APPENDIX G-1
WATER QUALITY

This appendix contains the Water Quality Technical Report prepared for the Supplement to the Final Environmental Impact Statement. The Water Quality Technical Report published in the June 2014 Final EIS has been updated to consider the Environmental Consequences and Impacts of Alternative E.

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Water Quality Technical Report

Gnoss Field Airport
Marin County, California

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1.0 INTRODUCTION

This report presents detailed information on existing conditions (2008) related to water quality associated with implementation of the proposed Gnoss Field Airport Runway Extension Project (proposed project). This report provides data and analysis in support of the Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) for the proposed project.

This Water Quality Technical Report discusses the regulatory setting, describes existing water quality conditions (2008) for the project site and immediate vicinity, and analyzes three project alternatives, including the No Action Alternative (Alternative A), the Preferred Alternative [Proposed Project (Alternative B)] and Alternatives D and E. This report also describes methodology used to assess hydrology and water quality impacts, and the environmental consequences and impacts associated with development of the Proposed Project and alternatives.

2.0 REGULATORY FRAMEWORK

Many federal, state, and local regulatory programs stipulate standards and conditions for the protection, maintenance, and improvement or enhancement of water quality relevant to implementation of the proposed project. Many of these programs build upon or tier off of the federal Clean Water Act (CWA). The primary regulatory provisions applicable to water quality standards relevant to the proposed project site are summarized below.

2.1 Federal Regulations

2.1.1 Federal Clean Water Act

The 1972 Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), establishes the basic structure for the United States Environmental Protection Agency (EPA) to regulate discharges of pollutants into waters of the United States. The CWA's primary intent is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

Section 301 of the CWA prohibits any person to discharge any pollutant unless implemented in a manner compliant with Section 301, and sections 302, 306, 307, 318, 402, and 404 of the CWA. Any discharge to waters of the U.S. requires a federal permit. Under Section 301, effluent guidelines and categorical pretreatment standards regulations have been established for 56 industrial land use categories discharging directly to surface waters

Section 401 of the CWA (33 U.S.C. 1341) requires any federal license or permit applicant to obtain a water quality certification if any proposed project activity may result in a discharge of a pollutants into waters of the United States. This certification assures that the discharge would comply with the applicable effluent limitations and water quality standards. The intent of this regulation is to preserve wetlands, avoid adverse impacts to existing aquatic resources where possible, and to offset unavoidable adverse impacts through mitigation. The overall goal of Section 401 is to achieve no net loss of wetland functions and values.

The CWA was amended in 1987 with the addition of Section 402(p), which established a framework for regulating storm water discharges under the National Pollutant Discharge Elimination System (NPDES). The NPDES permit system was established in the CWA to regulate point source pollution such as municipal and industrial discharges to surface waters of the United States. In California, the EPA has given the state authority to administer the NPDES program, which is implemented by the State Water Resources Control Board (SWRCB).

Under the NPDES permit system, the SWRCB adopted the current Industrial Stormwater General Permit (General Industrial Permit) in 1997. The General Industrial Permit regulates discharges associated with 10 broad categories of industrial activities, each of which are identified in the Federal regulations by a Standard Industrial Classification (SIC). The General Industrial Permit identifies effluent limitation guidelines for storm water discharges from facilities in the ten industrial categories. The General Industrial Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). Gnoss Field currently operates under the current Industrial Permit for Air Transportation Industrial Activities, SIC code 4581, under Waste Discharge Identification Number 221I000647.

Nonpoint pollution sources are defined as those that originate over a wide area, rather than from a definable location or point source. Nonpoint sources of pollution are generally exempt from federal NPDES permit program requirements with the exception of storm water discharges. Stormwater discharges during and after project construction can transport pollutants from impervious surfaces such as roads and parking lots into creeks and streams. NPDES municipal Phase II regulations require jurisdictions to initiate actions to prevent long term non-point pollution through appropriate design. Marin County operates under a General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems and has developed a Stormwater Management Plan (EOA 2005). The goal of the NPDES nonpoint source regulations is to improve the quality of storm water discharged to receiving waters to the "maximum extent practicable" through the use of Best Management Practices (BMPs).

In accordance with NPDES regulations, to minimize the potential effects of construction runoff on receiving water quality, the SWRCB requires that any construction activity affecting one acre or more must obtain coverage under the General Construction Activity Stormwater Permit (Construction General Permit, 99-08-DWQ). Effective July 1, 2010 all Permittees are required to obtain coverage under the new Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009. Construction activity subject to this permit includes clearing, grading and disturbances to the ground such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

Additionally, permit applicants are required to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) that specifies erosion and sediment control BMPs to reduce or eliminate construction-related impacts on receiving water quality. Permit applicants are also required to perform regular inspections of all BMPs.

Examples of construction BMPs identified in SWPPPs include: using temporary mulching, seeding or other stabilization measures to protect uncovered soils; storing materials and equipment to ensure that spills or leaks cannot enter the storm drain system or surface water; developing and implementing a spill prevention and cleanup plan, installing traps, filters, or other devices at drop inlets to prevent contaminants from entering storm drains; and using barriers, such as straw wattles or silt fencing to minimize the amount of uncontrolled runoff that could enter storm drain inlets or surface water.

The effect of this regulatory environment is that projects need to be managed carefully (i.e. BMPs are properly implemented, monitored, and maintained).

2.1.2 Federal Aviation Administration Order 1050.1E, Environmental Impacts: Policies and Procedures

Federal Aviation Administration (FAA) Order 1050.1E provides guidance regarding FAA policies and procedures for achieving compliance with National Environmental Policy Act (NEPA) and regulations issued by the Council on Environmental Quality for all FAAadministered projects. Appendix A of this order summarizes potential “impact categories” that must be considered during project planning and implementation. Section 17 of Appendix A provides requirements the FAA must meet in respect to analyzing project-related impacts to Water Quality under NEPA and determining whether project-related impacts are significant.

The environmental analyses must contain sufficient description of a proposed action’s design, mitigation measures, including best management practices developed for nonpoint sources under Section 319 of the CWA, and construction controls to demonstrate that State or Tribal water quality standards and any Federal, Tribal, State, and local permit requirements will be met. As stated in Section 17, of Appendix A, Significant Impact Thresholds, water quality regulations and issuance of permits will normally identify any deficiencies in the Proposed Project relevant to water quality or any additional information necessary to make judgments on the significance of impacts. When the thresholds indicate that the potential exists for significant water quality impacts, additional analysis in consultation with State or Federal agencies responsible for the protection of water quality may be necessary. The responsible FAA Official must ensure that the applicable water quality certificate is issued before FAA approves the proposed action.

2.1.3 Federal Safe Water Drinking Act

If the potential exists for contamination of an aquifer designated by the EPA as a sole or principal drinking water resource within the project area, the FAA is required to consult with the EPA regional office as required by section 1424(e) of the Safe Drinking Water Act, as amended. Consultation with the Federal, Tribal, State, or local officials will be undertaken if there is the potential for contamination of an aquifer designated by the EPA as a sole or principal drinking water resource for the area pursuant to section l424(e) of the Safe Drinking Water Act, as amended. Consultation

2.1.4 Fish and Wildlife Coordination Act of 1980

If the proposed action would impound, divert, drain, control, or otherwise modify the waters of any stream or other body of water, the Fish and Wildlife Coordination Act is applicable, unless the project is for the impoundment of water covering an area of less than ten acres. The Fish and Wildlife Coordination Act requires the FAA to consult with the U.S. Fish and Wildlife Service and the applicable State agency to identify means to prevent loss or damage to wildlife resources resulting from the Proposed Action.

2.2 State Regulations

2.2.1 State Water Resources Control Board

Section 303 of the CWA requires states to adopt water quality standards for all surface waters of the United States. Where multiple beneficial uses exist, water quality standards must protect the most sensitive use.

The SWRCB and the nine Regional Water Quality Control Boards (Regional Boards) are responsible for ensuring implementation and compliance with the provision of the federal CWA and California’s Porter-Cologne Water Quality Control Act. The project area is situated within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

The proposed project is located within the Petaluma River Watershed, which has been listed on the current Section 303d list of impaired waterbodies. Water quality pollutants of concern and that require total maximum daily loads (TMDLs) are diazinon, nickel, nutrients, and pathogens.

Section 13260 of the California Water Code requires that any person discharging waste or proposing to discharge waste, other than to a community sewer system, that could affect the quality of the waters of the State, shall file a Report of Waste Discharge (ROWD) with the appropriate regional board. Section 13260 of the California Water Code requires a ROWD for persons discharging or proposing to discharge waste that could affect the quality of the waters of the State. The Regional Board reviews the applicant's ROWD and may establish Waste Discharge Requirements (WDRs) for the proposed action. WDRs may include effluent limitations, as well as monitoring and reporting requirements.

San Francisco Bay Basin Plan

Regional Boards have the authority to implement water quality protection standards through the issuance of permits for discharges to waters at locations within their jurisdiction and through multiple enforcement mechanisms. Regional water quality objectives for all water bodies in the Petaluma River watershed (including Black John Slough and its tributaries) are specified in the Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin, prepared by the San Francisco Bay RWQCB in compliance with the federal CWA and the State Porter-Cologne Water Quality Control Act. Section III of the Basin Plan contains both narrative and numeric water quality objectives that are intended to protect these beneficial uses. The water quality criteria contained in the Basin Plan have been developed to protect the designated beneficial uses of the area.

The **Table 1** below summarizes the beneficial uses pertinent to the proposed project site.

Table 1 — Beneficial Uses Pertinent to the Proposed Project

County Water Body	Aquatic Life Uses						Wildlife Uses	Recreational Uses		
	COLD	EST	MIGR	RARE	SPWN	WARM	WILD	REC-1	REC-2	NAV
Petaluma River	E	E	E	E	E	E	E	E	E	E
San Antonio Creek	E		P		P	E	E	P	P	

*** E = Existing Beneficial Uses, P = Potential Beneficial Uses

1 Cold Freshwater Habitat (COLD)
2 Estuarine Habitat (EST)
3 Fish Migration (MIGR)
4 Preservation of Rare and Endangered
5 Species (RARE)
6 Fish Spawning (SPWN)
7 Warm Freshwater Habitat (WARM)
8 Wildlife Habitat (WILD)
9 Water Contact Recreation (REC1)
10 Noncontact Water Recreation (REC2)
11 Navigation (NAV)
12

California Industrial Activities Storm Water General Permit

The Industrial Storm Water General Permit is an NPDES permit that regulates discharges associated with 10 broad categories of industrial activities. The General Industrial Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). The General Industrial Permit also requires the development of a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. Through the SWPPP, sources of pollutants are to be identified and the means to manage the sources to reduce storm water pollution are described. The General Industrial Permit requires that an annual report be submitted each July 1. Facility operators may be able to participate in group monitoring program.

Gnoss Field is a participant in the American Association of Airport Executives and Airport Research and Development Foundation Group Monitoring Plan (GMP) for California Storm Water Monitoring Group Airports. Each airport participating in the GMP is required to collect and analyze two samples every five years. Representative ness of the outfall(s) chosen for sampling at individual facilities is determined by studying the drainage areas discharging to an outfall. The selected sampling outfall(s) discharges runoff repressing all potential pollutants for an individual facility. Sound representative samples of storm water discharges from individual facilities are assured through the implementation of proper sampling protocols outlined by the GMP and defined by the General Permit and the requirements of 40 CFR 136 and 40 CFR 122, as well as selection of the appropriate outfall. Gnoss Field samples at Outfall #1.

Testing parameters to be analyzed for each participating facility are specific to the transportation industry and are specified by Section B(5)(c)(i) of the Industrial General Permit. Section B requires collected storm water samples to be analyzed for total suspended solids (TSS), total organic carbon (TOC) or Oil and Grease, pH, and Specific Conductance. In addition to monitoring collected storm water samples, as required by the General Permit, the following monitoring activities are to be conducted annually:

- **Non-Storm Water Discharge Observations**. Non-storm water discharge visual observations are to be conducted on a quarterly basis.
- **Storm Water Discharge Visual Observations**. Storm water visual observations are to be conducted once during every storm event per month of the wet season and are to be conducted within the first hour of storm water runoff.
- **Annual Comprehensive Site Compliance Evaluation**. An annual comprehensive site compliance evaluation is to be conducted by trained Airport Managers within all areas of Industrial Activity. The Evaluation includes a review of the site-specific SWPPP, visual observations, and a comprehensive review of implemented BMPs for proper implementation, effectiveness, and adequacy. Any new areas of industrial activity are required to be recorded by the Evaluation, and addressed by a modified SWPPP, if applicable. If the facility is found to not be in compliance with the SWPPP or the General Permit conditions, the Inspector is required to document non-compliance specifics and modifications to the facility SWPPP and BMPs may be required.

Annual reporting requirements for each facility will result from a compilation of the forms completed during inspections conducted by the Airport Manager, reviewed by Environmental Compliance Operations, Group Leaders and the American Association of Airport Executives and Airport Research and Development Foundation Group, to be submitted annually to the Regional Water Quality Control Board by July 1st.

In addition to on-site inspections conducted by the Airport Manager, the Group Leader for the Group Monitoring Plan (or Environmental Compliance Options) shall conduct inspections twice within the five-year permit period. As required by the General Permit, the Group Leader will prepare an annual group evaluation report to be submitted to the State Water Resources Control Board by August 1st of each year.

2.3 Local Regulations

2.3.1 Marin County

The following Marin County policies and regulations are relevant to the proposed project:

Marin Countywide Plan

Goal WR-1:	**Healthy Watersheds. Achieve and maintain proper ecological functioning of watersheds, including sediment transport, groundwater recharge and filtration, biological processes, and natural flood mitigation, while ensuring high-quality water.**
Policy WR-1.1:	Protect Watersheds and Aquifer Recharge. Give high priority to the protection of watersheds, aquifer-recharge areas, and natural drainage systems in any consideration of land use.
Policy WR1.3:	Improve Infiltration. Enhance water infiltration throughout watersheds to decrease accelerated runoff rates and enhance groundwater recharge. Whenever possible, maintain or increase a site's predevelopment infiltration to reduce downstream erosion and flooding.
Goal WR-2:	**Clean Water. Ensure that surface and groundwater supplies are sufficiently unpolluted to support local natural communities, the health of the human population, and the viability of agriculture and other commercial uses.**
Policy WR-2.3:	Avoid Erosion and Sedimentation. Minimize soil erosion and discharge of sediments into surface runoff, drainage systems, and water bodies. Continue to require grading plans that address avoidance of soil erosion and on-site sediment retention. Require developments to include on-site facilities for the retention of sediments, and, if necessary, require continued monitoring and maintenance of these facilities upon project completion.

Policy WR-2.2: Reduce Pathogen, Sediment, and Nutrient Levels. Support programs to maintain pathogen and nutrient levels at or below target levels set by the Regional Water Quality Control Board, including the efforts of ranchers, dairies, agencies, and community groups to address pathogen, sediment, and nutrient management in urban and rural watersheds.

Policy WR-2.4: Design County Facilities to Minimize Pollutant Input. Design, construct, and maintain County buildings, landscaped areas, roads, bridges, drainages, and other facilities to minimize the volume of toxics, nutrients, sediment, and other pollutants in stormwater flows, and continue to improve road maintenance methods to reduce erosion and sedimentation potential.

Implementation Programs

WR-2.2b: WR-2.b Integrate Bay Area Stormwater Management Agencies Association (BASMAA) Stormwater Quality Protection Guidelines into Permitting Requirements for All Development and Construction Activities. All projects should integrate stormwater pollution prevention design features for water quality protection to the extent feasible, such as those included in the BASMAA Start-at-the- Source manual and the Tools Handbook.

<u>Marin County Code</u>

Chapter 23.09, Floodplain Management

(2A) The County shall restrict uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damage increases in erosion or in flood heights or velocities;

(2B) The County shall require that uses vulnerable to flood, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(2C) The County will control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters;

(2D) The County shall control filling, grading, dredging and other development which may increase flood damage; and

(2E) The County will prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.

Chapter 23.18, Urban Runoff Pollution Prevention

The County shall protect and enhance the water quality of our watercourses, water bodies and wetlands in a manner pursuant to and consistent with the Clean Water Act and the Porter-Cologne Water Quality Control Act.

The County shall abide by the previous by:

- Minimizing discharges other than storm runoff to storm drains or watercourses;
- Controlling the discharge to storm drains or watercourses from spills, dumping or disposal of materials other than rain water;
- Reducing pollutants in stormwater discharges to the maximum extent practicable.
- Complying with the County's NPDES permit that require implementation of appropriate source control and site design measures and stormwater treatment measures for projects;
- Maintaining pre-development stormwater runoff rates and preventing nonpoint source pollution whenever possible, through stormwater management controls and ensuring that these management controls are properly maintained (Marin County Board of Supervisors 2008).

3.0 ENVIRONMENTAL SETTING

3.1 Project Location

Gnoss Field Airport (proposed project) is located within the Novato Valley drainage basin approximately one mile north of the City of Novato, California, immediately east of Highway 101 on former Petaluma River tidelands. The proposed project is situated within an un-numbered section, Township 4 North, Range 7 West, of the USGS 7.5-minute series *Petaluma River* quadrangle (**Figure 1**).

The proposed project area consists of ±120 acres of land that is currently composed of developed areas associated with the airfield and annual grassland and wetland communities on the perimeters of the field.

3.2 Site History

Many years ago levees were constructed near the Petaluma River to protect the area behind the levee from tidal action and flooding. This particular site was originally farmed for hay production.

Various structures have been constructed on the site. These structures include ditches, roads, buildings, parking lots, culverts, and levees. All of these structures have affected the flow of surface water on the site. Pumps are used to return surface water from drainage ditches and canals from the airport and adjacent properties to the Petaluma River.

3.3 Land Use

The site is utilized primarily as a municipal airport, with centrally located infrastructure, including a landing strip, hangars, and buildings. The perimeter of the study area is used to graze cattle, and some of the grounds are denoted as a California Department of Fish and Game Wildlife Area. Roads, utilities, fences, levees, and drainage ditches are also found in the study area.

3.4 Project Description

The proposed project would involve the following actions:

- The construction of a 1,100 feet runway extension and runway safety area to the existing Runway 13/31;
- Construction of the corresponding taxiway to the full length of the runway;
- Construction of realigned drainage channel to drain the extended runway and taxiway;
- Construction of the corresponding levee extension to protect the runway and taxiway extensions from flooding; and

- Re-programming of navigational aids that pilots use to land at the Airport to reflect the extended runway.

3.5 Physical Features

3.5.1 Topography

The proposed project landscape is primarily level with elevations ranging from 0 to 15 feet above mean sea level (MSL). The airport is surrounded by a series of levees and rests on fill material and moderately impermeable bay mud. Precipitation falling on the site collects in ditches and topographic depressions, gradually evaporating or draining relatively slowly into larger sloughs and pumped into Black John Slough or the Petaluma River.

3.5.2 Soils

The Natural Resources Conservation Service (NRCS) has mapped three soil units on the proposed project (**Figure 2**). The soil units that occur onsite include **Reyes clay**; **Urban land-Xerorthents complex, 0 to 9 percent slopes**; and **Xerorthents, fill**. General characteristics associated with these soils types are described below.

- **Reyes clay**: This soil type is very deep and somewhat poorly drained. It is found on reclaimed tidelands between 0 and 10 feet above MSL. It formed in alluvium derived from various rock sources. Slopes are generally between 0 and 2 percent. Permeability is slow and runoff is slow. Native vegetation is generally composed of wetland plant communities.
- **Urban land-Xerorthents complex, 0 to 9 percent slopes**: This soil type is found on valley floors, toes of cut slopes, and tidelands covered with fill between 0 and 500 feet above MSL. The soil is composed of 70 percent urban land and 20 percent Xerorthents. The Urban land component consists of areas covered by roads and developed structures. Runoff within this component is rapid. Xerorthents consist of cut or fill areas. The original soils are often graded and contain mixed soil horizons. The characteristics of Xerorthents are highly variable.
- **Xerorthents, fill**: This soil type consists of soil material that has been moved mechanically and mixed. Most of this unit is contained in urban areas. Xerorthents are loamy and well-drained. Permeability and runoff characteristics vary.

3.5.3 Regional Hydrology

The proposed project site is located within the San Francisco Bay Hydrologic Region (HR), as defined by the California Department of Water Resources. Within this HR, Gnoss Field Airport is located in the 146 square mile Petaluma River watershed (Hydrologic Unit Code #18050002). The Petaluma River is the major drainage within this watershed and empties into San Pablo Bay.

3.5.4 Local Hydrology

The existing hydrologic boundaries defining the proposed project water quality extend from the southeastern slope of Burdell Mountain in the west, to the northernmost extent of the Airport levee in the north, to the levee along Black John Slough in the south, to the easternmost levee between the proposed project site and the adjacent agricultural field.

Surface Waters

Surface water drainage flows on the proposed project site can be delineated into four basic categories:

- Run-on/perimeter flows;
- Runway/taxiway flows;
- Asphalt apron flows; and
- Offsite flows.

Run-On/ Perimeter Flows

Approximately 218 acres drain down the eastern slope of Burdell Mountain into ditches and natural drainage swales (**Figure 3**). These flows continue east under Highway 101 through two culverts to the northwestern corner of the asphalt hangar apron, immediately northwest of the main entrance to the airport. The flows coming from the west join and enter the interior levee drainage through a culvert at the northwestern most corner of the asphalt hangar apron.

Runoff then flows east from the culvert in the vegetated interior drainage channel until it meets the taxiway shoulder. Waters are then directed north parallel to the taxiway. The flows continue north, per the original design via gravity, to the end of the taxiway and runway and then circle around to the east. Runoff continues south to the eastern windsock. From this point waters are conveyed due east along the northeastern property boundary, still inside the Airport levee system, to the confluence with the north flowing vegetated drainage channel along the easternmost property boundary. The two waters converge and then are discharged out of the proposed project boundary through twin culverts. The north flowing vegetated drainage channel originates along the southernmost property boundary, adjacent to Black John Slough (**Figure 4**).

Discharged waters continue to flow east in the vegetated drainage channel within the off-site levee system. These flows continue in the drainage channel until they reach the pump station adjacent to Black John Slough, where the surface waters are pumped into Black John Slough and flow into the Petaluma River (**Figure 3**).

Runway/ Taxiway Flows

Runway and taxiway flows run perpendicular to the operational flow of the structures. The asphalt runway and taxiway were designed with a center crown whereby rainfall would sheet to the shoulders of the runway and the taxiway. Rainfall that flows to the shoulders continues flowing into the vegetated perimeter channel. Stormwater runoff between the taxiway and runway flows together in the center drainage ditch and then flow north into the perimeter drainage channel (**Figure 4**).

Asphalt Apron Flows

Precipitation that falls onto the asphalt hangar and operational aprons on the west side of the airport, flows east into the drainage ditch parallel to the taxiway then north into the vegetated perimeter channel or waters flow directly north into the perimeter channel. Rainfall on the southwestern most portion of the proposed project site flows south into the southern vegetated area, then east, to join the north flowing vegetated perimeter channel on the eastern most property boundary.

Rainfall that reaches the eastern asphalt hangar apron flows northeasterly in the northern portion, easterly from the wash area in the central portion of the eastern apron, and southeasterly in the southern portion. The north and south portions flow into the vegetated perimeter channels immediately adjacent to their locations.

Flows in the central portion of the eastern asphalt apron drain into a subsurface stormwater filtration conveyance system. The flows that enter the wash drain flow through a sediment filter and then through an oil and grease separator before the flows are released into an evaporation basin on the eastern portion of the project boundary. When runoff volumes exceed the capacity of the evaporation basin, the flows will enter the vegetated perimeter channel, prior to offsite discharge (**Figure 4**).

Offsite Flows

Offsite flow is the fourth category of surface water at the Gnoss Field Airport. Due to the Airport Levee System these flows never enter the site unless a levee breach was to occur. These flows originate from Burdell Mountain and Olompali Park to the north. Rainfall from these areas is directed along Highway 101 to culverts that exit on the east side of the Highway and continue east into the tributaries and sloughs adjacent to the Petaluma River. Off-site surface water flows are pumped into the Petaluma River to the northeast (**Figure 3**).

Floodplains

The proposed project lies within the 100 year flood plain according to the Preliminary Design Report and the FEMA hazard area mapping; however, with the current levee system, airport flooding is minimized unless one or more of the following situations occurs:

- The Petaluma River breaches the riverside levee as well as the Airport levee;
- Black John Slough breaches its levee as well as the Airport levee;
- The San Antonio Creek levee is breached and then the north runway levee is breached;
- The drainage pumps fail or are inadequate; and/or
- The drainage channels onsite become clogged or overfilled.

Ground Water

Gnoss Field Airport is located within the northern San Francisco Bay region within the north coast ranges geomorphic province of California. Ground water occurs principally in alluvial deposits of Pleistocene to Holocene age that unconformably overlies non-water bearing rocks of the Franciscan assemblage (Cardwell 1958). The alluvial deposits are composed of unconsolidated clay, silt, and sand with discontinuous lenses of gravel. The total thickness of the alluvial deposits ranges from 60 feet near the city of Novato to more than 200 feet near San Pablo Bay (DWR 1975). Wells in sand and gravel layers 25 feet to 50 feet deep generally yield an average of 50 gallons per minute (DWR 1975).

Natural recharge occurs principally as infiltration from streambeds that exit in the upland areas within the drainage basin and from direct percolation of precipitation that falls on the basin floor. No published information was found addressing the groundwater storage capacity of the Novato Valley groundwater basin or quantity of groundwater in storage.

Groundwater is typically of the calcium bicarbonate type. Groundwater in the tidal areas of the alluvium is of the sodium chloride type and the total mineral content is greater than in areas farther from the bay (Cardwell 1958; DWR 1975).

3.5.5 Precipitation and Climate

The climate within the Petaluma River watershed is general described as a marine west-coast type climate with cool, wet winters and warm, dry summers with some fog and wind (SSC-RCD, 1999a). Annual temperatures range from 46 degrees Fahrenheit (°F) to 71°F, with a mean annual temperature of 67°F. Localized average annual rainfall is approximately 27.5 inches per year (Novato. 2008).

4.0 WATER QUALITY ASSESSMENT METHODOLOGY

The goal of this water quality assessment is to compare the projected water quality effects for Existing Conditions (2008) to the No Action/ Alternative A and the three build Alternatives, Alternatives B, D, and E. The potential water quality-related effects of all Alternatives were evaluated quantitatively by comparing projected pollutant loads discharged to Black John Slough and the Petaluma River associated with storm water runoff. The pollutant loads associated with storm water are defined as the estimated mass of pollutants of concern delivered to the receiving water body on an average annual basis.

The dry weather flows were evaluated qualitatively by identifying the operational practices that may potentially contribute to offsite flows.

4.1 Methodology

Estimating the mass pollutant load transferred to a water body requires knowledge of surface water volumes, discharge locations, and the pollutant sources for the water body. This analysis assesses pollutant loads transported by stormwater from non-point sources. The most accurate method to estimate a non-point source pollutant load is to collect, analyze, and evaluate samples of stormwater directly from the proposed project site (Camp Dresser and McKee Inc. 2003). Due to the variability in seasonal conditions, direct collection for pollutant loading evaluations requires several years and a large number of samples to provide statistically significant results. In the absence of direct site-specific sampling, pollutant loads are regularly assessed using publicly available water quality data generated from comprehensive stormwater investigations with statistically significant results. Stormwater results regularly are reported as event mean concentrations (EMCs).

The U.S. Environmental Protection Agency (EPA)'s Nationwide Urban Runoff Program (NURP) was the first comprehensive study of urban stormwater pollution presenting the results of extensive stormwater sampling and analysis of over 2,300 separate storm events. The NURP report affirmed that urban pollutant loads can be a function of land use and that EMCs can be used to evaluate loadings. Similar studies have been done by the Federal Highway Administration (FHWA) and jointly by the American Association of Airport Executives (AAAE) and the Airport Research and Development Foundation (ARDF).

Six general land use categories were identified with the proposed project water quality study area: agricultural, airport operations, commercial, industrial, rural, and transportation. To calculate stormwater pollutant loads for these land uses, published stormwater investigations were reviewed for EMCs that could best represent the quality of these land use categories. EMCs from the AAAE/ARDF stormwater investigation were used to represent the quality of runoff from the airport-related land uses and NURP data.

The potential pollutant loads, resulting from the No action / Alternative A, as well as implementation of the three build alternatives, Alternatives B, D, and E were calculated by multiplying each EMC by the average annual runoff volume. The annual runoff volume was calculated by using the average annual rainfall, the drainage area, the runoff coefficients, and the site impervious percentages.

This water quality analysis compares the estimated pollutant loads conveyed to the receiving waters resulting from the No Action/ Alternative A, as well as implementation of the three runway build alternatives, Alternatives B, D, and E, to the estimated existing conditions (2008).

4.2 Water Quality Parameters of Concern

Limited information is available regarding the identification of water quality parameters of concern at airports and within the Petaluma River watershed. Four data sources were considered to assist in selecting the water quality parameters of concern:

- The parameters required by the California State Water Resources Control Board (SWRCB) for the Industrial Permit (Industrial Permit) mandated by the National Pollutant Discharge Elimination System (NPDES)*;
- The San Francisco Bay Basin Water Quality Control Plan (Basin Plan);
- The AAAE & ARDF Monitoring Group Stormwater Monitoring Requirements; and
- The California Environmental Protection Agency (CEPA) 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments for San Francisco Bay.

Twenty two pollutants of concern have been identified for the Gnoss Field Airport proposed project and are listed below:

- pH *
- Specific conductance *
- Oil and Grease *
    - Total Petroleum Hydrocarbons (TPH)
        - Diesel
        - Gasoline
        - Motor Oil
- Total Organic Carbon (TOC)
- Biological Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Sediment
    - Total Suspended Solids (TSS) *
    - Turbidity
- Nutrients
    - Total Nitrogen (TN)
    - Total Kjeldahl Nitrogen (TKN)
    - Total Phosphorous (TP)
- Metals
    - Copper (Cu)
    - Lead (Pb)
    - Nickel (Ni)
    - Zinc (Zn)
- Pathogens
    - Total Coliform
    - Fecal Coliform
- Pesticides
    - Diazinon
    - Glyphosate

Many but not all of these pollutants are generally found in stormwater runoff and airport runoff. The twenty two pollutants of concern identified for the proposed project are summarized below.

4.2.1 pH

The pH scale measures how acidic or basic a substance is. Pure water has a neutral pH of 7.0, or a balance between free hydrogen ions (H+) and free hydroxyl ions (OH-). Conditions below neutral are considered to be acidic and have more hydrogen than hydroxyl ions. Conditions above neutral are considered to be basic and have more hydroxyl than hydrogen ions. According to the Basin Plan (SFBRWQCB 2006), pH shall not be decreased below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels. This range is based upon values that are healthy for most aquatic organisms.

The pH of a waterbody is controlled by the concentration of free hydrogen ions that are left in solution after ionic equilibrium is reached with all dissolved ions. The formation of carbonic acid from atmospheric carbon dioxide is one of the largest influences on pH in natural surface waters. However, diurnal fluctuations in pH occur due to photosynthesis of submerged aquatic vegetation. The oxygen produced by photosynthesis disassociates and strips out free hydrogen ions, forming water molecules and causing an increase in pH. Mixing of water tends to minimize the effects of this biogeochemical reaction, whereas in slow moving or isolated waterbodies effects on pH are more dramatic with significant increases throughout the day due to photosynthesis which then drops during the night as respiration drives the reaction in the opposite direction making the water acidic (EPA 1995).

4.2.2 Specific Conductance

Specific conductance, also known as Conductivity, is a measure of the ability for water to conduct or pass electricity. Conductivity increases as temperature or ion concentrations, often measured as Total Dissolved Solids (TDS), increase. However, because individual ions are characterized by unique electrical properties and contributions to conductivity vary, the relationship of TDS with conductivity is not direct. Conductivity is either measured at a standard 25°Celsius (°C) or is temperature corrected to 25°C. Ultimately, conductivity provides an inexpensive and easy field technique for determining changes in a waterbody's total ionic concentration. Conductivity typically ranges from 50 to 1,500 µS/cm (microSiemens/centimeter) in freshwater rivers in the US and 55,000µS/cm in seawater. Tidally influenced areas exhibit fluctuations in conductivities. Conductivity greatly affects aquatic ecosystems and the organisms that inhabit them by playing a role in the formation, or presence, of aquatic layers within a waterbody, and therefore also affects temperatures of these different aquatic layers.

4.2.3 Oil and Grease

Oil and Grease are characterized as high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products, esters, oils, fats, waxes, and high molecular weight fatty acids. Oil and Grease are frequently found in urban runoff from roadways, parking lots, and industrial & commercial properties. Oil and grease are visually unappealing and can limit many beneficial uses of a waterbody. The Basin Plan states that "waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses " (SFBRWQCB 2006). Oil and grease are listed as pollutants in the General Industrial Permit for airport facilities. However, the State Water Resources Control Board has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit for oil and grease.

Total Petroleum Hydrocarbons (TPH)

Diesel

TPH as Diesel is a measurement of the subset of Total Petroleum Hydrocarbons (TPH) within the sample that are of the structure or range of diesel fuel. Diesel is most notably found in road runoff and from leaks or spills associated with heavy construction equipment. TPH in water is a pollutant that can act as a toxin to both aquatic and human health.

Currently there are no threshold limits established for Diesel TPH in the proposed project drainage area and sufficient publicly available data does not exist to facilitate defining limits.

Gasoline

TPH as Gasoline is a measurement of the subset of Total Petroleum Hydrocarbons within the sample that are of the structure or range of gasoline. Gasoline is most notably found in road runoff typically caused by automobiles with leaks and un-combusted fuel in their exhaust. TPH in water is a pollutant that can act as a toxin to both aquatic and human health.

Currently there are no threshold limits established for Gasoline TPH in the proposed project drainage area and sufficient publicly available data does not exist to facilitate defining limits.

Motor Oil

TPH as Motor Oil is a measurement of the subset of Total Petroleum Hydrocarbons within the sample that are of the structure or range of oil. TPH in water is a pollutant that can act as a toxin to both aquatic and human health. Currently insufficient water quality data exists and there are no threshold limits for TPH as Motor Oil in the proposed project drainage area.

4.2.4 Total Organic Carbon

Total Organic Carbon (TOC) represents all organic forms of carbon, the relative amount of which is used to determine the degree of organic pollution of water. Organic carbon comes from natural organic substances, insecticides, herbicides, agricultural chemicals, and domestic and industrial wastewater. A high amount of organic carbon generally means that a higher level of decomposition is occurring and dissolved oxygen is consumed.

Currently, the General Industrial Permit (Water Quality Order No. 97-03-DWQ NPDES General Permit No. CAS000001) does not define benchmarks or limitations for TOC. The General Industrial Permit does require control of pollutant discharges using best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to prevent and reduce pollutants to meet water quality standards. However, the State Water Resources Control Board has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit for individual pollutants.

4.2.5 Biological Oxygen Demand

Biological Oxygen Demand (BOD) is a measurement of the amount of oxygen used by the decomposition of organic material, over a certain time period in a sample. BOD only takes into account organic matter, whereas Chemical Oxygen Demand examines organic and inorganic compounds.

Currently the SFRWQCB has not defined BOD thresholds in the proposed project drainage area. The General Industrial Permit does require control of pollutant discharges using best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to prevent and reduce pollutants to meet water quality standards. However, the State Water Resources Control Board has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit for individual pollutants.

4.2.6 Chemical Oxygen Demand

Chemical Oxygen Demand (COD) is a measure of the amount of oxygen equivalent needed to completely oxidize a sample. This method is applied to both organic and inorganic compounds, while Biological Oxygen Demand is applied to only organic compounds.

Currently the SFRWQCB has not defined COD thresholds in the proposed project drainage area. The General Industrial Permit does require control of pollutant discharges using best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to prevent and reduce pollutants to meet water quality standards. However, the State Water Resources Control Board has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit for individual pollutants.

4.2.7 Suspended Sediment

Total Suspended Solids

Total Suspended Solids (TSS) is the amount of material suspended in a sample that can be filtered out and measured. TSS may include sediment, decaying plant and animal matter, or essentially any material that is suspended within water. According to the Basin Plan, suspended material shall not be present in "concentrations that cause nuisance or adversely affect beneficial uses" (SFBRWQCB 2006). A high amount of suspended solids in water can result in the "abrasion and clogging gills of fish and clams, […] retarded egg development", reduced metabolic function, and reduced survival of young in many species. High concentrations of total suspended solids can affect the temperature of the upper aquatic zone by absorbing heat from sunlight, which can cause the dissolved oxygen content in the water to decrease (Murphy 2007).

Currently the SFRWQCB has not defined TSS quantitative thresholds in the proposed project drainage area and has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit.

Turbidity

Turbidity is a measure of the ability for light to pass through water. It is used as an easy and indirect measurement of suspended material, and often times mistaken to be a direct measurement of sediment. No direct physical relationship exists between turbidity and total suspended solids (TSS), although general site specific relationships can often be derived.

The Basin Plan (SFBRWQCB, 2006) requires that, in waters where natural turbidity is greater than 50 Nephelometric Turbidity Units (NTUs), increases shall not exceed 10 percent. Additionally, the Plan states “waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses” (SFBRWQCB, 2006).

4.2.8 Nutrients

Total Nitrogen

Total Nitrogen represents inorganic nitrogen (NO2-, NO3-, NH4+) and organic nitrogen. Generally, nitrogen is the limiting factor for growth of plant species within terrestrial ecosystems. Organic nitrogen levels are generally influenced by decomposition of aquatic life and sewage runoff, while inorganic nitrogen levels are usually affected by erosion and fertilizer runoff (Colmenares 2006). Nitrogen is often the limiting growth nutrient for saltwater ecosystems.

Nitrate Nitrogen (NO3-N) is the primary form of mineral nitrogen, which is the total available nitrogen for plant uptake. Nitrate (NO3-) that is not incorporated into organic matter either is converted back into nitrogen gas (N2) through the denitrification process or is leached into groundwater or surface water. Nitrate as nitrogen should remain below 10.2 mg/L according to the California Department of Health Services (CDHS) (CCR 2003).

Nitrite Nitrogen (NO2-N) is a minor occurring form of nitrogen in surface waters that is an intermediary step in the nitrification process which converts ammonium (NH4+) to nitrite (NO2-) and then to nitrate (NO3-) through an oxidation reaction. The sum of nitrate plus nitrite represents mineral nitrogen which is the total available nitrogen for plant uptake. Nitrite as nitrogen should remain below 1 mg/L in drinking water according to CDHS Drinking Water Standards (Colmenares 2006).

Ammonia Nitrogen (NH3-N) is formed through the deamination process which is the breaking down of organic nitrogen molecules such as proteins and nucleic acids. Ammonia (NH3) is also the initial form of nitrogen that has been fixed from atmospheric nitrogen gas. Ammonium (NH4+), the ionized form of ammonia, is naturally present in an acid-base equilibrium with ammonia and is the initial form of nitrogen used in the nitrification process which results in nitrate.

Ammonia has a 1.5 mg/L Taste and Odor Threshold and an EPA National Recommended Water Quality Criteria to Protect Freshwater Aquatic Life (EPA 1999a) that varies based on pH and temperature. With a pH of 7.3 and temperatures between 8°C to 22°C, the EPA Continuous Concentration (30-day average) ranges between 3.13 and 7.73 mg/L nitrogen.

Un-ionized ammonia is regulated under the Basin Plan, as it is a demonstrated toxicant. Ammonia discharged in the San Pablo Bay Region shall not cause the receiving waters to exceed the annual median of 0.025mg/L. This level has been established to preclude the build up of ammonia in the receiving waters. The Basin Plan also states “A more stringent maximum objective is desirable for the northern reach of the Bay for the protection of the migratory corridor running through Central Bay, San Pablo Bay, and upstream reaches” (SFBRWQCB 2006).

Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) is the measurement of both organic and ammonia nitrogen. It is measured by converting organic nitrogen into ammonium (NH4+), adding a base, and then measuring the resultant NH3 concentration. By subtracting the initial NH3 concentration from TKN the amount of organic nitrogen in the water can be calculated. Organic nitrogen is the nitrogen that has already been absorbed into and is a part of an amino acid. While organic nitrogen can not be directly taken up by plants, it provides a good indication of how much nitrogen is present in the system but has already been utilized. It is also important to recognize that organic nitrogen will eventually be converted back to mineral nitrogen through the decomposition process, at which point it will be available for plant uptake.

Currently the SFRWQCB has not defined TKN limitations or benchmarks in the proposed project area and has determined that it is not feasible at this time to establish such values.

Total Phosphate

Total Phosphate (TP) represents the amount orthophosphate (PO43-), metaphosphate (PO3-), and organically bound phosphate present in a sample. Phosphate naturally comes from erosion of rocks and decaying plant and animal matter, however it typically, predominantly comes from human derived sources including sewage, and urban and agricultural runoff. Phosphate is typically the main limiting nutrient in freshwater ecosystems. Phosphate Phosphorus (PO4-P) is the dominant and often sole form of phosphorus in natural waters. Phosphorus in general is highly immobile because of its low solubility, which is why the phosphate ion (PO43-) is often the only form found in natural waters. Phosphorus is an essential nutrient for the growth of biological organism and is often times the limiting nutrient for aquatic systems. Because of this, increases of phosphate in surface waters typically indicate a potential for algal growth and possible eutrophication.

Currently the SFRWQCB has not defined TP quantitative thresholds in the proposed project drainage area and has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit.

4.2.9 Trace Metals

Metals may be toxic at low levels, with toxicity varying based upon hardness of the water. Some metals, such as mercury, will bioaccumulate or biomagnify, resulting in increased tissue concentrations higher up in the food web making the consumption of such foods hazardous to human health. Title 22 of the California Code of Regulations outlines primary and secondary

Maximum Contaminant Levels (MCLs) for priority pollutants, including those metals of concern.

Copper

Copper is most often found as a solid or bound to sediment. The major chemical use of copper is in the chemical formulation of pesticides and in brake pads, but it is also widely used in plumbing and irrigation (copper pipes) and as a natural mineral in soils. Ingestion of copper above recommended levels can result in gastrointestinal problems due to short-term exposure and kidney or liver damage with long-term exposure. The Basin Plan establishes the overall objective for the 1 hour average concentration amount of copper at 0.013 mg/L (SFBRWQCB, 2006).

Lead

Lead is most often found as a solid or bound to sediment. Primary sources of lead in the environment are auto emissions and engine exhausts from burning leaded fuels, lead paint, lubricants and batteries. Lead can cause numerous problems in both aquatic and human health including affecting the nervous, reproductive and digestive systems. The Basin Plan establishes the overall objective for the one hour average concentration amount of lead at 0.065mg/L (SFBRWQCB, 2006).

Nickel

Nickel is largely found naturally in rocks, soils, and sediments. It is used to produce multiple types of alloys, stainless steel, chrome plating, fabric dyeing, batteries, foil, permanent magnets, and many more products. Nickel poses a health hazard to human health and has been demonstrated to be toxic to aquatic life. The toxicity of nickel to aquatic life is determined by the level of water hardness (e.g. the softer the water, the more the toxicity of nickel increases). Nickel is a constituent listed on the EPA 303(d) List of Water Quality Limited Segments as occurring within the tidal portion of the Petaluma River (CEPA 2002).

The Basin Plan establishes the overall objective for the amount of nickel in the one hour average concentration at 0.47 mg/L (SFBRWQCB, 2006).

Zinc

Zinc tends to be highly insoluble and immobile except for in flooded soils where reduced oxidation and increased pH conditions allow it to mobilize (Mitsch and Gooselink, 1993). Surface soils tend to have greater concentrations due to plant uptake reducing soil concentrations while organic matter decomposition increases the concentration of immobile zinc on the surface. Anthropogenic zinc (zinc from man-made activities) is a byproduct of tire wear, galvanized metal used to prevent rust (typically on gutters, flashing, and other outdoor metal applications) and the corrosion from galvanized metals and also from motor oils. Zinc acts as a blood, developmental, immune, and reproductive and respiratory system toxicant.

The Basin Plan establishes the overall objective for zinc concentrations to not exceed 0.12 mg/l in a one hour average (SFBRWQCB, 2006).

4.2.10 Pathogens

Total Coliform

Total Coliform is a measure of the amount of coliform bacteria present in a sample. Coliform bacteria are microorganisms that mainly originate in the intestines of warm-blooded animals. Coliform bacteria are indicators of pathogens harmful to human health, because it is difficult to test for pathogen bacteria directly.

The Basin Plan establishes the level of acceptable total coliform bacteria for areas of shellfish harvesting at a median level of less than 70 Most Probable Number (MPN) per 100 milliliters, based on a minimum of five samples collected at equally distributed times over a 30-day period. Additionally, the Basin Plan allows 10 percent of samples collected to exceed 230MPN/100mL, based on a five-tube decimal dilution test or 300MPN/100mL when a three-tube decimal dilution test is used (SFBRWQCB, 2006).

Fecal Coliform

E. coli is sometimes used as a surrogate for fecal coliform, which is bacteria found in feces, because it is the most common fecal species. E. coli and fecal coliform, and associated pathogens, cause many diseases and are considered a health concern. Fecal coliform coming from animal wastes has been identified as one of the main pollutants in the Petaluma River (SSC-RCD 1999).

The Basin Plan allows up to 10 percent of the total number of samples taken during any 30-day period to exceed 43MPN/100ml. The median of samples collected must be below 14MPN/100mL (SFBRWQCB 2006).

4.2.11 Pesticides

Diazinon

Diazinon is a nonsystemic organophosphate insecticide used to control cockroaches, silverfish, ants, and fleas in residential, non-food buildings. It is used on home gardens and farms to control a wide variety of sucking and leaf eating insects. It is used on rice, fruit trees, sugarcane, corn, tobacco, potatoes and on horticultural plants (EXTOXNET 1996). Diazinon is mobile and moderately persistent in the environment. Due to its chemical properties and its widespread use, diazinon is frequently found in wastewater treatment plant effluent and urban and agricultural runoff. Diazinon is toxic to aquatic life, particularly invertebrates (EPA 2006b). Diazinon is a constituent listed on the EPA 303(d) List of Water Quality Limited Segments as occurring within the tidal portion of the Petaluma River.

The Basin Plan requires that dianzinon concentrations in urban creeks shall not exceed 100mg/L as a one hour average (SFBRWQCB 2006).

Glyphosate

Glyphosate is a chemical compound used in numerous types of herbicides to control weed growth. It is domestically and commercially used in many food and non-food crops, lawns, and roadsides. Glyphosate has been found to cause congestion of the lungs and an increase in breathing rate in humans during short-term exposure, and can cause kidney disease and reproductive effects in humans following long-term exposure. Glyphosate tends to adhere to the sediments when released in water, and typically does not accumulate in aquatic life (EPA 2006a).

The Basin Plan establishes that the level of glyphosate may not exceed 0.7mg/L (SFBRWQCB 2006).

4.3 Airport Operations that May Affect Water Quality and Applicable Best Management Practices

This water quality analysis reviewed airport activities that have the potential to generate pollutants and that could contribute pollutants of concern into the stormwater drainage system and subsequently affect surface water quality in Big John Slough and the Petaluma River. Typical airport operations and the associated potential stormwater pollutants are listed in **Table 2**.

Table 2 — Gnoss Field Airport Operations and Potential Storm Water Pollutants

Current Airport Operations	Potential Storm Water Pollutants
Aircraft, vehicle and equipment maintenance and cleaning	Cleaning solutions, petroleum hydrocarbons, rubber particles, solvents, oils and grease, paint, and metals.
Airport construction activities	Sediment, oil, grease, petroleum hydrocarbons, pH, and pesticides.
Aircraft, vehicle and equipment fueling	petroleum hydrocarbons, rubber particles, oil and grease.
Aircraft runway maintenance	petroleum hydrocarbons, rubber particles, oil and grease, and paint.
Chemical storage and wastewater pretreatment	Cleaning solutions, herbicides, petroleum hydrocarbons, oil, rubber particles, and solvents.
Fire/Department Public Safety training activities	Firefighting foam; petroleum hydrocarbons, rubber particles, and oil and grease.
Fuel storage and transfer	Petroleum hydrocarbons, oil and grease.
Loading/unloading operations	Rubber particles.
Grounds and Building maintenance	Petroleum hydrocarbons, herbicides, fertilizers, paint, and sediment.
Roadway Maintenance	Herbicides and fertilizers.
Outdoor equipment, material and waste storage	Petroleum hydrocarbons, oils, grease, solvents, herbicides, fertilizers, and trash.
Non-allowable non-storm water discharges	Petroleum hydrocarbons, oils, hydraulic fluids, grease, cleaning solutions, Aircraft firefighting foam, herbicides, and paint.
Spill response	
Storm water channel maintenance and rehabilitation	Sediment and herbicides.
Non-Point Source Pollution	Sediment.

Aircraft Washing

Typical contaminants associated with aircraft washing include oil and grease, solvents, petroleum hydrocarbons, sediment (resulting in increased suspended solids), and surfactants (some of which contribute to BODs and phosphates). When the washing activities are performed outdoors, these pollutants must be contained to prevent discharges into the stormwater drainage system. Therefore, DVO has a designated wash area on the southeastern asphalt apron. All planes are washed in this area. The wash area was designed such that all wash waters drain into a subsurface stormwater filtration system. This system is comprised of a sediment filter and an oil separator and then an evaporation basin. Wash waters normally do not enter the perimeter drainage.

Chemical Storage

Appreciable amounts of airport or aircraft related chemicals are not stored onsite. FBO services using chemicals and DVO-related activities using chemicals obtain and use chemicals as they need them.

Airport activities such as herbicide application along runway and taxiway aprons, as well as along the perimeter drainage channels use chemicals that have the potential to pollute stormwaters. Spraying activities are performed by DVO staff and adhere to stringent practices which reduce or eliminate the potential for contact with stormwaters. Some practices that are observed are scheduling spray operations for non-rain days with low to non-existent winds and mixing chemical spray solutions away from storm drainages.

Fire/Department Public Safety Training Activities

Fire department public safety training activities are performed in a manner such that offsite pollutant movement is minimized by directing safety training activities in areas that will not flow directly into the perimeter drainages.

If a fire occurs onsite, there is the potential for firefighting foam, petroleum hydrocarbons, rubber particles, oil and grease to enter the DVO drainage.

Aircraft Fueling

Mobile refuelers are currently utilized at DVO as the means to provide fuel to all general aviation aircraft. Fueling of general aviation aircraft are fueled at their respective hangars or tie downs.

Routine and primary aircraft fueling activities have the potential to cause small leaks and spills that may enter the asphalt hangar and operational apron drainages. Minor spills can occur when fuel tanks are overfilled or when disposing of aircraft sump fuel. These minor spills can become entrained in stormwater runoff and transported into the perimeter stormwater drainage.

The likely stormwater pollutants associated with aircraft fueling are petroleum hydrocarbons. DVO does not currently support self service fueling, and all FBO fueling personnel are trained and required to follow the aircraft fueling BMPs and applicable Spill Prevention, Control, and Countermeasure (SPCC) plans. Onsite personnel have a vast array of spill response materials at their disposal twenty-four hours a day, seven days a week and FBO personnel promptly clean up spills and leaks to minimize potential impact on stormwater discharges.

Fuel Storage

Fuels are stored outdoors in underground storage tanks (USTs) and in mobile refuelers. All DVO fuel tanks are equipped with leak detection equipment to minimize releases and potential fuel leaks from entering the stormwater drainage system or groundwater, and tanks are subject to daily inspections by airport field crews (Sever 2010). Mobile refuelers, used for aircraft fueling, include uncovered outdoor fuel storage with secondary containment when in a non-operational or non-standby mode. FBO personnel handling fuel are required to follow standard aircraft fueling BMPs and applicable SPCC plans. Pollutants released from fuel storage areas have the potential to discharge through the double culverts on the eastern edge of the proposed project site.

Spill Response

Spill response materials are kept onsite at all times. Spill response materials are kept with DVO personnel performing routine operational activities in case of encountering spills. Oil booms, absorbent pads, absorbent materials, brooms, shovels, waste containers are some of the spill response items immediately available to DVO personnel.

Additionally, the perimeter drainage channel in the project site can be closed with sluice gates at the twin culverts on the east side in case of required spill response activities and subsequent water quality protection.

4.4 Water Quality Parameters of Concern Summary

After reviewing all of the potential pollutants of concern, the Industrial General Permit pollutant parameters, the Group Stormwater Monitoring Plan (GMP), the current water quality sampling data, and all of the airport operational activities that potentially contribute these pollutants, a subset of nine pollutants were identified for the Gnoss Field Airport that could be expected in stormwater runoff and that had useable data for analysis. These nine pollutants of concern include: oil and grease, BOD, COD, TSS, TKN, TP, copper, lead, and zinc. Event Mean Concentrations (EMC) used to represent stormwater runoff quality and their sources are shown in **Table 3**.

Table 3 — Event Mean Concentrations for Stormwater Runoff by Land Use (mg/l)[1]

Pollutant of Concern	Agriculture-Unimproved	Commercial - Improved	Commercial-Unimproved	Rural-Unimproved	Rural-Improved	Industrial-Unimproved	Transportation	Airport
Total Suspended Solids (TSS)[2]	22	22	22	22	22	22	22	22
Total Phosphorous (P)	0.7	.33	0.33	0.49	0.49	0.33	0.33	0.42
Total Kjeldahl Nitrogen (TKN)	3.3	1.66	1.66	3.3	3.3	1.5	2.1	2.2
Total Copper (Cu)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Total Lead (Pb)	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048
Total Zinc (Zn)	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Oil and Grease	0.5	0.5	0.5	0.5	0.5	1.87	3.5	3.5
Biological Oxygen Demand (BOD)	0	10	10	0	0	5	0	10
Chemical Oxygen Demand (COD)	113	65	65	113	113	51	93	93

[1] Sources: Due to limited available water quality data, all data unless otherwise noted is from the United States Environmental Protection Agency, Water Planning Division, Final Report on the National Urban Runoff Program (NURP), December 1983.

[2] Marin County Airport at Gnoss Field. 2009. Attachment 1, Storm Water Sampling Data. Sampled as part of American Association of Airport Executives/ Airport Research and Development Foundation, Airport California Monitoring Group. March 4, 2009.

4.5 Stormwater Pollutant Loads

This water quality analysis calculates pollutant loading by multiplying EMCs by average annual stormwater runoff volumes yielding an annual mass in pounds of discharged pollutants. This method for calculating pollutant loads is based on the Simple Method (Schueler, 1987).

Stormwater pollutant loads for each alternative were calculated for each land use within the Alternative analyzed using the Simple Method. The estimated annual pollutant loadings for each land use within each alternative are summed to yield an annual mass of pollutants discharged.

4.5.1 The Simple Method

The Simple Method estimates stormwater pollutant loads as the product of EMCs and runoff volumes on an annual basis. This report calculates the individual annual pollutant loads using the following equation:

$L = [(P \times P_j \times R_v)/12] \times C \times A \times 2.72$

Where:

L = Pollutant Load in pounds

P = Rainfall inches over desired time interval

P_j = P correction factor for storms that produce no runoff

R_v = Runoff coefficient = Measure of site response to rainfall events = 0.05 + 0.009 (I)

I = percent of site imperviousness

C = Average flow-weighted pollutant concentration

A = Total Site Area (acres)

5.0 WATER QUALITY EXISTING CONDITIONS (2008)

Water quality sampling and testing parameters required by the Industrial General Permit for Gnoss Field are specific to the transportation industry and are specified by Section B(5)(c)(i) of the Industrial General Permit. Section B requires collected storm water samples to be analyzed for total suspended solids (TSS), total organic carbon (TOC) or Oil & Grease, pH, and Specific Conductance. Current GMP sampling results for the Gnoss Field Airport and the relevant regulatory thresholds specified by the California Industrial Activities Storm Water General Permit are shown in **Table 4**.

Table 4 — Gnoss Field Water Quality Pollutant Sampling Data

Pollutant	Objectives [1]	2009 Sampling Results Outfall #1
pH	The San Francisco Bay Basin Plan (Basin Plan) states that pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.	6.1
TSS	The Basin Plan states that waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.	22 mg/l
Specific Conductance	The Basin Plan does not define thresholds or limitations for Conductivity. Conductivity typically ranges from 50 to 1,500 µS/cm (microSiemens/centimeter) in freshwater rivers in the US and 55,000µS/cm in seawater. Tidally influenced areas exhibit fluctuations in conductivities.	2800 umhos/cm
Oil and Grease	The San Francisco Basin Plan requires that waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.	ND

ND = non detect = resulting data value is below laboratory detection limit mg/l = milligrams per liter umhos/cm = micro ohms per centimeter [1] Parameter benchmarks are not defined by the current General Industrial Permit (Water Quality Order No. 97-03-DWQ NPDES General Permit No. CAS000001). NPDES Permits for storm water discharges must meet all applicable provisions of Sections 301 and 402 of the CWA. These provisions require control of pollutant discharges using best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to prevent and reduce pollutants and any more stringent controls necessary to meet water quality standards. However, the State Water Resources Control Board has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit for individual pollutants.

Nine pollutants have been identified for the Gnoss Field Airport that could be expected in stormwater runoff and that had useable data for analysis. These nine pollutants of concern include: oil and grease, BOD, COD, TSS, TKN, TP, copper, lead, and zinc. Stormwater pollutant loads discharged from the Gnoss Field Airport under existing conditions were estimated using the methods described in **Section 4.5**, *Stormwater Pollutant Loads* and are summarized in **Table 5**.

Table 5 — Gnoss Field Existing Conditions (2008) – Estimated Average Annual Pollutant Loads

Pollutant Load	Annual Pollutant Load (lbs/yr)
Total Suspended Solids (TSS)	13,078
Total Phosphorous (P)	147
Total Kjeldahl Nitrogen (TKN)	808
Total Copper (Cu)	4
Total Lead (Pb)	17
Total Zinc (Zn)	7
Oil and Grease	1,021
Biological Oxygen Demand (BOD)	2,800
Chemical Oxygen demand (COD)	32,705

Source: Foothill Associates, 2009.

6.0 ENVIRONMENTAL CONSEQUENCES AND IMPACTS

Thresholds of Significance

To determine significant impacts, FAA Order 1050.1E states that water quality regulations and issuance of permits will normally identify any deficiencies in the proposal with regard to water quality. It goes on to state that if consultation or analysis shows that there is the potential for exceeding water quality standards, identifies water quality problems that cannot be avoided or mitigated, or indicates difficulties in obtaining permits, then it may be concluded that the project would result in a significant impact.

The following sections present quantitative analyses and discussions pertaining to the potential water quality impacts relevant to development of the No Action, Alternative A, and each runway extension build alternative on water quality. The estimated pollutant loading values were derived from the AAAE/ARDF Monitoring Group Data collected at Gnoss Field and the NURP study EMC data values as a means of analyzing the potential for water quality impacts to result from implementation of the proposed project under the scenarios proposed by Alternatives A, B, and D.

Baseline data for the Petaluma River watershed is currently lacking. Parameters specified for monitoring by the Industrial General Permit include: total suspended solids (TSS), total organic carbon (TOC) or Oil and Grease, pH, and Specific Conductance. However, based on a review of all potential pollutants of concern, the GMP, current water quality sampling data, and all of the airport operational activities that potentially contribute these pollutants, nine pollutants of concern have been identified for the Gnoss Field Airport for the purpose of these analyses. The nine pollutants of concern include: oil and grease, BOD, COD, TSS, TKN, TP, copper, lead, and zinc. Potential sources of annual pollutant loadings within the project area include: agricultural operations/practices surrounding the project site, industrial land uses, urban runoff, historical mining operations on the southeast side of Mount Burdell, State Highway 101, and atmospheric decomposition. As shown in **Table 6**, quantitative water quality objectives are only defined for Cu, Pb, Zn, and BOD. The analyses of potential water quality impacts resulting from implementation of the Proposed Project and the alternatives within this report are based on a comparison of estimated pollutant loading values compared to San Francisco Bay Basin Plan water quality objectives established for these pollutants within the project area. Quantitative objectives relevant to the project area have not been established for TSS, P, TKN, COD, and Oil and Grease relevant to the project.

Aircraft operations are forecasted to increase from 85,500 operations in 2008 to 100,500 in 2018. However, currently there are no methods known to account for changes in the frequency of activities conducted on the existing land uses.

Details on the drainage areas, percent impervious surfaces, and the land use category used to determine pollutant loadings can be found in **Appendix A**.

Table 6 below provides average annual pollutant loads estimated for the No Action Alternative (Alternative A), and the three Build Alternatives (Alternatives B, D, and E).

Table 6 — Estimated Average Annual Pollutant Loads by Alternative

Pollutant	Annual Pollutant Load (lbs/yr)[1]				
	Alternative				Regulatory Threshold[3]
	A	B	D	E	Basin Plan Water Quality Objectives
Total Suspended Solids (TSS)	13,078	13,346	13,806	13,151	[2]
Total Phosphorous (P)	147	151	157	148	[2]
Total Kjeldahl Nitrogen (TKN)	808	826	857	813	[2]
Total Copper (Cu)	4	4	4	4	5
Total Lead (Pb)	17	17	18	17	23
Total Zinc (Zn)	7	7	7	7	42
Oil and Grease	1,021	1,048	1,097	1,028	[2]
Biological Oxygen Demand (BOD)	2,800	2,878	3,017	2,821	10,605
Chemical Oxygen Demand (COD)	32,705	33,443	34,742	32,906	[2]

Source: Foothill Associates, 2009; Landrum & Brown Analysis, 2018.

[1] The methodology used to compute parameter pollutant loadings are based on land use acreages, representative site EMC values, land use imperviousness, and rainfall.

[2] Parameter benchmarks are not defined by the current General Industrial Permit (Water Quality Order No. 97-03-DWQ NPDES General Permit No. CAS000001). NPDES Permits for storm water discharges must meet all applicable provisions of Sections 301 and 402 of the CWA. These provisions require control of pollutant discharges using best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to prevent and reduce pollutants and any more stringent controls necessary to meet water quality standards. However, the State Water Resources Control Board has determined that it is not feasible at this time to establish numeric effluent limitations, nor have benchmarks been established by this permit for individual pollutants.

Additionally, as shown in **Table 7**, comparisons were made for the annual pollutant load yield differences between Existing Conditions 2008 and each Alternative.

Table 7 — Estimated Annual Pollutant Loading Increase by Alternative Compared to Existing Conditions (2008) Pollutant Loading

Pollutant	Existing Conditions (2008)	Alternative				Threshold
		A (No Action)	B	D	E	
Total Copper (Cu)	4	4	4	4	4	5[2]
Total Lead (Pb)	17	17	17	18	17	23[2]
Total Zinc (Zn)	7	7	7	7	7	42[2]
Biological Oxygen Demand (BOD)	2,800	2,800	2,878	3,017	2,821	10,605[2]
Total Suspended Solids (TSS)	13,078	13,078	13,346	13,806	13,151	13,078[3]
Total Phosphorous (P)	147	147	151	157	148	147[3]
Total Kjeldahl Nitrogen (TKN)	808	808	826	857	813	808[3]
Oil and Grease	1,021	1,021	1,048	1,097	1,028	1,021[3]
Chemical Oxygen demand (COD)	32,705	32,705	33,443	34,742	32,906	32,705[3]

6.1 Alternative A – No Action

Estimated water quality pollutant loads discharged to receiving waterbodies under Alternative A., the No Action Alternative, would be consistent with those identified for the Existing Conditions (2008). Although it is anticipated that airport operations would increase through time, under Alternative A, no land use changes would be initiated at the Gnoss Field Airport. It is estimated that no changes to the existing water quality and pollutant loadings would therefore result.

Current Best Management Practices (BMPs) employed at the airport (i.e. the airport levee system, vegetated drainage ditch, oil and grease separator, evaporation basin, spill prevention procedures, and spill clean up products) are sufficient to reduce and maintain concentrations of pollutants of concern to meet the General Industrial Permit requirements and Basin Plan specified objectives.

Current BMPs are adequate to minimize or eliminate stormwater quality impacts from the project site to Black John Slough and the Petaluma River. Potential sources for TKN, copper, lead, and zinc may include agricultural operations/practices, industrial land uses, historical mining operations, urban runoff, State Highway 101, and atmospheric deposition. However, it is anticipated that Gnoss Field Airport operations would remain compliant with the terms and conditions specified by the General Industrial Permit.

Anticipated increases in aircraft operations from 85,500 operations in 2008 to 100,500 in 2018 at the Gnoss Field Airport would result in increased industrial uses within the facility. However, it is anticipated that compliance with the Industrial General Permit as demonstrated through participation in the GMP will ensure continued compliance with regulatory standards for pollutants of concern through amendments to the facility SWPPP, as well as continued implementation, monitoring and maintenance of on-site BMPs, as amended by modifications to the SWPPP in response to expanded operations.

6.2 Alternative B

Under Alternative B, changes in pollutant loading values are directly attributable to the change in impervious surfaces from the 1,100-foot runway extension. As shown in Table 7, annual pollutant loading estimates (or long-term impacts) under Alternative B would remain below the water quality thresholds for Cu, Pb, Zn, BOD, and COD. Annual pollutant loading values would exceed the thresholds for TSS, TP, TKN, and Oil & Grease; however, thresholds for these pollutants were established by current sampling data in the absence of thresholds established by the Basin Plan. Therefore, although loadings for these pollutants would exceed levels determined through existing sampling data, it is expected that compliance with the Industrial General Permit through participation in the Group Monitoring Plan would ensure that the Airport will continue to meet or exceed regulatory standards. In addition, adherence to or modification of existing SWPPP and future sampling and visual observations if warranted will be employed to minimize or eliminate water quality impacts.

Short-term impacts to water quality may potentially occur during the construction phase of the proposed project. Grading and construction activities typically increase the potential for sediment related pollutants (e.g. TSS, nutrients, metals) to enter waterbodies. Short-term impacts would be minimized through vigilant adherence to construction schedule, the project SWPPP, and BMPs. Construction of Alternative B would require the facility to obtain coverage under the NPDES General Construction Permit for construction activities. As of July 1, 2010, coverage under the newly adopted General Construction Permit must be obtained electronically via the SWRCB.

Implementation of Alternative B would require the fill of jurisdictional waters of the U.S. pursuant to Section 404 of the CWA. Any fill of waters of the U.S. would require authorization from the U.S. Army Corps of Engineers through a Section 404 permit. Pursuant to Section 401 of the CWA, any applicant for a Federal permit or license is also required to obtain and provide to the U.S. Army Corps of Engineers a 401 Water Quality Certification from the state. Therefore, development of Alternative B would require 401 Water Quality Certification through the State Water Resources Control Board. Pollutant loading changes to stormwater runoff will contribute to minor impacts to Black John Slough and the Petaluma River. However, as previously described, implementation of the measures outlined in the SWPPP, in accordance with the NPDES Construction General Permit, and Industrial General Permit coupled with the implementation, monitoring and maintenance of site-specific BMPs, is expected to reduce the potential for impacts to water quality and maintain water quality objectives..

Development of Alternative B would require Marin County to submit a Change of Information (COI) (found on the General Industrial Permit Notice of Intent) to the State Water Resources Control Board. The COI will update the facility information to include a revised site map with drainages, the facility acreages, the new site imperviousness percentage, and any changes that may relate to facility operations (i.e., SIC code changes). If at any time the Airport is found to not be in compliance with the SWPPP or the Industrial General Permit conditions, the facility inspector is required to document noncompliance specifics and modifications to the facility SWPPP and BMPs may be required. Similarly, if warranted by sampling data analyses, the SWRCB may require modifications to the SWPPP and BMPs.

Based on the current BMPs, SWPPP, and permits that are in place, it is not anticipated that Alternative B would exceed water quality standards, create water quality problems that cannot be avoided or mitigated, or result in difficulties in obtaining permits. Therefore, no significant impacts are anticipated with implementation of Alternative B.

6.3 Alternative D

The activities identified under Alternative B that could result in increased pollutant loadings are the same for Alternative D. The only difference between the two alternatives is that Alternative D has slightly more impervious surface than Alternative B. As a result, the pollutant loadings for some pollutants is slightly higher than Alternative B (see Table 7). However, these increases over Alternative B would not change the discharges to a point where they would not be able to be addressed through the BMPs, SWPP, and permits.

Based on the current BMPs, SWPPP, and permits that are in place, it is not anticipated that Alternative D would exceed water quality standards, create water quality problems that cannot be avoided or mitigated, or result in difficulties in obtaining permits. Therefore, no significant impacts are anticipated with implementation of Alternative D.

6.4 Alternative E

The activities identified under Alternative E that could result in increased pollutant loadings are less than those estimated for Alternatives B or D in Table 7. The only difference between the two alternatives is that Alternative E has significantly less impervious surface than Alternatives B or D. As a result, the pollutant loadings for some pollutants would be lower than Alternatives B or D. Therefore, the potential discharge due to Alternative E would be able to be addressed through the BMPs, SWPP, and permits.

Based on the current BMPs, SWPPP, and permits that are in place, it is not anticipated that Alternative E would exceed water quality standards, create water quality problems that cannot be avoided or mitigated, or result in difficulties in obtaining permits. Therefore, no significant impacts are anticipated with implementation of Alternative E.

6.5 Conclusions

All of the Alternatives will utilize similar BMPs to address potential pollutant impacts as a result of any of the build alternatives. BMPs employed will include levee extensions around the entire project and a slow flowing vegetated internal drainage system that will facilitate pollutant uptake and settlement prior to reaching the Airport discharge point. Additionally, Airport operations assert multiple spill prevention and clean up procedures that protect against potential pollutant impacts

Current Best Management Practices (BMPs) implemented by the facility, combined with the design of proposed improvements are sufficient to maintain concentrations of pollutants of concern below regulatory criteria, and minimize or eliminate the potential for stormwater quality impacts to Black John Slough and the Petaluma River.

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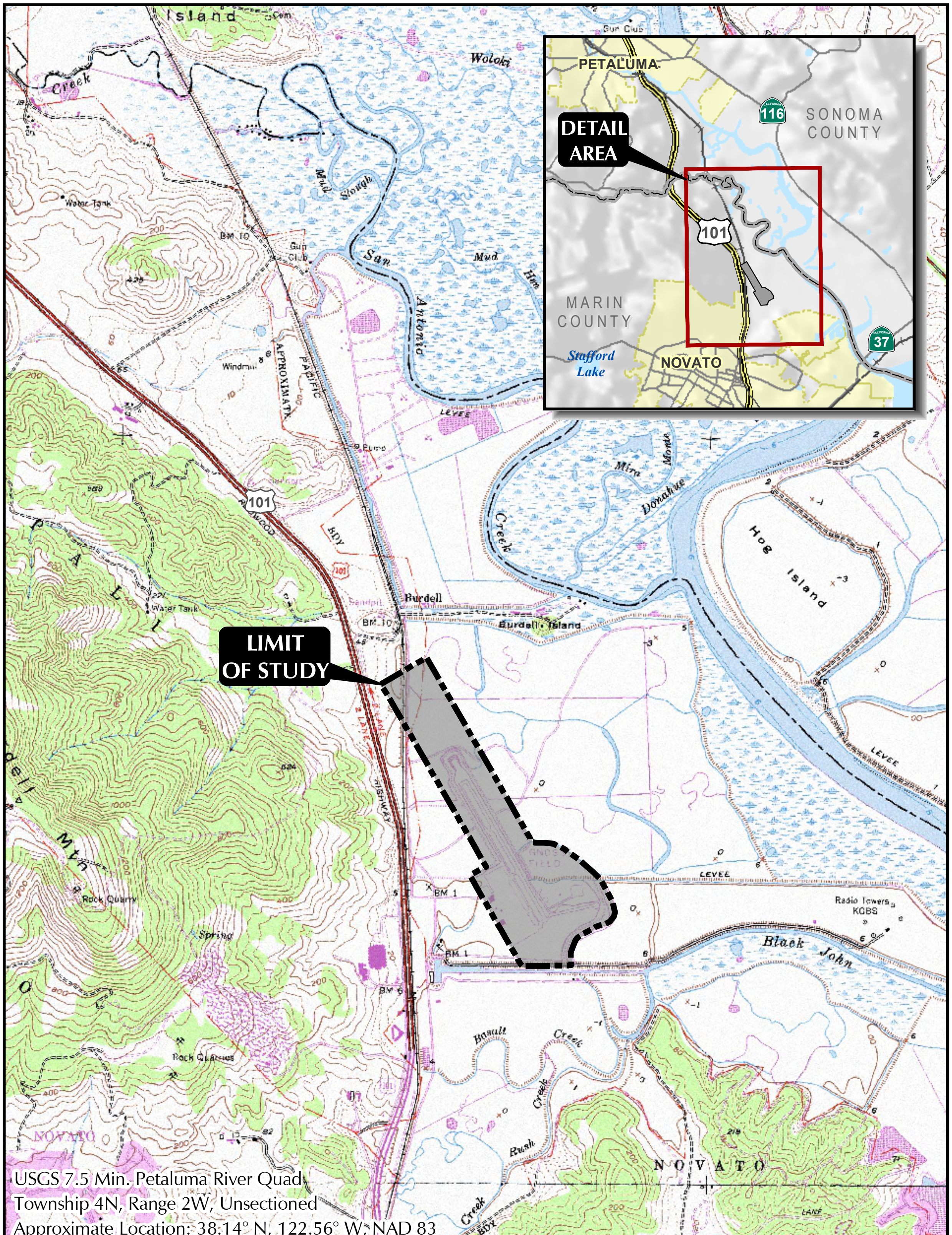
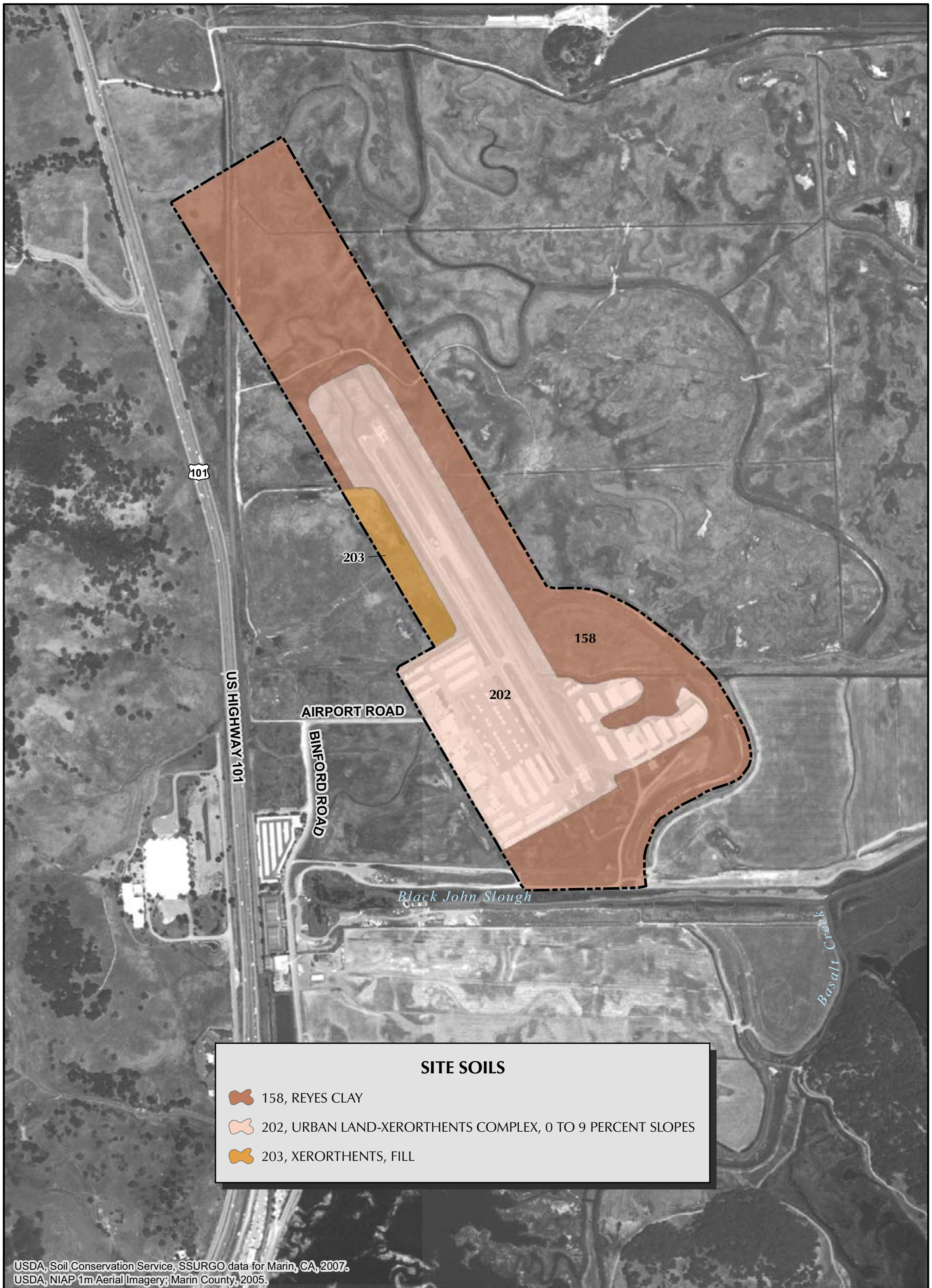


SITE AND VICINITY

FOOTHILL ASSOCIATES ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE	N	0 1500 3000 SCALE IN FEET	Drawn By: MJ Date: 04/29/08	FIGURE 1

GNOSS FIELD AIRPORT

site_and_vicinity.mxd



SOILS

FOOTHILL ASSOCIATES
ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE

N

0 800 1600
SCALE IN FEET

Drawn By: BF/PDL
Date: 03/10/09

FIGURE 2

GNOSS FIELD AIRPORT

soils_11x17.mxd

LOCAL DRAINAGE

FOOTHILL ASSOCIATES
ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE

N

0 1400 2800
SCALE IN FEET

Drawn By: RJM
Date: 11/19/09

FIGURE 3

GNOSS FIELD AIRPORT

local_drainage.mxd © 2009

GNOSS FIELD MARIN COUNTY AIRPORT - SITE DRAINAGE

FOOTHILL ASSOCIATES
ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE

N

0 250 500
SCALE IN FEET

Drawn By: BVDZ, RJM
Date: 11/20/09

FIGURE 4