



## Attachment 6: Monitoring, Assessment and Performance Measures

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### Introduction

This attachment presents the planned Project Monitoring, Assessment and Performance measures that will demonstrate that the Project will meet its intended goals and achieve measurable outcomes while providing value to the State of California. The information included herein will become part of the future Project Monitoring Plan.

This section provides a narrative and a Project Performance Measures Table and includes the following information:

- ❖ Project Summary
- ❖ Project Goals
- ❖ Project Performance Evaluation Metrics
- ❖ Project Goals and Performance Measures
  - Goal
  - Current Conditions
  - Desired Outcomes
  - Performance Targets
  - Performance Indicators
  - Performance Measures

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**Project Summary**

The City of Chino Arterial Flood and Stormwater Management Project is designed to manage stormwater runoff and reduce flood damages to Pine Avenue, a major east/west arterial, and surrounding properties within the City of Chino. The Project has been identified by the City of Chino for implementation due to the roadway's propensity for extreme flooding during rain events as small as a 2-year event. Flooding of the roadway and surrounding property causes considerable damage to the roadway, leads to significant delays to emergency service vehicle travel, leads to potential damage to underground utilities, and results in measurable erosion to surrounding private and utility easement properties.

The existing drainage course consists of a shallow and wide earthen channel that crosses Pine Avenue through six 30" CMP culverts. The flowline of the existing channel is approximately 3' below the pavement on Pine Avenue. The combination of insufficient flow channeling to the north and south of Pine Avenue, undersized culverts, and low elevation of the roadway exposes the roadway and surrounding properties to damaging flood waters in a 2-year storm event, which construction of this Project will alleviate.

The Project consists of installation of a triple 12'x4' precast reinforced concrete box (RCB) culvert that will extend approximately 300' from inlet to outlet. In addition, a 20'x10' trapezoidal earthen channel will be constructed upstream for 500' through the SCE transmission easement to connect to the existing channel, and a 24' x 8' trapezoidal earthen channel will be constructed for 800' downstream to outlet the flood waters beyond the existing dairy "ponds" through the southerly adjacent landowner's property. The existing vertical alignment of Pine Avenue will be raised to provide cover over the culvert, which will bring the roadway profile above the 100-year flood plain. The system is designed to handle the region's ultimate build-out condition in a 100-year storm event.

The combined design aspects of this Project will increase the expediency at which stormwater is routed away from the roadway and immediate property, reducing the frequency of "backwater" events and the number of days that this major arterial is closed due to flooding to only the most severe of storm events.

Reduction of flooding and backwater events will prevent undermining of the road and protect the underlying utilities, which include a sewage waste line, a recycled water treatment line, a private water line, and a high pressure natural gas line. Flooding also causes damages to the surrounding privately owned and utility easement properties. Flood events to the north of Pine Avenue affect SCE's access to their 500/220kv electrical transmission line, which services approximately 2.2 million Southern California residents. Flood events to the southerly property causes breaching of dairy "ponds" and increased erosion, which then carries sediment and pollutants downstream to the Prado Basin, the primary source of water for downstream water users.

The performance measures to be used to verify Project performance towards meeting these goals are shown in the accompanying performance measures table and summarily described below.

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## **Project Goals**

The City of Chino Arterial Flood and Stormwater Management Project is located in the Santa Ana Watershed and is consistent with the region's IRWM Plan, the Santa Ana Watershed Project Authority "One Water One Watershed" ("OWOW").

The Project's goals, which are consistent with the "OWOW" plan and Statewide priorities are:

- 1) Improve the region's flood protection by addressing stormwater flood risk at major master planned regional arterials
- 2) Provide sustainable flood water management systems through the construction of improved stormwater conveyance systems
- 3) Improve emergency preparedness and response and improve public safety through the management of stormwater
- 4) Improve regional water quality through the reduction of pollutants, erosion and sediment transport to the Prado Basin, the primary source of groundwater recharge for downstream water users

## **Project Performance Measures**

### **1. GOAL: Improve Regional Flood Protection**

➤ **Current Conditions:**

In its current state, Pine Avenue, a major east/west arterial that connects Interstate 15 and State Route 71, floods to an unusable and damage inducing state in a 2-year storm event. Flooding causes measurable damage to the roadway; erosion and flooding of surrounding properties, which include both privately owned property and Southern California Edison (SCE) 500/220kv power transmission line easement property; threatens the viability of public infrastructure; and adversely affects regional water quality. The combination of undersized culverts, the lack of channel to properly direct flows to the north and south of the Project, and the low elevation of the roadway exposes Pine Avenue and the surrounding properties to the damaging flood waters that construction of this Project will alleviate.

Pine Avenue is subject to flooding and erosive conditions in storm events as moderate as a 2-year event, resulting in damage inducing floodwaters crossing the roadway and forcing extended road closures. Exhibit A provides photos of the 2-year event that impacted the roadway in December 2010, illustrating the damaging and dangerous flood conditions this roadway has historically experienced.

The properties to the north and south of Pine Avenue, within the Project area, experience heavy flooding and erosion due to "backwater" events caused by the undersized culverts and lack of

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channels to direct stormwaters. SCE has an easement to the north of Pine through which 500/220kv power transmission lines run. This line services approximately 2.2 million Southern California residents. Flooding causes potential erosion around the towers and, more importantly, hinders maintenance access which could result in extended power loss to millions of Southern California residents. The privately owned property to the south is subjected to erosive conditions due to the inadequate stormwater conveyance system currently in place. These erosive conditions cause sediment transport, affecting the region's water quality and causes the water quality dairy ponds to breach. Breaching of these ponds causes downstream transport of pollutants to Prado Lake, a 303(d) listed impaired water body, and ultimately to the Prado basin, the primary source of groundwater recharge for Orange County.

During these moderate storm events with high frequency recurrence intervals (2-year storm events or larger) there is a high potential and historical occurrence of the undermining of Pine Avenue. Utilities running under this portion of the roadway, including water lines for the Department of Corrections California Institution for Women, the Inland Empire Utility Agency's Reclamation Plant (RP1) outfall discharge, and the Santa Ana Regional Interceptor (SARI) line, have a high probability of incurring damage. Damage to the underlying water lines would interrupt all water supplies to the prison. The SARI line is a sustainable means of disposal of non-reclaimable wastes for utilities and industry within the Santa Ana Watershed. The SARI line aids in the removal of salts from the watershed to keep them from degrading water quality within the watershed, thereby allowing better use of groundwater resources and expanding the ability to reclaim water. Protection of the SARI line is imperative to the region in its long term goal of achieving salt balance through the removal of salts from the watershed.

Flood events at this location have additional regional effects through deterioration in water quality due to erosion, sediment transport, and increased pollutant load of suspended solids and sediments being conveyed to the Prado Basin. The Prado Basin contains some of the best and largest riparian habitat in Southern California. The Prado Basin also serves as the principle source of groundwater recharge for downstream water users, primarily those within the Orange County Water District.

➤ **Desired Outcomes:**

The City conducted studies through the Chino Preserve Specific Plan in 2003 and prior to determine the size of the ultimate planned facilities within the subject area. To maximize the resources available for the region, the City will construct a flood and stormwater management system designed for the ultimate needs, which provides for a minimum 50-year life of the Project.

Construction of this Project will provide flood protection for Pine Avenue, the SCE electrical transmission towers to the north, and the existing water quality dairy basins to the south. The combined design aspects of this Project will increase the expediency at which stormwater is routed away from the roadway and immediate property, reducing the frequency of "backwater"

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events and the number of days that this major arterial is closed due to flooding. Reduction of these flood induced erosive conditions will also serve to improve regional water quality. The improved system under this Project is designed to withstand a 100-year storm event in the region's ultimate build-out condition.

➤ Performance Target:

The Performance Target for this goal is to construct a Project that protects the arterial and immediate surrounding properties from flooding and the resultant damages and road closures. Post-project road closures are eliminated except during the highest storm events (greater than a 100-year event).

➤ Performance Indicator:

Reduced road closures, reduced road maintenance costs, the ability to sustain and maintain usability of the arterial, and maintain access to SCE facilities up to and including a 100-year storm event in the current and ultimate build out condition.

➤ Performance Measures:

Project performance will be evaluated by comparing existing pre-project data with post-project performance monitoring data to demonstrate that flooding and erosion in the area has been minimized.

Costs associated with flooding and flood risk, including maintenance and repair of the roadway, drainage channel, and culvert will be quantified and tracked pre- and post-project, resulting in a measurement of the project's success in meeting this project performance goal. Annual road closures will also be documented and tracked pre- and post-project to quantify flood impacts and the effects of the improved flood protection for SCE's transmission line access, regional traffic and emergency response vehicles. Monitoring and analysis of these metrics will occur on an annual basis for a five year period following completion of the improvements.

**2. GOAL: Sustainable Flood Water Management Systems**

➤ Current Conditions:

The combination of undersized culverts, the lack of sufficient channeling to properly direct flows to the north and south of the Project, and the low elevation of the roadway exposes Pine Avenue and the surrounding properties to damaging flood waters during moderate storm events with high frequency recurrence intervals (2-year storm events or larger). Moderate storm events result in a high potential and historical occurrence of the undermining of Pine Avenue. Road failure at this section of Pine Avenue has the potential to damage the following

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four major utility lines running beneath the roadway: The Inland Empire Brine Line (formerly known as the Santa Ana Regional Interceptor or “SARI” line), the Inland Empire Utility Agency’s Treatment Plant 1 Outfall Line; the water line servicing the California Institution for Women in Chino; and a Natural Gas Line.

The Inland Empire Brine Line (“IEBL”) is intended to carry brine and domestic and industrial waste. Currently, it handles domestic sewage from California Institution for Women and residents within the City of Chino, and also has connections for emergency discharge for the surrounding dairies. In the event of line damage or failure, the resulting sewage leak would pose a regional environmental hazard to wildlife, habitat, the immediate public, and downstream water users.

The Inland Empire Utility Agency’s Treatment Plant 1 Outfall Line is owned and maintained by the Inland Empire Utility Agency (“IEUA”). The line conveys recycled water to downstream water users and outflows into El Prado Lake. Prior to discharging into the lake, the water is stripped of its high chlorine content at IEUA’s Dechlor facility. A breach of this line would allow chlorinated water to flow directly into El Prado Lake, killing the fish and plant life within the lake.

The water line running under Pine Avenue to the California Institution for Women, a female-only state prison located within the City of Chino, is the only source of water for the prison. Damage to this underlying water line would interrupt all water supplies to the prison. Water service disruption would have a significant impact to the Institution and would cause a relocation of prisoners to another facility.

A road failure has the potential to cause a rupture in the natural gas line running under the roadway. A rupture to this line has a significant impact both locally and regionally. A rupture locally, coupled with a detonation of the high pressure gas main, will likely have an impact area of a quarter mile from the rupture impacting over 250 local residences, the SCE transmission lines, and all circulation in the immediate area. Regionally, the impact would disrupt the service in several counties in Southern California including parts of San Bernardino, Riverside, Orange, and San Diego Counties. The gas transmission line is the southern California natural gas source for a significant number of residential, commercial, and industrial uses within the four county area.

In addition, Southern California Edison 500/220kv lines to the north of the roadway, which service approximately 2.2 million Southern California residents are subject to severe flood conditions, limiting the ability to service the lines for an extended period of time in as moderate as a 2-year storm event.

➤ **Desired Outcomes:**

This Project is the result of City planning efforts to design a long-term sustainable system that will have a life span of 50+ years, addressing current impacts and planning for the long term

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urbanization of the area. Through culvert and roadway improvements that have been modeled, designed and constructed for the ultimate build-out of the area, the roadways will require less short term as well as long term maintenance and result in a reduction in the frequency of potential road washout. Decreasing the potential for undermining of the roadway will eliminate the potential for utility line damage in conditions up to and including a 100-year storm event. In addition, flooding conditions to the north where SCE's transmission lines are located will be dramatically decreased through the construction of an engineered earthen channel, designed to increase the expediency at which stormwater is routed away from the roadway and boundary properties, allowing for continual access to this utility line. The system is designed to manage up to and including a 100-year storm event.

➤ Performance Target:

The Performance Target for this goal is to construct a Project that protects the arterial and surrounding properties from flooding and the resultant damages and road closures. Post-project road closures are eliminated except during the highest storm events (greater than a 100-year event).

➤ Performance Indicator:

Reduced road closures, reduced road maintenance costs, and the ability to sustain and maintain usability of the arterial up to and including a 100-year storm event in the current and ultimate build out condition.

➤ Performance Measures:

Project performance will be evaluated by comparing existing pre-project data with post-project performance monitoring data to demonstrate that flooding and erosion in the area has been minimized.

Costs associated with flooding and flood risk, including maintenance and repair of the roadway, drainage channel, and culvert will be quantified and tracked pre- and post-project, resulting in a measurement of the project's success in meeting this project performance goal. Annual road closures will also be documented and tracked pre- and post-project to quantify flood impacts and the effects of the improved flood protection for SCE's transmission line access, regional traffic and emergency response vehicles. Monitoring and analysis of these metrics will occur on an annual basis for a five year period following completion of the improvements.

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**3. GOAL: Improve Emergency Preparedness and Response and Improve Public Safety Through Stormwater Management**

➤ Current Conditions:

Pine Avenue is a primary east/west arterial between two major north/south roadways, State Route 71 and Interstate 15. East/west traffic in this part of Southern California is particularly congested during peak commuter hours. Reducing the number of available traffic routes, particularly during heavy commuter times, is associated with the potential to increase emergency response times. Road closures during peak commuter hours, particularly in the east/west direction, present a substantial burden on surrounding arterials.

The nearest major east/west arterial to the south is 5 miles away, and the nearest major east/west arterial to the north is 3 miles away. In its current state, Pine Avenue floods to an unusable and damage inducing state in a 2-year storm event, causing potential emergency service delays to area residents, particularly in the ultimate build out condition. There are additional east/west routes that may be taken; however, they are indirect and often include minimally marked roads through former or current farming properties.

➤ Desired Outcomes:

The improvements being constructed with this Project will increase flood protection and reduce the number of days that Pine Avenue is closed at this location due to flooding and “backwater” events. Improved emergency preparedness and response is being addressed by increasing flood protection, thereby reducing the number of days that Pine Avenue is closed at this location and providing the ability to keep traffic flowing at its greatest capacity. The system is designed to withstand a 100-year storm event in the region’s ultimate build-out condition.

➤ Performance Target:

The Performance Target for this goal is to construct a Project that protects the arterial from flooding and resultant road closures in events up to and including a 100-year storm event.

➤ Performance Indicator:

Reduced road closures and ability to sustain and maintain usability of the arterial up to and including a 100-year storm event in the current and ultimate build out condition.

➤ Performance Measures:

Project performance will be evaluated by comparing existing pre-project data with post-project performance monitoring data to ensure that flooding and erosion in the area has been minimized.

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Annual road closures will be documented and tracked pre- and post-project to quantify flood impacts to traffic and emergency response vehicles. Monitoring and analysis of these metrics will occur on an annual basis for a five year period following completion of the improvements.

**4. GOAL: Improve Water Quality within the Regional Santa Ana Watershed and The Prado Basin**

➤ **Current Conditions:**

Pine Avenue is located within the Prado Basin, which contains some of the best and largest riparian habitat in Southern California. The Prado Basin also serves as the principle source of groundwater recharge for the Orange County groundwater basin, a primary source of drinking water for Orange County residents. The designated beneficial downstream uses are water contact and non-contact recreation, warm fresh water habitat, wildlife habitat, and habitat for rare, threatened, or endangered species.

The existing drainage course in this area is a shallow and wide earthen channel that crosses under Pine Avenue through six 30" CMP culverts, which are undersized and cause "backwater" events. Current conditions do not provide for sufficient means to direct the flow before or after the existing undersized culverts, causing erosion inducing turbulence upstream and downstream of the Project which results in sediment transport to downstream water bodies. Breaching of the dairy waste ponds to the south causes pollutants to be discharged into Prado Lake and ultimately into the Prado Basin. The designated beneficial downstream uses are water contact and non-contact recreation, warm fresh water habitat, wildlife habitat, and habitat for rare, threatened, or endangered species.

➤ **Desired Outcomes:**

A 20'x10' trapezoidal earthen channel will be constructed upstream for 500' through the SCE transmission easement to connect to the existing channel, and a 24'x8' trapezoidal earthen channel will be constructed for 800' downstream to outlet the flood waters beyond the existing dairy basins for the southerly adjacent landowner. The alignment of the constructed culverts and earthen channels will be constructed to conform to the direction of the natural channel.

By increasing the flow through and improving the alignment of the earthen channels to the north and south of pine Avenue, and constructing a larger culvert system that conforms to the direction of the natural channel, the potential of "backwater" events and flooding within the Project area is decreased. Reduced flooding and improved storm flow control and conveyance as a result of the Project will reduce erosion and sediment transport to downstream water bodies and reduce the pollutant hazards of breached dairy "ponds", thereby improving regional water resources and protecting natural habitat.

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➤ Performance Target:

The Performance Target for this goal is to construct a Project that protects the arterial and immediate surrounding properties from erosive floodwaters and breaching of the dairy ponds in events up to and including a 100-year storm event.

➤ Performance Indicator:

Reduced frequency and extent of erosive conditions and minimization of dairy pond breaches in storm events up to and including a 100-year event.

➤ Performance Measures:

Specific water quality improvements provided by this project are not measureable due to its location in the watershed and other contributory factors within the near vicinity. Therefore, metrics for this goal will be measured by monitoring downstream levy/berm damage and failures on an annual basis for five years following the completion of the improvements.

The data produced by the project monitoring plan will be used to demonstrate the project's ability to meet the overall goals and objectives of the City of Chino Arterial Flood and Stormwater Management Project, which are consistent with the Santa Ana Watershed Project Authority's "One Water One Watershed" IRWM and Statewide priorities. Roadway maintenance repair records, road closures, and levy/berm damage and failures will be monitored and reported on an annual basis to quantify the outlined goals to reduce flood risk and provide for improved stormwater management.



### Project Performance Measures Table

Project Goals	Desired Outcomes	Targets	Performance Indicators	Measurement Tools and Methods
Improve Regional Flood Protection	Flood protection for Pine Avenue, SCE 500/220kv transmission towers, and private dairy lands	✓ Flood Protection for the arterial and surrounding properties up to and including a 100-year storm event	<ul style="list-style-type: none"> <li>✓ Reduced Road Closures</li> <li>✓ Reduced Road Maintenance Costs</li> <li>✓ Maintain Access to SCE Facilities</li> </ul>	<ul style="list-style-type: none"> <li>✓ Track pre- and post-project annual road closures for a period of 5-years</li> <li>✓ Track pre- and post-project maintenance costs for a period of 5-years</li> </ul>
Provide Sustainable Flood Water Management Systems	Construction of a sustainable flood water management system	✓ Flood Protection for the arterial and surrounding properties up to and including a 100-year storm event	<ul style="list-style-type: none"> <li>✓ Reduced Road Closures</li> <li>✓ Reduced Road Maintenance Costs</li> <li>✓ Maintain Access to SCE Facilities</li> </ul>	<ul style="list-style-type: none"> <li>✓ Track pre- and post-project annual road closures for a period of 5-years</li> <li>✓ Track pre- and post-project maintenance costs for a period of 5-years</li> </ul>
Improve Emergency Preparedness and Response and Improve Public Safety Through the Management of Stormwater	Improved emergency response during rain events	✓ Flood protection for Pine Avenue, a major east/west arterial, up to and including a 100-year storm event	<ul style="list-style-type: none"> <li>✓ Reduced Road Closures</li> </ul>	<ul style="list-style-type: none"> <li>✓ Track pre- and post-project annual road closures for a period of 5-years</li> </ul>
Improve Water Quality	Improve water quality within the Prado Basin	✓ Reduce frequency of erosive floodwaters that cause erosion and dairy pond breaches	<ul style="list-style-type: none"> <li>✓ Decreased frequency of erosive flood conditions</li> <li>✓ Minimized dairy pond breaches</li> </ul>	<ul style="list-style-type: none"> <li>✓ Track pre- and post-project erosive flood conditions</li> </ul>



## Exhibit A – Project Area Photos in a 2-year Storm Event (December 2010)

### Pine Avenue Roadway Failure



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**Existing Outfall  
December 2010 (2-year event)**



**Attachment 6: Monitoring, Assessment and Performance Measures**

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**Pine Avenue Existing Outfall and Storm Response Activities  
December 2010 (2-year event)**



**Attachment 6: Monitoring, Assessment and Performance Measures**

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**Pine Avenue Storm Response Activities  
December 2010 (2-year event)**

