP?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
4.j – If this BMP is implemented, will there be any one-time capital costs incurred, e.g., for new equipment required to maintain the BMP, that impacts project funding?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
4.j – Is there long-term funding available to maintain this BMP?	☐ Yes ☐ No
• If any of the findings from 4.i, 4.j or 4.k prevent the use of this BMP, then this BMP is infeasible; attach appropriate documentation as needed • If the findings from 4.i, 4.j, and 4.k do not prevent implementation of this BMP, then the BMP is feasible; incorporate into Table 7.1	

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Table 5.3 – LID BMP Feasibility Analysis
5 – Sidewalk Trees and Tree Boxes

5.a – Are there any or programmatic constraints that prevent the use of this BMP, *e.g., Americans with Disabilities Act; need for emergency access, funding restrictions, etc.? See Section 3.b of the Guidance.*	☐ Yes; if checked, provide basis for finding and STOP; this BMP is infeasible ☐ No; BMP is potentially feasible, continue to 5.b
5.b - Is there sufficient ROW to incorporate sidewalk trees or tree boxes into the project site?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 5.b, then STOP - this BMP is infeasible; attach appropriate documentation support as needed • If "Yes" is checked for 5.b, then this BMP is potentially feasible, continue on to 5.c and 5.d	
5.c - Are irrigation water and power available to support vegetation in the bioretention area or sidewalk planters?	☐ No; if checked, provide basis for finding ☐ Yes
5.d - If irrigation water and power are not available, can the site support native vegetation that does not require irrigation?	☐ No; if checked, provide basis for finding ☐ Yes
• If "No" is checked for 5.c and 5.d, then STOP - this BMP is infeasible • If "Yes" is checked for 5.c or 5.d, then this BMP is potentially feasible; continue on to 5.e	
5.e – Based on anticipated traffic capacity and MAS applicable to the project site, are there any traffic or pedestrian safety concerns that prevent application of this BMP?	☐ Yes; if checked, provide basis for finding ☐ No
• If "Yes" is checked for 5.e this BMP is infeasible • If "No" is checked for 5.e, then this BMP is potentially feasible; continue to 5.f	
5.f – Are there any special maintenance, equipment, or experience requirements associated with the implementation of this BMP?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
5.g – If this BMP is implemented, will there be any one-time capital costs incurred, e.g., for new equipment required to maintain the BMP, that impacts project funding?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
5.h – Is there long-term funding available to maintain this BMP?	☐ Yes ☐ No
• If any of the findings from 5.f, 5.g or 5.h prevent the use of this BMP, then this BMP is infeasible; attach appropriate documentation as needed • If the findings from 5.f, 5.g and 5.h do not prevent implementation of this BMP, then the BMP is feasible; incorporate into Table 7.1	

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Table 5.3 – LID BMP Feasibility Analysis
6 – Permeable Pavement

6.a – Are there any or programmatic constraints that prevent the use of this BMP, *e.g., Americans with Disabilities Act; need for emergency access, funding restrictions, etc.? See Section 3.b of the Guidance.*	☐ Yes; if checked, provide basis for finding; STOP, this BMP is infeasible ☐ No; BMP is potentially feasible, continue to 6.b
6.b - Does the planned road project include any of the listed types of impervious surfaces (check all that apply)?	☐ Roadside parking/parking lane ☐ Driveways ☐ Sidewalks, walkways ☐ None of the above
• If "none of the above" is checked in 6.b, then STOP – BMP is infeasible • If any box other than "none of the above" is checked, BMP is potentially feasible; continue to 6.c	
6.c – Will any of the transportation surfaces checked in 6.b be subject to high traffic volume or heavy traffic loads that prevent the use of permeable pavement?	☐ Yes; if checked, provide basis for finding ☐ No
6.d – Do the underlying soils at the project site provide adequate infiltration capacity for use of this BMP while not causing structural concerns?	☐ No; if checked, provide basis for finding ☐ Yes
• If "Yes" is checked for 6.c or "No" is checked for 6.d, then STOP - this BMP is infeasible; attach appropriate documentation support as needed • If "No" is checked for 6.c and "Yes" is checked for 6.d, then this BMP is potentially feasible for all impervious surface types checked in 6.b; continue to 6.e • If "Yes" is checked for 6.c and 6.d and "sidewalks, walkways" was checked in 6.b, then this BMP is potentially feasible for sidewalk or walkway elements of the project; continue to 6.e	
6.e – Are there any special maintenance, equipment, or experience requirements associated with the implementation of this BMP?	☐ No; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ Yes
6.f – Will the BMP maintain an adequate service life (at least 5 years) such that the BMP is economically feasible?	☐ No; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ Yes
6.g – If this BMP is implemented, will there be any one-time capital costs incurred, e.g., for new equipment required to maintain the BMP, that impacts project funding?	☐ Yes; if checked, provide basis for finding and determine whether the findings prevent implementation of this BMP ☐ No
6.h – Is there long-term funding available to maintain this BMP?	☐ Yes ☐ No
• If any of the findings from 6.e, 6.f, 6.g or 6.h prevent the use of this BMP, then this BMP is infeasible; attach appropriate documentation as needed • If the findings from 6.e, 6.f, 6.g and 6.h do not prevent implementation of this BMP, then the BMP is feasible; incorporate into Table 7.1	

Source Control BMPs

Source Control BMPs

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Table 6.1 - Source Control BMPs				
Source Control BMP	Check One		If not Included, Provide Basis	If Included, Agency Responsible for Implementation
	Included	Not Included		
Part 1: Category 3 or 4 Projects (other than Class I Bikeway or sidewalk projects)				
Irrigation System and Landscape Maintenance	☐	☐		
Sweeping of Transportation Surfaces adjoining curb and gutter	☐	☐		
Drainage Facility Inspection and Maintenance	☐	☐		
MS4 Stenciling and Signage	☐	☐		
Landscape and Irrigation System Design	☐	☐		
Protect Slopes and Channels	☐	☐		
Part 2: Class I Bikeway and Sidewalk Projects				
Public Education Program	☐	☐		
Use of Signage	☐	☐		
Installation and Maintenance of Trash Bins and Pet Waste Collection Bags	☐	☐		

BMP Sizing

Sizing Steps

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- Delineate drainage areas
- Look up sizing method and calculate target sizing criteria (Table 5.2)
- Appropriately design BMPs using guidance links (Table 5.2)
- Attempt to design BMPs to meet full sizing criteria
- If full sizing criteria cannot be met, documents constraints and provide largest portion that can be reasonably provided within constraints

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Table 5.2 – BMP Design Information

LID-based BMP Information Source	Minimum Street Width	Drainage Swales	Infiltration Basins	Bioretention	Sidewalk Trees & Tree Boxes	Permeable Pavement
Riverside County Flood Control and Water Conservation District Design Handbook for Low Impact Development Management Practices http://rcflood.org/NPDES/LIDBMP.aspx	--	--	Section 3.1	Section 3.5	Section 3.5, p. 5[1]	Section 3.3
Low Impact Development Manual for Southern California: Technical Guidance and Site Planning Strategies http://www.casqa.org/LID/SoCalLID/tabid/218/Default.aspx	--	pp. 137-138	--	pp. 68-84	p. 71[1]	pp. 83-113
U. S. EPA Municipal Handbook: Green Streets, Managing Wet Weather with Green Infrastructure[2] http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_green_streets.pdf	pp. 2-4	--	--	--	--	--
County of San Diego, Low Impact Development Handbook: Stormwater Management Strategies http://www.sdcounty.ca.gov/dplu/docs/LID-Handbook.pdf (General Information) http://www.sdcounty.ca.gov/dplu/docs/LID-Appendices.pdf (Fact Sheets)	Fact Sheet 14, 15	--	--	Fact Sheets 15, 19	--	pp. 46-51, Fact Sheets 8, 9, 10
County of Los Angeles Low Impact Development Standards Manual. January 2009. http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf	--	--	--	--	pp. 49-52[1]	pp. 53-57
City of Santa Barbara Storm Water BMP Guidance Manual http://www.santabarbaraca.gov/Resident/Community/Creeks/Storm_Water_Management_Program.htm	--	Section 6.6.2	--	Section 6.6.1	Section 6.9.2[1]	Section 6.8
Caltrans Treatment Control BMP Technology Report http://www.dot.ca.gov/hq/env/stormwater/annual_report/2008/annual_report_06-07/attachments/Treatment_BMP_Technology_Rprt.pdf	--	p. D-5	--	pp. B-11 – B-12	pp. B-7 – B-10	--
Evaluation of Best Management Practices for Highway Runoff Control: Low Impact Development Design Manual for Highway Runoff Control http://www.coralreef.gov/transportation/evalbmp.pdf	--	Section 14	--	Section 5	--	Section 10

[1] Information focuses on design of planter boxes

[2] Handbook provides information on all LID types except Infiltration Basins, but information is general in nature

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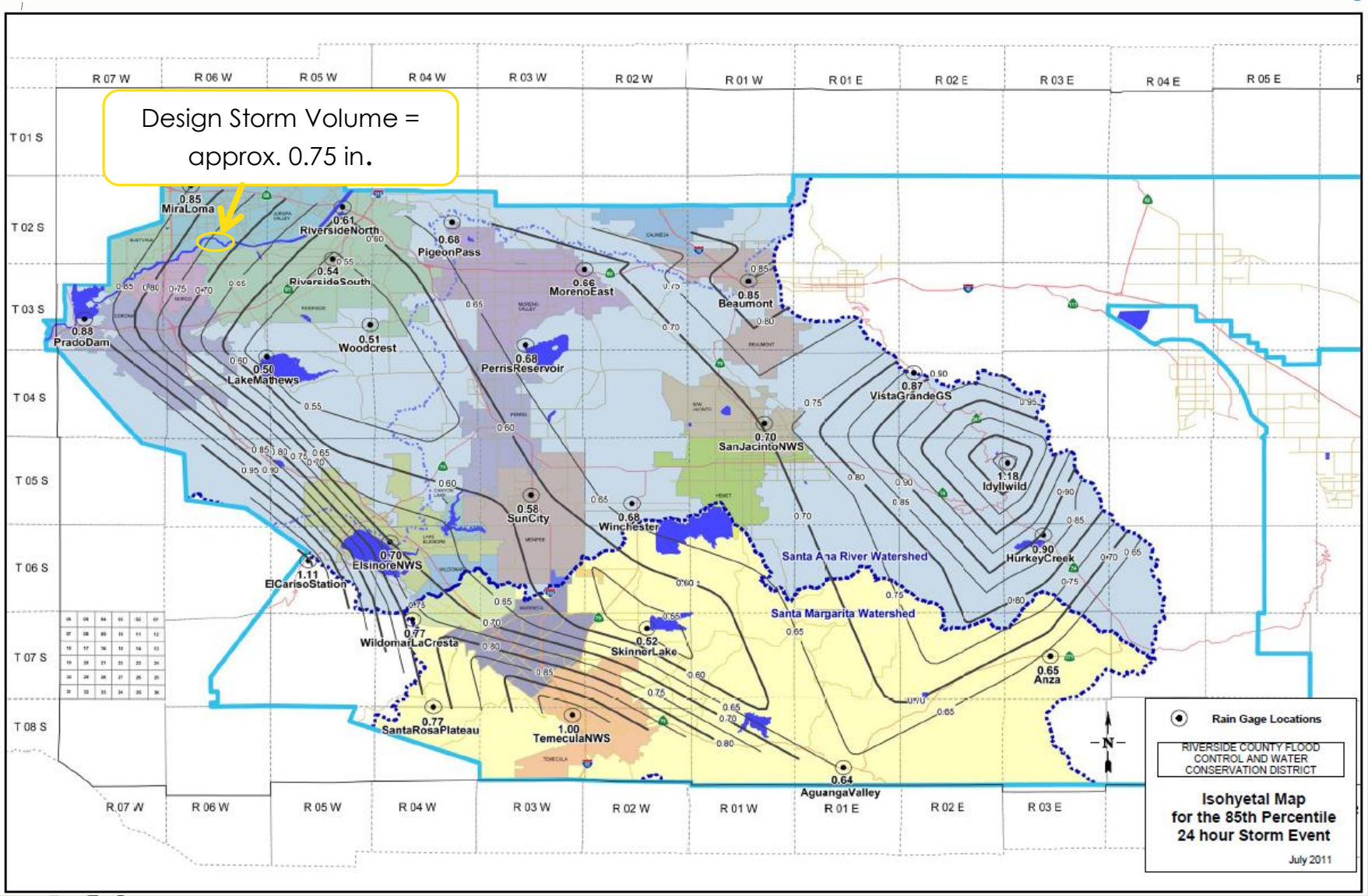

Calculate DCV or Design Storm Flow

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- Divide alignment into drainage areas
- Calculate area and % imperviousness of each drainage area
- Determine feasible BMP type for each drainage area
- Calculate DCV or Design Storm Flow to be used to size each BMP
- Infiltration based BMPs use DCV for sizing (e.g. drainage swales with infiltration, bioretention)
- Refer to RCFCWCD LID Handbook and other references for design details

Discuss opportunities and Limitations – Etiwanda to Ridgeview

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Positive Attributes

- County Owned Parcel
- Minor slopes on adjacent parcels

Limitations/Infeasibility

- Type C soils for entire area – low infiltration
- No existing storm drains
- May require ROW take
- No existing irrigation

Potential BMPs for Implementation

- Minimizing road widths
- Drainage Swales – select vegetation for no irrigation

Opportunities & Limitations:
Etiwanda to Ridgeview

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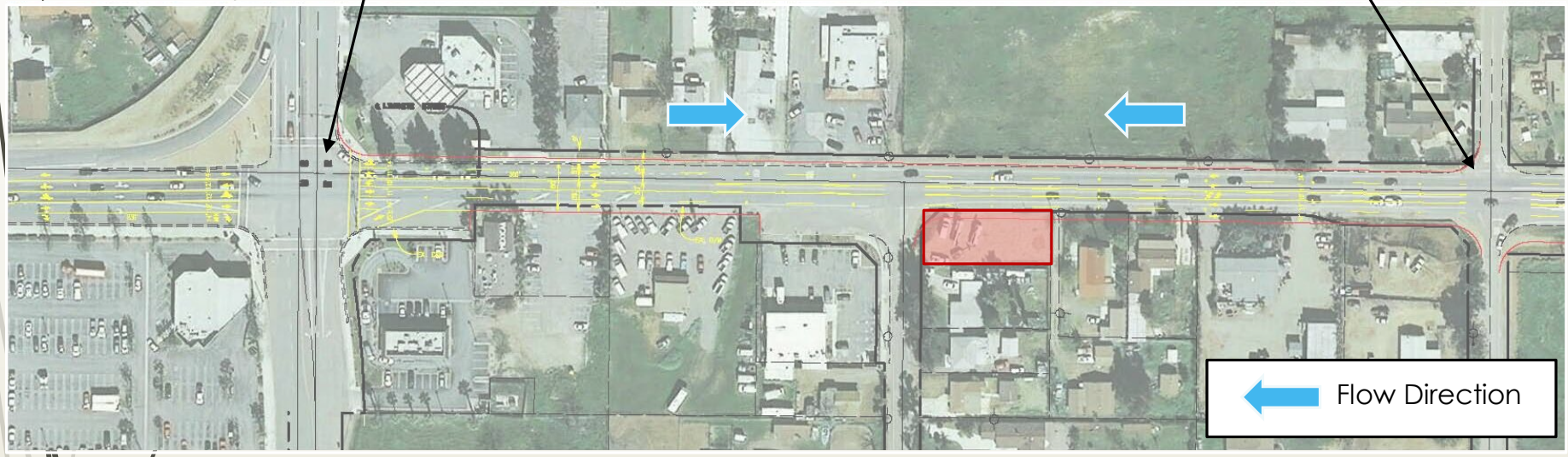

Positive Attributes

- County Owned Parcel
- Minor slopes on adjacent parcels

Limitations/Infeasibility

- Type C soils for entire area – low infiltration
- No existing storm drains
- May require ROW take
- No existing irrigation

Potential BMPs for Implementation

- Minimizing road widths
- Drainage Swales – select vegetation for no irrigation

Opportunities & Limitations:
Ridgeview to beyond Troth St.

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El. 682

Positive Attributes

- Type A soil areas on east end
- Minor slopes on adjacent parcels

Limitations/Infeasibility

- Type C soils for west area – low infiltration
- No existing storm drains
- May require ROW take
- No existing irrigation

Potential BMPs for Implementation

- Minimizing road widths
- Bioretention areas on west end
- Infiltration on east end
- Drainage Swales – select vegetation due to no irrigation

Opportunities & Limitations:
Marlett St. to Dodd St.

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Positive Attributes

- Type A soils on each end
- County of Riverside owned parcel
- Existing drainage outlets to lower retention areas

Limitations/Infeasibility

- Type A/D soils in low point – low infiltration
- Areas of adjacent steep slopes in A soil areas
- No existing storm drains
- No existing irrigation

Potential BMPs for Implementation

- Minimizing road widths
- Infiltration areas on each end
- Drainage Swales – select vegetation for no irrigation

Current Preliminary Design Drawings

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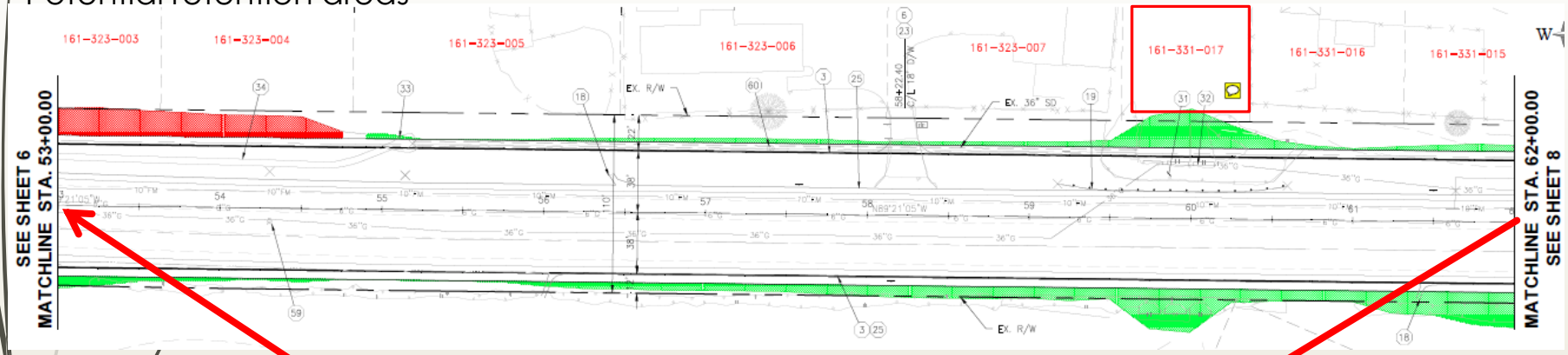
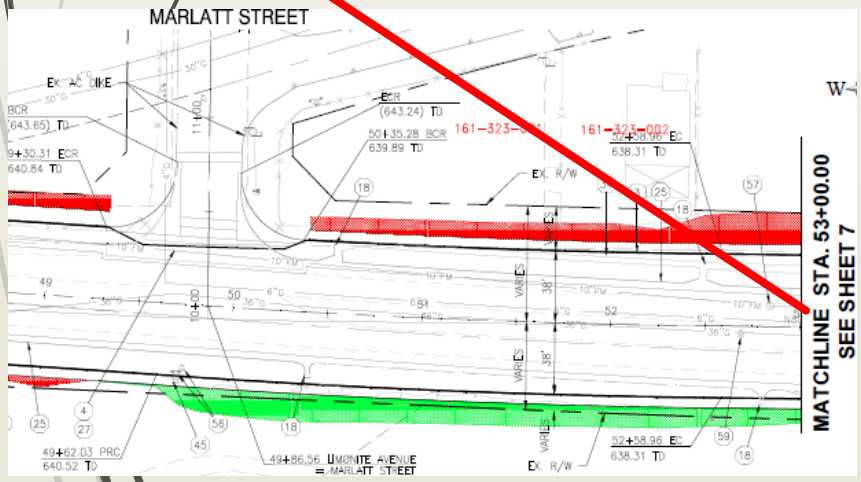
Green Areas = Opportunities

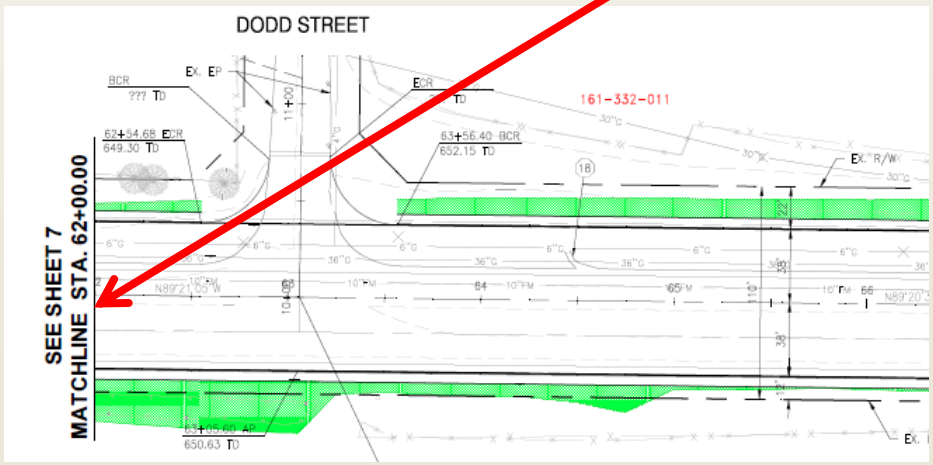
Potential retention areas

Red Areas = Constraints/Limitations

Higher elevs areas







Opportunities & Limitations:
Dodd St. to Bain St.

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Positive Attributes

- Minor slopes on adjacent parcels
- Adjacent natural area on north side
- Existing drainage channel

Limitations/Infeasibility

- Type C soils – low infiltration
- No existing storm drains
- No existing irrigation

Potential BMPs for Implementation

- Minimizing road widths
- Drainage Swales – select vegetation for no irrigation

LID-Based BMPs: Drainage Swales

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- Identify additional benefits that may be attained from swales through:
  - Amended soils
  - Bioretention soils
  - Gravel storage areas
  - Underdrains
  - Weirs
  - Thick diverse vegetation, including, where possible, use of native vegetation

Green Streets: EPA-833-F-09-002, August 2009, www.epa.gov/greeninfrastructure

Bioswsale Example., Low Impact Development Center, Inc.

LID-Based BMPs: Drainage Swales

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- Plan site drainage using vegetated swales (preferably without irrigation) to accept sheet flow runoff and convey it in broad shallow flow to:
  - Reduce stormwater volume through infiltration,
  - Improve water quality through vegetative and soil filtration, and
  - Reduce flow velocity by increasing channel roughness
- Consider use of vegetated or pervious material swales before considering use of hard-lined impervious channels

Table 7.1 – Project Summary (Category 3 & 4 Projects)

☐ **Category 3 or Category 4 Project (other than Class I Bikeway or sidewalk projects)** Summarize the LID BMPs incorporated into the project design (based on the findings of the Table 5.3 - LID BMP Feasibility Analysis). For each LID BMP checked: ▪ Describe briefly how the LID BMP was incorporated; and ▪ Provide references to attachments or design plans (e.g., sheet numbers) where needed to support description	☐ Minimum Road Width	
	☐ Drainage Swales	Maintenance Responsibility:
	☐ Infiltration Basins	Maintenance Responsibility:
	☐ Bioretention	Maintenance Responsibility:
	☐ Sidewalk Trees and Tree Boxes	Maintenance Responsibility:
	☐ Permeable Pavement	Maintenance Responsibility:
☐ **Class 1 Bikeway and Sidewalk Projects** Summarize the LID BMPs incorporated into the project design (based on the Table 5.4 - LID BMP Feasibility Analysis). For each BMP checked: ▪ Describe briefly how the LID BMP was incorporated; and ▪ Provide references to attachments or design plans (e.g., sheet numbers) as needed to support description	☐ Drain to Pervious Surfaces	
	☐ Minimum Width	
	☐ Use of Tree Wells	Maintenance Responsibility:
	☐ Permeable Pavement	Maintenance Responsibility:
Regulatory Requirements Document design elements that address any known regulatory requirements (see Table 3.1); if none, check the N/A box.	☐ Design elements affected by regulatory requirements Describe: ☐ N/A	
Source Control BMPs Summarize the applicable source controls and the agency responsible for implementation		
Documentation List all attachments that support this project summary		

Additional Items to Include

Transportation Site Plan

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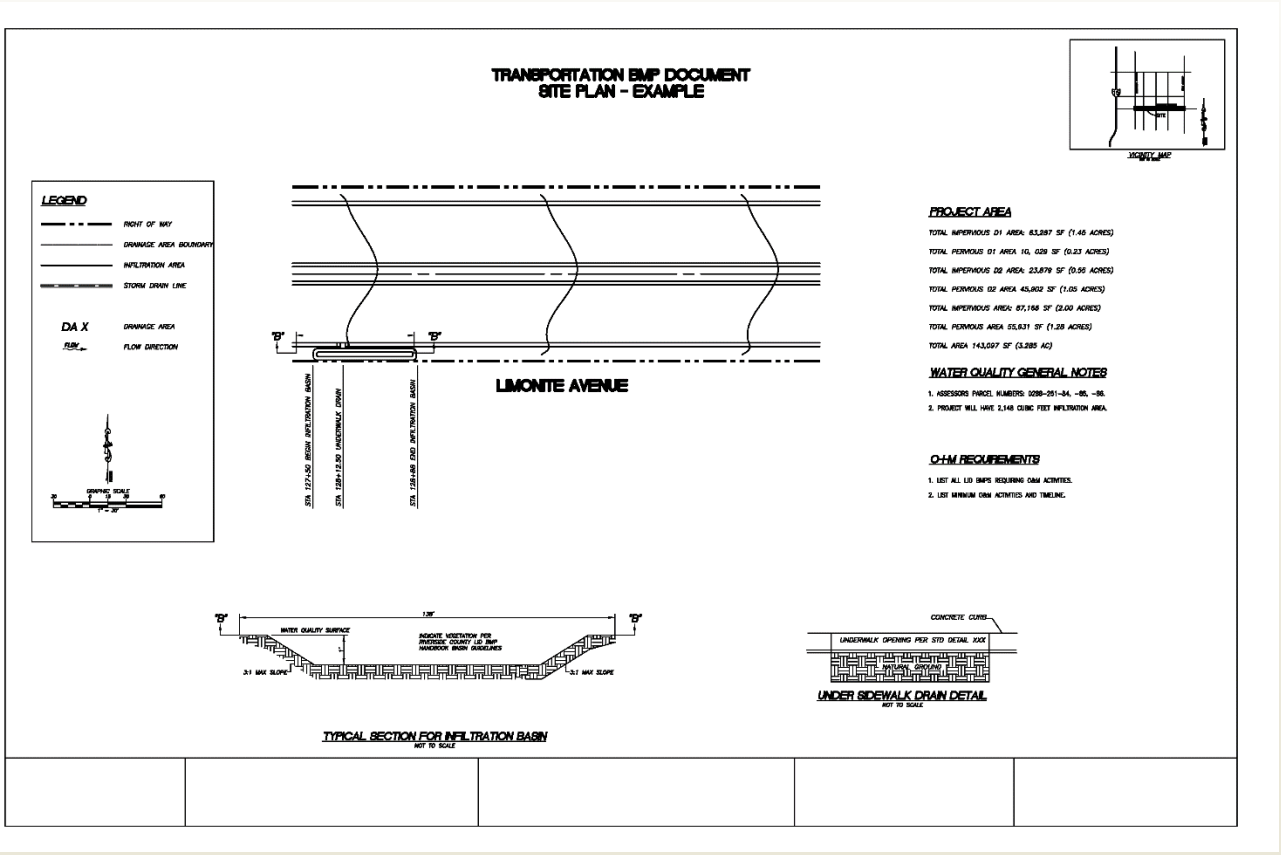
- Include TPG Project Site Plan showing all BMP locations.



Transportation Site Plan Items

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- Vicinity Map (may be a separate page)
- Project boundary (may be separate plan showing overall boundary)
- Pervious areas
- Impervious areas
- DA boundaries and flow arrows (may be separate sheets)
- Each DA LID DCV
- Design elevations and benchmark utilized
- Pre- and Post-topography
- LID BMP details and x-sections (may be separate sheets)
- Drainage connections (may be separate sheets)
- All source control BMPs identified
- Standard site plan labeling

OPERATION AND MAINTENANCE

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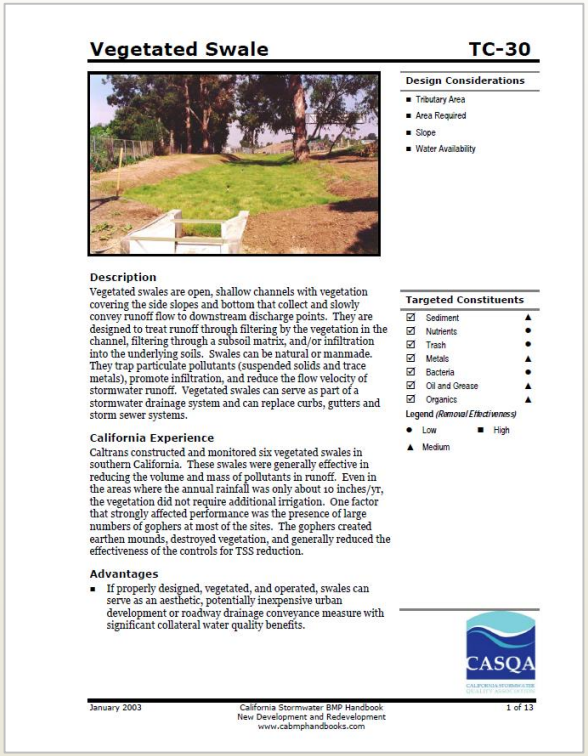
- Identify all O&M requirements for all LID BMPs
- O&M documentation should:
  - Designate responsible party that will manage the BMPs
  - Detail maintenance frequency – indicating minimum requirements
  - Detail maintenance activities – specific activity and waste placement
  - Detail routine service and updating schedule – e.g. update training annually
  - BMP Factsheets
  - Discuss any other necessary maintenance /irrigation activity



Vegetated Swale **TC-30**

Design Considerations
- Tributary Area
- Area Required
- Slope
- Water Availability

Description
Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

Targeted Constituents

☑ Sediment	▲
☑ Nutrients	●
☑ Trash	●
☑ Metals	▲
☑ Bacteria	●
☑ Oil and Grease	▲
☑ Organics	▲

Legend *(Removal Effectiveness)*
● Low ■ High
▲ Medium

California Experience
Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages
- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

CASQA

Filing the Transportation BMP Documentation

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- Transportation BMP Documentation should be kept in the Project file
- Transportation BMP Documentation should also be provided to Public Works, or other appropriate Department, to ensure O&M of all LID BMPs

Document Certification

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- Transportation Project BMP document requires certification.
- Certification Recommendations:
  - Stamped and signed by the Engineer of Record, and
  - Certified by Agency Representative responsible for approval of Project

Questions