CHAPTER 3 - PLAN FORMULATION

3.1 PLAN FORMULATION PROCESS

The Corps' planning process will be followed in the development of a recommended plan. The six steps of the iterative process include:

1. Specify the problems and opportunities which are relevant to the planning setting, and are associated with the Federal objective and specific stakeholder concerns.

2. Inventory, forecast, and analyze conditions in the study area that are relevant to the identified problems and opportunities.

3. Formulate alternative plans that would resolve the identified problems and realize the identified opportunities.

4. Evaluate the economic, environmental, and other effects, both beneficial and adverse, of each alternative plan.

5. Compare alternative plans and their effects.

6. Select a recommended plan.

3.2 PROBLEMS AND OPPORTUNITIES

The list of public concerns presented in the *Coordination, Public Views, and Comments* chapter was used as a guide for the baseline conditions analysis. These concerns are also the basis of the problem and opportunity statements presented in this section, in addition to other problems that have been identified during the baseline condition studies, including future without-project conditions. The ♦ symbol designates problem statements and the ◘ symbol designates opportunity statements.

- ♦ **Urbanization stressors on the Aliso Creek system have led to channel degradation and loss of habitat quality.**

  Since the 1960s, urbanization has significantly increased and today the Aliso Creek watershed is largely developed. Remaining undeveloped areas which offer needed protection of valuable natural resources are the Cleveland National Forest in the upper watershed, Aliso and Woods Canyon Wilderness Park in the lower watershed, and other conservation areas

(making up 3, 19 and 3 percent, respectively, of the total watershed area). The high degree of urbanization in the watershed has led to degradation in natural conditions and processes (for example, through loss of floodplain and its habitat) associated with Aliso Creek.

The natural hydrologic flow regime has been altered as urbanization and the building of impervious and harden surfaces has increased runoff, both wet weather stormwater discharge and dry weather flow, to the receiving Aliso Creek drainage system. Infiltration and groundwater recharge capability has been reduced. Increased development has also diminished the sediment contribution source areas to the creek system. With a relatively steep gradient, the stream must carry rapid flowing, "sediment-hungry" waters, which erode the banks and incise (downcut) the bed. Channel degradation will continue until equilibrium is established between runoff flow, sediment supply and the channel's ability to transport sediment.

Infrastructure and engineered channel modifications (bank armoring and straightening) can create lateral constraints and cause loss of sinuosity to a natural stream system. Sinuosity (meanders, bends) in a riverine system is a natural way to reduce the overall gradient and slow down the flow of water. A 1969 channel modification project built about the time of the construction of Alicia Parkway and the Chet Holifield building removed a 1,500-foot long natural bend and straightened the creek in the vicinity of Aliso Creek Road. Two 10-foot concrete drop structures were installed to lessen the effect of the resulting increased grade change and to help dissipate flow energy. However the overall added steepness of the channel and corresponding increase in water velocity has in part contributed to the bed degradation evident in the lower reaches of the watershed. Since 1967, the stream length within the study lower Aliso Creek has been shortened by a total of 3,100 feet due to both engineered modifications and to subsequent dynamic creek readjustment downstream, such as the abandoned "oxbow" channel.

Lower Aliso Creek is the most unstable reach in the watershed drainage system. The channel bed has incised up to 25 feet in the most degraded segment in the last 40 years. Additional downcutting (preliminary estimates approaching as much as 25 feet) is expected to continue before equilibrium is reached.

- ***Improve altered flow regime (frequency, duration, volume) and channel stability in the lower Aliso Creek watershed.***

- **Channel instability (vertical and lateral) has led to a decline of connectivity within the creek, and between the creek, historic floodplain and tributary system, resulting in fragmentation and decreased terrestrial and riparian habitat function and value.**

There are 29 special status species that have the potential to occur in the aquatic, riparian, wetland and upland habitats in the lower Aliso Creek watershed due to the presence of

suitable habitat and recent observations, including 10 listed species (threatened and endangered), and 19 California species of special concern.

Channel degradation causes loss of riparian, floodplain and aquatic habitat, and associated wildlife species.

As Aliso Creek continues to incise, the associated floodplain becomes less extensive with flow events increasingly ceasing to overbank. Overbanking serves an important function. During major events, overbank flooding and deposition adds sediments, nutrients and disperses contaminates to the floodplain surface, and enhance floodplain features including backwaters, wetlands, and abandoned channels. Valuable storage capacity offered by an extensive floodplain and its inherent ability to slow and reduce the power and peak flows downstream is lost. The riparian area shrinks. The footprint of the current 100-year floodplain is significantly less extensive than the historic floodplain. Without a significant floodplain extent, the flood flows are concentrated in the main channel, become more powerful and damaging, increasing mortality rates of affected wildlife.

With the hydrologic connection between the creek and the historic floodplain lost, soil moisture levels in the relict floodplain decline, groundwater levels drop with the lowering of the creek bed, and the associated habitat is altered. Tree die back has been observed downstream of the ACWHEP structure as a result of perched root systems. Water temperatures in the creek rise as shade canopy provided by vegetation decreases. Higher water temperatures can be detrimental to many aquatic plant and wildlife species. Bank failures occur as over steepened slopes, with little or void of riparian vegetation, succumb to drying, cracking, and mass failure, and/or undermining erosion. Steepened banks can pose a hindrance to wildlife movement.

Channel degradation has affected longitudinal connectivity and wildlife migration, most significantly at the ACWHEP structure where there is about a 25-foot drop downstream of the structure. The structure must be periodically maintained, without which a failure caused by a very large storm event could present potentially catastrophic consequences upstream as a resulting headcut could undermine infrastructure. As a result of the ACWHEP structure and ponding effects, a marsh habitat has become established upstream of the headworks structure.

Wood Canyon Creek which enters Aliso Creek downstream of the ACWHEP structure has also downcut accordingly to meet the grade at the confluence. Significant headcutting would continue upstream in this tributary if it were not for the AWMA road crossing providing provisional stability.

Downstream of the Wood Canyon Creek confluence, an abandoned bend (“oxbow”) sits approximately 18 feet above the active Aliso Creek. During a large flood event in the early 1980s, the channel bypassed the bend into a newly created channel. Downstream of the oxbow, the “S-bend” faces a potential similar future fate.

Numerous other drop structures for grade control are located upstream of the ACWHEP structure.

- ***Restore connectivity within riverine system both longitudinally along channels and laterally between channels, riparian areas and floodplains in lower Aliso Creek.***
- ***Restore floodplain inundation in lower Aliso Creek to provide flood flow storage, allow seasonal scouring, abate stream power and enable more stable aquatic habitat; increase floodplain moisture and associated habitat.***
- ***Re-establish fish passage capability in lower Aliso Creek.***

- **Exotic and invasive species are outcompeting riparian native species in the Aliso Creek watershed, including lower Aliso Creek and portions of the estuary area.**

  Exotic species include giant reed (*Arundo donax*), a highly invasive non-native plant. *Arundo* is a high water usage plant and forms impenetrable stands of vegetation that crowd out native plant species, establishing a monoculture, and decrease habitat function and value. Giant reed becomes established in waterways and spread by floodwaters that disperse stems and rhizomes downstream.

  Within the Aliso Creek watershed, there is about 115 acres of invasive plant species, of which about 50 percent are occupied by giant reed. Within the lower Aliso Creek watershed, riparian and estuarine areas will continue to decrease due to the spread of invasives.

- ***Eradicate exotics and invasive plant species within the Aliso Creek watershed.***
- ***Restore ecological and habitat diversity in the riverine, floodplain, and the estuarine lagoon area.***

- **The tidewater goby, a Federally Endangered species, occurred historically at the mouth of Aliso Creek but has not been observed in the area for over three decades.**

  Critical habitat for this species was designated in 2000 and includes the estuary and marsh at the mouth of Aliso Creek and the initial 0.6 miles of the creek.

  The small size of the estuary, reduced from its former historic size, and lack of salt marsh areas protected from high flow events are likely impediments to maintaining a population. Poor water quality is also a factor.

- ***Improve quality of estuarine habitat area by providing wetland/tidepool areas protected by high flow events.***

- **Poor water quality in creek system, beach outlet, and receiving waters is a threat to human health, has adverse effects on wildlife, and impacts active and passive recreational experience.**

  Aliso Creek and its major tributaries are included in the Clean Water Act Section 303(d) list of "impaired" water bodies for coliform bacteria, phosphorous, and toxicity. The primary cause of impairment is non-point source pollution. Residential and commercial use of fertilizers and pesticides, and pet and waterfowl waste are most likely the primary contributors. High water temperatures also contribute to poor water quality.

  Aliso Beach attendance figures have declined in the last decade, likely associated with water quality issues related to the creek. In addition, recurring sewage spills have resulted in beach closures and contributed to a reputation associating Aliso Beach with poor water quality and human health and safety risks.

  - ***Restore floodplain inundation natural functions and features to improve instream and coastal receiving water quality by settling out fine sediments and increasing nutrient uptake and processing rates, and in particular increased denitrification rates.***
  - ***Increase riparian reforestation to reduce creek temperatures.***
  - ***Contribute to comprehensive and integrated plan for Federal, State and local participation in addressing water quality improvement from urban stormwater runoff in the Aliso Creek watershed.***

- **The on-going channel, habitat and water quality degradation of the creek system within the Wilderness Park has devalued the recreational experience in the lower Aliso Creek watershed.**

  The Wilderness Park has lost up to 100 acres of land for recreational use from the degradation of the stream banks.

  The ACWHEP structure is not aesthetically pleasing.

  - ***Increase the passive recreational experience by improving the quality of the natural habitat and providing stability to the creek in a manner consistent with the surrounding natural setting.***

- **Flooding and channel instability and flooding within the study area have resulted in damages to structures and their contents, and to utility and transportation infrastructure.**

  Flooding and erosion damages in the Aliso Creek watershed since 1969 have exceeded $26 million.

- ***Decrease level of flood inundation by reconnection to a wider floodplain extent, allowing greater floodwater storage, reduction of flow power, and peak flows downstream.***
- ***Improve channel stability within the lower Aliso Creek watershed to reduce potential erosion susceptibility of infrastructure.***

3.3 OBJECTIVES AND CONSTRAINTS

The problems and opportunities identified in this study are used to define specific planning objectives that represent desired positive changes in the without-project conditions and provide focus for the formulation of alternative plans. The primary objectives for this study were developed by the Corps, the Sponsor, resource agencies and stakeholders based on public input, meetings, and the identification of problems and needs. The primary ecosystem restoration study objectives are:

- Restore degraded riverine (aquatic and terrestrial) habitat function in the lower Aliso Creek watershed to benefit wildlife species.
- Restore a more natural flow, connectivity, and channel stability along the lower Aliso Creek system.
- Improve water quality in lower Aliso Creek .
- Enhance passive recreational opportunities for the lower Aliso Creek watershed.

At this time, a study objective specific to restoring estuarine habitat function is not being considered due to financial and scope limitations of grant funding available to the local sponsor. Efforts will continue to seek other sponsors interested in providing financial and other resources support for the identification of Federal interest in estuary restoration as a separate study.

Constraints have been identified through the study process, particularly during meetings with the Sponsor, resource agency representatives and other stakeholders.

- No increase in flood and erosion risk damages to facilities and infrastructure as a result of a restoration project.

- Protect/preserve archeological findings and locations.
- Avoid unnatural structures in the Wilderness Park.

3.4 NATIONAL OBJECTIVES

The "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies", also known as Principles and Guidelines (P&G) identifies a single Federal objective emphasizing National Economic Development (NED). The P&G is one of the most important sources of Corps planning guidance.

> *"The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements."*

Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

Ecosystem restoration has become one of the primary missions of the Corps Civil Works program. Current Corps policy (Engineering Regulation (ER) 1105-2-100) establishes an additional national objective to contribute to National Ecosystem Restoration (NER). The NER objective is to contribute to the Nation's ecosystems through restoration, with contributions measured by changes in the amounts and values of habitat. Primary ecosystem restoration benefits to be associated with the final array of alternative plans considered for this study will be presented in non-monetary outputs (habitat units). The NER plan is the alternative with the greatest net ecosystem restoration benefits. The Corps has reaffirmed its commitment to the environment by formalizing a set of Environmental Operating Principles applicable to all its decision-making and programs. These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialogue on environmental matters, and ensure that conservation, environmental preservation, and restoration are considered in all Corps activities.

Four accounts will be included in this chapter in the next phase of this feasibility study to organize and summarize important considerations used to compare and evaluate alternative plans. The accounts are NED, Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). The four categories, known as the System of Accounts and suggested by the U.S. Water Resources Council, address long-term impacts, defined in such a manner that each proposed plan can be easily compared to the no action plan and other alternatives.

3.5 FORMULATION OF MEASURES AND ALTERNATIVE PLANS

3.5.1 Assumptions

Premises established for the purposes of this plan formulation effort are as follow:

(a) The ACWHEP structure, if left in place, will not be allowed to be undermined and County maintenance will continue into the future to assure its integrity and current level of functionality.

(b) The property occupied by the Aliso Inn and Golf Course will not change from its present use in the future.

(c) Compensatory mitigation- any remaining commitments associated with the mitigation sites identified in Section 1.8 will not affect the formulation of alternative plans.

3.5.2 Preliminary Measures

The following sections present preliminary measures to be considered in the formulation process, summarized by category. The measures address channel stability, habitat improvement, control of urban stormwater runoff and water quality improvement. Some of these measures are mutually exclusive, while other measures must be combined with other measures.

Measures Addressing Channel Stability

Stream Lengthening – By adding meandering to the system decreases the gradient and reduces flow velocities and erosion potential. The 2002 Watershed Management Study did not find this measure feasible due to the insufficient land needed to effectuate an increase in stream length necessary to reduce gradient sufficiently and promote stability. Before this measure however is eliminated from further pursuit, it would merit reevaluation should there be any possibility to provide some level of realignment to utilities infrastructure and/or maintenance roads in the Wilderness Park. Creation of stream meanders also provides habitat value.

Bank Stabilization – As the objectives of this study are geared for ecosystem restoration, any need to provide bank stabilization would be accomplished by re-contouring banks into stable slopes and utilizing bioengineering methods (e.g. live fascines, brush layering/mattresses) to the fullest extent possible. Trees and other native woody vegetation have deep root systems that help hold streambank soil in place. Bank stabilization needs would be congruent with efforts that promote a system that is in dynamic equilibrium.

Grade Control Stabilizers – These structures would be utilized for cases where the streambed needs to be stabilized to prevent further incision, or to maintain a specific gradient (slope). To prevent from being outflanked and undermined by flows, the structures would span the valley width and would be required in a series so as to preclude downcutting actions from transmitting

downstream. The number of structures and dimensions required would be dictated by the projected equilibrium slope. Criteria adopted by the study team establish that the stabilizers (1) be designed with the intent to appear as natural as possible, using natural materials consistent with the Wilderness Park setting; (2) allow fish passage; (3) would not incorporate hard crossing points (notches) to preclude the creek from being confined to a specific flow path; and (4) would be constructed with top of structure elevation at the desired stream invert grade and not above grade so as not to allow gradual filling behind stabilizers by natural depositional processes.

Managed Sediment Input – Loss of sediment contribution from development could be alleviated by a supplemental sediment plan. Trucked loads of construction-derived excess excavation earth materials from the region would be periodically introduced to the streambed to become part of the riverine sediment supply. As this technique would provide only short-term benefits if not sustained by periodic repetition, and carries associated water quality issues, this measure was not carried forward.

Armoring Channel (Invert and/or Sideslopes) – Armoring of sideslopes and/or channel invert would utilize traditional techniques (e.g. riprap stone). As this measure would not be consistent with the intent of ecosystem restoration, it was not carried forward in the formulation assessment.

Utility and Infrastructure Protection – Only in situations where a proposed alternative plan could allow for permanent utilities or other infrastructure to be at risk from erosion or undermining damage, would this measure be utilized. Protection methods would likely be a combination of traditional and bioengineering stabilization methods (e.g. buried stone and an overlying geosynthetic mat with planted vegetation). Flow deflectors would also be considered.

Measures Addressing Improvement of Habitat Conditions

Preservation of Existing High Quality Habitat – This measure would protect healthy, high quality habitat from further ecosystem degradation. Examples would include protecting existing riparian stands of significant value, such as willow, cottonwood, sycamore, and mulefat; and marsh habitat of which there are remnants in the Wilderness Park.

Create Marshland- Freshwater marsh habitat is extremely limited. Creation of permanently or seasonally flooded areas provides wetland habitat value and function, and opportunities for infiltration and aquifer recharge. These areas could be off-line or on-line. This measure also provides ancillary water quality improvement benefits.

Remove or Modify Physical Barriers – The presence of the ACWHEP structure and the AWMA road crossing at Wood Canyon Creek have created 25-foot grade longitudinal (up- or downstream) grade discontinuities along the Aliso Creek mainstem and at the tributary confluence. These physical barriers impair aquatic, amphibious, and terrestrial passage through the riverine and aquatic corridor, and create habitat fragmentation and disconnected refuge.

Access to the entire stream network is critical for migrating species that require suitable habitat and food. This measure would either remove or modify these barriers. Other drop structures in the lower Aliso Creek watershed acting as physical barriers would also be assessed for potential modification.

Fish Passage Structures – This measure would address the needs and means for passage facilitation of fish and other aquatic organisms over otherwise inaccessible instream barriers. Any structure considered in the Wilderness Park would be evaluated to ensure it does not conflict with natural aesthetics. Grade control stabilizers described above could also provide this function.

In-stream Habitat Improvements – Where it is appropriate to improve instream conditions, habitat enhancement features such as erratic clusters of boulders, pool and riffles systems, and overhanging vegetative canopy would be utilized. Created habitat utilizing this measure would be most appropriate in settings where the benefits are expected to be provided over a long-term. This measure also provides ancillary water quality improvement benefits.

Raise Streambed to Reconnect Floodplain – Earthfill would be used to raise the streambed to the desired elevation. Materials would be trucked in. If possible, the source of materials would be sought from excess excavated earth materials from construction activities related to the project. All or portions of the current emerging floodplain could also be raised to meet the former higher floodplain that can no longer be inundated. Vegetative habitat associated with the existing channel and emerging habitat, if applicable, would be lost. This measure also provides ancillary water quality improvement benefits.

Lower Floodplain to Connect with Active Channel – Portions of the former floodplain would be lowered to allow for connection with the stream. One possible area for lowering is an overbank area just downstream of Pacific Park Drive. This measure also provides ancillary water quality improvement benefits.

Habitat Connection through Golf Course – Within the constraints of the land use associated with the resort, this measure would address stability, habitat structure and processes necessary in this segment to provide continuity with the upstream and downstream biological community.

Reconnect Off-Channel Habitat Features – Remnant off-channel features are not sustained by stream flow and are thus disconnected hydrologically. This measure would provide reconnection to abandoned oxbow and other floodplain remnant features. The oxbow is currently about 18 feet above the active channel. Restored features could provide refugia and high value habitat for wildlife.

Exotic Plant Species/Invasive Eradication – This measure includes the removal of exotic invasive plant species within the study area. Prior eradication efforts would need to be completed upstream in the watershed to preclude spreading of plants downstream.

Revegetation – Restoration efforts will include revegetation of areas of native California species, including riparian and coastal scrub consistent with the Wilderness Park. Riparian reforestation provides ancillary water quality benefits by reducing stream temperatures.

Measures Addressing Control of Urban Stormwater Runoff and Water Quality Improvement

Stormwater Best Management Practices – Stormwater control measures or best management practices (BMPs) are designed to mitigate the changes to both the quantity and quality of stormwater runoff that are caused by urbanization. Practices to achieve these goals and pursuable at the local and regional level include green infrastructure and low impact development. Most structural BMPs are more readily applied to new development rather than existing urban areas. For existing urban areas, retrofitting or re-development is necessary, an effort characterized by greater technical constraints and by higher costs.

Recent Congressional legislation enacted under Section 438 of the Energy Independence and Security Act (EISA) requires that Federal agencies develop and redevelop Federal facilities with a footprint exceeding 5,000 feet in a manner that retains or restores the pre-development site hydrology to the maximum extent technically feasible. EPA guidance written to assist Federal agencies in implementing EISA Section 438 focuses generally on retaining rainfall on-site through infiltration, evaporation/transpiration, and re-use to the same extent as occurred prior to development. The Chet Holifield Building in Laguna Niguel, which was originally constructed as a private corporation but is currently used as a Federal building, would be subject to these new regulations. This feasibility study is not expected to formulate measures to retain rainfall on-site for implementation consideration under Section 438.

Measures to be addressed as part of this feasibility study follow below. These measures consider consolidated approaches based on a watershed scale and would be investigated to assess their ability to benefit a Federally implemented ecosystem restoration project. These measures should be evaluated in conjunction with current and previous BMP efforts undertaken by the County to improve in-stream water quality.

Stormwater Treatment Wetlands – Constructed wetlands would be utilized to improve water quality by settling, adsorption and transformation of pollutants and water filtration. Locations would be sought upstream of Aliso Creek Road in the vicinity of the mainstem creek and tributaries, especially areas associated with channel modifications. The constructed wetlands would utilize native aquatic vegetation and would benefit ecosystem function. However, a weakness of this measure is the large land requirement and possible water temperature effects.

Detention Basins – This measure would utilize detention (dry) basins to reduce peak flows and erosive action downstream. Basin locations would be sought upstream of Aliso Creek Road. A weakness of this measure is the large land requirement and possible water temperature effects.

Retention/Infiltration Basins – This measure would utilize retention (wet) basins to reduce the total volume of flows and allowing infiltration and groundwater recharge. Basin locations would be sought upstream of Aliso Creek Road. Both in-line and off-line sites would be considered. Similar to detention basins, a weakness of this measure is the large land requirement and possible water temperature effects.

Riparian Buffers – Riparian buffers can reduce runoff by increasing flow complexity and travel time to the stream, increasing the opportunity for water quality treatment by pollutant uptake, degradation, sorption and transformation. A buffer can be managed as a riparian forest and would provide wildlife habitat. Buffers moderate the temperature of the stream ecosystem by providing shade. These systems can be located near municipal stormwater drain pipes, but would require concentrated flows to be transformed to sheet flow for effectiveness. Limitations to the effectiveness of buffers are available land to provide adequate area, and potential reduced benefit when watershed impervious cover is significant.

Mechanical Treatment- This measure would address diversion of dry weather and stormwater flows, and treatment for contaminants. This effort would supplement in-stream water quality improvements obtained through habitat restoration efforts and BMPs.

3.5.3 Screening of Preliminary Measures

Following from the above discussion, measures that have been screened and will not be evaluated further include:

- Managed sediment input
- Armoring channel invert and/or side slopes

In addition, the following measure refinements have been screened out:

- Sole use of traditional methods for bank stabilization in the Wilderness Park
- Grade control stabilizers with a non-natural appearance composed of materials not consistent with the Wilderness Park setting
- Hard-point crossings (notches) at grade control structures
- Top elevations of grade control stabilizer constructed above grade to allow gradual filling by natural depositional processes.

3.5.4 Preliminary Alternative Plans

Measures that are carried forward will be combined in various configurations to form a preliminary set of alternative plans that will be formulated to address the group of goals and objectives established for potential projects. These preliminary plans are intended to be subjected to a more rigorous evaluation. Different combinations of the restoration management measures will be selected based on appropriate site selection characteristics and physical parameters. Some of these measures become alternatives; others will be combined to form alternatives; and those

that do not meet the criteria will be eliminated from further consideration. The descriptions of the preliminary plans that were considered in this study are presented below. These alternatives were developed to encompass the broadest range of potential alternatives that could be formulated to address ecosystem restoration opportunities within the study area.

3.5.4.1 Preliminary Plans Eliminated from Further Consideration

The Corps will not develop single-purpose flood risk management alternatives for this study. As the study reach is protected to the 100-year event in most areas, a single-purpose flood risk management alternative would not be economically justified. For the next milestone report, flooding impacts will be assessed again considering projected sea-level rise to confirm this conclusion.

3.5.4.2 Preliminary Plans for Further Consideration

In consideration of the project purpose of this study, the following preliminary alternative plans have been developed from the list of measures presented above.

Alternative 1: No Action Alternative

Under this alternative, the Federal government would take no action to restore any ecosystem functions or values within the Aliso Creek study area. The channel invert and channel banks would be allowed to continue to erode until an equilibrium condition and new floodplain is reached. The No Action Alternative is the basis for comparison with all other alternatives, as it represents a condition, both current and future, under which nothing has been done to address the identified problems. By comparing the No Action Alternative to each formulated alternative, one may assess the advantages and disadvantages of the study alternatives in relation to current and future "without-project" conditions. All alternatives are evaluated against the No Action Alternative to determine the benefits and risks associated with each of the proposed alternatives.

Alternative 2: Protect Existing Channel and Floodplain

This alternative would stabilize the channel near the existing grade, and would utilize the existing floodplain. A combination of grade control stabilizers and bank re-contouring and stabilization with bioengineering methods would be utilized. The number of stabilizers would be the minimum required to support a projected equilibrium slope. Other measures that would be considered with this alternative would include stream lengthening, fish passage over inaccessible barriers, in-stream habitat improvements, exotic plant eradication, revegetation, and habitat connection through the golf course. The abandoned oxbow would need to be excavated to reconnect to the active channel. Utility and infrastructure would be protected as needed.

Alternative 3: Reconnect to Historic Floodplain

This alternative would bring up the channel invert to the required grade to reconnect the channel and the historic floodplain. A combination of grade control stabilizers and bank re-contouring and stabilization with bioengineering methods would be utilized. The number of stabilizers would be the minimum required to support a projected equilibrium slope. Other measures that would be considered with this alternative would include stream lengthening, marshland creation, removal/modification of physical barriers, in-stream habitat improvements, exotic plant eradication, revegetation, reconnection with off-channel features (eg. abandoned oxbow),and habitat connection through the golf course. Utility and infrastructure would be protected as needed.

Alternative 4: Intermediate Floodplain Connection

This alternative would be a hybrid of Alternatives 2 and 3 that would minimize the infilling inherent to Alternative 3 with the intent to preserve existing high quality habitat where possible. Other measures that would be considered with this alternative would include stream lengthening, marshland creation, removal/modification of physical barriers, in-stream habitat improvements, exotic plant eradication, revegetation, reconnection with off-channel features (eg. abandoned oxbow), and habitat connection through the golf course. Utility and infrastructure would be protected as needed.

Alternative 5: Incorporate Stormwater Control/Water Quality Improvement Feature(s)

This alternative would utilize a detention/retention basin (or series of basins), and/or stormwater treatment wetlands, riparian buffers, and mechanical treatment in combination with the action alternatives above.

3.5.5 Conclusion from the Formulation of Preliminary Alternatives

The preliminary alternatives described above demonstrate that there is a full range of possibilities for ecosystem restoration in the Aliso Creek Mainstem study area. For subsequent milestone reports, the plan formulation process will continue, with expansion of alternative plans, screening, refinements, and assessments leading up to the identification of the tentatively recommended plan.