Prepared for:

Imperial County
Department of Public Works
155 S. 11th Street
El Centro, CA 92243

County Project Number: 4173SW

Final Closure and Post-Closure Maintenance Plan

Brawley Solid Waste Site

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April 2012

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LIST OF ACRONYMS & ABBREVIATIONS

27 CCR	Title 27 of the California Code of Regulations
A2GU	General Agriculture (as it refers to land use)
AFC	Alternative Final Cover
ASTM	American Society for Testing and Materials
BAS	Bryan A. Stirrat and Associates
BSWS	Brawley Solid Waste Site
BSZ	Brawley Seismic Zone
CalRecycle	California Department of Resources Recycling and Recovery
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CIMIS	California Irrigation Management Information System
CIWMB	California Integrated Waste Management Board
CM	Construction Manager
cm/sec	Centimeters per Second
COCs	Constituents of Concern
CQA	Construction Quality Assurance
cy	Cubic Yards
DWR	Department of Water Resources
ERP	Emergency Response Plan
°F	Degrees Fahrenheit
FCPCMP	Final Closure and Post-Closure Maintenance Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
Geosyntec	Geosyntec Consultants, Inc.
GLA	GeoLogic Associates
Group Delta	Group Delta, Inc.
GS	Government and Special (as it refers to land use)
ICDPW	Imperial County Department of Public Works
IID	Imperial Irrigation District
km	Kilometer
kV	kilovolt
LCRS	Leachate Collection and Removal System
LEA	Local Enforcement Agency
LFG	Landfill Gas
M1G	General Light Industrial (as it refers to land use)

MCE	Maximum Credible Earthquake
NAVD 88	North American Vertical Datum of 1988
NGA	Next Generation Attenuation
NOAA	National Oceanic and Atmospheric Administration
PHGA	Peak Horizontal Ground Acceleration
pbv	Percent by Volume
pcf	Pounds per Cubic Foot
psf	Pounds per Square Foot
PVC	Polyvinyl Chloride
RWQCB	Colorado River Basin Regional Water Quality Control Board
SBB&M	San Bernardo Base and Meridian
SPT	Standard Penetration Test
SWFP	Solid Waste Facility Permit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
VOCs	Volatile Organic Compounds
WDR	Waste Discharge Requirements

1. PROJECT OVERVIEW

1.1 Introduction

Geosyntec Consultants, Inc. (Geosyntec) has prepared this Final Closure and Post-Closure Maintenance Plan (FCPCMP) for the Brawley Solid Waste Site (BSWS) for submittal to the California Department of Resources Recycling and Recovery (CalRecycle), formerly the California Integrated Waste Management Board (CIWMB), the County of Imperial Public Health Department as the Local Enforcement Agency (LEA), and the Colorado Basin Regional Water Quality Control Board (RWQCB) on behalf of the Imperial County (County) Department of Public Works (ICDPW), the owner of the landfill.

The BSWS FCPCMP was initially prepared and submitted to CalRecycle, the LEA, and the RWQCB by Bryan A. Stirrat & Associates (BAS) in October 2008 (BAS, 2008). This FCPCMP includes significant revisions, addresses regulatory review comments, and supersedes previous versions.

1.1.1 Purpose

This FCPCMP has been prepared in accordance with the California Code of Regulations Title 27 (27 CCR), Chapters 3 and 4, and the Code of Federal Regulations (CFR) Title 40, Part 258 (Subtitle D). The objectives of this FCPCMP include:

- Providing a basis for an accurate, detailed cost estimate for closure and post-closure maintenance;
- Providing a plan and schedule for closure;
- Providing a plan and schedule for the inspection, maintenance and monitoring procedures for post-closure maintenance; and
- Facilitating closure and post-closure monitoring by CalRecycle, the RWQCB, and the LEA to ensure compliance with the approved FCPCMP.

Closure and post-closure maintenance at the BSWS is regulated by 27 CCR. Table 1 summarizes the regulatory requirements from 27 CCR and identifies the section of this FCPCMP where the regulations are addressed.

1.1.2 Project Description

In general, closure of the BSWS will involve relocation of waste around the perimeter of the landfill to within the landfill footprint, improvements within and along the

southern bank of the New River to help direct the flow of the river away from the site, construction of a perimeter access road around the landfill, and construction of a final cover system and surface drainage control system. Post-closure maintenance will include regular inspections and maintenance of the environmental control systems at the BSWS.

1.1.3 Plan Organization

The remainder of this FCPCMP is organized as follows:

- Section 2, *General Site Information*, describes the BSWS, including the location, boundaries, surrounding land use, topography, climate, previous investigations and construction activities, geologic, hydrologic, and hydrogeologic conditions, and the existing site environmental control monitoring systems;
- Section 3, *Final Closure Plan*, describes the activities and design associated with the final closure of the BSWS, including waste relocation, the final cover system, surface drainage system, river bank stabilization system, other final closure design considerations, and monitoring systems;
- Section 4, *Final Closure Construction Considerations*, describes the requirements, processes, and considerations for the BSWS final closure construction, introducing additional permitting requirements, the technical specifications, and the Construction Quality Assurance Plan;
- Section 5, *Final Post-Closure Maintenance Plan*, describes the post-closure maintenance requirements for the BSWS and the environmental control systems;
- Section 6, *Closure and Post-Closure Maintenance Cost Estimate*, describes the development of the cost estimates to demonstrate financial assurance for closure and post-closure maintenance;
- Section 7, *Professional Certification*, presents the Engineer's affidavit and stamp;
- Section 8, *References*, presents the list of documents used to generate this FCPCMP.

  Tables, figures, and a permit-level drawing set (reduced size, 11″x17″) follow the text of this report. In addition, several appendices to this FCPCMP present supporting information, including background information, technical studies and plans, design calculations, typical inspection forms, and financial assurance documentation.

1.2 Site Background

1.2.1 Regulatory Framework

The site is regulated under federal, state, and local regulations, including, but not limited to, 27 CCR and Subtitle D (in accordance with State Water Resources Control Board Resolution 93-62). Copies of the pertinent permits and approvals for the BSWS are presented in Appendix A.

The BSWS operated under the Solid Waste Facility Permit (SWFP) No. 13-AA-0008, until it was suspended on 16 February 2007 in accordance with Notice and Order No. EA-2007-01. The BSWS is also regulated by the RWQCB with Waste Discharge Requirements (WDR) Order Number 97-007 (RWQCB, 1997). The current WDR updated a more general WDR (Order No. 93-071), which applied to all municipal solid waste landfills in the region (RWQCB, 1993). The BSWS is permitted through the Imperial County Air Pollution Control District (ICAPCD) with Permit to Operate No. 3073.

The proposed closure activities, described in more detail in Sections 3.0 and 4.0, include construction of improvements within and along the banks of the New River, a water of the United States. Accordingly, a Streambed Alteration Agreement (Section 1602 Permit) through the California Department of Fish and Game (CDFG) will be obtained, as well as a U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 Permit and a RWQCB Clean Water Act Water Quality Certification (Section 401 Permit).

1.2.2 Historic Overview

The City of Brawley had operated the BSWS for a number of years prior to 1972, when disposal operations were taken over by the ICDPW. Beginning in September 2006, waste disposal at the site was significantly reduced when the surrounding communities and the City of Brawley stopped using the landfill. The BSWS ceased accepting waste in February 2007.

The BSWS served the central portion of Imperial County, accepting waste from surrounding unincorporated areas of the County and the City of Brawley. The site accepted mixed municipal waste that is classified as Class III non-hazardous solid waste and construction/demolition waste, as defined in 27 CCR, Sections 20220 and 20230. No liquid or hazardous waste was knowingly accepted at the site.

The BSWS was open six days a week (Monday through Saturday) and permitted for a maximum daily disposal rate of 120 tons per day (CIWMB, 2003). Landfill disposal operations utilized the area fill method, and were last conducted in the northwestern corner of the site.

The maximum permitted capacity for the BSWS is 2,044,000 cubic yards (cy). The estimated volume of in-situ waste is approximately 1,658,000 cy; therefore, the remaining capacity is estimated to be approximately 386,000 cy (CalRecycle, 2011).

In 2001, the CIWMB provided a grant for remedial slope repair on the north side of the site adjacent to the New River in accordance with the Brawley Participation Agreement (see Appendix A). Approximately 97,000 cy of soil and waste were excavated and relocated. Two feet of cover soil was placed in the excavated areas and the new slopes adjacent to the New River were regraded at a 2H:1V (horizontal:vertical) slope (BAS, 2008).

On 16 February 2007, the LEA issued Notice and Order EA-2007-01 suspending the SWFP for the BSWS after inspections identified the site was in violation of 27 CCR Section 20700 for intermediate cover. An amended Notice and Order EA-2007-01 required the ICDPW to submit a FCPCMP for the BSWS by 20 October 2008. Because a FCPCMP was not submitted by the specified date, the LEA issued Notice and Order EA-2008-04 revoking the SWFP for the site and ordering that a FCPCMP be submitted by 19 May 2009. Amended Notice and Order EA-2008-04 was later issued extending the FCPCMP submittal date to 18 October 2010.

1.2.3 Responsible Parties

The BSWS is currently owned and maintained by the ICDPW. The responsible party who will be involved in closure and post-closure maintenance and monitoring activities at the BSWS is:

Landfill Owner: Imperial County Department of Public Works
155 South 11th Street
El Centro, California 92243
Director of Public Works
(760) 482-4462

Should the title to the site be transferred during closure and/or post-closure maintenance, the new owner shall be notified by the previous owner or their agent of the existence of the 27 CCR standards and of the conditions and agreements assigned to

assure compliance. In accordance with 27 CCR, Section 21200, the previous owner shall notify the LEA of the change in writing within 45 days prior to the anticipated transfer of title and shall provide the name, firm, mailing address and telephone of the new owner. The new owner shall submit to the LEA and CalRecyle documentation of its financial assurance and an affidavit stating it has read and will comply with the terms stated in the governing SWFP and this FCPCMP. Questions pertaining to the FCPCMP should be directed to the ICDPW.

2. GENERAL SITE INFORMATION

2.1 Site Location

The BSWS is located approximately 1.5 miles north of the City of Brawley as presented on Figure 1. The site is approximately 53.32[1] acres and encompasses assessor parcel numbers 046-030-004, 046-030-005, and 046-030-012. The site is situated immediately south of the New River, between N. Western Avenue (also called Hovley Road adjacent to the BSWS) and N. Imperial Avenue (Figure 2). The site address is 4700 Brawley Dump Road, Brawley, California 92227. The site includes portions of Tract 141 and 199 of Township 13 South, Range 14 East, San Bernardino Meridian (SBM). The latitude and longitude of the site are approximately 32°59'40" N and 115°32'27" W, respectively. A copy of the record of survey for the property is included in Appendix A.

2.2 Facility Information

Initial waste filling activities at BSWS predated current state and federal regulations. As such, the BSWS is unlined and has no leachate collection or recovery system (LCRS). No records are available documenting the level of the bottom of waste. Based on the current landfill topography and that of the surrounding area, the estimated maximum waste depth is approximately 54 feet. The landfill footprint includes approximately 36.3 acres (Geosyntec, 2010). This waste acreage has been modified from previous estimates based on a waste delineation study performed in 2010 by Geosyntec (Appendix C).

The property boundary, existing site features such as access roads, groundwater monitoring wells and LFG probes, previous exploration locations, and the approximate limit of waste are shown on the Site Plan (Figure 3).

2.3 Land Uses

2.3.1 Surrounding Land Use

The land use designations for the BSWS and the surrounding areas from the City of Brawley Final General Plan Update are presented on Figure 4 (City of Brawley, 2008).

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[1] Acreage based on record survey measurements (see Appendix A). Parcel map book indicates site acreage of approximately 53.86 acres.

The BSWS is designated for government and special (GS) purposes per Title 9, the Land Use Ordinance for the County (Imperial County, 2009). Land uses permitted in the GS zone include construction, development and operation of governmental facilities and special public facilities. Typically, this zoning designation permits government owned and/or government operated facilities such as offices or other uses. This designation also permits special uses such as jails, and solid and/or hazardous waste facilities (Imperial County, 2009). Currently, the only structure in this designated land use within 1,000 feet of the BSWS is the office of the Riverview Cemetery.

Areas to the north, east, and west of the BSWS are designated as general agriculture (A2GU). This designation permits primarily agricultural uses and agriculture compatible uses, provided the land area is a minimum of 40 acres (County of Imperial, 2009). Currently, a mobile home trailer is located in an A2G zone within 1,000 feet of the landfill property boundary. There is a small area zoned for general, light industrial (M1G) uses northeast of the site. Wholesale commercial, storage, trucking, assembly type manufacturing is permitted on land designated as M1G (County of Imperial, 2009). Land bordering the BSWS to the southeast is zoned by the City of Brawley as low density residential (City of Brawley, 2011). A housing development called Parkside Estates West has been constructed in this area immediately adjacent to the landfill property boundary. An additional housing development has been constructed southwest of the site, west of Hovely Road. The locations of existing structures within 1000 feet of the BSWS are shown on Figure 4.

2.4 Site Topography

The BSWS is located in the Salton Trough, which lies in the south-central part of the Imperial Valley. The pre-landfill topography of the site is illustrated on Figure 5.

The current topographic map of the landfill was prepared from an aerial survey performed by Rick Engineering of San Diego, California in June 2010 and is shown on Figure 3. The elevations surrounding the BSWS are below Sea Level and vary from approximately -170 feet North American Vertical Datum of 1988 (NAVD 88) to -115 feet NAVD 88. For this project, a datum has been established by adding 1,000 feet to the elevation so that the values are always positive. Two topographic depressions on the southern side and southeast corner of the landfill represent the lowest points of the site, while the highest portion of the site is located in the central, eastern half of the landfill. The existing slopes of the BSWS range from 3H:1V to 1.5H:1V and rise to 875 to 885 feet NAVD 88 (project datum).

2.5 Climate

The climate at the BSWS can be broadly characterized by very low rainfall, high evaporation, and extreme temperatures.

Weather Station #41, managed by the California Irrigation Management Information System (CIMIS), was identified as the nearest to the BSWS with comprehensive and available weather data. This weather station is located approximately 7.5 miles to the northeast of the BSWS and is at a comparable elevation to the BSWS. The weather period evaluated is between 2000 and 2010 at Weather Station #41.

The average annual rainfall is approximately 2 inches. The highest precipitation event recorded at Weather Station #41 occurred in 2005 and was approximately 2.4 inches. The recorded average evapotranspiration is approximately 70 inches, or approximately 35 times the average annual precipitation rate.

The temperatures range from lows around 35 degrees Fahrenheit (^{o}F) in the winter to highs over 100^{o} F in the summer. The average annual minimum temperature recorded was approximately 54^{o} F, while the average annual maximum temperature recorded during this period was approximately 87.5^{o} F.

2.6 Previous Investigations and Construction Activities

Several investigations and construction projects have been performed at the BSWS. Boring and well construction logs from these activities are provided in Appendix B.

2.6.1 Groundwater Monitoring Well Installation and Abandonment

Groundwater monitoring wells (designated B-WW-1 through B-WW-6) were installed at the site in 1989 to depths ranging between 13 and 35 feet. The groundwater monitoring wells designated B-WW-3 and B-WW-6 were abandoned in 1999, and replaced with wells B-WW-3R and B-WW-4R (GLA, 1999). Groundwater monitoring well B-WW-2 was abandoned in November 2005 (GLA, 2005). Based on available information, B-WW-4 is reportedly inaccessible and not currently monitored. Available boring and well construction logs for these groundwater monitoring well locations are presented in Appendix B.

2.6.2 Geotechnical Investigation

In 1998, two areas of intermediate cover failure and significant erosion were noted on the northern slope of the BSWS, adjacent to the New River. Those areas had no bank

protection, and due to the steepness of the slopes and the close proximity to the New River, it was difficult to safely operate equipment to place cover soil needed for slope maintenance.

To remediate the erosional features on the northern slope of the BSWS, a geotechnical investigation was initiated jointly by the CIWMB and the County. A geotechnical investigation report was prepared in 2001 by BAS and GeoLogic Associates (GLA) to evaluate slope stability, seismic risk, and potential northern slope remediation options (BAS, 2001). The investigation included limited field explorations, geotechnical laboratory testing, and engineering analyses.

Three borings, designated B-1, B-2, and B-3, were advanced to depths of 50 feet, 50 feet, and 60 feet, respectively, along the northern perimeter of the BSWS. The approximate locations of these borings are presented on Figure 3. The geotechnical laboratory program included moisture content and dry density testing, particle size analyses, and direct shear strength testing. Static and dynamic slope stability analyses were performed to evaluate the proposed slope configurations, and a seismic risk assessment was performed to develop seismic design parameters. Pertinent excerpts from this investigation are provided in Appendix B.

2.6.3 North Slope Remediation Project

In 2001, the CIWMB facilitated the northern slope erosional feature repair, which was designated the North Slope Remediation Project as part of the Solid Waste Site Cleanup Program (CIWMB, 2001). The project included excavation of approximately 97,000 cy of soil and waste from the northern area of the landfill, and flattening the steep slope adjacent to the New River to an average 2H:1V slope inclination. The regraded slope included an access road at the toe and a 15-foot wide mid-slope bench. Intermediate cover soil was placed to a minimum thickness of 2 feet.

2.6.4 County Potholing Investigation

ICDPW performed a potholing investigation in 2009 to evaluate the existing intermediate cover thickness. Twenty-six excavations were performed primarily on the top deck areas of the BSWS. These excavations indicate that the existing intermediate cover thickness ranges from approximately 8 inches to more than 3 feet, with an average thickness of 23 inches (ICDPW, 2009). A copy of the summary report of these excavations is included in Appendix B.

2.6.5 Waste Delineation Study

In 2010, Geosyntec conducted a study to delineate the limit of waste and characterize the subsurface conditions at the BSWS (Geosyntec, 2010). The study included historical aerial photograph review, trench and pothole explorations, field mapping, and waste dating. A copy of the referenced study is presented in Appendix C.

Geosyntec reviewed 10 aerial photographs dated from 1953 through 2010. The aerial photographs indicated areas of land disturbance that appear to be related to landfill operations and provided an indication of the historical extent of site waste placement activities.

Field waste delineation activities were performed 21 through 24 September and 12 October 2010. The updated limit of waste was estimated by excavation of 38 trenches, 7 pothole explorations, and logging existing cracks in the surface materials in the northeast corner of the site. During the delineation, certain areas of the site were not investigated due to instability of the area or the presence of asphalt surfacing. Where waste was discovered adjacent to the access road, it was conservatively assumed to continue beneath the paved access road to the toe of the southern slope. The updated limit of waste is shown on Figure 3. The study identified waste in several areas outside the previously identified limit of waste (BAS, 2008), particularly along the western boundary of the site (along Hovley Road), in the southeast corner near the southeastern depression, and along the western portion of the northern landfill slopes. Based on this study, the existing waste footprint is estimated to be 36.3 acres.

2.6.6 Landfill Gas Probe Installation

Multiple studies pertaining to LFG monitoring have been performed at the BSWS. Boring and probe construction logs for these LFG probe locations are presented in Appendix B.

In 2010, 11 LFG probes (designated P01 through P10 and P4R) were installed outside the waste footprint and within the permitted boundary of the BSWS. The boring depths range from 8 feet to 41 feet below the ground surface (Ninyo & Moore, 2010).

Additionally, in late 2010, one LFG monitoring probe (designated W01) was installed inside the waste footprint to investigate the source of methane detected in the deep probe of perimeter LFG monitoring probe P4R. The boring depth was 71.5 feet (Bodhi Group, 2010).

2.6.7 Landfill Gas Pilot Study

In April 2011, Geosyntec installed three LFG extraction wells (designated EW-2 through EW-4) and three LFG monitoring probes (MP-1 through MP-3) as part of a pilot study to evaluate LFG control systems. Boring logs and extraction well/probe construction logs are presented in Appendix B. The LFG pilot study is described in more detail in Section 3.10.2.

2.7 Geologic Conditions

2.7.1 Geologic and Seismic Setting

The BSWS is located within the Salton Trough, which occupies a broad lowland area in the Colorado Desert Geomorphic Province. The Salton Trough is essentially a closed basin, bounded by mountains within the Mojave Desert Province to the north and east, the Peninsular Ranges to the west, and the Gulf of California to the south.

The Salton Trough represents the transition zone between the crustal spreading centers in the Gulf and the right-lateral transform boundary between the North American and Pacific Plates. Although the San Andreas fault zone is the primary element in this transform boundary, the total plate motion is distributed across a broad zone of deformation that essentially extends from the San Andreas fault on the east to offshore faults far to the west. The other primary structures in the right strike system of faults that compose the plate boundary within the immediate site vicinity are the San Jacinto, Imperial, Cerro Prieto, and Brawley fault zones.

The closest active fault (exhibiting evidence of rupture in the last 11,000 years) to the site is the Brawley Seismic Zone (BSZ). The BSZ is approximately 1/2 mile southwest of the site. No known faults are located within 200 feet of the BSWS. A regional geologic map is presented on Figure 6. Table 2 summarizes the major faults in the vicinity of the BSWS.

2.7.2 Site Geology

The BSWS is underlain by older alluvium and lacustrine, deltaic, and fluvial deposits associated with Holocene-age and Pleistocene-age stands of ancient Lake Cahuilla. These deposits, as encountered during previous site investigations, generally consist of interbedded silty sand, sand, sandy and clayey silt, and clay (Unified Soil Classification System [USCS] classification SM, SP, ML, CL, and CH, respectively). Based on a review of available boring logs, below the BSWS, the coarse-grained materials are typically medium dense to dense, and the fine-grained materials are typically very stiff

to hard. Boring and well construction logs from previous site investigations are presented in Appendix B.

At the northern perimeter of the site, along the banks of the New River, recent alluvial deposits were observed that are characterized by lower strengths, greater vulnerability to erosion, and generally soft, saturated ground conditions.

2.8 Hydrogeologic Conditions

2.8.1 Hydrogeologic Setting

The BSWS is located in the 1,870-square-mile Imperial Valley Groundwater Basin (Basin 7-30) of the Colorado River Hydrologic Region. The Salton Sea bounds the region to the north and acts as the discharge point for the region's groundwater. To the east the region is bordered by the Sand Hills, and to the west the region is bordered by the Fish Creek and Coyote Mountains. The groundwater basin extends south into the Mexicali Valley in Mexico, but the southern boundary is politically defined as the border between the United States and Mexico (DWR, 2003).

Two major aquifers, separated at depth by a semi-permeable aquitard, are located in the region. The aquifers consist mostly of alluvial deposits of late Tertiary and Quaternary age. The upper aquifer has an average thickness of 200 feet and a maximum thickness of 450 feet, while the lower aquifer has an average thickness of 380 feet and a maximum thickness of 1,500 feet (DWR, 2003).

Groundwater in the basin generally flows to the center of the Imperial Valley and then northwest towards the Salton Sea. Elevations of groundwater vary widely in the basin due to differing hydraulic heads caused by localized confining clay beds (DWR, 2003).

2.8.2 Site Hydrogeology

The aquifer materials underlying the BSWS consist of interbedded sand, silt, and clay deposits associated with Lake Cahuilla (BAS, 2008). Groundwater at the BSWS occurs primarily within the sand and silty sand deposits. Groundwater generally flows north towards the New River with a velocity ranging from 0.36 feet per day (ft/day) to 0.46 ft/day (GLA, 2011). Groundwater elevations generally range from 822 feet mean sea level (MSL) to 825 feet MSL, and water levels in the New River generally range from 819 feet MSL to 823 feet MSL with a datum of MSL plus 1,000 feet (GLA, 2011). Recent (August 2011) groundwater elevations and estimated gradients are shown on Figure 7.

2.9 Hydrologic Conditions

2.9.1 Hydrologic Setting

The surface water in closest proximity to the BSWS is the New River, which borders the site to the north. The New River originates approximately 16 miles south of the City of Mexicali in Baja California, Mexico, and flows north approximately 69 miles through the Imperial Valley before discharging into the Salton Sea. The New River watershed is bounded on the north by the Salton Sea, on the east by the New River and Alamo River drainage divide, on the south by the Colorado River Delta and Cucapus Mountains, and on the west by the Peninsular Range. The New River conveys agricultural runoff from Mexicali and the Imperial Valley, as well as contaminated urban runoff from Mexicali. Daily flows in the New River at the BSWS range from approximately 400 to 5,000 cubic feet per second (cfs). The New River gains flow along its course between Mexicali and the Salton Sea.

Two meanders in the New River encroach on the BSWS, and erosion of the landfill has been a reoccurring problem in these areas. Section 3.6 of this FCPCMP discusses the river bank stabilization design.

2.9.2 Site Hydrology

A portion of the BSWS exists in the 100-year floodplain of the New River, as defined by the Flood Insurance Rate Map (FIRM) developed by the Federal Emergency Management Agency (FEMA). 27 CCR, Section 20260 and Subtitle D require that the BSWS be protected during closure from a 100-year flood event. The 100-year floodplain defined by the FIRM was developed based on a peak river flow estimated from an undated and unpublished hydrology study by the USACE. Geosyntec developed a report detailing the reevaluation of the New River floodplain as part of an application for a Conditional Letter of Map Revision (CLOMR) submitted to FEMA (Geosyntec, 2011). FEMA has provided comments on the CLOMR application and tentatively approved the floodplain re-evaluation (see Appendix G.1). Final approval will be provided after completion of the closure project when final topographic elements are in place. The 100-year flood flows in the New River have therefore been reduced from approximately 24,600 cfs to approximately 4,700 cfs, resulting in a significant reduction in stage and scour protection measures. The design included in Section 3 and the Final Closure Drawings is based upon the reduced flow rates. The proposed revised floodplain is shown on the Final Closure Drawings.

Stormwater runoff from the BSWS flows into the New River, located along the northern site boundary. Runoff is conveyed from portions of the top deck and northern side

slopes through surface flumes and eventually discharges to the river through several concentrated discharge points. Some discharge to the New River is by sheet flow.

Runoff from the central and southern portions of the site is collected in two depressions on the south and southeastern side of the landfill. Stormwater collected in the southerly depression will be lifted via a sump pump into a force main and discharged into a new storm drain pipe on the eastern side of the BSWS. The southeasterly depression will drain by gravity through a buried closed conduit to the New River. The proposed drainage control system is described in detail in Section 3.8.

2.10 Surface Water Quality and Beneficial Uses

2.10.1 Surface Water Quality

In general, the New River exhibits very poor water quality. Along with agricultural runoff, the river is known to convey community and industrial wastewater, raw and inadequately treated sewage, toxic industrial waste, garbage and other solid wastes, animal wastes, and occasionally geothermal wastewaters, all originating from the Mexicali area (RWQCB, 2006). Furthermore, the New River is included in the 2006 Clean Water Act Section 303(d) list that identifies significantly polluted waters and proposes total maximum daily loads (TMDLs) for specific pollutants contributing to the water's impairment. Twenty-two TMDLs have been proposed for the New River, including several metals, pesticides, several VOCs, and nutrients, to reduce pollutant levels (RWQCB-SWRCB, 2006).

2.10.2 Surface Water Beneficial Uses

Beneficial uses of New River water are limited due to the high level of pollution in the river. Currently, the RWQCB does not approve New River water for agricultural or municipal use, and the Imperial County Health Department has posted warnings against recreational uses of the river's water (RWQCB, 2006).

2.11 Groundwater Quality and Beneficial Uses

2.11.1 Regional Groundwater Quality

The Imperial Valley Groundwater Basin is considered to have high total dissolved solids (TDS) concentrations and is generally considered to be unsuitable for domestic or irrigation purposes without treatment. Approximately 7,000 acre-feet of water from the New River is estimated to recharge the groundwater basin, negatively affecting the groundwater quality (DWR, 2003).

2.11.2 Site Groundwater Quality

In general, analysis of the groundwater at the BSWS has shown consistently high concentrations of TDS and chloride. TDS concentrations typically range from 5,000 mg/L to 30,000 mg/L and chloride concentrations typically range from 2,500 mg/L to 15,000 mg/L, both exceeding State of California secondary drinking water standards. Data from the site's background and compliance wells suggest that high concentrations of TDS and chloride are considered to be naturally occurring and not indicative of a release from the landfill (GLA, 2011). Additional groundwater monitoring results are discussed in Section 2.12.2.

2.11.3 Groundwater Beneficial Uses

The BSWS is located within the Imperial Hydrologic Unit (RWQCB, 1997). Some untreated groundwater in the Imperial Hydrologic Unit is designated for industrial use, and only a limited amount is designated for municipal use. Currently, no untreated groundwater is approved for agricultural use. The limited beneficial use of groundwater in the Imperial Hydrologic Unit is a result of the generally high concentrations of TDS (RWQCB, 2006).

2.12 Environmental Control Monitoring

This section describes the environmental control and monitoring systems in accordance with 27 CCR 21790(b)(4). The existing environmental control and monitoring systems at the BSWS include a LFG monitoring system and a groundwater monitoring system. The BSWS is unlined and has no LCRS, as described in Section 2.2; therefore, there is no leachate system monitoring.

2.12.1 Landfill Gas Monitoring

27 CCR Sections 20921 through 20939 establish the performance standards and the requirements for LFG monitoring and control for solid waste disposal sites to protect public health and safety and the environment. 27 CCR Section 20921 stipulates that the concentration of methane gas must not exceed 1.25 percent by volume (pbv) in air within any portion of any on-site structures, and that the concentration of methane gas migrating from the disposal site must not exceed 5 pbv in air at the disposal site permitted facility boundary or an alternative boundary approved in accordance with 27 CCR Section 20925.

The current LFG monitoring program consists of quarterly monitoring of perimeter LFG probes for methane, carbon dioxide, oxygen, and balance gas using a

LandGEM2000 or equivalent consistent with 27 CCR Sections 20932 and 20934(a). The LEA may require more frequent monitoring or that LFG samples be collected for laboratory analysis of trace gases as needed for public safety per 27 CCR Sections 20932 and 20934(a)(2).

2.12.1.1 Landfill Gas Monitoring System

As shown on Figure 3, perimeter LFG probes were installed pursuant to 27 CCR Sections 20921 and 20925 to monitor for the presence of LFG surrounding the BSWS. The LFG probe construction logs are presented in Appendix B. The locations of the wells are presented on Figure 3.

In 2010, ten LFG probes (designated P01 through P10) were installed outside the waste footprint and within the permitted boundary of the BSWS. The lateral spacing between the probes ranges from 500 feet to 1,000 feet, except between P04 and P4R, where the spacing is 140 feet. The smaller lateral spacing was used to account for structures in the residential development and the cemetery within 1,000 feet of the boundary of the facility south of the site. The LFG probes range from single- to three-level probes and are designed to evaluate the vertical LFG profile. The probe depths range from 8 feet below the ground surface at P01 to 40 feet below the ground surface at P04 and P05. Most of the probes are installed below the bottom of waste (Ninyo & Moore, 2010).

Additionally, one LFG probe (designated W01) was installed inside the waste footprint in September 2010 to investigate the source of methane detected in the deep probe of perimeter probe P4R (Bodhi Group, 2010).

As part of the FCPCMP, a compliance boundary will be established around the perimeter landfill gas probes in accordance with 27 CCR Section 20925.

2.12.1.2 Landfill Gas Monitoring Results

Pursuant to CCR 27 Section 20933, ICDPW has monitored the LFG probes quarterly since their installation in 2010. Concentrations of methane measured in these probes range from 4 to 22.2 pbv in the deeper levels of probe P4R during the 1st quarter 2010 monitoring to 8.8 pbv in P04 and 23.9 pbv in P4R in the 1st quarter of 2011, exceeding the maximum 5 pbv threshold in perimeter probes. No significant concentration of methane has been detected in any of the other LFG probes installed at the site.

2.12.2 Groundwater Monitoring

27 CCR Section 20380 through Section 20435 establish requirements for groundwater monitoring systems and groundwater analysis at solid waste disposal sites. Specific groundwater monitoring requirements for the BSWS are outlined in the site's WDR (RWQCB, 1997).

2.12.2.1 Groundwater Monitoring System

The groundwater monitoring system at the BSWS consists of four monitoring wells (designated B-WW-1, B-WW-3R, B-WW-4R, and B-WW-5). The locations of the groundwater monitoring wells are shown on Figure 3. The depths of these wells range from approximately 13 to 45 feet below the existing ground surface. Groundwater well construction logs are included in Appendix B.

The groundwater monitoring wells designated B-WW-3 and B-WW-6 were abandoned in 1999, and replaced with wells B-WW-3R and B-WW-4R (GLA, 1999). Groundwater monitoring well B-WW-2 was abandoned in November 2005 (GLA, 2005). Based on available information, B-WW-4 is reportedly inaccessible and not currently monitored, but it has not been abandoned.

2.12.2.2 Groundwater Monitoring Results

The groundwater monitoring wells at the BSWS are monitored in accordance with RWQCB Order No. 93-071 for all solid waste facilities in the Colorado River Basin, and Order No. 97-007 issued specifically for the BSWS. On 3 June 2004, the ICDPW submitted a letter to the RWQCB requesting a reduction in the frequency of the groundwater elevation monitoring from quarterly to semi-annually. The RWQCB approved the request, and as a result, the groundwater elevations are monitored semi-annually to coincide with groundwater monitoring events (GLA, 2011). Sampling of the wells is performed in accordance with the site's Sampling and Analysis Plan (Appendix D) which complies with 27 CCR Sections 20380 through 20435.

Constituents of Concern (COCs) for the BSWS include all constituents in Appendices I and II of Subtitle D: TDS, sulfate, carbonate, pH, chloride, and all volatile organic compounds (VOCs) (RWQCB, 1997). High concentrations of TDS and chloride are consistently detected in groundwater samples collected from the site. The elevated concentrations of TDS and chloride are considered to be naturally occurring and not indicative of a release from the site (GLA, 2011). Trace concentrations of VOCs have occasionally been detected in groundwater samples from the site. In the BSWS 2011

Annual Groundwater Monitoring Report, GLA reported that verification testing was ongoing for VOCs detected during that monitoring period.

3. FINAL CLOSURE PLAN

3.1 Introduction

Closure of the BSWS will be performed in accordance with applicable regulatory standards included in 27 CCR and Subtitle D. Closure of the BSWS will include the following activities:

- Relocation of waste along the landfill's northern and western perimeters to the top deck area;
- Construction of in-river and river bank features to redirect the thalwag of the New River;
- Construction of a monolithic final cover system, including an erosion protection layer;
- Construction of surface water drainage conveyance and pumping systems; and
- Relocation of site security features (e.g., fencing).

As outlined in 27 CCR 21870(d), significant changes to the design presented in the approved final closure plan must be submitted for review and approval by the LEA, CalRecycle, and the RWQCB. Revisions to the approved closure plan design may not be made during the construction-level design without concurrence by the LEA (for minor changes) and/or approval by the LEA, CalRecycle, and RWQCB (for significant changes).

Typically minor modifications to the design during construction do not materially impact the design or change the design intent. Such modifications may include adjustments to concrete properties or steel reinforcement, electrical control equipment, corrosion protection for fencing, minor adjustments to pipe or buried conduit elevations, etc. Minor modifications of this nature will be made by the Engineer with a notification to the LEA to avoid construction delays for regulatory review.

3.2 Maximum Extent of Closure

In accordance with 27 CCR, Section 21790(b)(6), the estimated maximum extent of the landfill that will require closure, based on the revised waste disposal area footprint, is approximately 36.3 acres.

3.3 Closure Date

The BSWS ceased accepting waste in February 2007, with a suspended SWFP as described in Section 1.2.2. The existing Amended Notice and Order No. EA-2008-04, for the site requires the BSWS to complete closure of the site by 18 October 2011. Final closure activities will commence upon approval of this FCPCMP. The anticipated start of closure construction is early 2013; however, this date may be revised based on the schedule for permit approvals (see Section 4.2). A projected schedule for closure is included in Figure 8.

3.4 Structure Removal and Decommissioning of Environmental Control Systems

There are currently no permanent structures located at the BSWS and none are proposed; therefore, no structures will remain on site more than 180 days after closure.

Four existing LFG probes (Probes W01, MP1, MP2, and MP3) are located within the waste footprint (see Sheet 3 of the Closure Drawings) and will be decommissioned during final closure. No additional existing environmental control systems are planned to be decommissioned. Decommissioning will be conducted in accordance with the appropriate regulatory requirements and in accordance with the post-closure maintenance plan.

3.5 Waste Relocation

Design goals for the closure of BSWS include removal of waste from the Hovley Road right-of-way and providing a perimeter landfill access road, which will require removal of existing municipal solid waste (MSW) in the following areas:

- The northeast corner of the landfill adjacent to the New River;
- The middle and western portion of the northern edge of the landfill adjacent to the New River; and
- The western edge of the landfill adjacent to Hovley Road.

Waste is proposed to be excavated from these areas and relocated to the western portion of the top deck of the landfill. The volume of material (including waste) that will be relocated during closure construction is estimated to be approximately 34,000 cy. New waste slopes will be constructed at inclinations of 2H:1V or flatter. Specific waste slope inclinations are shown on the Final Cover Grading Plans (Sheets 15 through 17) in the Final Closure Drawings. A waste relocation plan is provided in Appendix E

which details areas of waste excavation and relocation, construction considerations, and visual and analytical confirmation testing requirements. Additionally, non-hazardous construction and demolition waste developed on-site as part of the closure project, such as vegetation from clearing and grubbing of the site, may be incorporated into the waste relocation area. A 90 kilovolt (kV) Imperial Irrigation District (IID) electric transmission line is located along the eastern boundary of Hovley Road. Based on the waste delineation study (Appendix C), three poles along this line are potentially located within the limits of existing waste. The waste in the vicinity of these poles has been identified as pre-1980 waste based on newspaper observed in test pit excavations in the waste (Geosyntec, 2010 – Appendix C). Because excavation of waste around these poles may impact the stability of the poles, no waste excavation will be performed within 20 feet of these poles. As such, limited areas of waste outside the Hovley Road right-of-way may remain in place and the final cover system will not extend to cover these areas.

Areas of construction and demolition (C&D) and burn ash waste were discovered near the asphalt paved site entrance from Hovley Road and continuing to the edge of the southern depression area during the Waste Delineation Study (Geosyntec, 2010). The extent of the waste was assumed to be at the toe of the northern facing slopes in the area. This waste will remain in place and be covered with asphalt concrete or compacted aggregate base road surfacing.

Additional areas of waste relocation may be required based on field conditions determined during closure construction. Regulatory agencies will be notified of significant changes to the waste relocation plan.

3.6 River Bank Stabilization System Design

Two meanders of the New River have encroached on the landfill. This encroachment through gradual erosion of the bank has resulted in sloughing and over-steepening of slopes along the northern landfill perimeter access road. Over time, this situation will result in further erosion, entrainment of waste into the river, and possible failure of the larger waste slopes. Therefore, protective measures are needed to reduce erosion as part of closure. It is important that the protective measures are not only engineered to reduce further encroachment into the landfill, but also provide restoration of the riparian corridor that has been truncated by the meanders. Consequently, a minimally invasive technique known as river training will be implemented. River training includes the placement of bendway weirs in the river, longitudinal stone toe protection (LSTP), and on-site native vegetation to enhance the stream bank stability.

3.6.1 Bendway Weirs

Bendway weirs are linear rock structures which extend into the river thalweg at the river bends (meanders). The objective of the weirs is to reduce the bend migration and bank erosion through a reduction in near-bank velocities and redirecting the river energy away from the bank. Design of this protection system was done in close coordination with the USACE expert with bendway weirs, Mr. David Derrick, and the USACE design guidance cited in Appendix G.1. Behavior of the weirs was modeled using two-dimensional finite element river modeling software as described in Appendix G.1, to demonstrate the shift in river energy away from the southern bank toward the central portion of the river.

Weirs will consist of granitic rock and will extend into the river approximately 20 to 25 feet from the south bank. The rock will include a variety of clast sizes, but will generally have a median stone diameter d_{50}, of approximately 1 to 1.5 feet. Weirs will largely be submerged at normal low flow stages. Weirs are spaced between 40 to 60 feet at the two bends and angled upstream to produce the desired hydrodynamic effects. The layout and details of the bendway weirs are shown on the Final Closure Drawings.

3.6.2 Longitudinal Stone Toe Protection

Bendway weirs are designed to function in concert with LSTP, which protects the bank-side portion of the weir from erosion and provides a key to anchor the weir stone. LSTP is generally located below grade and consists of stone generally placed in an excavation parallel to the bank. LSTP will be constructed with granitic stone having a median diameter d_{50} of approximately 1 foot, such that the stone can 'launch' if portions of the bank are compromised by scour. Keys, placed perpendicular to LSTP and comprised of the LSTP stone, are planned as a safety measure in the unlikely event the river scours behind the LSTP. Separate stone keys are provided for some bendway weirs that are not directly keyed into the LSTP.

LSTP is designed to contain approximately 40 cubic feet of rock per lineal foot of these features. LSTP areas along the river will include plantings of on-site native plants, which have demonstrated the ability to thrive in the saline soil and challenging aquatic chemistry of the New River. Common reeds located in the northeastern portion of the property will be removed as part of clearing and grubbing for earthwork. Reed stalks will be harvested and planted as cutting as part of the LSTP. Furthermore, reed root mass will be excavated and placed perpendicular to the LSTP to provide further biotechnical bank stabilization.

Areas above the LSTP up to the 100-year flood stage will be protected similar to the slopes of the landfill. On-site soil will be added to the erosion protection layer below the 100-year flood stage to promote plant propagation. The layout and details of the LSTP are shown on the Final Closure Drawings.

3.6.3 River Bank Stabilization Monitoring Poles

Two erosion monitoring poles will be constructed along the southern bank of the New River as a tool to evaluate the effectiveness of the river bank stabilization (see Section 5.7). The locations and details for the proposed erosion monitoring poles are shown on the Final Closure Drawings.

3.7 Final Cover System Design

Per 27 CCR Sections 21090 and 21140, the final cover system is designed to minimize long-term surface water infiltration into the waste and therefore minimizes the generation of leachate and LFG. The final cover system is also designed to minimize erosion and protect public health and safety by controlling, at a minimum, vectors, fire, odor, litter, and LFG migration.

3.7.1 Regulatory Requirements for Final Cover

The minimum final cover standards for the BSWS, as outlined in the closure and post-closure requirements for Class III Landfills contained in 27 CCR, Section 21090, include:

- Foundation Layer - A minimum two-foot-thick layer of approved soil, contaminated soil, incinerator ash, or other waste materials placed immediately over the entire surface of the last lift of waste. This layer shall have the appropriate engineering properties so as to provide a relatively unyielding surface upon which to place and compact the low hydraulic conductivity layer;
- Low Hydraulic Conductivity Layer - A minimum one-foot-thick layer of low hydraulic conductivity soil containing no waste or leachate placed over the foundation layer. The low hydraulic conductivity soils shall be placed on top of the foundation layer soils and compacted to attain a hydraulic conductivity, which is the lesser of either:
  - $1x10^{-6}$ centimeters per second (cm/sec).
  - The hydraulic conductivity of any bottom liner system or underlying natural geologic materials.

- Erosion Resistant Layer - A minimum one-foot-thick layer of soil containing no waste or leachate placed on top of all portions of the low hydraulic conductivity layer. Vegetation root depths must not exceed the top soil layer thickness. Vegetation is to be replanted, as needed, to provide effective erosion resistance. Alternatively, a mechanically erosion-resistant layer may be constructed which resists wind-scour, raindrop impact, and runoff.

3.7.2 Alternative Final Cover System

Several factors were taken into consideration in evaluating the proposed alternative final cover system design for the BSWS to provide adequate performance. These factors include: 1) regulatory requirements; 2) climatic conditions; 3) material availability; 4) erosion protection; 5) limited potential for vegetation growth; 6) short- and long-term performance; and 7) end use at closure. Due to the arid environment, material availability, constructability, and the factors listed above, a monolithic soil cover, also known as a water balance cover, was selected as the preferred cover system for the final closure of the BSWS.

Approval of alternative final cover systems is allowed in 27 CCR, Section 20080(b) in cases where the discharger demonstrates that:

- The construction of prescriptive standard is not feasible as provided in Section 20080(c), and
- There is a specific engineered alternative that:
  - is consistent with the performance goal addressed by the particular construction or prescriptive standard; and
  - affords equivalent protection against water quality impairment.

As stipulated in 27 CCR Section 20080(c), to establish that the prescriptive standard is not feasible the discharger must demonstrate that the prescriptive standard:

- is unreasonably and unnecessarily burdensome and will cost substantially more than alternatives which meet the criteria in subsection (b) of Section 20080; or
- is impractical and will not promote attainment of applicable performance standards.

Geosyntec has prepared an Alternative Final Cover Performance Analysis for the BSWS which evaluates the performance of the alternative final cover system as compared to the prescriptive final cover. A copy of this analysis is included in Appendix F. Based on this analysis, the proposed alternative monolithic final cover

system provides equivalent or better percolation control, reduces the effects of settlement and animal intrusion, is easier and more economical to construct, and requires less maintenance than the prescriptive final cover.

The proposed alternative final cover system includes the following components, from bottom to top:

- Foundation Layer. A 1-foot thick foundation layer, assumed to be in-place throughout the landfill with the exception of areas of waste relocation. In these areas, a minimum 1-foot soil foundation layer will be constructed in accordance with the project specifications. The top 6 inches of the foundation layer will be scarified and recompacted in areas outside waste relocation.
- Final Cover Soil. A 2.5-foot thick layer of select final cover soil material that will comprise the monolithic cover layer.
- Erosion Protection Layer. A minimum thickness of 6 inches (top deck area) to 8 inches (side slope areas) of pit run rock material will be placed on the surface to provide water and wind erosion control. The pit run rock will be screened to 3 inch minus size for the top deck areas and 4 inch minus size for the side slope areas. A minimum thickness of 3 inches of bedding sand will be placed below the pit run rock material on the side slope areas.

A typical cross-section of the proposed alternative final cover system is shown on Figure 9.

3.7.2.1 Final Cover Soil Material

The Alternative Final Cover Performance Analysis (Appendix F) was based on a field and laboratory investigation from the Holtville Borrow Site performed by Group Delta Consultants, Inc. (Group Delta) in 2011. The Holtville Borrow Site is located at the southeast corner of the intersection of Graeser Road and Holtville Dump Road in Imperial County. Copies of this data are incorporated as appendices to the report presented in Appendix F. Alternative borrow sites may be proposed. ICDPW will notify the RWQCB, LEA, and CalRecycle of changes to the borrow source(s) and related costs, if any.

Material and placement requirements for the soil used for the construction of the final soil cover are presented in the Technical Specifications (Appendix J). Cover soils shall consist of relatively homogeneous soils which are free of debris, sludge, compost, organics and construction debris. The maximum particle size shall be 3 inches, with no greater than 2% by weight retained on the No. 4 sieve and at least 60% passing the No. 200 sieve. Final cover soil shall be classified by the USCS as SM, SC, CL, CH, ML, or

CL-ML and have an average plasticity index of less than 22 per American Society for Testing and Materials (ASTM) Standard D4318. The average saturated hydraulic conductivity of the final cover soil shall be no greater than $2x10^{-5}$ cm/s. Soil materials used for the construction of the proposed monolithic soil cover should be compacted to 90 percent relative compaction and within 3 percent of the optimum moisture content as measured by Modified Proctor test (ASTM D1557). Cover soil not meeting the Technical Specifications require approval by the Engineer and the LEA.

3.7.2.2 Erosion Protection Layer Materials

The uppermost component of the monolithic final cover system is the erosion protection layer. The primary function of this layer is to protect the final cover soil from stormwater and wind erosion.

Calculations for sizing and layer thicknesses for the erosion protection material, including the rock and the bedding layer (for the landfill side slopes) are presented in Appendix H.4. These materials were sized based on the erosional resistance characteristics and filtration characteristics to limit particle migration from adjacent soil layers. Discussion of soil loss analyses is presented in Section 3.8.3. Material and placement requirements for the soil and rock materials used for the construction of the erosion protection layer are presented in the Technical Specifications (Appendix J).

3.7.3 Final Cover Grading

The final grading plan proposed for the BSWS is presented on the Final Closure Drawings. Existing conditions are based on the July 2010 topography. As discussed in Section 3.5, the final closure activities include relocation of waste, reducing the approximate waste footprint from 36.3 acres (prior to waste relocation) to 35.4 acres.

The primary components of the final grading plan include:

- Waste excavation along the northern and western perimeter;
- Relocation and compaction of excavated waste to the existing top deck area;
- Typical waste slopes ranging from 2H:1V along regraded areas along the eastern portion of the north boundary and on the west boundary to 3H:1V;
- Bench for every 50 feet of vertical height on side slopes;

- Placement and compaction of a minimum of 2.5 feet of final cover soil on the existing waste slopes;

- Grading of the top deck area to a minimum slope of 3.5 percent;

- Placement of a minimum of 6 and 8 inches of pit run rock on the top deck and side slopes, respectively, as an erosion protection layer (slope areas will include an additional 3-inch-thick bedding layer beneath the pit run rock layer);

- Construction of a perimeter access road (16-foot wide typical) around the northern, eastern and western boundary of the waste;

- Construction of drainage diversion berms along the crest of the landfill slopes to divert stormwater to drainage control features;

- Placement of engineered fill and grading the topographic depressions south of the landfill to provide drainage to the eastern corner, where it will be collected and pumped to a stormwater discharge point.

- Total fill placement on the order of 210,000 cy, including final cover soil and engineered fill required to backfill the waste excavation areas, to construct the perimeter road, and to promote drainage in the southern and southeastern depression areas.

Additional discussion of the waste relocation is presented in Section 3.5 and in Appendix E. Additional discussion of the drainage components of the grading design is presented in Section 3.8 and Appendix G.2.

3.8 Surface Drainage System Design

A hydrology study for proposed landfill closure conditions was performed in accordance with 27 CCR, Section 20365. The objective of the hydrology study was to design the final closure surface drainage system for the 100-year, 24-hour storm event. The primary function of the surface drainage system is to divert and convey stormwater flows in a controlled manner to limit, to the greatest extent possible, ponding, infiltration, inundation, erosion, slope failure, washout, and overtopping. The following sections describe the existing and proposed drainage control features of the BSWS.

3.8.1 Design Storm Event

The design event is a 100-year, 24-hour storm event in accordance with 27 CCR Section 20365. Rainfall depth from this event is estimated to be 3.6 inches based on rainfall depth duration frequency data for Brawley obtained from the National Oceanic and Atmospheric Administration (NOAA).

3.8.2 Final Closure Drainage Control System

The hydraulic calculations performed to design the final surface drainage control system are presented in Appendix G.2. Details regarding this system are presented on the Final Closure Drawings. The final surface drainage system includes diversion berms, surface channels, down drains, energy dissipaters, and a pumping system. In general, surface water from the landfill will drain to the nearest conveyance system for discharge to the New River via one of five outfalls. The drainage system has been designed to minimize sheet flow over slopes.

Surface water draining toward the north side of the landfill will be collected in down drains, benches and/or rock-lined channels and discharged to the New River in one of the five outfalls. Surface water draining to the northern portion of the perimeter road will sheet flow through vegetation to the New River. Surface water draining toward the west side of the landfill will be collected in a rock-lined channel on the western side of the perimeter road and drain toward the northwest corner of the site where it will discharge to the New River. Surface water draining toward the south side of the landfill will collect in the existing south depression area, where it will be pumped in a buried pipe (force main) along the abandoned portion of Dump Road toward the eastern side of the landfill, where it will discharge to a buried gravity conveyance pipe. This buried gravity conveyance pipe, located along the eastern side of the landfill, will collect stormwater from the southeastern depression area and runoff from the eastern landfill slopes prior to discharge in an outfall to the New River at the northeast corner of the site. Discussion of the system components is presented in the following sections.

3.8.2.1 Earthen Diversion Berms

Earthen diversions berms are proposed to divert the stormwater runoff away from slopes and toward the nearest drainage conveyance. Diversion of stormwater flow away from slopes and toward conveyance structures helps reduce erosion or rill formation on slopes.

3.8.2.2 Surface Channels

Surface channels are incorporated into the drainage design along the benches, access roads, and perimeter roads. The surface channels are designed to be lined with rock to protect against scour and reduce erosion. The bench drains are typically designed to be located on the inboard side of the bench, have an inboard gradient, and have a berm on the outer edge to convey the stormwater runoff to the nearest cross culvert. In some areas, the entire cross section of the bench is used to convey stormwater runoff during the design event.

Access roads are designed to drain inboard toward the landfill with rock-lined channels or other flexible drainage conveyance systems along the inside bench edge on final slope. The access roads are designed with a minimum cross-fill gradient of 2 percent. The perimeter road along the north side of the BSWS is designed to drain outboard into the New River. The north perimeter road collects stormwater runoff from slopes below the middle access road and discharges it as sheet flow to the New River. The north perimeter road is designed such that it is outside of the reevaluated 100-year floodplain limits submitted to FEMA for approval. A rock-lined channel and inlet is proposed on the eastern perimeter road to convey stormwater runoff from the eastern drainage area to the buried gravity conveyance pipe. Drainage conveyance systems are designed to have capacity to convey the design flow with freeboard. Details, calculations, and the design methodology for surface water conveyance are located in Appendix G.2.

3.8.2.3 Down Drains

High density polyethylene (HDPE) pipe or similar conveyance systems anchored at regular intervals along the landfill surface are designed to convey the stormwater runoff from the top deck and concentrated flow locations along the surface channels to the discharge locations. Down drain discharge will be conveyed across access and perimeter roads using culverts. Culverts will consist of HDPE pipe or similar with a grated inlet or junction box. A typical detail showing these features is shown in the Final Closure Drawings.

3.8.2.4 Energy Dissipaters

Riprap energy dissipaters are proposed at five outfall locations along the New River and at the toe of the down drains that discharge to the south and southeast depression areas. The riprap to be placed at the outfalls at the New River is sized based on the forces acting on the rock, and based on the river 100-year design event, as all the outfall locations along the New River are within the 100-year floodplain limit. Riprap to be

placed at the toe of down drains in the two depressions is based on the 100-year, 24-hour storm event.

3.8.2.5 Pumping Systems

A pumping system, including a submersible pump, catch basin/pump house and associated conveyance piping, is incorporated into the drainage design to route the stormwater runoff which drains to the south depression area. The stormwater temporarily stored in this depression area will be routed within 72 hours of the storm event as required by the County of Imperial (2008). Assumptions and calculations performed to design the pump and conveyance piping size are presented in Appendix G.2.

A submersible pump with auto switch levels will be housed inside a concrete catch basin/pump house with a grated steel cover. Typical details for the pump and catch basin are presented in the Final Closure Drawings. The pump will be powered from the nearby electric source via a buried conduit. The electric pump motor is rated as 15 hp, and will require 3 phase, 440 V, and 60 amp electric services. The pumping system will include a control panel, float switches and automatic alarms.

A buried PVC pipe or similar will convey the pumped stormwater to the proposed manhole along the eastern perimeter of the BSWS as shown on Sheets 21 and 22 of the Final Closure Drawings.

3.8.3 Soil Loss

The potential soil loss due to stormwater erosion and wind erosion was evaluated for the BSWS design, including the erosion protection layer. Assumptions and calculations performed to estimate the soil loss for BSWS are presented in Appendix G.3.

The revised Universal Soil Loss Equation was used to evaluate the potential soil loss from BSWS from stormwater erosion. The USDA Wind Erosion Equation was used to evaluate the potential soil loss from BSWS from wind erosion.

After final closure, the potential for soil loss will be significantly reduced by the erosion protection layer. The estimated average soil loss due to stormwater and wind erosion after closure is estimated to be on the order of 0.6 tons/acre/year, which is below the two tons/acre/year accepted by CalRecycle. Over the 30-year post-closure maintenance period, the average soil loss due to stormwater and wind represents approximately 0.3 percent of the total final cover thickness.

3.9 Geotechnical Design Considerations

Geotechnical engineering calculations and analyses were performed to serve as the basis of the design of the final closure system for BSWS. These calculations include:

- Seismic hazards;
- Slope stability;
- Settlement; and
- Erosion protection layer design.

Discussions regarding these design considerations are presented in the following sections. Detailed information regarding these design components is presented in Appendix H.

3.9.1 Seismic Hazards

3.9.1.1 Strong Ground Motions

Geosyntec performed a deterministic seismic hazard analysis for the Site. The analysis was performed for Maximum Credible Earthquake (MCE) in accordance with 27 CCR Section 21750(f)(5). The design event for the site is a moment magnitude (M_w) 6.5 event on the Brawley Fault located approximately 0.53 miles (0.86 kilometers) from the site. The resulting peak horizontal ground acceleration (PHGA) from this event is on the order of 0.50g based on median values using the suite of Next Generation Attenuation (NGA) relationships. Detailed information regarding the design ground motions is presented in Appendix H.1.

3.9.1.2 Soil Liquefaction

Seismically-induced soil liquefaction can be described as a significant loss of strength and stiffness due to cyclic pore water pressure generation from seismic shaking or other large cyclic loading. The material types considered most susceptible to liquefaction are granular soils and low-plasticity fine grained soils which are saturated and loose to medium dense. Manifestations of soil liquefaction can include the loss of bearing capacity below foundations, surface settlements and tilting in level ground, instabilities in areas of sloping ground, and increased lateral and uplift pressures on buried structures.

Standard Penetration Tests (SPT) blowcounts within soil below the groundwater were 50 or greater, indicating that the native soils below groundwater are dense to very dense

(BAS/GLA, 2001). Due to the relatively dense nature of the subsurface materials below the BSWS, the probability of soil liquefaction adversely impacting the project is low.

3.9.1.3 Secondary Effects

The secondary effects of seismic activity include liquefaction-induced settlement, lateral spreading, tsunamis and seiches. The probability of occurrence of each depends on the severity of earthquake, distance from the epicenter, faulting mechanism, topography, soil and groundwater conditions, and other factors.

Due to the very low potential for soil liquefaction, the potential for seismic settlement and lateral spreading adversely impacting the project is also considered very low. Due to the inland site location and distance from a large body of water, the potential for a tsunami or seiche to affect the site is extremely low.

3.9.2 Slope Stability

3.9.2.1 Global Stability

Limit equilibrium slope stability analyses were performed to evaluate the static stability of the final landfill slopes. The analyses are presented in Appendix H.2. The design process involved performing a number of two-dimensional analyses on various cross sections of the landfill. The critical element of the design was typically the steepness of the landfill side slopes. Two-dimensional slope stability analyses were performed on 7 representative cross sections selected by inspection, considering maximum waste thickness and slope inclination. A groundwater level of 824 ft NAVD 88 was used for the analyses.

The two-dimensional analyses were performed using the modified Spencer's Method of Slices as coded in the computer program SLOPE/W (Version 6.22, www.geoslope.com). The modified Spencer's Method of Slices satisfies both moment and force equilibrium by assuming a constant inclination of inter-slice shear force. For each cross section analyzed, the program searches for the sliding surface that produces the lowest factor of safety. Factors of safety are defined as the ratio of the shear forces/moments resisting movement along a sliding surface to the forces/moments driving the instability.

Soil properties used for the stability analyses were selected based on the results of the site characterization described in BAS/GLA (2001), borings, Standard Penetration Test (SPT) blowcounts, laboratory tests performed on the proposed cover material for the closure design, published information, and engineering judgment. The material

properties for the final cover were based on the results of laboratory testing and engineering judgment. The material properties of the waste fill was based on published data (Kavazanjian et al., 1995).

The native soils were modeled as a single unit (either sand or clay) under static (drained) and pseudo-static (undrained) conditions. Under drained conditions, the material properties for the sandy and clayey native soils were modeled based on the results of laboratory testing by others (BAS/GLA, 2001). The sandy native soils were considered to behave in a drained manner. When modeled under undrained conditions, the clayey native soils below the groundwater were modeled with an undrained shear strength as a function of depth that was established from an empirical correlation to SPT blowcounts.

The results of the static slope stability analyses are summarized in Appendix H.2. A minimum factor of safety of 1.5 for static conditions was found in all sections analyzed, as required by 27 CCR §21750(f)(5). Cross Section E-E' on the northern slope in the area of river bank stabilization produced the lowest calculated factor of safety of approximately 2.0 and 1.7 for the sandy and clayey native soil models, respectively.

Pseudo-static slope stability analyses were performed to determine yield acceleration (k_y) values. This procedure is based on determining a sustained lateral acceleration which produces a safety factor of 1.0 (theoretical slope yielding). Cross Section E-E' produced the lowest calculated yield acceleration of 0.21 g. As could be expected, slopes having higher static factors of safety generally have higher yield accelerations.

Seismically-induced maximum permanent displacements of waste mass were evaluated using the Newmark (1965) approach as implemented in the Bray and Travasarou (2007) seismic displacement evaluation method. Detailed seismic deformation analyses are provided in Appendix H.1. The analyses indicated estimated seismic deformations on the order of 4 inches or less for the selected stability cross sections. The calculated displacements are less than 12 inches which is considered the current state of practice in California for unlined landfills.

3.9.2.2 Final Cover Veneer Stability

The veneer slope stability of the final cover system inclined on a 2H:1V side slope was evaluated using the methodology outlined by Matasovic (1991). The cover stability was evaluated for long-term static conditions, short-term seepage conditions, and short-term seismic conditions. The analyses are presented in Appendix H.2. The analyses considered the various strength parameters (cohesion and friction angle) required to

achieve minimum factors of safety for each of the conditions analyzed, including static seepage, and pseudostatic conditions. Strength testing on the proposed BSWS final cover borrow source materials indicate strength parameters resulting in the static factors of safety exceeding 1.5 and seismically-induced displacements less than the current state of practice for unlined landfill (typically 12 inches, Seed and Bonaparte, 1992).

3.9.2.3 Results

Based on the results of the analyses, the waste mass and the proposed final cover was found to have a long term static factor of safety greater than 1.5 as required by 27 CCR 21750(f)(5). In addition, the estimated seismically-induced permanent displacements are within acceptable levels established by the current state of practice.

3.9.3 Settlement Analysis

Settlement at the BSWS during the post-closure period was estimated to evaluate the performance of the landfill, including the final cover system. Performance of a monolithic final cover system is not as sensitive to settlement as a cover with a barrier layer (e.g., clay or geomembrane). The primary impacts of settlement on a monolithic cover would be differential settlement resulting in grade reversals and/or ponding. Analyses were performed to evaluate the settlement of the waste and the underlying native soils and are included in Appendix H.3.

3.9.3.1 Waste Settlement

The estimated magnitude of waste settlement was used to evaluate the impact of settlement on the final cover system performance, including the likelihood of grade reversals and ponding. The waste settlement calculations are presented in Appendix H.3.

The settlement of waste includes primary settlement and secondary compression (Sharma and Lewis, 1994). Primary settlement due to elastic compression of waste occurs within a few months of load placement. Secondary compression occurs over several years after load placement. The mechanisms of waste settlement are complex because of the extreme heterogeneity of waste fill and the presence of large voids. Edil et al. (1990) suggest that the primary mechanisms involved in waste settlement include:

- Mechanical compression (e.g., densification, distortion, bending, crushing, and reorientation);
- Raveling of finer particles into large voids or cavities within the fill;

- Physical-chemical change due to corrosion, oxidation, and combustion; and
- Bio-chemical decomposition due to aerobic and anaerobic processes.

For the BSWS, settlement magnitude was estimated at selected points on the landfill surface spaced at 150 ft intervals. Based on the surrounding topography, previous site explorations, and previous evaluations by others, the bottom of waste elevation was modeled at 834 ft NAVD 88. The bottom of waste elevation was compared to existing elevations to estimate the waste thicknesses at each of the calculation points and the existing elevations were compared to proposed final cover elevations to estimate final cover thicknesses at each of the calculation points.

Settlement due to secondary compression is caused by creep and biochemical degradation of the waste. Secondary settlement was calculated from the placement of the final cover to the end of the post-closure maintenance period (assumed to be 30 years).

The estimated waste settlement due to primary settlement and secondary compression ranges from 0.8 feet to 4.5 feet. Evaluation of the pre-settlement elevations and post-settlement elevations on the top deck of the landfill suggest that no significant grade reversals are anticipated. Furthermore, waste settlement in the side slope areas of the landfill will tend to 'lay back' the landfill slopes due to greater settlement at the center of the landfill and less at the perimeter. Due to the proposed inclination of the landfill slopes, no grade reversals are anticipated in these areas.

Due to inherent heterogeneity of landfills, localized zones of differential settlement and potential ponding are expected at all municipal solid waste landfills. Routine monitoring as discussed in the Post-Closure Maintenance Plan (Section 5) will identify potential areas of settlement and/or ponding, and maintenance will be performed as necessary.

3.9.3.2 Foundation Settlement

The maximum estimated settlement of the native soil resulting from placement of the monolithic final cover material and/or relocated waste is conservatively estimated to be on the order of 2.5 inches. It is unlikely that settlement of the native soils would cause significant strains in the monolithic final cover. There is no active leachate collection system at the site; therefore, the impact of subgrade settlement on the landfill containment systems is considered negligible.

3.10 Environmental Control Monitoring System Design

3.10.1 Landfill Gas Monitoring System

As discussed in Section 2.6.6 and Section 2.12.1 and as shown on Figure 3, the current LFG monitoring system consists of 11 LFG probes which are monitored in accordance with the approved LFG monitoring plan included in Appendix P. No additional LFG probes are planned to be installed as part of closure since the current system meets the requirements of 27 CCR Section 20925.

3.10.2 Landfill Gas Control/Migration Monitoring System

The BSWS has perimeter gas probes for monitoring LFG quarterly. During previous the monitoring events, methane levels exceeding 5% methane by volume have been detected in two perimeter probes, which have been an indication of lateral LFG migration. The site is required per 27 CCR Section 20939 to mitigate migration at the permitted facility boundary. Potential mitigation measures may include installation of an active LFG collection and control system (GCCS), installation of a passive barrier-type system, and/or air injection systems.

To meet this requirement for LFG control for closure, the ICDPW conducted a LFG pilot study in 2011 at the BSWS in an effort to evaluate a proposed LFG remediation system. The findings and recommendations of the LFG pilot study indicate that a GCCS could be used to control offsite LFG migration at the BSWS. In February 2012, ICDPW installed a GCCS system. The GCCS consists of three extraction wells, LFG conveyance pipes, and LFG control system including blower operating on electricity, an air-water separation tank, a condensate collection batch tank, a heat exchanger, granular activated carbon (GAC) drums and a remote monitoring system based on wireless technology. A dedicated 240 volt, 3 phase and 200 amps service meter was also installed to power the GCCS operations at the site. A layout of the existing GCCS system is provided on Sheets 3, 5 and 16 of the Closure Drawings. The GCCS system was permitted with ICAPCD. The ICDPW operates the GCCS and performs periodic monitoring, inspection and maintenance including evaluation of LFG effluent concentration, operating parameters, and proper off-site disposal of spent carbon and condensate. The GCCS system also includes a remote monitoring system as part of continuous operations and maintenance at the BSWS. The GCCS Operation and Maintenance Plan is provided in Appendix R.

Modifications to the GCCS including may be required during the post-closure period to reflect changing on-site and adjacent land uses. ICPDW may request a reduction of

monitoring or control activities based upon the results of monitoring data collected and submitted to the LEA and CalRecycle.

3.10.3 Groundwater Monitoring System

As discussed in Section 2.12 and as shown on Figure 3, the current groundwater monitoring system consists of four groundwater monitoring wells which are monitored in accordance with the Sampling and Analysis Plan included in Appendix D. No additional groundwater monitoring wells are planned to be installed as part of closure since the current system meets the requirements of 27 CCR Section 20380 through 20435.

3.10.4 Leachate Collection and Removal System

The BSWS operated prior to 1972 as presented in Section 1.2.2. The site construction and operation predates many components of current landfill design criteria, including the requirements to install a liner system and LCRS. As such, no LCRS exists or will be installed at the site. No leachate production has been observed to date and leachate production is not anticipated at the site in the future. This lack of observed leachate is consistent with other landfills in arid environments and is primarily due to the low precipitation and high evaporation characteristics of the site area.

3.11 Access Roads

Vehicular access to the BSWS is provided by access roads around the site perimeter and to the top deck. The perimeter road will be surfaced with 4 inches of aggregate base. Landfill access roads to the top deck will be surfaced with the erosion protection material described in Section 3.7.2.2. Requirements for aggregate size and gradation of the perimeter road and landfill top deck access road surfacing materials are contained in the Technical Specifications. The access roads are presented on the Final Closure Drawings and have gradients ranging from approximately 1 percent to 12 percent, and incorporate minimum cross-slope drainage of approximately 2 percent and/or drainage channels on the inboard or outboard sides of the road.

3.12 Site Security

ICDPW will secure points of site access with a lock and gate and place signs at access points prohibiting unauthorized entry. These measures are intended to reduce incidents of vandalism and illegal disposal of wastes during the post-closure maintenance period.

In accordance with 27 CCR, Section 21135, all points of access to the site were restricted as of the date of the final waste shipment. Site security at the BSWS is currently provided by a locking gate and chain-link fence around the south, east, and west sides of the site as shown on Figure 3. No fencing exists along the northern site boundary since access is restricted by steep slopes along the New River.

At closure, fencing will be constructed (or existing fence relocated) along the southeast, east and west boundaries of the BSWS. Fencing has been constructed on the southern perimeter along an easement from the Riverview Cemetery. A copy of the easement agreement is included in Appendix A. Notice and Order No. EA-2011-03 directs the southern perimeter fence to be constructed by 18 October 2011. No fencing is proposed along the northern site boundary since access is restricted by steep slopes along the New River. Additional security will be provided by replacing or reinstalling the existing site gates at closure.

3.13 Survey Monuments

In accordance with 27 CCR, Section 20950(d), at least two permanent survey monuments currently exist at the landfill to provide controls for facilities constructed during closure, the location and elevation of wastes, containment structures and monitoring facilities can be determined throughout the post-closure maintenance period, and controls can be provided from which to monitor future landfill settlement. These existing survey monuments are presented on Sheet 3 of the Final Closure Drawings.

4. FINAL CLOSURE CONSTRUCTION SCHEDULE AND CONSTRUCTION CONSIDERATIONS

4.1 Notice of Closure

Signage will be posted at the BSWS for the post-closure period. The operator's name and contact information will be provided as an emergency contact for the public.

4.2 Additional Permitting Requirements

4.2.1 CEQA

The final closure project described in this FCPCMP is currently being evaluated in accordance with the requirements of the California Environmental Quality Act (CEQA). The County Planning and Development Services department compiled the CEQA document and the Imperial County Environmental Evaluation Committee approved a Mitigated Negative Declaration for the project on 26 April 2012. It is anticipated the CEQA determination will be final by 1 July 2012, following the Planning Commission hearing scheduled in June 2012.

4.2.2 River Work Permitting

Permits required for the river-related work include a 404 Permit with the USACE, a 401 Water Quality Certification with the RWQCB, and a 1602 Stream Alteration Permit with the CDFG. All permit applications will be done concurrently, and typically the order of approval is 401, 404, then 1602. It is anticipated that the river work will be permitted separately by the USACE under one or more nationwide or regional permits or alternatively under an individual permit.

4.3 Closure Process

Time frames for closure activities for the BSWS were stipulated by Amended Notice and Order No. 2008-04 issues by the LEA on 30 November 2009 and the 2002 Participation Agreement between ICDPW and CIWMB provided in Appendix A. Amended Notice and Order No. 2008-04 dictates the following:

- Maintain the cessation of operations at the BSWS;
- Install the perimeter landfill gas monitoring probe network and fully implement the approved Landfill Gas Monitoring Plan by 31 December 2009;

- Submit and approved FCPCMP on or before 18 October 2010;
- Initiate closure construction at the site on or before 18 April 2011; and
- Submit the final certification of closure and CQA report for the BSWS prior to 18 October 2011.

The closure construction process will begin after regulatory approval of the FCPCMP and other regulatory permits and approvals (see Section 4.2 above), completion of final construction-level design, preparation of a bid package, bidding and award to a qualified contractor, and the subsequent issuance of notice to proceed.

A closure implementation schedule for the BSWS is presented in Figure 8, which delineates the estimated time frame to complete the closure tasks described in this FCPCMP. The estimated time frame for completion of all of the construction activities for closure of the site is approximately 7 months.

4.4 Construction Management

A construction management team will be utilized during construction. The team will be under the direction of a Construction Manager (CM), who will be responsible for supervision of construction of the various features included in the closure plan. The CM will coordinate the activities of the on-site contractors and will provide liaison among the design engineers, the ICDPW, Construction Quality Assurance (CQA) staff, and the contractor(s). Other key staff will include a Deputy Director and Construction Inspector(s). A survey crew and CQA staff will be present on-site, as required.

4.5 Survey Control

The survey control crew, under the direction of the contractor, will be responsible for location of the closure plan improvements and for record drawing information. They will be responsible for establishing that the various components of the cover conform to grade and/or thickness requirements of the Final Closure Drawings and Technical Specifications.

4.6 Labor Transition Plan

In accordance with Section 43501.5 to the Public Resources Code and 27 CCR Section 21785, ICDPW has developed a Labor Transition Plan, which is included as Appendix I of this FCPCMP.

4.7 Technical Specifications

Detailed permit level technical specifications for final closure construction for the BSWS are presented in Appendix J. These specifications cover components of the closure construction including, but not limited to:

- Health and safety;
- Stormwater controls;
- Earthwork;
- Waste relocation;
- River improvements;
- Drainage features; and
- Concrete work.

The specifications provide requirements for construction submittals, products, execution, and measurement and payment. The permit-level technical specifications provided in Appendix J will be updated to construction-level specifications prior to construction. Necessary regulatory agencies will be notified of changes to the Technical Specifications prior to implementation.

Due to the potential for continued waste settlement during the closure permitting and bidding process, final design grades shown in the Final Closure Drawings should be considered approximate. Project grading control will be based on minimum material thicknesses and slope grades.

4.8 Construction Quality Assurance Plan

The purpose of the CQA Plan is to address the quality assurance procedures and monitoring requirements for closure construction. The CQA plan is intended to: 1) define the responsibilities of parties involved with the construction; 2) provide guidance for the proper construction of the major components of the project; 3) establish testing protocols; 4) establish guidelines for construction documentation; and 4) provide the means for assuring that the project is constructed in conformance with applicable regulatory requirements, Technical Specifications, and Final Closure Drawings. The CQA Plan addresses CQA consultant activities required during closure

construction. Implementation of CQA programs is an established method for improving the performance of constructed facilities and for documenting the quality of the construction.

27 CCR Sections 20323 and 20324 require landfill closure construction to be performed in accordance with a CQA plan certified by a California-registered civil engineer or engineering geologist. The CQA Plan for the final closure construction of BSWS is provided in Appendix K of this FCPCMP.

4.8.1.1 Final CQA Report

Within 180 days (or as dictated by enforcement directives) of the completion of closure activities at the BSWS, a Final CQA Report will be submitted to CalRecycle, RWQCB, and LEA acknowledging: 1) that the work has been performed in compliance with the Final Closure Drawings, the Technical Specifications, and approved changes; 2) physical sampling and testing has been conducted at the appropriate frequencies specified in the CQA Plan; and 3) that the required CQA documentation has been completed.

The CQA Report will include, but is not limited to, the following items:

- Summaries of construction activities;
- Summaries of approved deviations from the design or specifications;
- Approved contractors submittals, as appropriate;
- Documentation of CQA testing;
- As-built costs of closure in the same arrangement as estimated closure costs in this FCPCMP;
- Record drawings as outlined in the Technical Specifications; and
- Certification by a California-licensed civil engineer or engineering geologist.

In accordance with 27 CCR 21800(b), the owner will amend this FCPCMP to include the final closure certification, final as-built drawings and details, completed closure costs and implementation schedule, and any other supporting documents to support closure certification.

4.9 Closure Construction Considerations

The closure project elements are discussed in Section 3 above. Consideration for each element of the project was evaluated with respect to the project construction and unusual project conditions and project elements which could potentially affect the public and surrounding properties. General construction considerations for the project include the preparation by the Contractor of a project-specific Health and Safety Plan (HASP) and a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the California General Permit for Discharges of Storm Water Associated with Construction Activity. The Contractor will need to develop a SWPPP and the project Owner will need to submit the SWPPP and obtain a Waste Discharge Identification number prior to the start of construction. In addition, the construction site will require interim and final fencing around the project to protect the safety of the public during and after construction.

Construction considerations were evaluated separately for the final cover and drainage system and the river bank stabilization as described below.

4.9.1 Final Cover and Drainage System Considerations

Due to the need to import soil and rock for the soil cover and the erosion protection rock, a traffic control plan will need to be prepared for the project. As landfill waste will be exposed on the project during the waste relocation, the project plans and specifications have been adapted to control the potential odor and vector issues which could potentially affect the surrounding community. These issues are addressed in the Waste Relocation Plan (Appendix E).

During and at the completion of the project, the proposed pump station for drainage water will need to be maintained. Access to the pump will need to be maintained to allow for pump maintenance and cleaning.

Water will be required for soil compaction and dust control during construction. The contractor will identify an appropriate source of water to be used at the site for construction water, such as the fire hydrant on North Imperial Avenue, southeast of the site, and obtain the necessary permits for use of the water.

4.9.2 River Bank Stabilization Considerations

The depth and fast current of the New River require special attention from workers and will require water safety measures be implemented during construction. In addition, as the New River is environmentally impacted, workers will need to be protected during

construction. Safety is of paramount importance on this project. Prior to beginning construction as designated in the project specifications, the contractor will be required to designate proper personal protective equipment (PPE) and/or engineering controls to be used by the on-site workers working near the river. The contractor shall implement the use of PPE and engineering controls throughout the project.

One of the project elements included widening of the access road along the northern boundary of the landfill. Widening of the access road may require encroachment into the river or areas of the surrounding area affected by the river. These areas may require ground improvement or reinforcement using gravel or geosynthetic materials, which will be evaluated during construction as the subsurface is exposed. The contractor will be prepared to address these ground improvement areas as indicated in the project specifications.

4.10 Recording

Regulatory requirements dictate that, upon completion of closure construction activities, a survey record of the closed landfill be established and recorded with the title of the property with the County Recorder's office and copies made available to the CalRecycle, LEA and kept in the operating record. The survey of record shall include the following information:

- The date closure construction was completed.
- Boundaries of the disposal area.
- The location and telephone number of where the closure and post-closure plans can be reviewed.
- A statement that future site use is restricted in accordance with the post-closure maintenance plan.

Per 40 CFR Section 258.60(i), a notation on the deed to the landfill facility property will be made, the State will be notified that the notation has been recorded, and a copy has been placed in the facility operating record.

5. FINAL POST-CLOSURE MAINTENANCE PLAN

5.1 Introduction

Post-closure maintenance of the closed BSWS will be performed in accordance with the applicable regulations presented in 27 CCR, Chapters 3 and 4, and Subtitle D Section 258.61. The FCPCMP is regulated by 27 CCR Section 21830, and provides a plan for the inspection, maintenance, and monitoring of the landfill during the post-closure maintenance period. The FCPCMP serves as a "living" document and, in accordance with 27 CCR Section 21890, is to be updated as necessary, as post-closure site conditions dictate, or at least every five years.

It is expected that modifications to the monitoring program frequency and protocols will take place, due to changing conditions, monitoring results, and advancing technology. This FCPCMP will be amended to include any changes in the monitoring program or modifications to the system including any proposed remediation systems. Amendments to an approved plan will meet requirements of 27 CCR, Section 21890, and shall, upon concurrence with the LEA, be approved by CalRecycle and RWQCB as appropriate.

The responsible party who will be involved in post-closure maintenance and monitoring activities at the BSWS is presented Section 1.2.3. Should the title to the site be transferred during closure and/or post-closure maintenance, the new owner shall be notified by the previous owner or their agent of the existence of the 27 CCR standards and of the conditions and agreements assigned to assure compliance. In accordance with 27 CCR, Section 21200, the previous owner shall notify the LEA of the change in writing within 30 days and shall provide the name, firm, mailing address and telephone of the new owner. Questions pertaining to the FCPCMP should be directed to the ICDPW.

Post-closure maintenance and monitoring of the BSWS will include the following systems: LFG monitoring, groundwater monitoring, final cover, surface water drainage, river stabilization system, access roads, settlement monitoring, and security systems.

5.2 Post-Closure End Use

The currently proposed post-closure use for the BSWS will be non-irrigated open space. Current closure and post-closure requirements limit end use options in order to maintain the integrity of the final cover surface. The LEA, RWQCB, ICAPCD, and local land use agency must review and/or approve any proposed changes to the currently proposed

post-closure end use in accordance with 27 CCR, Section 21190. There are no structures planned to be constructed on the site.

5.3 Emergency Response Plan

An emergency response plan (ERP) has been prepared for the site in accordance with 27 CCR Sections 21130 and 21132 and identifies potential events that may exceed the design of the site and endanger public health or the environment. The ERP also describes specific procedures that minimize these hazards to protect public health and safety. A copy of the ERP is included in Appendix L.

5.4 Equipment, Material, and Labor Requirements

5.4.1 Equipment and Materials

Any required equipment and materials for post-closure monitoring and maintenance that are not available from the ICDPW will be rented or procured as needed.

5.4.2 Labor

The labor necessary to monitor and maintain the BSWS during post-closure will be assembled from the ICDPW and their contractors. The schedule for the post-closure monitoring activities is presented in Table 3. The schedule for the post-closure maintenance activities is shown on Table 4, and identifies the frequency of mandatory inspections for the various systems.

5.5 Operating Record

The ICDPW will continue to maintain an operating record in accordance with State and Federal regulations under 27 CCR Section 20515, and Subtitle D Section 258.29. Closure and post-closure activities will be documented in the operating record and will include, but will not be limited to, the following information:

- Inspection and training records;
- Groundwater, surface water, and gas monitoring, testing or analytical data and any remediation plans;
- Closure and post-closure maintenance plans;
- Notice of intent to close the unit;
- Notice of certification of closure;

- Deed notation;
- Cost estimates and financial assurance documentation.

Approvals, determinations and other requirements authorized by the LEA under 27 CCR Sections 20510 through 20945, shall be documented in writing to the operator and placed in the operating record in accordance with 27 CCR, Section 20517.

The operating record will be maintained at the ICDPW Main Office since there are no facilities at the BSWS. CalRecycle has been notified of the alternative location of the operating record. The records are available for inspection during normal business hours by authorized representatives of those regulatory agencies having jurisdiction over the BSWS.

5.6 Inspections

The post-closure maintenance program is an inspection program used to detect problems and potential problems before they become serious. ICDPW will perform regular quarterly inspections of the site. The inspections will include visual evaluation of the following:

- General site condition;
- The condition of the landfill cover system, including the top deck, benches, and side slopes (note any ponding or evidence of significant settlement, erosion, or exposed waste);
- The condition of stormwater conveyance systems;
- The effectiveness of erosion control BMPs;
- The condition of water quality monitoring networks;
- The status/condition of the LFG monitoring system and LFG control system;
- The status/condition of site security features;
- Maintenance activities performed at the site;
- Condition, location, and source of temporary soil stockpiles at the site, if appropriate;

Detailed criteria for inspections are presented in the sections below. Additional inspections and monitoring events may be performed as required, including following significant seismic or precipitation events. A sample post-closure inspection form is presented in Appendix M. A written summary will be prepared for all inspections and will be maintained as part of the operating record.

In the event that a deficiency is identified during inspection, the following steps will be followed:

1. A field inspector notices a problem during a site visit. The inspector identifies the problem cause, severity, and potentially a proposed solution or further inspection on the site inspection report.

2. The inspection report is given to the inspector's supervisor or engineer who will review the problem and assign a field crew or consultant to address the problem. The supervisor or engineer will notify the ICDPW staff. If required, the appropriate enforcement agency (RWQCB, LEA, or APCD for example) will be notified of the action and expected remedy date.

3. The inspector's supervisor or engineer will track the progress of the solution and will adjust field work as needed until completion.

4. Upon the correction of the deficiency, the field crew supervisor or consultant will report the completion to the engineer. The inspector or engineer field confirms the adequacy of the corrective action and informs ICPDW staff and any appropriate enforcement agency as necessary.

By following this procedure, a method is established to identify problems, correct the situation, and establish responsibility for timeliness and adequacy of the solution.

5.7 River Bank Stabilization Maintenance

Protective measures designed for the New River are designed to provide a low maintenance biotechnical stabilization. These measures include the bendway weirs, LSTP, and planting. Bendway weirs will not be visible and will be submerged during the normal low flow. Areas where LSTP is exposed should be checked annually or after a significant flood event (25-year or greater) in the New River watershed. LSTP slopes should be visually inspected for areas that may be over-steepened, indicating that the stone has "launched" as a result of base scour. These areas should be visually monitored annually to ensure that the LSTP remains on the bank surface. In addition, after very large flood events (100-year or greater), the areas bordering the New River

should be checked to make sure the river channel remains outside the protective measures, and to assess if protective measures are needed elsewhere along the southern bank in the area of the BSWS. Visual observation of the distance between the erosion monitoring poles and the river bank edge will be recorded during annual inspections.

LSTP and bendway weirs are designed to be essentially maintenance free. Some maintenance may be necessary for the biological component of the stabilization to promote vegetation growth near the LSTP.

5.8 Final Cover System Monitoring and Maintenance

The purpose of the final cover monitoring program is to minimize stormwater infiltration into the landfill, isolate buried wastes, promote drainage, and minimize erosion by maintaining the integrity of the cover.

5.8.1 Final Cover Monitoring

Inspections of the final cover will be performed on a quarterly basis by walking the site to visually observe for items including, but not limited to:

- Erosion or sediment accumulations;
- Visible depressions;
- Exposed waste;
- Ponded water;
- Damage from equipment operation;
- Differential settlement;
- Slope failure;
- Leachate seeps;
- Odors; and
- Cracks.

In addition to the routine quarterly inspections, the site will be inspected following a major storm event, seismic event, or other natural disaster for impacts to the final cover in accordance with the Emergency Response Plan (Appendix L).

5.8.2 Final Cover Maintenance

The proposed final cover system for the BSWS is described in detail in Section 3.7. Final cover repair and/or reconstruction activities will be conducted in a manner maintaining the integrity of the as-built final cover system, and should be consistent with the final cover construction.

Potential final cover damages requiring maintenance include:

- Penetration into or through the final cover;
- Settlement related cracking;
- Settlement related depressions, ponding, and/or surface erosion;
- Local surficial slumping on slopes; and
- Invasive plants.

Final cover deficiencies will be identified during regular or unscheduled inspections (e.g., post-seismic event) and mitigation plans will be determined in accordance with the protocols discussed in Section 5.6.

Final cover repair activities will be conducted and documented, including the location and extent of the repair, as specified in the CQA Plan included as part of Appendix K. A California-registered engineer or certified engineering geologist should observe and certify repairs to the final cover, as appropriate.

The final soil materials which comprise the final cover may dry over time and, as a result, some shrinkage cracking is anticipated. In the event that cracking is observed or suspected, the depth and extent of cracking will be investigated. The cracks will be excavated to the maximum extent of the crack and the final cover soil will be recompacted in accordance with requirements of the final closure project specifications. Alternative methods of repair, such as grouting, may be utilized providing the method maintains the integrity of the final cover system. Grouting should be performed by a licensed contractor with experience in this type of application.

Repair of depressions, ponding, or surface erosion which interfere with the controlled flow and discharge of surface waters from the final cover will be completed on an as-needed basis. The final cover system components should be reconstructed to the minimum thicknesses presented in Section 3.7.2 and at the same placement conditions presented in the final closure project specification. Surface erosion cuts exceeding the depth of the erosion protection layer (e.g. greater than 6 inches on the top deck) and

extending into the final cover soil shall be repaired under the supervision of an engineer consistent with the CQA Plan and the repairs shall be certified to conform with the Final Closure Plan. Areas of significant settlement, ponding and erosion as well as areas of significant repair will be documented in the operating record.

No discharges of leachate, gas condensate, or other waste liquids will be made to the final cover system. Watering for dust control during maintenance repairs will be used as necessary.

5.8.3 Invasive Plants

No significant vegetation growth is anticipated on the final cover system. However, removal of invasive plants with deep root systems will be performed as necessary. Removals will concentrate on plants which may threaten cover integrity by possessing root systems deeper than 24 inches.

5.9 Landfill Settlement Monitoring and Maintenance

5.9.1 Settlement Monitoring

Existing survey monuments located outside the waste footprint for survey control are discussed in Section 3.13 and presented on Sheet 3 of the Final Closure Drawings.

5.9.2 Settlement Monitoring Reporting

27 CCR Section 21090(e)(2) requires operators to produce an iso-settlement map every five years throughout the post-closure maintenance period. Control points for the aerial survey should be located on firm ground outside of the waste footprint. Aerial topographic and iso-settlement maps will be generated to provide an updated contour map of the disposal area. The maps will be drawn to the same scale and contour interval as the as-built final closure topography.

5.10 Drainage Control System Monitoring and Maintenance

The landfill drainage facilities must be operational and free of debris. Maintenance of the drainage system is based on the site inspection program to identify potential and existing problems, and the general program of responsible and timely corrective action. Inspections will be performed quarterly and after each heavy rainfall or significant seismic event. Inspections will include review of the site for the following conditions:

- Open channel and ditches are draining and free of debris;

- Areas of excessive sedimentation or scour;
- Pumping systems are operable and in good condition;
- Diversion berms are intact and operable;
- Downdrains are free of debris and vegetation and cracks;

Deficiencies will be noted and addressed in accordance with the procedures presented in Section 5.6.

Removal of sediment (either silt or windblown sand) in rock-lined channels may be accomplished with a leaf blower or other equipment suitable for sediment removal that will not damage the rock-lined channels or surrounding facilities.

In addition, visual inspection of concrete components will be conducted to identify deficiencies such as cracking, settlement, or spalling. The following corrective measures may be taken for deficiencies identified during the inspection, as appropriate:

- Cracking
  - Construction of expansion/control joints.
  - Placement of sealants such as epoxy resins, asphaltic material, thermo plastics, silicones, etc.
- Settlement
  - Grout injection
  - Complete replacement with subgrade rework
- Spalling
  - Sandblast affected area and resurface.
  - Sawcut and remove affected area, dowel into existing undamaged portion and resurface.

5.11 Landfill Gas System Monitoring and Maintenance

The main objective of the LFG system is to control subsurface gas migration and fugitive surface emissions to safeguard the public and the environment. The LFG monitoring system must be monitored and maintained to comply with regulations.

5.11.1 Landfill Gas Collection System

In February 2012, ICDPW installed a GCCS at the site (see Section 3.10.2) to mitigate off-site LFG migration observed at two of the perimeter probes. The ICDPW operates the GCCS and will perform periodic monitoring, inspection and maintenance of the system at the site as part of post-closure maintenance. An operations and maintenance plan for the GCCS is provided in Appendix R.

5.11.2 Landfill Gas System Monitoring

The BSWS has 11 perimeter probes used to detect lateral migration of LFG from the site. As part of the post-closure maintenance plan and pursuant to CCR 27 Sections 20932 and 20933, the BSWS is required to monitor all probes at least quarterly for methane to minimize hazards to the public and the environment (see Appendix P for the approved LFG Perimeter Probe Plan). The quarterly perimeter gas monitoring will consist of monitoring for methane (CH_4), carbon dioxide (CO_2), oxygen (O_2) and balance gas using LandGEM2000 or equivalent. The LEA may require more frequent monitoring or that samples be collected for laboratory analysis of trace gases as needed for public safety (27 CCR Sections 20932 and 20933(a)(1)).

The BSWS is not regulated under New Source Performance Standard (NSPS) or California Assembly Bill 32 (AB32) because the permitted design capacity at 1.55 million cubic meters is below NSPS threshold of 2.5 million cubic meters, and the waste in place at 430,000 tons (Cal EPA Air Resource Board, 2009) is below the AB32 threshold of 450,000 tons. Therefore, the BSWS is not required by these regulations to monitor surface emissions.

5.11.3 Landfill Gas System Reporting

Perimeter probes results will be reported to LEA in general accordance with 27 CCR, Section 20934 within a time period specified by LEA or no more than within 90 days of sampling. However, since compliance requirements are exceeded in some of the probes at the BSWS, the requirements of 27 CCR Section 20937 where results have to be reported to the LEA within 7 days and measures to mitigate LFG migration within 60 days will apply.

LFG monitoring reports will include the following in accordance with 27 CCR, Section 20934:

- The concentrations of methane, as measured at each probe within each well;
- The concentration of specified trace gasses, if required by the LEA;
- Documentation of the date, time, barometric pressure, atmospheric temperature, general weather conditions, and probe pressure at the time of sampling or the probe was monitored;
- The names of sampling personnel, apparatus utilized, and a brief description of the methods used; and
- A numbering system to correlate monitoring results to a corresponding well and probe location.

LFG data collected from the probes including the concentration of CH_4, CO_2, O_2 and balance gas, as well as inspection and maintenance reports, should be regularly analyzed to evaluate LFG migration trends at the site.

Operation of the GCCS system will be in compliance with the specifications and requirements of the ICAPCD permit to operate. The GCCS operating conditions will be reported to ICAPCD in general accordance with the requirements of the permit to operate. A copy of the Permit to Operate is included in Appendix A.

5.11.4 Landfill Gas System Maintenance

Monitoring probes and gas collection wells should be inspected monthly to evaluate their proper functioning. Inspection and maintenance may be performed during monitoring events. Probe maintenance requires checking the integrity of various components associated with the monitoring system and performing repairs as needed. The components involved are:

- Piping Systems: Inspect piping (header and laterals) for leaks, degradation, sagging and slope reversal. Above ground pipes should be inspected for periodic UV resistant re-painting/recoating to prevent deterioration due to UV exposure. Excessive pipe deflection could cause condensate accumulation and block passage of LFG. The pipes should regularly be checked and adjusted to prevent deflection.
- Well head components: Inspect the various wellhead components including flow control valve, sampling and pressure ports including thermometers to ensure their integrity. Check for signs of condensate collection in the flexible hose of

the wellhead, nipple and elbows. Improperly functioning component parts should be replaced after inspection.

- Probe casings, labcock valves, fittings and labels: Inspection and repair of physical damages to casings, failing or broken labcock ball valves and fittings, dewatering of monitoring vaults, inspection and cleanup against vegetation overgrowth and accessibility.

- Probe wellhead vault: Inspect the vault and surface area around the vault for erosion, cracks, openings, settlement or damage, ponding, clogging, vegetation overgrowth, or flooding with water. The vaults can be damaged by settlement, structural aging, and develop air leaks. Appropriate remedial actions should be taken to fix the damaged vaults. The maintenance tasks include corrective grading to divert surface runoff and prevent cover deterioration due to settlement or erosion, and vault cover maintenance, including replacement.

- LFG control skid: Maintenance of the LFG control skid should be done in accordance with the equipment manufacturer's recommendations and will include periodic inspection of the knock out pot and its component parts, blower, heat exchanger, GAC drums, exhaust stack, condensate batch tank, control panel, and telemetry system.

5.12 Groundwater System Monitoring and Maintenance

The groundwater monitoring program for the site is performed in accordance with the WDR (Appendix A) and the Sampling and Analysis Plan (Appendix D). The purpose of the groundwater monitoring system is to detect potential migration of contaminants from the BSWS to the groundwater.

5.12.1 Groundwater Monitoring

As discussed in Section 2.12.2, the current groundwater monitoring system at the BSWS consists of four monitoring wells. Monitoring will be performed in accordance with 27 CCR Section 20380 through 20435. Sample collection, storage and analysis will be performed in accordance with the most recent version of Standard United States Environmental Protection Agency (USEPA) Methods and in accordance with the most current sampling and analysis plan approved by the RWQCB.

Groundwater samples will be analyzed for routine monitoring parameters and volatile organic compounds (VOCs) on a bi-annual basis. Constituents of concern (COC) monitoring will be performed every five years in accordance with the current WDR.

5.12.1.1 Groundwater Monitoring Reporting

Bi-annual monitoring reports will be prepared in accordance with the current WDRs and 27 CCR requirements. Every five years, the results of the COC testing will be incorporated into the bi-annual monitoring report. If a release is noted, the ICDPW will verbally notify RWQCB staff immediately and provide written notification within seven days, as required by 27 CCR, Section 20420.

5.12.2 Groundwater Monitoring System Maintenance

The groundwater monitoring wells will be maintained to allow the wells to perform as designed. Monitoring wells will be inspected prior to each sampling event to evaluate: 1) if the well has been tampered with or damaged; 2) to verify that the well cover is secure; and 3) to determine if the well needs cleaning or redevelopment. Well repairs will be made by a California licensed well driller.

If a groundwater monitoring well cannot be repaired, it will be abandoned following RWQCB and Imperial County Department of Planning and Building standards, and the most current guidelines in the "California Well Standards: California Department of Water Resources" (DWR Bulletin 74-90). If a groundwater monitoring well needs to be replaced, a workplan for installation of a new well will be prepared and submitted to the LEA, RWQCB, and CalRecycle for approval.

5.13 Leachate Management

The BSWS does not have and is not required to install a LCRS; therefore, no leachate monitoring or system maintenance procedures are discussed herein.

5.14 Surface Water Monitoring

The purpose of the surface water monitoring is to detect potential migration of contaminants from the BSWS to the New River. As discussed in Section 3.8, the proposed surface water control system at the BSWS includes five discharge points to the New River. Monitoring will be performed in accordance with current standards of practice. Sample collection, storage and analysis will be performed in accordance with the most recent version of Standard United States Environmental Protection Agency (USEPA) Methods.

Surface water samples will be collected during working hours from 3 of the 5 BSWS discharge points to the New River and from the concrete-lined drainage channel on the east side of the property after significant precipitation events, defined as a storm event

producing more than 1 inch of precipitation. Visual observations of the surface water samples for turbidity, sheen, and foam will be recorded on a water sample field data sheet (see Appendix M). The surface water samples will be monitored for pH and temperature, and analyzed for TDS and total petroleum hydrocarbons (TPH) by a State-certified analytical testing laboratory. Field measurements of temperature and conductivity could potentially be substituted for TDS analysis if approved by the RWQCB. The analytical testing results from the concrete-lined drainage channel would serve as a point of comparison for the discharge from the BSWS.

5.14.1.1 Surface Water Monitoring Reporting

Monitoring reports will be prepared in accordance with current standards of practice, and will be submitted semi-annually to the RWQCB. If a release is noted, the ICDPW will verbally notify RWQCB staff immediately and provide written notification within seven days.

5.15 Access Road Maintenance

The site access roads will be inspected on a quarterly basis for cracks and depressions. If any cracks or depressions large enough to negatively impact the proper function of the access roads or to collect surface water are noted, the affected area will be regraded and/or resurfaced, as necessary.

5.16 Site Security Monitoring and Maintenance

The security fencing, access gates, and signs will be inspected quarterly to ensure that their integrity has been maintained. The fencing will be inspected for breaks, settlement damage, loose tension, and corrosion. The gates will be inspected for adequate movement and to ensure that the locks are intact. Any necessary repairs or replacements will be made in a timely manner after identification of the issue.

5.17 Vegetation Maintenance

The final cover will not have any planted vegetation that will require maintenance. Weed control on the final cover system is discussed in Section 5.8.3. The only vegetation that is part of the BSWS closure that will need to be maintained during post-closure is the vegetation along the New River, which will be maintained for one year to establish vegetation in the river bank areas which will be disturbed as part of closure construction.

6. CLOSURE AND POST-CLOSURE MAINTENANCE COST ESTIMATE

6.1 Introduction

Cost estimates were prepared to reflect closure and post-closure maintenance plan features presented in Sections 3, 4 and 5 of this FCPCMP. Cost estimates for a water release corrective action were also prepared. Closure cost estimates and post-closure cost estimates were prepared in accordance with 27 CCR Sections 21820 and 21840, respectively. *Caltrans 2011 Labor Surcharge and Equipment Rental Rates* and prevailing wages for Imperial County, where available, per California Labor Code Sections 1770, 1773, and 1773.1 were used in the cost estimates per 27 CCR Section 21815. Where these rates were not available, RSMeans values and typical rates provided by vendors were used. The cost estimates will be adjusted annually per 27 CCR Section 22236 to reflect estimated annual inflation. Cost estimates may also be updated following amendments to the FCPCMP per 27 CCR Section 21865.

6.2 Closure Cost Estimate

The closure cost estimate presented in Table 5 has been prepared to identify the expected costs for closure construction of the BSWS, including labor, equipment, and materials, quality assurance, and documentation. The closure cost estimate includes anticipated components of closure including:

- Final cover placement
- Access and perimeter road improvements
- Waste relocation
- Drainage systems
- River stabilization systems
- Construction quality assurance
- Project management and reporting
- Security
- Survey

The total closure cost is estimated to be $7,507,178 in 2011 dollars. Background and supporting information for the closure cost estimate is presented in Table 6. Supporting documentation for the closure cost estimate is presented in Appendix N.

A 20 percent contingency factor has been added to the construction cost estimate in accordance with 27 CCR Section 21820(a)(4) to account for increased closure costs due to unforeseen circumstances.

6.3 Post-Closure Maintenance Cost Estimate

The post-closure maintenance cost estimate has been prepared to identify the maintenance costs, repair costs, and replacement costs throughout the post-closure maintenance period of the BSWS. The cost estimate includes the following items:

- Cover inspection and maintenance
- New River stabilization monitoring and maintenance
- LFG monitoring, inspection and maintenance
- Groundwater monitoring, inspection, and maintenance
- Drainage system inspection and maintenance
- 5-year iso-settlement surveys
- Security maintenance

The annual post-closure maintenance and monitoring costs are estimated to be $186,697 in 2011 dollars and are presented in Table 7. The total post-closure cost for 30 years is $5,600,910 in 2011 dollars. Background and supporting information for the post-closure cost estimate is presented in Table 8. The maintenance and monitoring costs presented have been projected utilizing current regulations and applicable requirements. If changes occur in the regulatory conditions pertaining to the BSWS, these estimates will be adjusted accordingly, if necessary, and submitted to the CalRecycle, LEA and RWQCB. Supporting documentation for the post-closure cost estimate is presented in Appendix N.

6.4 Corrective Action Financial Assurance

In accordance with the requirements outlined in 27 CCR Sections 22101(a), 22220-22222, and 20380(b), a water release corrective action cost estimate was prepared for the BSWS. A report detailing the assumptions used to develop the water release corrective action cost estimate is provided in Appendix Q. The costs associated with the water release are estimated to be $97,020.

In accordance with the requirements outlined in 27 CCR 22101(b)(1)(B), the non-water corrective action cost estimate is assumed to be equivalent to the closure cost of the entire site (see Section 6.2) or approximately $7,507,178 in 2011 dollars.

6.5 Demonstration of Financial Responsibility

In accordance with 27 CCR Sections 22206, 22211, 22225, and 22228 and Subtitle D, Subpart G, the ICDPW must demonstrate financial responsibility for closure and post-closure costs. The financial assurance mechanism for the closure of BSWS is in the form of a municipal bond issued by Imperial County in 2010. ICDPW plans on using a Pledge of Revenue Agreement for post-closure maintenance and corrective action of the BSWS. A demonstration of financial responsibility is presented in Appendix O.

6.6 Closure Cost Disbursement Schedule

27 CCR Section 21800(d) requires a detailed schedule for disbursement of funds for closure activities. Table 9 presents a disbursement schedule for the BSWS closure construction.

7. PROFESSIONAL CERTIFICATION

27 CCR Section 21780 requires that a registered civil engineer or a certified engineering geologist prepare and certify the accuracy of closure and post-closure maintenance plans for all Class III landfills.

I certify under penalty of perjury that I have personally examined and am familiar with the information submitted in this FCPCMP for the BSWS and all attachments and, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the information is true, accurate, and complete.

Jane W. Soule, P.E.
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C-59815
Registration Number
California Civil Engineer

17 November 2011
Date

8. REFERENCES

Bodhi Group, 2010. "Methane Source Identification, Brawley Solid Waste Site, County of Imperial." 15 October.

Bray, J.D., and Travasarou, J., 2007, "Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements," Journal of Geotechnical and Geoenvironmental Engineering, Vol. 133, No. 4, pp. 381-392, April 2007.

Bryan A. Stirrat & Associates, Inc. 2008. "Final Closure/Post-Closure Maintenance Plan, Brawley Solid Waste Site, Imperial County, California." October.

Bryan A. Stirrat & Associates, Inc. 2001. "Geotechnical Investigation Report, Brawley Solid Waste Site, Imperial County, California." June.

California Code of Regulations, Title 27.

California Department of Water Resources. 2003. "California's Groundwater, Bulletin 118, Update 2003." October.

California Department of Resources Recycling and Recovery, 2011. Solid Waste Information System website for Brawley Solid Waste Facility (SWIS No. 13-AA-0008). http://www.calrecycle.ca.gov/SWFacilities/Directory/13-AA-0008/Detail/. 16 June.

City of Brawley, 2008. Final General Plan Update, 2030, September.

City of Brawley, 2011. "City of Brawley Official Land Use Map."

Code of Federal Regulations, Title 40, Section 258.

County of Imperial, Planning/Building Department, Title 9 - Land Use Ordinance.

County of Imperial Department of Public Works, 2009. "Brawley Solid Waste Site Test Holes – Estimate of Final Cover." 4 March.

Cal EPA Air Resource Board. 2009. Initial Statement of Reasons for the Proposed Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills. Stationary Source Division Emission Assessment Branch. May

California Integrated Waste Management Board, 2001. “Construction Plans for: Brawley Landfill Remediation, North Face Reconstruction.” Sheets 1 through 18. November.

California Integrated Waste Management Board, 2003, "Solid Waste Facilities Permit No. 13-AA-0008."

California Regional Water Quality Control Board - Colorado River Region, 1997. "Waste Discharge Requirements Order No. 97-007."

California Regional Water Quality Control Board - Colorado River Region, 1993. "Amended Waste Discharge Requirements Order No. 93-071."

California Regional Water Quality Control Board – Region 7, 2006. “Fact Sheets Supporting the Revision of the Section 303(d) List.”

California Regional Water Quality Control Board – State Water Resources Control Board, 2006. “Water Quality Control Plan, Colorado River Basin – Region 7, Including Amendments Adopted by the Regional Board Through June 2006.”

Geosyntec, 2010. “Waste Delineation Study, Brawley Solid Waste Site.” 19 November.

Geosyntec, 2011. “Application for Conditional letter of Map Revision (CLOMR), New River at Brawley Solid Waste Site, Imperial County, California.” May.

GeoLogic Associates, 1999. “Imperial County Solid Waste Facilities Repair/Replacement Well Logs.” 30 April.

GeoLogic Associates, 2005. “Well Construction and Abandonment Program,” Imperial County, California. 15 February.

GeoLogic Associates, 2011. “County of Imperial Water Quality Monitoring Report – Semiannual 2011 (Winter/Spring) and Annual Report.”

Kavazanjian Jr., E., Matasovic, N., Bonaparte, R., and Schmertmann, G. (1995), “Evaluation of MSW Properties for Seismic Analysis,” Proceedings, Geoenvironmental 2000, Vol. II, New Orleans, LA, February, pp. 1126-1141.

Matasovic, N., 1991. "Selection of Method for Seismic Slope Stability Analyses", Proceedings of Second International Conference on Recent Advances in

Geotechnical Engineering and Soil Dynamics, St. Louis, Missouri, Paper No. 7.20, pp. 1057-1062.

Newmark, N.M., 1965. "Effects of Earthquakes on Dams and Embankments," Geotechnique, Volume 15, Number 2.

Ninyo & Moore, 2010. Construction and Certification Report Landfill Gas Monitoring Well Installations. Brawley Solid Waste Site, Imperial County, California. May.

Seed, R.B. and R. Bonaparte. 1992. "Seismic Analysis and Design of Lined Waste Fills: Current Practice," Proceedings of ASCE Specialty Conference on Stability and Performance of Slopes and Embankments — II, pp. 1521-1545.

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TABLES

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Table 1. Regulatory Requirement Index
Brawley Solid Waste Site

FCPCMP Requirements	27 CCR Section	FCPCMP Section
General		
Dated and Signed Professional Certification	21780(a)	7.0
Site Acreage	N/A	2.2
Closure Date and Schedule	21790(b)(7) and (8) 21769(c)	3.3, 4.3, Figure 8
Description of Waste Types	N/A	1.2.2
Maximum Extent of Closure	21790(b)(6)	3.2
Labor Transition Plan	21785	Appendix I
Closure Plan		
Location Map	21790(b)(2)	Figures 1,2, 3
Maps of Current Monitoring and Control Systems	21790(b)(4)	Figure 3, Drawing Set
Topographic Map	21769(c)(2)(D)	Figures 3, 5, Drawing Set
Site Security	21135	3.12
Structure Removal	21137	3.4
Final Cover Description	21090(a), 21140, 21769(c)(2)(F)	3.7, Appendix F
Final Cover Grading	21090(a) and (b)(1), 21142	3.7.3, 3.8
Drainage Control	21090(b)(3), 21150, 21769(c)(2)(F)	3.8
Erosion-Resistant Layer	21090(a)(3), 21150	3.7.2
Slope Stability Analysis	21090(a) 21750(f)(5), 21145	3.9.2
Seismic Analysis	21750(f)(5)	3.9.1, 3.9.2
CQA Plan	21880(b), 20324	Appendix K
Landfill Gas Monitoring and Control	21790(b)(8)(E),	3.10.1, 3.10.2
Leachate Control and Monitoring	21790(b)(8)(F), 21769(c)(2)(F)	3.10.4
Groundwater Monitoring	21090(c)	3.10.3
Recording	21170	4.10
Financial Assurance	Chapter 6	6.5, Appendices N, O, Q
Final Closure Cost Estimate	21769(c)(2)(A) 21820	6.2, Tables 5 and 6, Appendix N

FCPCMP Requirements	27 CCR Section	FCPCMP Section
Other		
CEQA	N/A	4.2.1
References	N/A	8.0
Post-Closure Maintenance Plan		
Post-Closure Land Use	21830(b)(3) 21769(c)(2)(H) 21790(b)(5) 21190	5.2
Change of Ownership	21200	1.2.3
Responsible Party	21830(b)(2)	1.2.3
Emergency Response Plan	21130, 21132	Appendix L
Operations/Maintenance Plan for LFG Control System	21830(b)(6)	Appendix R
Final Cover Maintenance	21090(a)(4) and (c)(4)	5.8
Vegetation Maintenance	21090(a)(4)(D)	5.8.3, 5.17
Discharge of Liquids to Cover	21090(a)(5)	5.8.2
Landfill Gas Monitoring	21180(a)(2) 21830(b)(6) 21180(a)(2)	5.11
Leachate Monitoring	21090(c)(2) 21160(c)(2)(D) 21160	5.13
Groundwater Monitoring	21090(c)(3) 21790(b)(8)(E) 21769(c)(2)(F)	2.12.2, 5.12
Surface Water Monitoring	21090(c)(3)	5.14
Survey Monument Maintenance	21090(c)(5)	5.9
Site Security Maintenance	21180(a)(1)	5.16
Post-Closure Maintenance Funding	Chapter 6	6.5, Appendix O
Post-Closure Cost Estimate	21769(c)(2)(A), 21815, 21840	6.3, Tables 7 and 8, Appendix N
Final Cover Surveys	21090(e), 21142	5.9
Optional Clean Closure	21090(f)	N/A
Corrective Action Cost Estimates	22101	6.4, Appendix Q

Note:
This table is meant to be a guideline for regulatory requirements for landfill closure and post-closure. Additional requirements may exist in 27 CCR.

Table 2. Major Faults in the Site Vicinity
Brawley Solid Waste Site

Fault Name	Distance from Site (kilometers)	Maximum Credible Earthquake Magnitude (M_w)
Brawley Seismic Zone	0.86	6.5
Imperial	9.6	7.0
Superstition Hills (San Jacinto)	15.2	6.6
Superstition Mountain (San Jacinto)	19.4	6.6
Elmore Ranch	24.9	6.6
San Jacinto - Borrego	40.6	6.6
San Andreas - Southern	42.3	7.4
San Andreas - Coachella	42.3	7.1
Laguna Salada	44.0	7.0
Elsinore-Coyote Mountain	49.8	6.8
San Jacinto - Anza	61.8	7.2
San Jacinto - Coyote Creek	65.0	6.8
Elsinore-Julian	76.7	7.1
Earthquake Valley	81.7	6.5
Pinto Mountain	129.7	7.0
Eureka Peak	130.9	6.5
Burnt Mountain	131.1	6.5
Pisgah-Bullion Mountain - Mesquite Lake	133.9	7.1
San Andreas - San Bernardino	135.0	7.3
Emerson Southern - Copper Mountain	142.0	6.9
Elsinore - Temecula	143.7	6.8
Rose Canyon	152.0	6.9
San Jacinto - San Jacinto Valley	152.7	6.9
Landers	153.2	7.3

Notes:
(1) Distance from geometric center of BSWS at 32.9977, -115.5400.
(2) M_w = Earthquake Moment Magnitude.

Table 3. Post-Closure Monitoring Schedule
Brawley Solid Waste Site

Monitoring Activity	Minimum Monitoring Frequency
Groundwater Monitoring System	
Groundwater Elevation/Flow Rate/Direction	Semi-Annually
Groundwater Monitoring	Semi-Annually
Groundwater COC Monitoring	Every Five Years
Surface Water Monitoring	
Surface Water Outfall Monitoring	After significant precipitation[1]
LFG Monitoring System	
LFG Perimeter Probe Monitoring	Quarterly
Settlement/Erosion Monitoring	
Settlement Monument Monitoring	Every Five Years
Erosion Monument Monitoring	Annually
River Bank Stabilization Monitoring	
Bendway Weir Monitoring	Annually

Note:
(1) Significant precipitation is defined as an event producing greater than 1 inch of precipitation.

Table 4. Post-Closure Maintenance Schedule
Brawley Solid Waste Site

Maintenance Activity	Minimum Maintenance Frequency
River Bank Stabilization Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	As Required
Erosion Monument Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	As Required
Final Cover Maintenance	
Inspection	Quarterly[1]
Weed Control	As Required
Maintenance and Repair/Replacement	As Required
Survey Monument Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	As Required
Access Road Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	Annually and As Required
Surface Drainage System Maintenance	
Inspection	Quarterly[1]
Debris Removal	Quarterly[1]
Maintenance and Repair/Replacement	As Required
LFG System Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	As Required
LFG Collection System Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	As Required
Groundwater System Maintenance	
Inspection	Semi-Annually
Maintenance and Repair/Replacement	As Required
Security System Maintenance	
Inspection	Quarterly[1]
Maintenance and Repair/Replacement	As Required

Notes:

(1) Inspection shall also be performed after any precipitation or significant seismic event (moment magnitude ≥ 6 within 100 miles of the site) and after other types of natural disasters that could potentially affect the site. Stormwater sampling shall only occur after a precipitation event of 1-inch or greater.

(2) A sample post-closure inspection form is provided in Appendix M.

Table 9. Closure Cost Disbursement Schedule
Brawley Solid Waste Site

Construction Period	Estimated Disbursement (%)	Estimated Disbursement ($)
Month 1	15%	$ 1,117,444
Month 2	15%	$ 1,117,444
Month 3	15%	$ 1,117,444
Month 4	15%	$ 1,117,444
Month 5	15%	$ 1,117,444
Month 6	15%	$ 1,117,444
Month 7	10%	$ 744,963

Notes:
(1) Estimated disbursement costs based on financial assurance closure cost estimates (see Table 5).
(2) Actual construction duration and cost disbursement will be based on the Contractor's schedule and the final construction bid schedule.

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FIGURES

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FINAL CLOSURE DRAWINGS

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APPENDIX A

SITE INFORMATION, PERMITS, AND APPROVALS

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APPENDIX M

POST-CLOSURE INSPECTION FORM

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APPENDIX N

Supporting Documentation for Financial Assurance Cost Estimates

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APPENDIX O

DEMONSTRATION OF FINANCIAL RESPONSIBILITY

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APPENDIX P

LANDFILL GAS MONITORING PLAN

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APPENDIX Q

GROUNDWATER CORRECTIVE ACTION FINANCIAL ASSURANCE COST ESTIMATE

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APPENDIX R

Landfill Gas Operations and Maintenance Plan