A Collaborative Approach for Providing Flood Protection
And Continuity of Airport Operations
In the Natomas Basin, California

Prepared By the:

Sacramento County Airport System

&

Sacramento Area Flood Control Agency

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SUMMARY

This paper updates and revises an earlier draft prepared in March 2008 by the Sacramento Area Flood Control Agency (SAFCA) and the Sacramento County Airport System (SCAS), describing the elements of a cooperative arrangement on the design and construction of flood control and related improvements being undertaken by SAFCA on Sacramento International Airport (Airport) land in the Natomas Basin (Basin) in Sacramento and Sutter Counties.

These improvements will accomplish the following shared objectives of the parties:
(1) significantly reduce the risk of flood damage to Airport facilities and operations that would result from a failure of the perimeter levee system around the Natomas Basin;
(2) support implementation of an updated Wildlife Hazard Management Plan (WHMP) and a reduction in wildlife hazards for the Airport; and
(3) facilitate long-term plans for expansion of the Airport Operations Area (AOA) to reflect contemplated additional and extended runways in accordance with the Airport master plan approved by the Sacramento County Board of Supervisors on August 7, 2007.

As described herein, the elements of the cooperative arrangement include:
- Raising and strengthening of the Sacramento River east levee through construction of a new adjacent levee and associated seepage remediation and operation and maintenance features on Airport land adjacent to the levee north and south of the AOA.
- Relocating the existing Elkhorn Irrigation Canal partly on Airport land to accommodate the flood control footprint northwest of the AOA.
- Obtaining up to four million cubic yards of soil material for levee improvements from the Airport northern Bufferlands. Following borrow operations the drainage pattern of this area will be improved to reduce hazardous wildlife attractants.
- Re-configuring and redesigning the Airport West Ditch that currently runs through the west side of the AOA and constructing a new drainage canal partly on Airport land parallel to the Elkhorn Irrigation Canal to compensate for eliminating the irrigation, off-airport drainage and habitat functions currently provided by the Airport West Ditch.
- Removing trees from the flood control footprint on Airport land in the Airport Critical Zone.
- Acquiring and exchanging land outside the AOA that will expedite SAFCA’s flood control and related improvements and facilitate future expansion of the AOA in accordance with SCAS long-term development plans.
- Financing for the above improvements that allocates costs to SAFCA and SCAS based on the benefits received by each agency and ensures compliance with the U.S. Department of Transportation (DOT) Policy and Procedures Concerning the Use of Airport Revenue together with grant assurances given by SCAS to the Federal Aviation Administration (FAA) in connection with the affected Airport land.

SAFCA and SCAS are committed to incorporating these elements into a series of real estate and contractual agreements that will permit SAFCA to award construction contracts for the flood control and related improvements no later than March 2009. This process will expedite completion of these improvements and greatly reduce the Airport’s current exposure to flood and wildlife hazards without imposing new funding obligations on SCAS beyond the shared
obligation of all property owners in the 200-year floodplain to participate on an equitable basis in SAFCA’s Consolidated Capital Assessment District.

BACKGROUND

SAFCA is proposing early implementation of improvements to the perimeter levee system around the Natomas Basin in Sacramento and Sutter Counties north of Sacramento, California. These improvements are part of the Natomas Levee Improvement Program (NLIP) that SAFCA has initiated in concert with the California Department of Water Resources and the Central Valley Flood Protection Board (State). SAFCA anticipates that these improvements and the NLIP as a whole will be incorporated into the federally authorized American River Common Features Project (Common Features Project).

PROJECT PURPOSE

The early implementation project has been planned and designed to achieve the following objectives adopted by SAFCA in connection with the NLIP:

1. Provide at least a 100-year level of flood protection to the Natomas Basin as quickly as possible;
2. Provide 200-year protection to the Basin over time; and
3. Avoid any substantial increase in expected annual damages as new development occurs in the Basin.

Consistent with these objectives, the early implementation project focuses on expediting improvements to the segments of the perimeter levee system that do not currently meet the 100-year flood protection standards adopted by the Federal Emergency Management Agency (FEMA).

To provide for construction efficiency, these segments will be improved to a 200-year level of protection. This work will be completed by the end of 2011. The remaining segments of the perimeter levee system will be improved to the 200-year flood protection standard in 2012 and 2013. It is anticipated that this work will be carried out by the United States Army Corps of Engineers (USACE) following Congressional approval for expanding the scope of the Common Features Project based on a General Re-evaluation Report (GRR) to be completed by the USACE and presented to Congress in 2010.

PROJECT NEED

As shown in Plate 1 and 2, the Natomas Basin is located at the confluence of the American and Sacramento Rivers. Encompassing approximately 53,000 acres, the Basin extends northward from the American River and includes portions of the City of Sacramento, the County of Sacramento, and the County of Sutter. In addition to the American and Sacramento Rivers, the Natomas Basin is bordered on the north by the Natomas Cross Canal (NCC) and on the east by the Pleasant Grove Creek Canal (PGCC) and the Natomas East Main Drainage Canal (NEMDC). The NCC, in concert with the PGCC and the East Side Canal, diverts the runoff from a large watershed in western Placer and southern Sutter Counties around the Natomas Basin and is a contributor to the flows in the upper reach of the Sacramento River channel in SAFCA’s jurisdiction. These drainage flows in turn increase the volume of water carried by the Sacramento River near the Airport.
The NEMDC is an engineered channel along the southeastern flank of the Natomas Basin. Tributaries to the NEMDC include Dry Creek, Arcade Creek, Rio Linda Creek, Robla Creek, and Magpie Creek Diversion Channel. The Natomas Basin is protected from high flows in these...
water bodies and in the American and Sacramento Rivers by an interconnected perimeter levee system. This levee system was originally created to promote agricultural development. Today, however, urban development, including the Airport, occupies over one-third of the Basin. This intensity of development has increased the volume of stormwater runoff that must be accommodated by the regional drainage system, and ultimately, the Sacramento River.

Due to this urban development, an uncontrolled flood in the Natomas Basin will cause substantial direct damage to structures and contents and, depending on the timing and circumstances of the flood, pose a serious threat of loss of life and injury. Direct flood damages were estimated based on an inventory of structures created in connection with the formation of SAFCA’s Consolidated Capital Assessment District (April 2007). Structure replacement values were estimated using Marshall & Swift unit construction cost factors. Content values were derived using structure-to-content ratios established by USACE, FEMA and the State. Based on these data, it is estimated that the structures and contents exposed to flooding have a depreciated replacement value of approximately $8.2 billion.

The need for the early implementation project was initially outlined in the *Natomas Levee Evaluation Study Prepared for SAFCA in Support of the Natomas Basin Components of the American River Common Features, Final Report* (July 14, 2006) which indicated that segments of the perimeter levee system do not provide adequate protection to the urban and urbanizing portions of the Natomas Basin. This evaluation was based on several engineering studies and reports that were included as appendices to the above-referenced report and have been updated as the design of the early implementation project has proceeded. These studies and reports identify the following problems for both the FEMA 100-year and 200-year design water surface elevations:

- Inadequate levee height;
- Through-levee seepage and foundation underseepage due to permeable soil conditions;
- Embankment instability; and
- Susceptibility to erosion and scour.

Although not highlighted in the levee evaluation, portions of the perimeter levee system, particularly along the east levee of the Sacramento River, are also subject to vegetative and structural encroachments into the levee structure.

**PROJECT DESCRIPTION**

The early implementation project will involve improvements to the NCC south levee, the Sacramento River east levee, the PGCC west levee and portions of the NEMDC west levee that will be implemented over the next three years, ending in 2011. These improvements will address identified levee height and seepage problems as necessary to provide the Natomas Basin with a 100-year level of flood protection while laying the groundwork for providing a 200-year level of flood protection to the Basin by the end of 2013. The 200-year project will involve erosion control and seepage remediation improvements along the Sacramento River east levee as well as seepage remediation improvements to the balance of the NEMDC west levee and the American River north levee.
**Levee Raises.** Identified levee height deficiencies will be addressed along the full length of the NCC south levee and much of the Sacramento River east levee. The deficient portions of the NCC south levee will be raised in place. Along the Sacramento River east levee, an adjacent levee will be constructed with crown elevations high enough to contain the 200-year flood with three feet of additional levee height. As shown in Plate 3 the adjacent levee will be higher than the existing levee and Garden Highway roadway in the upper reaches of the project area. In the lower reaches, where the existing levee has sufficient height, the adjacent levee will be the same height as the existing levee.

**Seepage Remediation.** Due to permeable soil conditions, much of the levee system around the Natomas Basin is considered vulnerable to foundation and through levee seepage in high water conditions, as shown schematically in Plate 4. These deficiencies will be addressed either by inserting seepage cutoff walls through the affected levee sections and foundations, as shown schematically in Plate 5, or by constructing earthen seepage containment berms and installing seepage wells, as shown schematically in Plates 6 & 7.

**Irrigation and Drainage Improvements.** To accommodate these levee improvements, the early implementation project includes relocation of several pumping facilities owned and operated by Reclamation District 1000 (RD 1000) and the Natomas Central Mutual Water Company (NCMWC) along the NCC south levee and the Sacramento River east levee. The project also includes relocation of two major NCMWC irrigation canals which are currently located along the landside toe of the Sacramento River east levee. The Elkhorn Irrigation Canal extends from the RD 1000 North Drainage Canal just south of the Sacramento-Sutter County line to just south of Elkhorn Boulevard. The Riverside Irrigation Canal extends from Power Line Road to the Interstate 80 over-crossing of the Sacramento River. Both of these canals will be relocated and reconstructed just outside the adjacent levee footprint several hundred feet east of their current locations.

Finally, the project will include construction of a new drainage canal extending from the North Drainage Canal across Airport operational buffer land just east of the adjacent levee footprint to the NCMWC’s Elkhorn Reservoir north of the Teal Bend Golf Club (Golf Club) and from the Elkhorn Reservoir around the eastern perimeter of the Golf Club to RD 1000's West Drainage Canal at Interstate 5 (I-5). This new drainage canal will permit modifications to the Airport West Ditch, which flows in a southerly direction on the west side of the Airport's west runway (16R/34L). Irrigation supply water and runoff from adjacent privately-owned farms that currently flows through the Airport West Ditch will be routed to the new drainage canal. The Airport West Ditch will be re-graded and maintained in accordance with FAA's recommended airfield grass heights, while continuing to convey Airport stormwater runoff away from the AOA. These irrigation and drainage improvements are shown in Plate 8.
Plate 3  Adjacent Setback Levee

Plate 4  Underseepage and Through-Seepage Levee Risks
Plate 5  Typical Levee Raise, Flattening of Landside Levee Slope, and Seepage Cutoff Wall

Plate 6  Typical Seepage Berm
Plate 7  Typical Relief Well
Plate 8  Alignment of New Irrigation and Drainage Canals
Borrow Operations. Construction of the needed levee and canal improvements will require up to eight million cubic yards of soil material. In order to minimize the traffic, roadway, and air quality impacts\(^1\) and reduce construction costs associated with hauling this material to the various construction sites, SAFCA has identified five principal locations around the Natomas Basin where the needed borrow material could be obtained. All of these borrow sites are located within one mile of the perimeter levee system and within five miles of their destination project construction sites. This will allow material haulage to occur primarily along temporary haul routes established within the flood control footprint, thereby minimizing the project’s use of existing paved roadways and facilitating an efficient construction program.

These borrow locations are shown in **Plate 9**. They include:

1. the Brookfield site, an active rice field located approximately 5.5 miles from the Airport in the northeast corner of the Natomas Basin (and therefore outside the Airport's Critical Zone). This site will be used to provide borrow material for improvements along the NCC south levee and the PGCC and NEMDC west levees.
2. the Airport northern Bufferlands which will provide borrow material for the upper and middle sections of the Sacramento River east levee;
3. an aggregation of parcels near the Sacramento River east levee south of the Golf Club, which will provide borrow for the middle section of the Sacramento River east levee.
4. the Fisherman’s Lake area located approximately 2.5 miles southeast of the Airport, which will provide borrow material for the middle and lower sections of the Sacramento River east levee.
5. two parcels along the NEMDC west levee south of Elkhorn Boulevard, which will provide borrow material for the work on this levee section.

As a general rule, the borrow operations at these locations will consist of shallow grading with the aim of preserving existing agricultural or other landscape qualities. In the Fisherman’s Lake area, the borrow operation will involve substantial deeper excavation and the sites will be reclaimed to create managed marsh habitat. Similar to the managed marsh mitigation habitats constructed throughout the Natomas Basin in recent years, the managed marsh near Fisherman's Lake will be designed and constructed to meet the habitat needs of the giant garter snake, which is protected pursuant to the federal and California Endangered Species Acts. As such, the marsh will consist of narrow, steep-sided channels which facilitate use by the snake, but which are not conducive to waterfowl and other avian species potentially hazardous to aircraft operations.

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\(^1\) The air quality mitigation costs associated with heavy-duty truck transport of fill material from more distant locations, as determined through the CEQA process, would impose a large financial burden on the project.
Wildlife Habitat Features. The Natomas Basin provides critical habitat for the giant garter snake and the Swainson’s hawk, which is protected under the federal and State Endangered Species Acts and the Natomas Basin Habitat Conservation Plan (NBHCP).² In order to compensate for the effects of project construction activities on this habitat, which includes active rice fields, row crops, woodlands and canals, the early implementation project includes the following wildlife habitat features:

- preservation of up to 175 acres of active rice fields following borrow operations on the Brookfield property;
- creation of a new woodland/grassland corridor comprising up to 140 acres just outside the adjacent levee footprint along the Sacramento River east levee; and
- creation of canal habitat through relocation of the Elkhorn and Riverside Irrigation Canals and construction of the new drainage canal, which will be designed to discourage usage by waterfowl hazardous to aircraft while providing habitat conducive to giant garter snakes. The features of the new drainage canal are shown in Plates 10a & 10b.

Plate 10a  Typical Cross Section of the New GGS/Drainage Canal from Walnut Road to Southeast Corner of Teal Bend Golf Course

² The NBHCP is promulgated by the United States Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (DFG). The NBHCP allows development in the portions of the Natomas Basin within the jurisdictions of the City of Sacramento and the County of Sutter, which are referred to as the "Permitees." The NBHCP requires development in these two jurisdictions to be mitigated on a ratio of 0.5:1. The County of Sacramento is not a participant in the NBHCP. As such, development in the County's portion of the Basin is addressed separately from the NBHCP.
PROJECT PHASING

As shown in Plate 11, the early implementation project is being constructed in four major phases over a five-year period that commenced in 2007. The Phase 1 and Phase 2 construction projects focus on improvements to the NCC south levee and the upper four miles of the Sacramento River east levee in the lightly populated portion of the Natomas Basin in Sutter County. The Phase 3 and Phase 4 construction projects focus on the levees along the east side of the Basin and on the lower fourteen miles of the Sacramento River east levee in the vicinity of the Airport and the more heavily populated portion of the Natomas Basin.
Plate 11 NLIP Construction Phases
Consistent with this construction phasing plan, USACE has prepared a draft environmental impact statement (DEIS) that provides a detailed analysis of the potential environmental effects of the Phase 2 Construction Projects combined with a program level analysis of the Phase 3 and 4 Construction Projects. The DEIS incorporates substantial portions of the environmental impact report (EIR) which was previously issued by SAFCA and certified in November 2007. The DEIS will support federal agency decision making in connection with the Phase 2 Construction Projects. Additional EIS/EIRs will be issued to provide a detailed analysis of the potential effects of the Phase 3 and 4 Projects and support the Federal, State and local decisions that must be made in connection with these projects. The FAA has submitted a formal request to the USACE to act in the capacity of a Cooperating Agency for the EIS.

In summary, because of the volume of borrow material needed to construct the proposed improvements, the early implementation project will result in significant temporary increases in traffic on local roadways. This impact will be minimized to the greatest extent practical by securing borrow sites that will confine the majority of haul truck traffic to little-used rural roadways west of SR 99/70.

Nevertheless, due to this truck traffic and to the operation of a wide range of construction equipment, temporary emissions of reactive organic gases (ROG), oxides of nitrogen (NOX), and particulate matter less than ten microns in diameter (PM$_{10}$) during construction will result in substantial temporary air quality impacts. Temporary short-term noise and vibration impacts affecting residents along the Garden Highway also will be substantial at times. These impacts will be minimized by limiting construction-related hauling activities to 12 hours per day, six days per week.

The expansive footprint of the project will result in the conversion of a substantial amount of important farmland to non-agricultural use. Moreover, because of the existence of known prehistoric resources along the Sacramento River, it is possible that project construction activities will encounter these resources as well as other undiscovered cultural resources and human remains. These impacts will be minimized to the extent feasible through avoidance where feasible, recovery and preservation of resources where disturbance is unavoidable, and close coordination with representatives of the tribal communities that historically occupied the area.

The habitat enhancement components of the project, including the design of the needed borrow operations, will enable the project to avoid any significant impacts on fish and wildlife habitat in the Natomas Basin. Rather, it will likely contribute to achieving the habitat enhancement goals of the NBHCP, but in a manner that will not increase bird strike hazards on or near the Airport.

**EFFECTS OF THE PROJECT ON THE AIRPORT**

The Airport is located in the western portion of the Natomas Basin abutting portions of the Sacramento River east levee north and south of the AOA. Airport lands account for approximately ten percent of the total acreage within the Natomas Basin. The AOA occupies half of these lands and contains buildings and infrastructure representing about ten percent of all
the damageable property in the Natomas Basin. SCAS-owned open space “bufferlands” north and south of the AOA comprise the remaining half of the Airport lands.

Because of the Airport’s size, location and critical public safety needs, SAFCA has focused on opportunities for cooperation with SCAS in planning and designing the NLIP to advance each agency’s ongoing effort to reduce public safety hazards in the Natomas Basin. In March 2008, the two agencies cooperated in producing a draft white paper outlining a proposed arrangement that would allow SAFCA to use portions of the Airport’s northern Bufferlands (north of Elverta Road) as a source of borrow material for the early implementation project and then re-grade and reclaim the affected lands in a manner that would permit SCAS to reduce wildlife hazards associated with these lands in accordance with applicable FAA policies and guidelines.

In addition, the arrangement would allow SCAS to discontinue the current use of the Airport West Ditch by shifting its agricultural irrigation, basin-wide drainage and habitat functions to SAFCA’s new drainage canal, and regrade and design the Airport West Ditch to a gently sloping swale to facilitate vegetation maintenance, such as mowing. Finally, the arrangement would allow SCAS and SAFCA to incorporate a land exchange component into the early implementation project that will expedite construction of the flood control project and facilitate the long-term operation and maintenance needs of the Airport. This paper updates the draft white paper analysis presented in March 2008 as described below.

**Flood Control Footprint**

The new adjacent levee and associated seepage remediation features that will be constructed as part of the early implementation project along the Sacramento River east levee will occupy approximately 150 acres of Airport land northwest of the AOA and directly south of this area as shown in Plate 12 and 13. This footprint will include the adjacent levee crown and landside slope; seepage berms varying in width from 80 to 500 feet; seepage wells located along the landside toe of some of the seepage berms; and a 70-foot wide operations and maintenance (O&M) corridor that will include space for relocating existing utility lines currently located along or in the landside slope of the existing levee. This footprint will include grasslands along the adjacent levee slope, berms, and O&M corridor that will be managed in accordance with the Airport WHMP.
Plate 12  Flood Control Footprint North of Airport
Plate 13  Flood Control Footprint South of Airport

**Elkhorn Irrigation Canal Relocation**

To accommodate the adjacent levee and seepage remediation features, the upper reach of the Elkhorn Irrigation Canal extending from the North Drainage Canal to the Elkhorn Reservoir will be relocated away from the landside toe of the current Sacramento River east levee to a new location just east of the flood control footprint. Because the land in this area slopes away from the existing levee, the relocated canal will have a slightly larger footprint than the existing canal. Accordingly, it will occupy approximately 25 acres of Airport land northwest of the AOA. This portion of the new canal will be managed for vegetation and erosion by NCMWC in accordance with the Airport WHMP.

**Airport West Ditch Reconfiguration**

Through collaboration with SCAS, SAFCA has included certain design changes to the Airport West Ditch in the early implementation project. This facility currently serves as a conduit for irrigation water delivered by NCMWC to private agricultural lands west of the Airport and for storm water that currently runs off Airport land and private land west of the Airport, including portions of the Golf Club. The Airport West Ditch is currently classified as "suitable habitat" for the giant garter snake, which requires aquatic habitat. Eliminating irrigation water and agricultural runoff from the Airport West Ditch and re-grading the ditch to a gently sloping swale that will facilitate vegetation maintenance is a WHMP priority. This will be accomplished as part of the project through construction of SAFCA’s new drainage canal.
The portion of the new canal extending from the North Drainage Canal within Airport land to the Elkhorn Reservoir will create sufficient giant garter snake habitat value to offset the loss of the habitat value resulting from reconfiguration of the Airport West Ditch. The portion of the new canal that extends from the Elkhorn Reservoir to the RD 1000 West Drainage Canal will provide a new conduit for NCMWC irrigation water and for most of the storm water that currently enters the Airport West Ditch from areas outside the AOA. As described in Appendix A, reconfiguration of the Airport West Ditch will also require construction of new minor irrigation facilities servicing the private agricultural lands southwest of the AOA. The RD 1000 West Drainage Canal will be improved and realigned to provide enhanced GGS habitat while moving the canal further away from the Runway 34L threshold.

**Borrow Operations**

SAFCA has identified over 700 acres of land within the Airport’s northern bufferlands complex that could provide suitable soil material for adjacent levee construction along the upper nine miles of the Sacramento River east levee. These bufferlands, which are shown in Plate 14, generally consist of idle land that had previously been leveled and diked to retain surface water for rice production. Specific acreages by borrow area can be found in Table 1. As described in Appendix B, SAFCA has developed a grading plan for this area that is designed to re-contour the land into a series of sloped surfaces and receiving swales capable of moving storm water more efficiently to surrounding drainage canals, thereby greatly reducing the likelihood of standing storm water accumulation during the winter months.

![Plate 14: Airport Northern Bufferlands Proposed Borrow Areas](image)
The graded land surface will be about three to four feet lower than the current land surface in most locations, but will still be at least two to three feet above the elevation of the groundwater basin in this portion of Natomas and one to two feet above the receiving water in the drainage canals surrounding the affected Airport land during a ten-year flood. The soil material removed as part of the borrow operation (up to four million cubic yards) will enable SAFCA to construct the upper portion of the adjacent levee. The borrow area will be reclaimed to a cover type that will reduce long-term maintenance costs and facilitate SCAS implementation of the updated WHMP for the Airport.

**Table 1 – Acreage by Borrow Area – Airport Northern Bufferlands**

<table>
<thead>
<tr>
<th>Borrow Area</th>
<th>Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>145 ac.</td>
</tr>
<tr>
<td>Site 2</td>
<td>182 ac.</td>
</tr>
<tr>
<td>Site 3</td>
<td>193 ac.</td>
</tr>
<tr>
<td>Site 4</td>
<td>100 ac.</td>
</tr>
<tr>
<td>Site 5</td>
<td>41 ac.</td>
</tr>
<tr>
<td>Site 6</td>
<td>107 ac.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>768 acres</strong></td>
</tr>
</tbody>
</table>

**Land Exchange**

SAFCA and SCAS have identified a land exchange opportunity that will facilitate the early implementation project and provide long-term benefits to the Airport. This exchange would involve SAFCA’s acquisition of three SCAS properties totaling approximately 68 acres on each side of SAFCA’s Lausevic property in Sutter County. In exchange, SCAS would acquire portions of the Horangic and Binford-DeYoung properties totaling approximately 45 acres on each side of the SCAS’s Yuki property within the 10,000 foot Critical Zone. These parcels are shown in Plate 15. This exchange would facilitate expansion of the AOA along the eastern edge of the new Elkhorn Irrigation Canal while providing SAFCA additional land for mitigating project impacts along the upper portion of the Sacramento River east levee outside of the 10,000-foot Critical Zone.
Plate 15  Proposed Land Exchange
COMPLIANCE WITH FAA GRANT ASSURANCES

Most of the Airport lands affected by the early implementation project were acquired in part with Federal grant funds administered by FAA. As a condition of receiving these funds, SCAS was required under FAA policy to provide assurances to FAA that the acquired lands will be used for Airport purposes. Accordingly, SCAS must demonstrate that the uses proposed in connection with the early implementation project are beneficial to the Airport and that the costs associated with these uses are proportional to the benefits received.

Beneficial Use

The early implementation project will benefit the Airport in two ways. First, by raising and strengthening the perimeter levee system protecting the Natomas Basin, the project will significantly reduce the risk of damage to Airport facilities and operations due to flooding from the rivers and canals surrounding the Natomas Basin. The Natomas Basin is currently one of the most flood threatened urban areas in the United States. When recently requested by FEMA to rate the Basin’s perimeter levee system, USACE advised that the levee system could not reliably contain a flood event with a 30-year return frequency. The early implementation project will allow the levee system to reliably contain at least a 100-year flood by 2011 and will lay the groundwork for reliably containing a 200-year flood by 2013, thereby greatly reducing the exposure of the urban areas within the Natomas Basin, including the substantial improvements within the AOA, to catastrophic damages due to uncontrolled flooding.

Second, the early implementation project will facilitate implementation of an updated WHMP focusing on hazardous wildlife attractants within the 10,000-foot Critical Zone, where the risk of bird-aircraft strikes is greatest. Within this zone, SCAS and FAA have identified two potentially hazardous wildlife attractants: the Airport West Ditch and irrigated agricultural operations in the bufferlands north of the AOA. The Airport West Ditch is an open ditch that conveys irrigation and drainage water through the western portion of the AOA. Because of its proximity to the runway in this portion of the Airport, the Airport West Ditch is not only a potentially hazardous wildlife attractant; it is also a potential hazard for aircraft that may veer off the runway.

Agricultural fields occupy several hundred acres north of the AOA on County property under the control of the County Airport System. Many of these fields have been leveled and divided into compartments to hold water for rice production. Accordingly, such fields can become attractants to potentially hazardous wildlife due to irrigation during the growing season, rainfall during the non-growing season, and winter flooding to decompose the remnants of the rice crop after harvesting in the late summer and early autumn. The tenant agriculture leases on all of these lands expired on or about December 31, 2007, prior to the 2008 growing season. These lands are not slated for any agricultural activities in the future, however, they will continue to pond rainwater. As discussed herein, SAFCA’s removal of the borrow material will result in a re-grading of this area to reduce stormwater retention.

As discussed above, the project will allow SCAS to re-design and re-grade the Airport West Ditch and to improve surface drainage of the idle agricultural fields north of the AOA. The ditch reconfiguration will be accomplished through construction of a new drainage canal outside of the AOA (and outside the contemplated future AOA for the new west runway). This canal will
extend from the existing RD 1000 North Drainage Canal near the Sacramento-Sutter County line southward to the existing RD 1000 West Drainage Canal at its intersection with Interstate 5 southwest of the Airport. It will replace the current irrigation and drainage functions of the Airport West Ditch and provide compensation on Airport land for giant garter snake habitat impacts associated with the ditch abandonment and re-grading activities. Surface drainage improvements on the Airport’s northern bufferlands will be accomplished through the design and implementation of the borrow operations undertaken on these lands as part of the project. The new surface area will be converted to a cover type that will attract less hazardous wildlife than agricultural crops that require disking or irrigation.

The project will also include removal of a large number of trees on Airport land in the 10,000-foot Critical Zone along the landside toe of the Sacramento River east levee. Replacement trees will be planted partly on the Airport land outside the Critical Zone in Sutter County, which will be acquired by SAFCA as part of the land exchange discussed above. Woodlands are known to support some potentially hazardous wildlife species (primarily raptors) and the tree plantings will result, eventually, in an increase in the acreage of woodlands in the vicinity of the Airport. However, because there will be a net reduction in the number of trees within the 10,000-foot Critical Zone, there will also be a corresponding net reduction in attractants to hazardous wildlife within the 10,000-foot Critical Zone.

Cost/Benefit Analysis

The costs associated with using Airport land as part of the early implementation project will be allocated between SAFCA and SCAS based on the benefits each agency will derive from this use. SAFCA will compensate SCAS for the value of all of the borrow material removed from Airport land. SAFCA has completed an analysis of the value of this material that considers the likely cost of pursuing alternative borrow sources in the Natomas Basin and the costs incurred by SAFCA in securing borrow material for prior levee improvement efforts. This analysis, which has been reviewed and approved by SCAS, indicates that the borrow material to be obtained from SCAS is worth approximately $1.00 per cubic yard.

For land use rights or land exchanges, each party's costs will be based on fair market value appraisals for all of the land and land use rights that are acquired and exchanged in connection with the project as discussed above. For infrastructure improvements, SAFCA will cover all of the costs of constructing the early implementation project on Airport land except for the costs associated with reconfiguring and re-grading the Airport West Ditch and compensating for the wildlife habitat impacts associated with this effort. These costs will be allocated to SCAS. Table 2 (following page) summarizes these cost allocations. Based on current estimates, the final cost allocation will be based on final appraisal and actual construction costs. A single transaction will serve to address any payment differential between SAFCA and SCAS.

---

3 As a beneficiary of SAFCA’s flood control improvements, including the early implementation project, SCAS is subject to a special assessment which will provide funding for the fair share costs of the improvements. The assessment district was approved in April 2007 and includes property at the Airport and Executive Airport.
Table 2 - MONETARY TRANSACTION - SUMMARY

<table>
<thead>
<tr>
<th>Payments from SCAS to SAFCA</th>
<th>Payments from SAFCA to SCAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLIP Flood Control Assessment(^4)</td>
<td>Flood control easement(^5)</td>
</tr>
<tr>
<td>$4,589,859</td>
<td>$1,400,000</td>
</tr>
<tr>
<td>Airport West Ditch reconfiguration(^6)</td>
<td>Water facilities easement(^7)</td>
</tr>
<tr>
<td>$2,300,000</td>
<td>$175,000</td>
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<tr>
<td>Airport West Ditch habitat mitigation(^8)</td>
<td>Drainage Canal Easement(^9)</td>
</tr>
<tr>
<td>$1,344,000</td>
<td>$28,000</td>
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<tr>
<td>Purchase 45 acres within 10,000 foot</td>
<td>Borrow material(^11)</td>
</tr>
<tr>
<td>Critical Zone - portion of Horangic/Binford DeYoung(^10)</td>
<td>$4,000,000</td>
</tr>
<tr>
<td></td>
<td>Purchase 67 acres in Sutter County adjacent to Lausevic(^12)</td>
</tr>
<tr>
<td></td>
<td>$1,809,000</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
<tr>
<td>$9,448,859</td>
<td>$7,412,000</td>
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Monetary & Non Monetary Benefits to SCAS

<table>
<thead>
<tr>
<th>Benefit Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrow Material obtained from SCAS used on SCAS(^13)</td>
<td>$1,600,000</td>
</tr>
<tr>
<td>Avoided construction cost escalation - West Ditch Flood Protection(^14)</td>
<td>$830,000</td>
</tr>
<tr>
<td>Avoided costs to relocate SMF operations(^15)</td>
<td>$49,723,000</td>
</tr>
<tr>
<td>Avoided lost revenue during flood event(^16)</td>
<td>$100,800,000</td>
</tr>
<tr>
<td>Avoided flood damage repair expenses(^17)</td>
<td>$208,000,000</td>
</tr>
<tr>
<td>Avoided credit hit from default on Revenue Bonds(^18)</td>
<td>Not quantifiable</td>
</tr>
<tr>
<td>Avoided environmental contamination from flooding(^19)</td>
<td>Not quantifiable</td>
</tr>
<tr>
<td>Wildlife hazard reductions (improved drainage approx. 800 acres)(^20)</td>
<td>Not quantifiable</td>
</tr>
</tbody>
</table>

---

\(^4\) Based on present value of 30-year assessment for SMF and SAC at 5.5% discount rate. Note: this payment would be due regardless of whether SCAS and SAFCA entered into the balance of this transaction.

\(^5\) For footprint of flood control facilities. To be based on appraisal. Table assumes 200 acres @ $7000/acre. Total to be adjusted based on actual design of flood control footprint south of Airport.

\(^6\) Replacement cost that SCAS would otherwise incur to reconfigure the Airport West Ditch and convert to drainage swale.

\(^7\) For relocation of Elkhorn Irrigation canal across SCAS land. To be based on appraisal. Table assumes 25 acres @ $7000/acre.

\(^8\) For cost of constructing the new drainage canal across SCAS land to provide compensation for loss of canal habitat due to reconfiguration of the Airport West Ditch.

\(^9\) For footprint of the RD 1000 West Drainage canal across SCAS land. To be based on appraisal. Table assumes 4 acres @ $7000/acre.

\(^10\) No woodland easements to be placed on Airport property. To be based on appraisal. Table assumes $27000/acre.

\(^11\) Cost for removing 4,000,000 cubic yards of material from Airport property. (1.6 million cubic yards will be used for levee improvements located on Airport Property). Final quantity to be determined upon completion of project.

\(^12\) To be based on appraisal. Table assumes $27000/acre.

\(^13\) 1.6 million cubic yards will be used for levee improvements on Airport Property.

\(^14\) Assumes 2 years at 7% construction cost escalation associated with SCAS preparation of plans, specifications, environmental documentation, bidding to relocate and mitigate the Airport West Ditch.

\(^15\) SCAS Continuity of Operations Plan prepared by Faith Associates estimates initial cost to relocate operations to MHR at $11,323,000 plus recurring monthly expense of $3,200,000. Assumes 12 months of operations at MHR.

\(^16\) Assumes 12 months of revenue loss at SMF due to flooding and recovery period.

\(^17\) Assumes 1.17 million square feet of building space @ 90 $ per square feet and 2.58 million square feet of runway space @ 40 $ per square feet

\(^18\) Not able to quantify at this time

\(^19\) Not able to quantify at this time

\(^20\) Not able to quantify at this time. Elimination of standing water in west ditch, engineered aggressive drainage plan associated with re-grading sites of borrow material will reduce attractiveness of airport lands to waterfowl
CONCLUSION

The proposed cooperative arrangement between SAFCA and SCAS will accomplish several shared objectives of the parties including significantly reducing the risk of flood damage to Airport facilities and operations due to the failure of the perimeter levee system around the Natomas Basin; supporting implementation of an updated WHMP and a reduction in wildlife hazards for the Airport; and facilitating long-term plans for expansion of the AOA. SAFCA and SCAS are committed to incorporating the elements of the cooperative arrangement as described above into a series of real estate and contractual agreements that will permit SAFCA to award construction contracts for the flood control and related improvements no later than March 2009.
Technical Memorandum

To: Peter Buck and John Bassett, SAFCA
From: Stephen Sullivan and Rahul Ranade, Mead & Hunt, Inc.
Date: October 6, 2008
Subject: Airport West Ditch Reconfiguration & Redesign

1. Introduction

Through collaboration with the Sacramento County Airport System (SCAS), the Sacramento Area Flood Control Agency (SAFCA) has supported the goal of reducing wildlife hazards for the Airport in levee and canal improvements implemented as part of its Natomas Levee Improvement Program (NLIP).

Consistent with the SCAS updated Wildlife Hazard Management Plan (WHMP), an important element of the NLIP includes the reconfiguration and redesign of the Airport West Ditch and the construction of a new GGS/Drainage Canal.

The NLIP’s new GGS/Drainage Canal would intercept the year-round irrigation and drainage sources from adjacent private farms, which currently flow into the Airport West Ditch and the Airport Operations Area (AOA). Additional irrigation infrastructure, e.g. pipelines, check structures & other canal improvements required to reroute these flows, would be implemented along with the new GGS/Drainage Canal construction.

Salient features of the proposed irrigation and drainage facility relocations related to Sacramento International Airport are outlined below and shown in Plates 1 and 2. A summary of costs is provided in Table 1. This estimate is based on limited information available at this time. In order to get an accurate estimate of cost, preliminary design will have to be completed and detailed surveying and geotechnical data obtained.

2. Drainage facilities

A. Reconfigure & Redesign Airport West Ditch

The existing Airport West Ditch is up to seven feet deep. This depth and the irrigation and drainage water that flows through the ditch results in standing water conditions that attract wildlife that potentially creates a hazard to aircraft. Filling and leveling the ditch will involve placing a two feet deep layer of aggregate in the bottom of the existing ditch and continuing with earthen fill to just below the invert of the existing runway storm drain pipes that outfall into the ditch.

The ditch cross section will be re-graded to form a shallow drainage swale with flattened side slopes to accommodate mowing operations required for vegetation control. The swale will be
approximately five feet deep with 5H:1V side slopes. In general practice, a minimum side slope to accommodate machinery access for mowing operations is 3H:1V. The swale is outside the Runway Safety Area (RSA)\textsuperscript{21} in accordance with FAA Advisory Circular 150/5300-13. The SCAS will be responsible for maintenance of the proposed swale.

B. **Construct check structure in drainage swale north of Reservoir Road**

To prevent drainage water entering the drainage slough north of Reservoir Road from flowing into the AOA, a new check structure will be constructed in the slough at the existing Airport fence. Note that the construction of the future third parallel runway will require moving this check structure further to the west and filling in a portion of the slough.

C. **Construct Sandy Drain**

The field immediately north of Sandy Canal (Figure 1) is currently drained through a buried pipe that discharges into the Airport West Ditch. Upon conversion of the Airport West Ditch to the swale, drainage from that field will be routed to the new Drainage Canal by constructing a new drainage canal (Sandy Drain), sloped to drain towards the west, parallel and north of the Sandy Canal.

D. **Remove and dispose existing 24-inch pipe**

An existing 24-inch Airport irrigation supply pipe has created wetland-like conditions adjacent to the runway because of leakage. Although use of this pipeline has been discontinued, the artificial wetland areas created have been delineated jurisdictional wetlands by the U.S. Army Corps of Engineers, on Airport property.\textsuperscript{22} This pipe will be removed or abandoned in place as part of this work.

E. **Utility coordination at Elkhorn Boulevard**

Existing facilities at Elkhorn Boulevard will be avoided to the extent possible during construction of the drainage swale. Some utility relocation, such as the buried gas pipeline owned by Calpine Natural Gas, may be required.\textsuperscript{23}

F. **SWPPP Implementation**

A Storm Water Pollution Prevention Plan will be developed and implemented during construction to provide erosion, sediment, and water pollution control at the site.

\textsuperscript{21} Based upon approximate measurements from available existing data. Detailed topographic information will be required to better evaluate the location of the new swale relative to the RSA.

\textsuperscript{22} The requirements for mitigation for these jurisdictional wetlands, if any, have yet to be determined and therefore costs have not been accounted for in this memo.

\textsuperscript{23} It is unclear at this time whether this pipeline is still functional, as well as its purpose. Coordination with the Owner of this facility is ongoing.
G. Site Restoration

Following construction, disturbed ground surface areas will be restored to pre-project conditions. Erosion control seeding will be applied to disturbed areas and maintained in accordance with FAA's recommended airfield grass heights.

3. Irrigation facilities

A. Demolish/salvage Airport North Pump in Airport West Ditch

The existing North Pump in the Airport West Ditch is operated by the Natomas Mutual Water Company to supply irrigation to private farms west of the AOA. This pump and discharge pipe will be demolished and the pump equipment salvaged. The irrigation supply provided by the North Pump will be replaced by a new 24-inch irrigation supply pipe (see item 3B).

B. Construct irrigation supply pipeline to replace North Pump agricultural supply

A new 24-inch irrigation supply pipeline will be constructed from the Reservoir Road Canal to the field south of Elkhorn Boulevard. This field is currently supplied by the Airport North Pump. The design supply rate is 11 cfs based upon agricultural demands. The pipeline work would include:

- Intake structure on Reservoir Road Canal
- 24” HDPE pipe between intake structure and Elkhorn Blvd

C. Demolish portion of Reservoir Road Canal

The portion of the existing Reservoir Road Canal within the AOA will be demolished to prevent canal water from entering airport property. The existing concrete will be removed and the canal will be filled with earthen material or embankments removed.
Irrigation and Drainage Relocation – Existing Features & Proposed Demolition
Irrigation and Drainage Relocation – New Features
<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>2008 Item Cost</th>
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<td></td>
<td><strong>DRAINAGE FACILITIES</strong></td>
<td></td>
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</tr>
<tr>
<td>1.1</td>
<td>Convert Airport West Ditch into drainage swale</td>
<td></td>
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<tr>
<td></td>
<td>Fill for existing ditch</td>
<td>26,930</td>
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<td></td>
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<td>Contingency at 25%</td>
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<td>$ 261,107</td>
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<td><strong>Total Drainage Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td>$ 1,305,533</td>
</tr>
<tr>
<td></td>
<td><strong>IRRIGATION FACILITIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Remove North Pump</td>
<td></td>
<td>LS</td>
<td>$ 5,000.00</td>
<td>$ 5,000</td>
</tr>
<tr>
<td>2.2</td>
<td>24&quot; pipeline for substitute irrigation</td>
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<td>LS</td>
<td>$ 730,270</td>
<td>$ 730,270</td>
</tr>
<tr>
<td>2.3</td>
<td>Demolish existing Reservoir Rd Canal</td>
<td></td>
<td>LS</td>
<td>$ 5,000.00</td>
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<td><strong>Subtotal 1</strong></td>
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<td><strong>Total Irrigation Cost</strong></td>
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</tbody>
</table>

**TOTAL COST (ROUNDED)**

$ 2,300,000

**Note:** 1. Estimated cost does not include right of way and mitigation costs
Appendix B – Technical Memo - Proposed Borrow Operations

Airport Northern Bufferlands
SACRAMENTO AREA FLOOD CONTROL AGENCY

NATOMAS LEVEE IMPROVEMENT PROGRAM

SUMMARY REPORT

GRADING OF AIRPORT NORTHERN BUFFERLANDS AREA

Prepared for:

Prepared by:

October 2008
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1. Executive Summary

The Sacramento Area Flood Control Agency (SAFCA) has identified the Bufferlands area north of the Sacramento International Airport (Airport) as a potential source of soil borrow material for levee improvements as part of the Natomas Levee Improvement Program (NLIP). The required volume of soil will be shallow excavated from approximately 700 acres of inactive rice land (Figure 1) to an average depth of 3 to 4 feet and hauled for end use along the Sacramento River East Levee (SREL). Following soil borrow operations, SAFCA will re-grade the site and install drainage features to improve drainage conditions consistent with the Airport operating principle of reducing potential hazardous wildlife attractants.

Figure 1  Airport Borrow Sites
The following design objectives have been incorporated into the plans and specifications for final grading of the proposed borrow sites:

- Reduce the frequency and extent of standing and flowing water that may occur during and after a 10 year design storm event through construction of drainage ditches, swales and finish grading.
- The sites will be shallow graded, with finished grade approximately 2 to 6 feet above normal groundwater elevation.
- Provide access for control of unwanted vegetation or habitat development.
- Grading within the future runway safety area for the future extension of runway 16L will comply with Federal Aviation Administration criteria.
- Provide for future relocation of Elverta Road to accommodate runway extension.

Based upon a review of the applicable FAA advisory circulars (storm frequency, drainage, wildlife hazards etc.), existing site conditions (including groundwater data obtained from backhoe test pits and piezometer well readings) our analysis indicates the proposed borrow sites can be configured to drain without significant ponding for storm events exceeding the 10-year frequency. This plan would exceed the FAA minimum criteria of a 5-year minimum design storm. Moreover, the design would accommodate proposed airport expansion plans affecting runway 16L and the current alignment of Elverta Road.\(^{24}\)

\(^{24}\) Our analysis indicates the sites will drain within 48 hours after 10-year storm event. The bottom elevation of the borrow areas are above the peak level of a 10-year design storm within the receiving waters (water will not back onto fields). The drainage facilities (pipes and ditches) are sized for a 10-year event. Any ponding will be confined to ditches during the storm event and will drain quickly during after rainfall ends.
2. **Introduction and Background**

This memo presents the proposed plan for grading of potential "borrow" sources within the Airport northern Bufferlands area owned by the Sacramento County Airport System (SCAS). The area currently has no direct airport use and was traditionally been utilized for rice agriculture due to the flat terrain and heavy clay soils that are necessary to retain water and successfully grow rice. The area was selected as a potential borrow source for the NLIP due to the factors described below. Although the Airport Master Plan approved by the Sacramento County Board of Supervisors on August 7, 2007 provides for the "all north" extension of the east runway during Phase 2 of the Master Plan, the FAA only recognizes projects within a five-year time frame as being suitable for environmental analysis.

A. **Proximity**

The borrow source is centrally located alongside the upper half of the SREL. One centralized source of material will allow for the contractor to conduct borrow activities in a manner that minimizes disruption to the surrounding community. Proximity to the SREL will allow for off-road hauling to work areas, thereby limiting roadway, traffic and air quality impacts.

B. **Site Capacity**

Due to the relatively flat terrain of the Airport land and shallow depth of grading operations, a large area is required to supply the volume of material required for the SREL. The site is estimated to contain up to 4 million cubic yards of borrow material.

C. **Surrounding Land Use Constraints**

Surrounding land use and ownership limit the availability of alternative sources of borrow with this size and proximity to the SREL project area.

The Airport northern Bufferlands properties were acquired by SCAS with FAA funds to control land uses, such as residential housing development, which conflict with Airport operations. In the past these properties were leased to farmers as a way to maintain the land without increasing expenditures for County maintenance personnel and machinery. More recently, the agricultural leases on all Airport land north of Elverta Road and south of I-5 were allowed to lapse. As a result, the former rice fields north of Elverta are now permanently idle, and will no longer be leased for agricultural production. In order to grant permission for SAFCA to use the proposed Bufferlands sites, SCAS and FAA must be assured that SAFCA’s proposed borrow operations will not result in an increase to hazardous wildlife attractants beyond existing conditions.

The sites are not currently developed for Airport use. However plans for future Airport development include a future 2,400-foot extension of the east runway to accommodate intercontinental flights, and the relocation of Elverta Road to accommodate the runway expansion. SCAS and FAA must be assured that SAFCA’s proposed borrow operations will not conflict with these future plans.

This memo presents the criteria SAFCA will use as the basis of design for the proposed borrow operations with emphasis on site finish grading and drainage facilities. Final design plans and specifications for the NLIP borrow sites will be subject to review by the SCAS and FAA.
3. Setting & History

The Airport northern Bufferlands are located north of Elverta Road, south of the Sacramento County line, and west of Power Line Road (refer to Figure 1). The site is in the vicinity of the historic Prichard Lakes (Figure 2). The area was reclaimed for agricultural purposes through construction of the Natomas Basin levee system in the early 1900s by construction of the North Drainage Canal (NDC) and leveling of the land to support crop production. Original ground elevations ranged between 18.5 and 29\textsuperscript{25}.

Figure 2  Historic Pritchard Lakes

Prior to the development of the Airport, the area was converted to rice agriculture by construction of flat paddies (sub basins) with check structures to control elevation drops between each paddy. Generally there is a 6” drop between basins. Currently the rice fields are idle, but existing leveling for rice irrigation, including check structures and drainage pipes remain. Current ground elevations within the proposed borrow areas vary between elevation 23 to 25.

\textsuperscript{25} Datum for all elevations is NAVD88.
A. Drainage System Infrastructure & Operations

There are a number of drainage ditches which run through the area (Figure 3) including the NDC, which serves as a main drainage canal with an approximate bottom elevation of 9. This interconnected canal serves the entire Natomas Basin drainage system and is operated by Reclamation District 1000 (RD 1000).

![Figure 3 Existing Drainage Systems in the Vicinity of Airport Borrow Sites](image)

The NDC receives drainage from the Prichard Lake area and the P Drain, a ditch which drains the northeast portion of the Airport Operations Area (AOA). The Prichard Lake area is located in the center of the proposed borrow area with a bottom elevation of approximately 13. The P Drain, which runs through the site, has a bottom elevation of approximately 13 at the outlet to the NDC. The NDC water surface elevation (WSEL) is typically maintained at approximately 16 in the summer and 12 in the winter. These WSEL conditions are artificially maintained by irrigation water during the summer and by necessary drainage pumping during the winter. It would therefore be expected that the normal water level would be within this range.

Overall drainage within the Natomas Basin is provided by pumping through a series of pumping plants that are interconnected with other drainage canals, including the NDC. RD 1000’s
Pumping Plant No. 2, located on the Sacramento River immediately west of the Airport northern Bufferlands, is the main outlet for the NDC; however, interconnectivity with other pumping plants allows for Natomas Basin outlet pumping at other locations.

During severe storm events high water levels in the main drainage ditches prevents adjacent fields from draining, thereby providing natural detention storage. Additional detention is provided by the configuration of agricultural fields (i.e. checks, berms, pipes & ditches) which moderates the rate of runoff. This agricultural detention buffers the severity of a large storm upon the Natomas Basin’s drainage system and has been consistent with historic agricultural land use. As development has occurred within the Natomas Basin, the removal of any water storage capacity provided by natural detention has been mitigated with site specific detention and/or other improvements to the RD 1000 drainage system. These improvements can include conveyance improvements i.e. construction of canals and or swales, and increases in pumping capacity. Consistent with this practice, SAFCA’s proposed borrow plan on the Airport northern Bufferlands will be appropriately mitigated by other drainage system improvements to prevent impact upon surrounding properties.

B. Irrigation System Infrastructure & Operations

Irrigation supply ditches operated by the Natomas Mutual Central Water Company (NMCWC) run through the proposed borrow areas and supply water to agricultural fields east of the Airport northern Bufferlands. Major ditch systems which are elevated above field levels include the Central Main Canal and Pullman irrigation canals. The Central Main Canal conveys river water from the NMCWC Prichard Pumping Plant, located on the Sacramento River at River Mile 75.1 to the central part of the Natomas Basin. The Pullman Canal conveys recirculated agricultural runoff from the Pullman Pumping Plant which is located on the NDC north of Prichard Lake and serves the areas west of the Airport northern Bufferlands. A lateral canal off of Pullman Canal, Lateral 2A, splits a field in the northeast area of the proposed borrow site. All irrigation infrastructure and associated facilities pre-date Airport development.

Irrigation canals typically contain water during the irrigation season, generally April 1 through September 15. They are also utilized for re-flooding of rice fields for rice straw decomposition in the fall.

C. Groundwater Conditions

Groundwater conditions at the proposed borrow area were evaluated by the NLIP team from data collected from approximately 280 test pits and piezometer well readings strategically located across the entire area. These data indicate that normal groundwater elevations will be approximately 7 to 10 feet below the existing grade. Analysis by the NLIP’s groundwater hydrologist, Luhdorff and Scalmanini, indicates that under normal conditions groundwater will be flowing towards the river with higher groundwater elevations to the east side of the borrow area and decreases in elevation moving towards the river. These groundwater elevations are influenced by a number of factors including surrounding irrigation canals (since they are constructed above field level), drainage ditches, as well as river levels. Analysis indicates that

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26 Facility is being reconstructed as part of the NLIP.
During the summer irrigation season, some groundwater recharge occurs from seepage (infiltration of irrigation water).

During the winter season, high river elevations will cause groundwater elevations in the borrow area to rise and the normal flow of groundwater toward the river will be reversed. These hydraulic impacts will be moderated by the distance of the borrow area from the river and by the elevations of Prichard Lake and the existing drainage ditches around the borrow area. Surface water levels in these water bodies will be below the finished grade of the borrow sites. To the extent that groundwater rises above this finished grade, it will discharge to the surrounding water bodies through the facilities created as part of the borrow operation.

4. FAA Advisory Criteria

The following FAA advisory circulars provide design guidance we have used in the development of the drainage plan for the Airport northern Bufferlands borrow areas:

- Advisory Circular No. 150/5320-5C, SURFACE DRAINAGE DESIGN
- Advisory Circular No. 150/5200-33B, HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

Advisory Circular No. 150/5320-5C on surface drainage design states that: “For airports, it is recommended that the 5-yr storm event be used with no encroachment of runoff on taxiway and runway pavements.” The circular further states that: “certain facilities may have restrictions on surface storage of water due to the potential attraction of waterfowl.”

Guidance for design to minimize wildlife attractants is provided in Advisory Circular No. 150/5200-33B. The relevant guidance from this circular is provided in the following paragraph:

“Where possible, airport operators should modify storm water detention ponds to allow a maximum 48-hour detention period for the design storm. The FAA recommends that airport operators avoid or remove retention ponds and detention ponds featuring dead storage to eliminate standing water. Detention basins should remain totally dry between rainfalls. Where constant flow of water is anticipated through the basin, or where any portion of the basin bottom may remain wet, the detention facility should include a concrete or paved pad and/or ditch/swale in the bottom to prevent vegetation that may provide nesting habitat.”

The following FAA advisory circular provides guidance for grading of these sites:

- Advisory Circular No. 150/5300-13, RUNWAY DESIGN
- Advisory Circular No. 150/5300-13, SURFACE GRADIENT AND LINE OF SIGHT

Advisory Circular No. 150/5300-13, runway design states that: “The runway safety area shall be:

1. Cleared and graded and have no potentially hazardous ruts, humps, depressions, or other
surface variations;
2. Drained by grading or storm sewers to prevent water accumulation;
3. Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft”

Advisory Circular No. 150/5300-13, Surface Gradient and Line of Sight, states that: The longitudinal grade for the runway area safety area (i.e. aircraft approach C and D categories) from 0-200 feet beyond runway end is 0-3%. The slope must be negative, or downward from the runway end. Laterally, the transverse grade is a maximum of plus or minus 5%, beyond 200' of the end of the runway. This may be a positive slope, as long as it does not penetrate the approach surface.

A. Application of FAA Criteria

The discussion that follows describes how these FAA guidelines and the borrow needs of the NLIP have been incorporated into the design of the proposed grading plan. The primary focus of the plan will be to minimize standing water by directing water into drainage ditches and swales. The plan will address FAA grading requirements for the runway safety area and accommodate the future realignment of Elverta Road.

5. Proposed Airport Northern Bufferlands Borrow Site Grading

A. Summary

The proposed borrow area is currently configured for agricultural irrigation and drainage. As sites are excavated, fields will be re-leveled and sloped to provide more positive runoff. The depth of excavation is limited by modeled water surface elevations in the drainage ditches at field drainage outlets.

Based upon our analysis the proposed excavation can generate a sufficient volume of borrow material with finished grade elevations above the drainage canal water elevations for the 10-year storm event27. As a result the areas will be free draining for storm events of this magnitude. Storm drain facilities will therefore be sized based upon a 10-year design event, which exceeds the FAA 5-year design storm. It should be noted that storms exceeding the 10-year storm, result in significant standing water throughout the local area and within the Natomas Basin as a whole.

B. Drain Elevations

Following removal of soil borrow material, the areas will be re-graded to minimize the potential for standing water. Grading plans will stipulate finished elevations at the lowest ends of the affected fields will be approximately 1 foot above the calculated peak water surface elevations anticipated during the 10-year design storm. This design elevation is approximately 2 to 3 feet

27 Based upon Natomas Basin drainage system SWIMM model using 10-year, 24-hour design storm from Sacramento City/County Drainage Manual, SAC-PRE.
above the normal operating elevation in the drainage ditches. For the northern borrow sources, (immediately north of the NDC), field runoff will be discharged directly into the NDC. For areas south of the Central Main Flume/Canal runoff will be discharged into the P Drain. For the area between the Central Main Flume/Canal and the Pullman Irrigation Canal the runoff will be discharged into the remnant of Prichard Lake (see discussion under separate heading below) via culvert pipes.

The existing Natomas Basin drainage system has been modeled, and the modeling has been calibrated against historical storm events. The model is maintained and updated by RD 1000 as changes in land use or other facility changes occur within the Natomas Basin. The model is also used as the basis for FEMA mapping of residual floodplains within the Natomas Basin.

As part of our analysis the drainage system model has been run for various storm events to obtain appropriate elevations for use in design of the grading plan at various locations in the vicinity of the Airport northern Bufferlands borrow sites. The modeling also provides hydrographs which show how drain elevations vary over time during a storm event. Based upon our modeling the critical storm event that affects drainage appears to be a 10-year, 10 day storm. Less significant and shorter duration storm events do not have a significant enough impact upon drainage to warrant the construction of additional drainage facilities. This is due to storage capacity within the drainage canal system and natural detention on surrounding fields which do not fully drain for short duration storm events. The existing drainage canal system water surface elevations (WSEL) at key nodes (refer to Figure 3) for a 10-year storm within the system are summarized below:

- NDC at Pullman Pumping Plant – WSEL 17.6
- P Drain at outlet to North Drainage Canal (outlet for Prichard Lake) - WSEL 17.6
- P Drain at Lambert Ditch - WSEL 17.6
- P Drain at Elverta Road - WSEL 20.7

Other critical elevations have been considered during our analysis and will be utilized in the proposed borrow plan design. To facilitate distribution of irrigation water, the WSEL that the NDC is operated at during the summer is slightly elevated from normal. This peak summer WSEL has been considered in the design of seepage collection ditches that are proposed around site perimeter adjacent to irrigation sources.

In consideration of this summer drainage data, the modeling results for the 10-year storm, and the proposed improvements, we conclude the Airport northern Bufferlands borrow sites can be graded to elevations above anticipated water elevations in the surrounding drain canals. The result is that the tailwater at field drain outlets will not create a significant backwater condition. Provided the design field levels can be achieved, the tailwater levels in the drains should not hinder compliance with FAA criteria which requires areas to be drained within 48 hours after design storm events.

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28 SCAS will be provided design drawings to review and confirm this element and other elements of the borrow plan.
29 The current published mapping is based anticipated levels resulting from levee failure. It is assumed that once levee system rehabilitation is complete, FEMA mapping of interior floodplains will revert to original mapping of residual floodplains within the basin.
Borrow Area 1 Drainage – Remnant of Prichard Lake & SCAS GGS Pritchard Lake Preserve

The proposed grading plan for Borrow Site 1 will be designed to avoid any adverse affects to the SCAS GGS Prichard Lake Preserve (Preserve), which was completed by the Sacramento County Airport System during 2007 pursuant a federal court order resulting from a complaint filed by the United States Army Corps of Engineers. The preserve mitigates in situ for unauthorized filling of jurisdictional wetlands by County Airport System maintenance personnel. The preserve is managed by the Center for Natural Lands Management (CNLM).

Our borrow site analysis indicates portions of Borrow area 1 currently drains into a deeper marsh area that is a remnant of Prichard Lake and would not effect the Preserve. In fact the Preserve is not within remnant Prichard Lake, but it does drain into this area. A review of the design drawings (see West Yost Drawing C-2) for the Preserve reveals the preserve is actually located much higher and drainage runoff as a result of proposed borrow operations would not flood GGS upland areas that have been created.

Actions we would undertake to adequately drain the borrow site and prevent any adverse effects to the Preserve include: lowering the drain outlet pipe (this pipe does not outfall within the limits of the Preserve); re-sloping the sites to drain quicker will allow runoff to occur prior to the peak in the RD1000 drainage system; the plans and specifications will include provisions requiring the Contractor to fence off work area adjacent to the preserve and maintain access for maintenance of preserve. All standard minimization and avoidance measures will be employed to protect the preserve site and adjacent wetlands.

We would recommend a design coordination meeting with SCAS staff and the Preserve manager (CNLM) to review details and discuss appropriate measures to be included in the construction documents. It should be noted there is no change in drainage shed area and therefore any differences in the volume of runoff from this and other borrow areas is not anticipated.

C. Field Drain Outlets

The existing fields at the proposed Airport northern Bufferlands borrow sites are configured for agricultural drainage, with pipe outlets to drainage ditches at the low end of the fields. Pipe sizes are normally 12” to 18” in diameter for fields up to 80 acres. While this may be adequate for agricultural drainage, it is our opinion that additional pipe outlets or increased pipe sizes will improve field drainage following borrow operations. Flow capacity for design of outlet pipes will be obtained from field drainage modeling as described below. Pipe outlets will be designed based upon the flow regimes resulting from site specific conditions and outlet water levels for the design condition.

In some cases, drainage pipe outlets for proposed irrigation seepage collection ditches will be lower than storm water runoff collection ditches. This is required because seepage collection
ditches will intercept seepage at levels lower than the fields (proposed seepage collection facilities are described in further detail below). These pipe outlets will be fitted with flap gates to prevent backflow during high water levels. The outlet elevations will be set at least 1 foot above maximum normal operating level.

D. Field Grading Design

As previously described, the existing Airport northern Bufferlands borrow sites are graded for agricultural drainage. The design requirements for agricultural drainage are significantly different than the FAA and SCAS objectives of minimizing the extent and duration of standing water on these sites. The objective of the re-grading to be performed during NLIP borrow operations will be to improve grading to minimize standing water where practical.

To develop a concept for field grading, a preliminary design for the northeast area of the site has been completed and an analysis of the drainage performance for pre- and post-grading conditions has been made. The existing condition modeling was based upon field topography and as-built surveys of the drainage infrastructure. The proposed post-project grading condition is shown in Figures 4a, 4b and 4c. The field drainage conditions were input into XP-SWMM (a dynamic hydraulic modeling software) and the model runs were made for various storm events from the Sacramento City/County Drainage Manual. The tailwater boundary conditions in the North Drainage Canal were obtained from the RD1000 SWMM model outputs at nearby nodes.

Figure 4a  Proposed Post-Project Grading Conditions
E. Time of Detention

Based upon our analysis, the fields at the proposed Airport northern Bufferlands borrow sites can be graded to avoid any significant detention time for 10-year design storm events. Due to the proximity of the fields to main drainage receiving waters it is clear from the analysis that there
will be no significant detention time for drainage runoff from these sites. Sites will be free draining after rainfall events up to the level of the design storm. Although there may be minor ponding during rain events the site will drain relatively quickly after rain stops. As discussed earlier, it is expected that any existing detention is a result of ponding due to inadequate sloping.

During more severe rainfall events the sites may see some flooding and the time of detention will be controlled by the capacity of the Natomas Basin’s drainage system and not site grading. Based upon a review of the historical pumping records from the significant 1986 and 1997 storm events, the pumping of rainwater out of the interior Natomas Basin canals will return levels to normal within 2 to 4 days. The field outlets will be sized to prevent backup as the system is drained down, but there are no other on-site improvements that will further reduce time of detention.

F. Proposed Site Grading for Control of Groundwater and Seepage

The finished grade of the borrow excavations will be above normal ground water levels. Seasonal fluctuations of water due to influence of the Sacramento River are expected to be only a few feet and decreasing in an easterly direction. Groundwater is also greatly influenced by irrigation seepage in areas adjacent to irrigation canals and irrigated fields. This influence appears to decrease rapidly moving away from the seepage source. Existing piezometers installed by SAFCA at the site will continue to be monitored through the winter.

To address potential groundwater fluctuations, the finish grade of the sites will be held 3 to 4 feet above the anticipated normal levels at the site. There is a potential for extremely high water in the Sacramento River to create groundwater seepage at the site, although this condition would be infrequent and associated with large storm events. We would expect this condition to be mitigated by the distance from the river and lower ground levels around and within the Airport north bufferlands (i.e. Prichard Lake, North Drainage Canal, P Drain). If seepage onto fields should occur, the site grading would route any runoff to collection ditches and off the site with minimal detention.

To address the potential for irrigation seepage, the sites will include collection facilities around the perimeter of fields adjacent to these sources and provide setbacks to the extent practical. The collection facilities will generally be ditches several feet below adjacent field grade. The ditches will be configured with shallow side slopes to allow for mowing and vegetation control. It is anticipated that this will confine any continuous water to the ditches which can be aggressively maintained to prevent the establishment of habitat attractive to waterfowl.

G. Proposed Site Grading for Proposed Future Airport Facilities

Future Airport projects will be accommodated in the finish grading of the borrow area. Based on review of the Airport Master Plan and communications with the SCAS staff, the planned extension of runway 16L may extend into the southwest portion of the site, as shown in Figure 5 (below). The borrow operation will be designed to accommodate a full runway extension northward. Although indications are that the runway extension may not be as long as the maximum proposed in the planning documents, our review indicates that the maximum extension can be accounted for without impacting the soil volumes required for NLIP
construction. Excavations will not occur in the runway safety area of the proposed extended runway. In addition, any grading within the runway protection zone will not encroach upon the 3% projected surface from the end of the runway, based upon FAA Advisory Circular 150/5300-13.

Figure 5  Future Airport Runway Extensions

To accommodate the future runway extension, Elverta Road would need to be relocated. Alignment of the road will be highly dependent upon length of runway extension. Conceptual road alignments do not appear to follow any existing site features and bisect existing drainage watersheds. Our review indicates that the more optimal alignment would be to parallel the alignment of the existing Central Main Canal, which is constructed along a natural ridge through the site. We would therefore propose maintaining a corridor for the road along this alignment as shown in Figure 6. If an alternative alignment is selected in the future, this ridge can be degraded to construct a road embankment through the site along the selected alignment. The proposed extension of Earhart Drive also does not follow any natural site contours. We would similarly recommend reserving a corridor along natural ridges through the site as shown in Figure 6. Should alternative alignments be selected in the future, fill material can be borrowed from these corridors for embankment construction.
H. Mitigation for Changes in Rate of Runoff

The improved site drainage will result in an increased rate of runoff from the sites. This increase will be mitigated by the proposed NLIP offsite improvements to avoid impacts upon surrounding properties. Our analysis indicates that the timing of releases is such that the impacts will be relatively minor. Planned NLIP improvements in capacity at Pumping Plant No. 2 and the North Drainage Canal will be sufficient to offset any potential increase in drainage system water levels that may result from improved site drainage. Should final design show that additional drainage system improvements are required, they will be incorporated into design. An example would be the replacement of Prichard Road culvert in the North Drainage Canal.

30 During reconstruction of Pumping Plant No. 2, a minor increase in pumping capacity was designed into the project to accommodate potential increases in seepage discharges from relief wells proposed as part of the NLIP. Due to differences in timing this additional capacity will also be available to pump runoff from the Airport borrow during storm events. Additionally, proposed channel improvements (flattening side slopes) to the NDC will enhance its conveyance capacity for runoff from the proposed borrow sites.
6. Conclusion

The soil borrow material needed to support the NLIP improvements for a portion of the Sacramento river east levee can be obtained from the approximately 700 acres of idle agricultural land north of the Airport Operations Area in a manner that:

- Improves surface water drainage in accordance with FAA guidelines;
- Facilitates future management of this land in accordance with the Airports Wildlife Hazard Management Plan; and
- Accommodates future improvements to Airport facilities in this area.