Appendix D Hydrogeologic Impacts Report (Youngdahl 2013)

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Attention: Mr. Richard Hanson, Senior Project Manager

Subject: **WESTERN AGGREGATES RECLAMATION PLAN ENVIRONMENTAL IMPACT REPORT**
Assessment of Hydrogeologic Conditions and Potential Impacts of Mine Reclamation

Dear Mr. Hanson:

With your authorization, we have prepared this report on the assessment of hydrogeologic conditions in the vicinity of Western Aggregates LLC (Western Aggregates) in the Yuba Gold Fields, located twelve miles northeast of Marysville, California. Youngdahl Consulting Group, Inc. (Youngdahl) also reviewed the draft reclamation plan. This information was used to make an assessment of the potential impacts to groundwater by reclamation. This assessment focuses only on the impacts of reclamation. It is our understanding that Western Aggregates LLC has a vested right to mine and therefore mining impacts are not addressed in this assessment except as necessary to help to quantify the expected impacts from reclamation.

1. Physical Setting

The Western Aggregates LLC mine is located in an unincorporated portion of Yuba County, California, south of the Yuba River, north of Hammonton-Smartville Road, and approximately equidistant (20 miles) between Marysville and Smartville. The site is situated at the western edge of the Sierra Nevada foothills near the south bank of the Yuba River, north of Beale Air Force Base (Figure 1). The mine extracts gravels (dredger tailings) that have been previously mined by dredges for gold and manufactures various types of aggregate from these gravels that are sold commercially. The area considered in the Amended Reclamation Plan (Reference No. 17) is approximately 1,960 acres.

The area surrounding the project site is known locally as the Yuba Goldfields. Currently, the surrounding land is mined for gold and aggregate (sand and gravel) and used for aggregate processing. The majority of the existing mining operations area is characterized by active mining operations, a processing facility, numerous dredge tailing ridges interspersed with waterways, and small to large siltation and freshwater ponds created by mining activities. Access to the mine is via an access road off of Hammonton Road.

The eastern side of the areas planned for reclamation is bounded by the Yuba County Water Agency canal (YCWA Main Canal) that collects water from the Yuba River

Diversion Works at the Daguerre Point Dam northeast of Western Aggregates and carries the water through a series of unlined ponds and channels to the east of and nearly adjacent to the easternmost of the lakes as shown on the conceptual model for final reclaimed configuration after 45 years (Figures 2 and 3). The northern extent of the area planned for reclamation is bordered by a low levee known as the Linda Levee, north of which are areas of additional mine tailings and the Yuba River. The area planned for reclamation is bounded on the south by unmined fields used for agriculture and cattle grazing as well as other active aggregate mines on the western end and by the YCWA Main Canal on the eastern end. The western side of the area planned for reclamation is bounded by dredger tailings piles.

2.0 Hydrogeologic Conditions

The property overlies the eastern edge of the Sacramento Valley Groundwater Basin in an area described as the Yuba Groundwater Basin which is further divided into the North Yuba Subbasin (north of the Yuba River) and South Yuba Subbasin (south of the Yuba River) (Figure 4). The area planned for reclamation is on the northern edge of the South Yuba Subbasin. The relevant hydrogeologic conditions are the major water bearing formations, the regional groundwater resources and historical levels, and the groundwater quality.

<u>Major Water Bearing Formations</u>

The Yuba County Water Agency 2010 Groundwater Management Plan (Reference No. 15) describes the North Yuba and South Yuba subbasins as being underlain by deposits as follows (Page 2-5):

> Alluvial deposits and nonwater-bearing rocks occurring in the groundwater basin are subdivided into geologic units called formations. Ages of these formations range from Paleozoic bedrock to the present-day overlying alluvial materials. The older Alluvium, the Laguna, and the Mehrten formations are significant water-bearing formations in the groundwater basin and comprise over 95 percent of the basin volume.
>
> ***Older Alluvium — Pleistocene***
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> The Older Alluvium is composed of floodplain deposits (Modesto Formation) and alluvial fan deposits (Riverbank Formation). Estimates on unit thickness range from 100 feet in the south to 150 feet in the Yuba River vicinity. Several wells with depths of 150 feet below ground surface (bgs) or less have yielded 1,000 to 1,200 gallons per minute (gpm).
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> ***Laguna Formation – Pliocene***
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> The Laguna Formation is exposed along the eastern basin boundary and found in deep wells to the west. Its thickness ranges between 180 and 400 feet depending on specific locations and variable underlying and overlying contact units. Wells screened in the Laguna Formation are capable of producing up to 2,000 gpm.
>
> ***Mehrten Formation – Late Miocene to Pliocene***
>
> The Mehrten Formation is of great importance to the fresh groundwater basin in the Central Valley. Generally, the Mehrten Formation yields large quantities of water to wells, although hydraulic conductivity in the Mehrten varies from place to place. Surficial exposures of this unit are limited to a few square miles in the eastern central portion of the basin south and east of the Yuba Goldfields, dipping to the west and extending to great depths.

The report “Hydrogeologic Understanding of the Yuba Basin” (Reference No. 13) describes the primary groundwater producing deposit/formations as follows (direct excerpt):

Primary Groundwater-Producing Deposits/Formations

Geologic deposits and formations (from youngest to oldest) that contain groundwater in the Yuba Basin are described in the following sections. Water-bearing formations in the North and South Yuba subbasins are similar, with the exception of depth to the underlying Pre-Tertiary metamorphosed igneous and sedimentary rocks of the Sierra Nevada block (DWR, 2003a).

Surface Basin Deposits – Holocene

Holocene surface geology, dredge tailings, and stream channel and floodplain deposits are described in this section.

Surface Geology

Surface geology for the Yuba Basin consists mainly of alluvial valley sediments that gradually increase in thickness toward the west. The Yuba Basin is bounded along its eastern flanks by the Sierra Nevada Mountain Range. The Sierra Nevada rock-types that are exposed are mainly metavolcanics; throughout the foothills, exposures of metamorphic volcanic rocks such as serpentine and greenstone occur sporadically.

Recent geologic logs (presented in **Chapter 3**) on the flanks of the Dry Creek alluvial fan indicate that the soils at ground surface and upper sedimentary deposits consist of silts, siltstones, and fine-grained cemented geologic materials that exhibit a low hydraulic conductivity (DWR, 2007b). Groundwater percolation from these formations to higher conductivity sands present at greater depths is anticipated to be low over a fairly large areal extent.

Dredge Tailings

Extending downstream from the Sierra Nevada Mountain Range along the Yuba River for 15 miles are large piles of very coarse gravels and cobbles. These piles have been dredged for gold mining and range in thickness between 60 to 80 feet in the eastern area, and 100 to 125 feet in the west (DWR, 2003a). A more detailed discussion of mining effects on the Yuba River is presented in **Section 2.6.1**.

Recent Stream Channel and Floodplain Deposits

Holocene alluvial deposits are located along the present-day stream channels of the Yuba, Bear, and Feather rivers and Honcut Creek, as well as within the incised channels of the smaller drainages. Olmstead and Davis (1961) defined the recent alluvial deposits as those found at relatively shallow depths that appear to be hydraulically continuous with the present stream channels, floodplains, and natural levees. The recent alluvial deposits are mainly highly permeable, coarse-grained gravels containing boulders and rounded cobbles as well as sands, and can be up to 110 feet thick. The high permeability soils of these stream channel and floodplain deposits allow them to act as a large recharge area. Reported well yields within these deposits are from 2,000 to 4,000 gallons per minute (gpm) (DWR, 2003a). Based on a recent geologic log, cobble- to boulder-sized clasts were encountered about 4 miles south of the Yuba River. These deposits were found at about 70 to 100 feet below ground surface (bgs) and could be an indication of a paleochannel of the ancestral Yuba River (DWR, 2007b).

Older Alluvium — Pleistocene

Pleistocene deposits consisting of older floodplain and fan deposits are described below.

Older Floodplain Deposits – Modesto Formation

The older floodplain deposits of the Modesto Formation lie above the recent alluvium and create a 1- to 2-mile-wide band of terraces on both sides of the Feather River. The Modesto formation and the older Riverbank Formation also form terraces along the banks of the smaller drainages including Reeds Creek, Dry Creek and Jack Slough, which are filled with recent alluvium (Saucedo and Wagner, 1992). Along with these terraces, the Modesto Formation comprises some alluvial fans and abandoned channel ridges. Because these deposits border still-existing rivers and streams, it is inferred that they laid down the Modesto Formation previous to depositing the recent alluvium. Information from well logs shows that the formation is approximately 15 feet thick. Although the permeability of this layer is moderate, it is not considered to be a substantial storage unit because the formation is so thin. Instead, it provides a means for infiltration of precipitation and irrigation water (Bookman-Edmonston Engineering Inc., 1992).

Fan Deposits – Riverbank Formation

Older alluvial fans and terraces with a higher degree of soil development than the Modesto Formation have been mapped as the Riverbank Formation and consist of loosely compacted silt, sand, and gravel with lesser amounts of clay (Saucedo and Wagner, 1992). Deposits are also more stratified and have a higher percentage of sands and gravels than the underlying Laguna Formation. The gravel deposits appear to be more concentrated in the upper 150 feet of the study area and the formation as a whole is exposed for over 50 percent of Yuba County's surface area. Unit thickness is estimated to range from 100 feet in the south to 150 feet in the Yuba River vicinity. Thickness is difficult to determine because the lower boundary of the Laguna formation is highly eroded and poorly delineated. The Riverbank Formation is moderately permeable except at the surface where hardpan and claypan soils have developed. More recent geologic logs in the south portion of the South Yuba Subbasin show numerous layers of paleosol development at depths of 30 to 95 feet bgs within the Riverbank Formation (DWR, 2007b). Several wells with depths of 150 feet bgs or less have yielded 1,000 to 1,200 gpm (Bookman-Edmonston Engineering Inc., 1992).

Recent geologic logs in the South Yuba Subbasin show the occurrence of a fairly widespread and thin gravel layer at about 60 to 80 feet bgs (DWR, 2007b). This layer, containing pebble-, cobble-, and some boulder-sized clasts, is interpreted as Early Pleistocene. Along the midsection of the Yuba River in the Yuba Basin, the Riverbank Formation, containing oxidized sand and gravel, and metamorphic and volcanic clasts, was identified from 30 to 88 feet bgs (DWR, 2007b).

Laguna Formation – Pliocene

Derived in large part from the pre-Tertiary rocks of the Sierra Nevada, the Laguna Formation consists of a heterogeneous mix of generally poorly sorted clay, silt, sand, and gravel. Specifically in the Sacramento Valley, the Laguna Formation contains abundant beds of somewhat clayey silt to silty fine sand, some well-sorted sand in relatively thin zones, and scarce, poorly sorted gravel beds (Page, 1986). The formation is irregularly exposed along the eastern boundary of the basin (see **Figure 2-2**) and dips gently to the southwest to great depths. Its actual thickness is difficult to determine in well logs because of the discontinuous contact of its upper boundary with the older alluvium. The Laguna Formation ranges in thickness from 0 to 180 feet (Page, 1980) near the eastern margin of the basin, to a reported 400 feet (DWR, 2003a) near the Yuba River. Based on a recent geologic log in the South Yuba Subbasin near the Bear River, undifferentiated surface basin deposits (Holocene) to Older Alluvium (Pleistocene), and Laguna Formation (Pliocene) deposits are believed to be present to a depth of approximately 133 feet bgs (DWR, 2004). In the vicinity of the midsection of the Yuba River in the Yuba Basin, the Laguna Formation, with oxidized silt, sand, and gravel, was encountered from 100 to 200 feet bgs (DWR, 2007a).

Recent geologic and lithologic data collected during the installation of eight new wells in the Yuba Basin show evidence that the thickness of the Laguna Formation varies widely across the basin. In the Trainer Hills in the North Yuba Subbasin, the Laguna Formation was found in the first 42 feet bgs only (see **Section 2.6.2**). In the South Yuba Subbasin, the formation is reported to be present at greater depths, from 105 to 195 feet bgs southeast of Cordua ID, and from 136 to 284 feet bgs in central South Yuba WD (DWR, 2007b). About 2 miles north of the Bear River in central Dry Creek MWC, the thickness of the Laguna appears to be approximately 203 feet, from 103 to 306 feet bgs. About 2 miles north of the Bear River within South Yuba WD, the Laguna Formation appears at shallower depths and extends to greater depths (from 53 to greater than 300 feet bgs). In the south portion of the South Yuba Subbasin, geologic logs show numerous layers of paleosol development at depths from 53 to 182 feet bgs within the Laguna Formation (DWR, 2007b).

Mehrten Formation – Late Miocene to Pliocene

This sequence of volcanic-derived sedimentary rocks was deposited in the late Miocene through Pliocene epochs. In the Sacramento Valley, the Mehrten Formation consists of two distinguishable units: (1) an overlying unit composed of unconsolidated black sands interbedded with blue-to-brown clay, and (2) an underlying unit of hard, very dense tuff breccia that may act as a confining layer between sand layers. The Mehrten is reported to range from 190 to 500 feet thick

(Page, 1986; Helley and Harwood, 1985). Surficial exposures of this unit are limited to a few square miles in the northeastern corner of the basin (Saucedo and Wagner, 1992). The Mehrten Formation is considered to be equivalent to the Sierra-derived Mio-Pliocene volcaniclastic rocks that outcrop in the Sutter Buttes that have been called the Sutter Formation (Williams and Curtis, 1997; Saucedo and Wagner, 1992).

The Mehrten Formation is of great importance to the fresh groundwater basin in the Central Valley. Generally, the Mehrten Formation yields large quantities of water to wells, although hydraulic conductivity in the Mehrten varies from place to place (Page, 1986). Bulletin 118-6 (DWR, 1978) describes the Mehrten Formation in more detail, with emphasis on specific lithologic features.

Recent subsurface geologic and lithologic data are available from studies conducted in the Yuba Basin from 2001 to 2007. These data are summarized below to further describe the Mehrten Formation at specific localities throughout the Yuba Basin (see **Chapter 3** for well drillers' logs, geologic logs and subsurface lithology data).

Olivehurst

A groundwater supply evaluation study conducted south of Olivehurst in the South Yuba Subbasin reports three confined aquifers with significant production potential (Nimbus Engineers, 2001). These confined aquifers, occurring at depths of approximately 70 to below 350 feet bgs, comprise thin, laterally continuous, coarse-grained sand and gravels interbedded between thicker sequences (tens of feet thick) of fine-grained lake bed and/or overbank deposits.

Bear River

Based on recent well log data near the Bear River, deposits similar to those of the Mehrten Formation are believed to be present at a thickness of 470 feet, from about 133 feet bgs to the total exploration depth of 603 feet bgs (DWR, 2004a). In this area, the Mehrten Formation consists primarily of gray-colored sand, some silt, and minor gravel zones.

Yuba River

Based on more recent geologic data in the vicinity of the midportion of the Yuba River, the Mehrten Formation, containing mostly gray siltstone and andesitic sandstone, may have a thickness of nearly 320 feet, from 200 to 520 feet bgs, (DWR, 2007a).

Plumas Lake

A recent groundwater supply study conducted in the South Yuba Subbasin near the Plumas Lake Specific Plan area reported a 180-foot thick aquitard between an intermediate aquifer (320 to 420 feet bgs) and deep aquifer (below 600 feet bgs) (Wood Rodgers, 2006). The intermediate and deep aquifers identified contain black sands to very coarse sands with gravels and cobbles. These deposits are similar to those found in the Mehrten Formation.

City of Wheatland

In an area approximately three miles northwest of the City of Wheatland, two significant sand horizons were reported in a groundwater supply study (Dunn Environmental, Inc., 2007). These layers, encountered from depths of 210 to 310 feet bgs and from 355 to 420 feet bgs, are believed to be deposits of the Mehrten Formation.

Other Areas Within Yuba Basin

Recent geologic data collected during the installation of eight new wells in the Yuba Basin provide valuable geologic and lithologic information throughout the Yuba Basin. Data from the geologic logs show that subsurface materials representing the regional Mehrten Formation were encountered at various depths ranging from 97 feet bgs to 306 feet bgs (DWR, 2007b). In the North Yuba Subbasin, geologic formations encountered in the Trainer Hills area contain volcanic sands at depths of 180 to 287 feet bgs, possibly representing the Mehrten Formation equivalent. Data from five geologic logs in the South Yuba Subbasin suggest that the thickness of the Mehrten Formation varies widely, from 19 feet to nearly 190 feet. East of Wheatland WD, a thin layer of the Mehrten Formation containing gray to grayish brown clayey and silty sand materials appears to be present from 97 to 116 feet bgs. About 3 miles west of this location, within Dry Creek MWC, the Mehrten Formation, containing sand, siltstone, clayey sand, and silty sand materials, is present from 306 to 497 feet bgs.

Valley Springs Formation – Late Oligocene to Miocene

The Valley Springs Formation is mainly a series of fluvial deposits of sandy clay, sand, ash and gravel (Page, 1986). In vicinity of the Yuba Basin, the formation crops out just south of the Bear River, and further crops out discontinuously along the eastern edge of the Central Valley to the Chowchilla River. Depending on location, the Valley Springs Formation unconformably overlies either the Ione Formation or pre-Tertiary rocks, and it dips gently southwestward beneath the valley. The formation is 0 to 200 feet thick in the Sacramento Valley, and it is water-bearing. However, because of the fine-grained clay and ash matrix, it is generally considered to be a small-yield aquifer (Page, 1986).

2.1 Yuba Goldfields Hydrogeology

Western Aggregates LLC mines aggregates from the Yuba Goldfields that are mostly tailings resulting from gold dredging previously conducted by others. This makes the mined and placed sediments highly conductive to groundwater flow. Flow in the mine tailings is somewhat heterogeneous and likely controlled by the geometry of the previous dredging activity and material types. These conditions result in the dredger tailings behaving as an extremely porous unconfined shallow aquifer. Reference No. 13 describes the Yuba Goldfields as being an inferred location of substantial groundwater recharge due to the following:

1) The presence of large piles of coarse gravels and cobbles with high transmissivity and storativity in the present Yuba River channel and Yuba Goldfields;
2) The deep original river channel in the metavolcanic bedrock and groundwater flow occurrence between the bedrock and coarse gravel lenses;
3) The occurrence of continuous high winter flow recharging the Yuba Goldfields; and
4) The high topographic gradients toward the south and increasing groundwater flow toward deeper bedrock and toward zones of lower elevation throughout the Yuba Goldfields.

A Preliminary Engineering Report for the Yuba Goldfields Fish Barrier Project (Reference No. 8) describes the hydrology of the Yuba Gold Fields as follows:

> Groundwater hydrology within the Goldfields is greatly influenced by Daguerre Point Dam and the Yuba River. Daguerre Point Dam, constructed in the early 1900s to control migration of hydraulic mining debris, creates a river stage differential; river stage above Daguerre Point Dam is more than 20 feet greater than river stage below the dam. As a result of this differential and with the Goldfield's highly permeable soil, Yuba River water enters the Goldfield area from above Daguerra Point Dam, then migrates downgradient through the Goldfields, forming interconnected ponds and canals throughout the area. Water within many of these pools and canals is directed back to the Yuba River via an outlet canal that is located approximately one mile downstream of Daguerre Point Dam.
>
> Seasonal variations in Yuba River flow also affect groundwater hydrology of the Goldfields. River flows during winter and spring months are generally greater than flows during summer and fall months. As river flows change so do river stages. The Goldfield's highly permeable soil allows water elevations within the Goldfields to rise and fall quickly according to Yuba River stage.
>
> As a result of the Goldfield's hydrology, water elevations within the outlet canal always exceed water elevations in the Yuba River at the confluence of the outlet canal. Consequently, water within the outlet canal always flows to the river, never the opposite. Currently, during river flows less than 20,000 cubic feet per second (cfs), water elevations within the outlet canal exceed river elevations by approximately six feet. As river flows increase above 20,000 cfs, so does the difference in water elevations.
>
> The Goldfield's outlet canal is used throughout the year to direct Goldfield water into the Yuba River, preventing high water levels from adversely impacting current mining and aggregate operations. Canal flows during summer and fall months are estimated to range from five to 50 cfs; canal flows during winter and spring months can exceed 1,000 cfs. The canal is especially important for the prevention of flooding in certain areas of the Goldfields during high flow periods.

During these periods, the canal is used to direct large quantities of water back to the Yuba River.

The Yuba-Brophy diversion also influences flow in the outlet canal. This diversion, located at Daguerre Point Dam, is used by the Yuba County Water Agency to distribute water from the Yuba River to nearby farms for irrigation. During high diversion periods, water levels within the diversion canal elevate, inducing additional seepage into the goldfields.

Appendix D of Reference No. 17 is the Slope Stability Analysis Report for the Amended Reclamation Plan. In order to characterize subsurface conditions for the slope stability assessments, subsurface drilling was performed across the area planned for mining. A total of 7 borings were advanced using a truck mounted dual-tube reverse air rig and a Becker Hammer drill bit to a maximum depth of 200 feet. The first five of the seven borings were described as being relatively coarse materials (gravel and cobbles), as well as relatively unconsolidated lenses/layers of sand and silt. The last two of the seven borings reported similar ideologies underlain by hard metavolcanic bedrock at a depth of 162 feet (-54 feet above mean sea level) in Boring No. 6 and 175 feet (-42 feet above mean sea level) in Boring No. 7. Groundwater was encountered in all of the exploratory borings.

Based on geologic mapping, Appendix D reported surface and near subsurface subsurface conditions as follows:

FILL (f2):
Fill (f2) associated with aggregate mining activities was observed in the central portion of the site. The fill is comprised of large gravel to cobble-sized clasts in a silty, fine- to coarse-grained sand matrix. It should be anticipated that other areas of fill and/or disturbed soils and localized areas of deeper fill may exist.

FILL (f1):
Fill (f1) comprised of mine tailings associated with historic dredging activities was mapped on large portions of the site. The tailings are comprised of layers of silty to clean, fine- to coarse-grained sand matrix with some beds containing large gravel to boulder-sized clasts.

YOUNGER ALLUVIAL DEPOSITS (Qya):
Younger alluvium on the site is comprised of bedded silty to clean, fine- to coarse-grained sand with some beds containing large gravel to cobble-sized clasts. The younger alluvium was not observed in outcrop at the site but was observed in subsurface samples collected during our exploration.

OLDER ALLUVIAL FAN DEPOSITS (Qof):
Older alluvium of probable Pleistocene age (Burnett and Jennings, 1965), comprised of bedded layers of silty to clean, fine- to coarse-grained sand matrix with some beds containing large gravel to cobble-sized clasts, was observed in the southeastern portion of the site. The upper portion of the older alluvium includes moderately- to weakly-developed argillic (clayey) and cemented soil horizons, as observed in the bank of a drainage channel near the eastern site boundary. These upper portions have a reddish-brown hue. Below the upper soils the color range is olive gray, dark gray, blue gray, and greenish gray. The development of the reddish-brown argillic soil horizons such as those

observed in the older alluvium support the interpretation that the older alluvium is Pleistocene age.

MISCELLANEOUS:
Fills associated with aggregate mining activities are relatively shallow (up to approximately 10 feet deep) except in the two silt ponds where the fill could be significantly deeper. Fills associated with mine tailings were encountered in our exploratory borings to a maximum depth of 97 feet.

In general, the depths to native (non-mine tailings) materials in the borings ranged from 0 feet (Boring B-1 in an unmined area south of the proposed reclamation area) to 100 feet (Boring B-7 in the eastern portion of the proposed reclamation area). Groundwater was encountered within all of the borings at depths ranging from 15 to 45 feet. Appendix D of Reference No. 4 reported that the groundwater depths corresponded to the surface elevations of the existing bodies of water nearest each of the borings as shown on the Reclamation Plan and observed in the field.

No direct characterizations of the aquifers beneath the Western Aggregates LLC operations have been performed. However, work completed by Luhdorff & Scalmanni Consulting Engineers (LSCE) for the nearby Teichert Aggregates Yuba Hofman Facility, south of the Western Aggregates LLC facility (Reference No. 11), and for the Teichert Aggregates' Hallwood Plant across the Yuba River to the northwest of the Western Aggregates LLC facility (Reference No. 10), was reviewed to provide information regarding groundwater conditions adjacent, south, and northwest of the Western Aggregates LLC facility. LSCE discusses the Bookman-Edmonston 1992 report (Reference No. 6) that describes the sediments as being stream channel and floodplain deposits of Holocene age. The sediments are described as forming a one to three mile wide Yuba River terrace downstream from the Yuba Goldfield. LSCE describes the materials, identified by a Teichert drilling program, as being loosely-compacted, coarse sand and rounded gravel, cobbles, and boulders, with minor amounts of sand and clay. The Holocene deposits are in turn described as being underlain by older terrace deposits which are in turn underlain by the Pleistocene Victor Formation and the Plio-Pleistocene Laguna Formation. LSCE describes the cumulative thickness of the alluvial deposits as ranging from 105 feet in the eastern part of the Teichert Property, to as much as 185 feet in the western part of the property. LSCE concluded that these materials are underlain by Tertiary-aged fluviatile volcanics and undifferentiated sedimentary rocks emplaced on the basement complex of the Sierra Nevada (Reference No. 6). According to LSCE, Reference No. 6 identified the effective base of the groundwater reservoir to be within the shallow section of the undifferentiated sedimentary rocks. However, LSCE then concluded that for the Teichert project, the effective base of the main water bearing unit to be the base of the alluvium due to the reported poorer yield and quality of water from wells completed in the volcanics.

LSCE installed three shallow monitoring wells and reviewed well drillers reports for three wells on the Teichert property. They concluded that there are two aquifers separated by discontinuous layers of clay and silt beneath the Teichert property. LSCE evaluated groundwater elevations beneath the Teichert property for the time frame of Spring 1991 through Summer of 2004. They indicated a groundwater flow direction trend (based on 97 measurements) that is predominately west-southwest.

Youngdahl Consulting Group, Inc. is of the opinion that the LSCE data most likely identifies more low permeability materials than are present to the depths planned for mining beneath the Western Aggregates reclamation area. Not all borings contained clay and where identified, the clay would be difficult to interpret as being in continuous layers. Instead of two aquifers separated by discontinuous layers, the drilling information shows mostly sands, gravels and silts containing what are likely to be discontinuous lenses of clay. Based on the boring logs, the practical thickness of the potentially affected aquifer ranges from approximately 142 to 155 feet.

Based on our literature review and review of boring logs, we are of the opinion that the shallowest water bearing sediments are the dredger tailings and possibly some Holocene alluvial deposits. This is underlain by fan deposits of the Riverbank Formation as evidenced by the high percentages of sands and gravels. There is a limited possibility that the Laguna Formation is also present in the deepest portions of the borings beneath the area of planned reclamation as represented by some of the clays and silts.

Reference No. 13 (MWH) discusses aquifer hydraulic properties in the Yuba Basin. MWH cites the study by Bookman-Edmonston Engineering, Inc. (Reference No.6) that estimates an estimated transmissivity of 260,000 gallons per day per ft (gpd/ft) of aquifer width. They discuss testing done at the Hallwood Irrigation Company and the Ramirez Water District showing aquifer transmissivities ranging from 23,000 ft^2/day to 34,000 ft^2/day (172,000 gpd/ft to 250,000 gpd/ft). MWH discusses several aquifer tests conducted at Beale Air Force base by others, indicating transmissivities ranging from 0.5 ft^2/day to 15,700 ft^2/day (3.7 gpd/ft to 117,000 gpd/ft). The Yuba Gold Fields have some of the highest transmissivities in the region; so for the purposes of this assessment tranmissivities from 100,000 gpd/ft to 260,000 gpd/ft are most likely appropriate.

MWH discusses storage coefficients in the Yuba Basin. MWH cites the Bookman-Edmonston Engineering, Inc. study (Reference No. 6) that estimates the highest specific yields of 10 to 12 percent in the upper zones along the Yuba River. As a part of their analyses for the Yuba Basin, they assigned values of 22 percent for gravel. For the purpose of this assessment, Youngdahl chose to use the more conservative 10 percent value.

<u>Regional Ground-Water Occurrence and Historical Levels</u>

The Hydrogeolgic Understanding of the Yuba Basin (Reference No. 13) and the Yuba County Water Agency Groundwater Management Plan (Reference 15) provides a wealth of information on groundwater occurrence and historical groundwater levels for the Yuba Basin. This information is periodically updated as is reflected in the Yuba County Water Agency Annual Monitoring and Measuring Report for the year 2011-1012 (Reference No. 18).

Reference No. 15 describes the Yuba Basin as being hydraulically isolated from the rest of the Sacramento Valley basin by the streams that surround it. Additionally the South Yuba subbasin is hydraulically isolated from the North Yuba subbasin by the Yuba River. The Yuba County groundwater subbasins encompass an area of approximately 270 square miles. Groundwater in the basins occurs under mostly unconfined conditions, with some possible local confinement due to lenses of clay and silt within the alluvial deposits (Reference No. 6). Reference No. 6 reported that well drillers reported no change in water levels during drilling in many wells, including shallow and moderately deep, indicating a lack of confinement in the area, with some exceptions in wells deeper than 300 to 440 feet into the Laguna Formations. Reference No. 13 indicated that wells of different depths near Beale Air Force Base had similar non-pumping water levels, indicative of unconfined conditions.

The South Yuba Subbasin has historically relied heavily on groundwater supplies. The California Department of Water Resources and more recently, the Yuba County Water Agency has monitored groundwater levels in wells of the South Yuba Subbasin. The hydrograph for Well 15N04E23A001M (Figure 5) shows groundwater elevations dropping from approximately 60 feet above mean sea level in the late 1940's to zero feet in the 1976/1977 drought. According to Reference No. 15, between 1948 and 1981, groundwater elevations in the South Yuba subbasin declined an estimated 130 feet. In 1984, the Yuba County Water Agency began delivering surface water from its New Bullards Bar Reservoir to offset groundwater extraction, resulting in a groundwater rise to near-historical levels. A review of Yuba County Water Agency Historical Water Transfers from 1987 through 2010 suggests that groundwater storage decreases during the years 1991, 2001, 2002, 2008, 2009, and 2010 were due to groundwater substitution transfers.

References No. 13, No. 15, and No. 18 all include historical groundwater elevation contour maps based on the monitoring well networks. Figures C-5 through C-12 of Reference No. 13 dramatically show the groundwater elevation decline and recovery in the South Yuba subbasin discussed above. The groundwater elevation contours show that groundwater in general flows from east to southwest in the South Yuba subbasin. The convex nature of the contours along the Yuba River supports the assertion that the Yuba River is a major source of groundwater recharge.

The edge of the area planned for reclamation is a distance of 3,500 feet to 4,500 feet from the Yuba River with extensive dredger tailings present between the mine and the river. The Yuba County Water Agency Main Canal draws water from the Daguerre Point Dam impoundment and conveys this water through a series of unlined ponds and channels through the dredger tailings field east and southeast of the area planned for reclamation, passing within 350 feet of the easternmost conceptual reclamation lake. Operators at Western Aggregates have reported that water levels fluctuate as a result of Canal operations (personal communication with Lloyd Burns, 2013). It is our opinion that groundwater levels in the area planned for reclamation are heavily influenced by Yuba River flows and flows within the Yuba County Water Agency Main Canal through the dredger tailings field.

Regional and Local Groundwater Quality

Reference No. 3 states that groundwater quality in the Yuba Basin appears to be generally very good. Saline conditions have been observed in two deep agricultural wells in the southern end of the South Yuba Subbasin. Most areas in the North and South Yuba subbasins show increasing trends for calcium, calcium carbonate, chlorides, alkalinity, electrical conductivity (EC). Total dissolved solids (TDS) are either near or exceed the secondary maximum contaminant level of 500 milligrams per liter (mg/L). More recent (at the time of preparation of Reference No. 3) groundwater quality met all of the primary State and Federal MCLs.

Table I-6 of Appendix I or Reference No. 13 provides a statistical summary of groundwater quality data in the Brophy Water district which is the closest water district to the south of the area planned for reclamation. The average concentrations of the constituents analyzed shows that only dissolved manganese and total dissolved solids exceeded secondary MCLs. The maximum concentrations exceeded secondary MCLs for conductance, dissolved iron, and dissolved manganese. The maximum concentration of total dissolved solids exceeded the primary MCL for dissolved solids.

Hynerlach, M.P., Alpers, C.N., Marvin-DiPasquale, M. Taylor, H.E., and De Wild, J.F., discuss the presence of mercury in the dredger tailings of the Yuba Goldfields (Reference No. 9). They report that the mercury was released in part due to use in placer gold mining in the riverbeds and in hydraulic mining. Mercury was also used by the dredgers to recover gold but gold dredges commonly recovered more mercury than they lost because of their efficient recovery of heavy sand- and silt-sized particles and the fact that much of the material being dredged was either hydraulic tailings or previously dredged ground.

The condition of low levels of mercury in the dredger tailings is supported by characterization work done for Western Aggregates LLC by Neptune and Company Inc. (Neptune) to evaluate the levels of mercury in fine gained materials collected from their designated disposal area (DDA) and planned for sale in soil amendments (The Neptune report is in Appendix B of Reference No. 14). Neptune reported detected mercury ranging from 0.030 milligrams per kilogram (mg/kg) to 0.591 mg/kg in 37 samples. Neptune reported detectable soluble mercury of 0.0006 milligrams per liter (mg/L) in one of nine samples analyzed. Neptune compared the results to background mercury concentrations and concluded that the levels of mercury within the DDA sediments were within and generally in the low range of background concentrations.

Western Aggregates, LLC is required to implement Monitoring and Reporting Programs No. 5-00-107 (MRP) (Reference No. 20). The MRP requires them to record daily flow rates into the DDA, periodic monitoring of physical water parameters in the DDA, two sampling locations along the Yuba River, and aggregate excavation areas greater than 3 feet below the water table. From January of 2013 through July of 2013, Western Aggregates, LLC reported that pH of the DDA ranged from 7.61 to 8.0. Electrical conductivity (EC) (micromhos per centimeter at field temperature) ranged from 87 to 106. The pH of the water at the Clamshell Dredge ranged form 7.51 to 8.08. The electrical conductivity ranged from 228 to 235. Western is also required to analyze grab samples from the DDA and aggregate excavations greater than 3 feet below the water table on a semiannual basis to analyze for low levels of mercury and for Total Petroleum Hydrocarbons (TPH). The mercury concentrations in the DDA ranged from 18 nanograms per liter to 28 ng/L. The TPH concentrations in the DDA were reported to be 490 micrograms per liter (ug/L) in January of 2013 and in July of 2013.

Western Aggregates, Inc. has indicated that they have no monitoring wells and have collected no groundwater quality data. LSCE reported on groundwater quality at the Teichert Aggregates' Marysville Aggregate Mining and Processing Site (adjoining Western Aggregates to the southwest). Four monitoring wells sampled in June 2004 at the Marysville Aggregate Mining and Processing Site were reported to have Total Dissolved Solids (TDS) ranging from 110 to 190 mg/L. The EC values ranged from 140 to 330 micromhos per centimeter, and pH ranged from 6.4 to 7.4. Metal concentrations, including mercury, were all below their respective reporting limits and below their respective water quality standards (MCLs). LCSE reported that the deeper groundwater was of slightly better quality, with TDS values ranging from 92 to 120 mg/L, EC values between 170 and 210 micromhos per centimeter, and pH ranging between 7.0 and 7.3. Surface water sampling in the wet pit reported pH values ranging from 7.41 to 7.52 and in the settling/recycling pond system of from 7.62 to 7.73. Recoverable mercury was reported at 0.0031 and 0.012 ug/L in the wet pit and between 0.0040 and 0.100 ug/L in the settling/recycling ponds.

LSCE reported on a mercury characterization study performed at the Teichert Hallwood Plant (across the Yuba River from Western Aggregates) (Reference No. 10). Mercury was determined to be present in the sediment in many different forms with varying solubility and mobility. Methyl mercury was present in some sediment and water samples in extremely low concentrations; typically less than 0.1ug/kg and 0.000050 ug/L, respectively. LCSE concluded that the Hallwood ponds are not conducive to methylation of the mercury present in the sediment, likely because the ponds are not organic rich and biologically active.

In general, groundwater surface elevations have mostly recovered to historical levels near Western Aggregates. Groundwater in the South Yuba Basin tends to exceed the MCL for total dissolved solids. The groundwater at a mine neighboring Western Aggregates contains total dissolved solids well below the MCL. The required Monitoring and Reporting Program for Western Aggregates is protective of groundwater quality.

3.0 Reclamation

According to the Amended Reclamation Plan (Reference No. 17), mining will create five lakes bordered by vegetated woodlands and dikes or berms. The lakes will have irregular meandering shorelines to support wildlife habitat and vegetation. Reclamation does not include the lakes created by mining, but does include the establishment of vegetation on the shore, berms, and areas surrounding the lakes. The slope gradients of the shoreline will vary from 2 horizontal units to 1 vertical unit (2H:1V) to 4H:1V) to create diverse habitats including beaches and shallows for wildlife and vegetation enhancement. The final anticipated end use following reclamation is open space and wildlife habitat consisting of aquatic lake, marsh, woodland and upland habitat.

The emergent marsh (marsh) will consist of approximately 4 miles of shoreline over 25 feet in width of 4H:1V sloped bench resulting in approximately 12 acres of emergent marsh. The settling pond area reclaimed to a vegetative state may also contribute to the total planned revegetation; at this time the areal extent of the settling pond has not yet been specified. The woodland (riparian upland) will range from 5 to 20 feet above the average lake level. The upland habitat (riparian upland) will consist of the constructed slopes, roadways, and lake boundaries that form the perimeters of the portions of the revegetated shoreline.

4.0 Potential Impacts Assessment

Youngdahl reviewed the draft Amended Reclamation Plan for Western Aggregates LLC (Reference No. 17) in regards to water use and an assessment was made for the potential impacts to ground water associated with the lakes resulting from mining and for the proposed reclamation. These included potential water level impacts from evaporative losses, possible cumulative water quality impacts from aggregate processing and discharge, impacts on the ability of the remaining tailings piles to contain the Yuba River during periods of high water, impacts on the Yuba County Water Agency Main Canal operations, and impacts on water temperature in the Yuba River.

Youngdahl (Reference No. 14) reported that in 2008 production ranged from 3.0 to 5.0 million tons per year but was anticipated to eventually reach 7.0 million tons per year, dependent upon market demands. Youngdahl also reported that approximately 3.3 to 5.5 million gallons per day (mgd) of water was supplied to the processing plant but could reach 15 mgd for dredge processing and 15 mgd for plant processing as market conditions change. Most of this water is and will be recycled through the mining and settling ponds.

The Amended Reclamation Plan indicates that aggregate operations will occur in 3 fifteen-year phases and will ultimately result in a total of 1,602 acres of lakes (including both mined lakes and reclaimed areas). Youngdahl is of the understanding that as of June 2012, there were approximately 342 acres of existing ponds in the area to be mined. Mining will therefore result in an additional surface area of 1,260 acres (including both mined lakes and reclaimed areas).

<u>Overall Evapotranspiration Losses From Lakes</u>

The primary water loss upon the completion of mining the lakes will be through evapotranspiration from the lakes and the reclaimed emergent wetlands (here included in the lake aerial extents). Rainfall falling on a lake and not lost to evaporation will be recharged into the lake and surrounding porous materials. In 2008 Youngdahl (Reference No. 14) described an estimated annual precipitation of 37.98 inches per year, and an annual evapotranspiration of 52.95 inches per year. Correcting for precipitation and evapotranspiration on a monthly basis results in an average estimated annual net water loss of 32.39 inches per year.

Table 1 – Average Annual Evapotranspiration Net Water Losses (inches)

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Average Rainfall	4.55	3.42	2.4	1.65	0.44	0.24	0.07	0.1	0.31	1.3	2.7	3.37	
Average ET	0.74	1.52	2.78	4.17	6.45	7.93	8.89	7.94	5.96	3.91	1.65	1.0	
Difference	-3.81	-1.9	0.38	2.52	6.01	7.69	8.82	7.84	5.65	2.61	-1.05	-2.37	32.39

For 1,260 acres of lake the additional average annual loss to evapotranspiration as compared to June of 2012 is estimated to be 3,402 acre-feet per year or about 3.0 mgd. The areal extent of ponds in June of 2012 of 342 acres is estimated to have an average annual loss due to evapotranspiration of 0.82 mgd.

The peak evapotranspiration time of year near Marysville is summer. For the month of July, the rate of evapotranspiration is estimated to be about 9.7 mgd for a 1,260-acre pond. The areal extent of ponds in June of 2012 of 342 acres is estimated to have a July loss due to evapotranspiration of 2.6 mgd.

The planned lakes are a distance of from 3,500 feet to 4,500 feet from the Yuba River with extensive dredger tailings present between the mine and the river. The Yuba County Water Agency Main Canal draws water from the Daguerre Point Dam impoundment and conveys this water through a series of unlined ponds and channels through the dredger tailings field east and southeast of the area planned for mining.

An analytical solution was used to estimate the impact of the increased water loss on groundwater levels in the area of Western Aggregates using the Papadopulos-Cooper solution (Reference No. 2) for drawdown in a large-diameter well that would account for water derived from storage in the planned reclamation lake scenario. A storativity value of 0.1 and transmissivity of 100,000 gpd/ft^2 was used for all calculations. Powers (Reference No. 5) discusses how many well system problems can treat multiple wells as a single well with an equivalent radius encompassing all of the wells. Youngdahl chose to treat the mining lakes as a single circular lake with a surface area equal to the sum of the surface areas of all of the lakes. The radius of a round lake with a surface area of 1,602 acres is 2,660 feet. Further complicating the analysis was the presence of recharge boundaries in the form of the Yuba River to the north and the Yuba County Water Agency Main Canal to the east (Figure 3). Both the Yuba River and the Yuba County Water Agency Main Canal are in direct contact with the highly porous mine tailings. Reference No. 8 describes how the Daguerre Point Dam diverts water to pass through the dredger tailings of the Yuba Gold Field. While the Canal draws water from a diversion at the Daguerre Point Dam, it also must draw water flowing westerly through the dredger tailings. Aqtesolv™ Version 4.5 software was used to implement a solution with recharge boundaries. For the purposes of drawdown calculations within the limitations of the software, the Yuba County Water Agency Main Canal recharge boundary was estimated to be from 8,700 to 9,700 feet east of the center of the reclamation lake system, although the Canal does pass within 350 feet of the edge of the easternmost reclamation lake (discussed in more detail in section 4.1 of this report). The Yuba River recharge boundary was estimated to be from 4,160 to 4,800 feet north of the center of the lakes.

The predicted changes in water levels associated with the expected increase in lake evaporation at the peak evapotranspiration time of July (9.7 mgd), after 3 months at the peak rate (to simulate end of summer conditions), and for one, five and fifty years at the average annual evapotranspiration rate of 3.0 mgd are provided in Tables 2 and 3. The drawdowns for the cases of the Yuba River and the Yuba County Water Agency Canal both being recharge boundaries and the case of only the Yuba River being a recharge boundary were calculated due to the consideration that the canal might eventually be lined or otherwise reconfigured to not leak into the surrounding gravels..

Table 2 – Predicted Decline in Water Levels near the Western Aggregates LLC Property Upon the Completion of Mining (water level decline in feet)*

Time	Reclaimed Ponds	One-Half Mile	One-Mile
July - 31 days	1.6	0.2	0
Summer – 92 days	4.0	1.1	0.3
1-Year	2.9	1.2	0.3
5 Years	4.6	2.0	0.35
50 Years	5.1	2.1	0.35

* Based on the Yuba River and the Yuba County Water Agency Canal being recharge boundaries.

Table 3 – Predicted Decline in Water Levels near the Western Aggregates LLC Property Upon the Completion of Mining (water level decline in feet)*

Time	Reclaimed Ponds	One-Half Mile	One-Mile
July - 31 days	1.6	0.2	0
Summer – 92 days	4.0	1.2	0.35
1-Year	3.0	1.21	0.6
5 Years	5.2	2.5	1.5
50 Years	5.9	3.2	1.9

* Based on only the Yuba River being a recharge boundary.

The calculated values represent the estimated levels of aquifer drawdown due to evaporative losses at the resulting lakes. The declines lessen with distances from the lakes to a little more than 2 feet after 50 years at one-half mile if both the Yuba River and Yuba County Water Agency Canal act as recharge barriers. The decline is estimated to be approximately 3.2 feet at one-half mile after 50 years if the Yuba county Water Agency Canal is not in use or is lined.

Conservative aquifer parameters were used, the storativity used was 0.1 and the transmissivity was 100,000 gpd/ft^2 . A storativity of as much as 0.22 and transmissivity as high as 260,000 gpd/ft could have been used based on some of the available data. This would result in calculated drawdown values less than one-half of those listed.

The estimated drawdowns listed in Tables 2 and 3 were calculated using the Papadopulos-Cooper solution for large diameter wells (Reference No. 2). Youngdahl also performed calculations for one year, five years, and fifty years using solutions by Moench (Reference No. 7) and Tartakovsky-Neuman (Reference No. 12), with the estimated drawdowns being close to that of the Papadopulos-Cooper solution.

The calculations indicate that groundwater level declines associated with the creation of the lakes by mining can be expected to be relatively small as compared to past drawdowns in the South Yuba Basin. According to Reference No. 13, between 1948 and 1981, groundwater elevations in the South Yuba subbasin declined an estimated 130 feet. The maximum 3.2 foot decline at one-half mile after 50 years is small in comparison.

<u>Emergent Marsh Impacts on Groundwater Levels</u>
Reclamation will result in the creation of at least 12 acres of emergent wetlands around the perimeter of the lakes. Additionally, the draft Amended Reclamation Plan indicates that the settling pond area reclaimed to a vegetative state may also contribute to the total planned revegetation. Without knowing the planned size of the settling pond upon the completion of reclamation, for the purposes of this assessment we assumed that a total of 100 acres will be a combination of emergent wetlands and settling pond area subject to evapotranspiration losses.

The average water loss from a pond area of 100 acres will be approximately 270 acre-feet per year or 0.24 mgd. For the month of highest evapotranspiration (July) the water loss would be about 73.5 acre-feet or 0.77 mgd. These values are less than 10% of the losses resulting from the lakes. The groundwater drawdown due to reclamation would be an order of magnitude less than that of the lakes. The 50-year drawdown at the lakes due to reclamation can be expected to be ½-foot or less. At one-half mile from the lakes after fifty years, it can be expected to be less than ¼ –foot and probably not detectable at a mile from the lakes.

If the settling pond is not converted to emergent marsh, the reclaimed area contributing to evapotranspiration will be 12 acres. The evapotranspiration would then be 32 acre-feet per year or 0.03 mgd. For the month of highest evapotranspiration (July) the water loss would be about 8.8 acre-feet or 0.09 mgd. The 50-year drawdown at the lakes due to reclamation would then be expected to be less than 0.1 feet and probably not detectable at one-half mile from the lakes.

Youngdahl is of the understanding that the creation of the lakes is not considered to be reclamation. Reclamation instead consists of the creation of the emergent wetlands along with the establishment of vegetation communities on the berms and areas surrounding the lakes.

Potential Water Quality Impacts

There are several ways in which the mining can result in a cumulative impact on groundwater quality that might be present upon reclamation.

1) Contamination of water in the excavation ponds could occur during mining from routine chemicals used during mining, fuel spills, and nearby pesticide applications;
2) Degradation of water quality in the designated disposal areas during mining by increased general minerals or mercury; and
3) Methyl mercury could form in the ponds following reclamation.

The Central Valley Regional Water Quality Control Board requires Western Aggregates, LLC to implement Monitoring and Reporting Program No. 5-00-107 (MRP) (Reference No. 20) in order to stay in compliance with Water Quality Order 97-03-DWQ National Pollutant Discharge Elimination System General Permit No. CASS000001. This monitoring program includes measurements of pH and electrical conductivity at selected locations. Western Aggregate is also required to analyze grab samples from the DDA on a semiannual basis to analyze for low levels of mercury and for Total Petroleum Hydrocarbons (TPH). According to reference No. 14, no chemicals are used in aggregate processing. All chemical use and storage at the facility is subject to regulatory requirements that are designed to be protective of the environment.

A review of monthly monitoring reports from January 2013 through July 2013 indicates that the water quality has remained within the parameters required by the MRP in this time period. It is our understanding that corrective action may be required by the Central Valley Regional Water Quality Control Board if the MRP detects water quality parameters outside of the ranges specified by the MRP.

Section 3.10 of the Amended Reclamation Plan describes groundwater protection measures. Water used for production and dust control is pumped from on site water supply ponds. The excavation and restoration methods do not require the use of toxic or hazardous substances with the sole exception of diesel fuel, oil, and lubricants required for the operation of excavators, loaders, dozers, haul trucks, and transformer oil. The electrically-powered dredge uses only bio-degradable oils. Equipment and machinery repairs requiring the use of lubricants, solvents, solutions, grease, or other compounds will be performed at the maintenance shops. Western Aggregates LLC indicated that they shall maintain the site and operations free of environmental hazards and the operator shall enforce good housekeeping standards and Best Management Practices. They shall provide a copy of their Business Emergency Plan to the State Mining and Geology Board. They shall provide a copy of the Regional Water Quality Control Board-issued General Activity Certificate and/or its Spill Prevention Control and Countermeasure Plan to the State Mining and Geology Board.

There is a potential for methyl mercury to form in the water of the reclaimed ponds, possibly as the wetlands on the edge of the ponds become biologically active and richer in organic materials. Reference 14 includes an assessment of the mercury in the fines that concludes that the mercury concentrations are within naturally occurring background levels. Additionally, the water quality monitoring under the MRP would likely detect any increase in mercury concentrations should mining disturb pockets of aggregates with elevated concentrations of mercury, allowing corrective actions. Therefore it is not likely that significant amounts of methyl mercury will develop as a result of reclamation.

4.0 Comments on Initial Study

The State Mining and Geology Board received two comments on the Initial Study. One letter was received from the Yuba County Water agency expressing concerns regarding the impacts of the reclamation on groundwater, Yuba County Water Agency facilities, and flows and water temperatures in the Yuba River near the mine. Another letter was received from the Three River Levee Improvement Authority (TRLIA) regarding the reclamation plan and TRLIA's flood protection goals.

4.1 Yuba County Water Agency

In a letter dated 24 May 2013, the Yuba County Water Agency (YCWA) expressed the following concerns:

1) The creation of a large amount (250,000 acre-feet) of stored water in the excavated ponds could affect groundwater levels and storage in the Yuba groundwater basin;
2) This could affect the operation of irrigation water canals in close proximity to the ponds;
3) The close proximity of the ponds and large amount of water stored has the potential to affect flows and water temperatures in the Yuba River.

The YWCA requested that Western Aggregates LLC coordinate with YCWA in the development of the ponds to ensure that no significant negative impacts occur.

<u>Stored Water Impact</u>

In terms of storage, the lakes will provide substantially more storage than the saturated gravels that they replace. Youngdahl used a conservative specific yield value of 10%. For a given volume of aquifer, 90% of the volume is therefore not water. The void left from mining will be completely filled with water. The volume of space occupied by the water in the lakes that replace the gravels would therefore be increased about 10-fold. The lakes are anticipated to be unlined and will be in direct hydraulic contact with the gravel aquifer. This water would still be available to the aquifer and the increased water availability would moderate the affects of local major groundwater withdrawals, reducing the drawdown due to these withdrawals.

<u>Operation of Canals Impact</u>

The YCWA Main Canal conveys water from the Daguerre Point Dam through the Yuba Gold Fields through a series of unlined channels and ponds in direct contact with the porous dredger tailings. According to Reference No. 19, an average of 99,000 acre-feet per year is diverted from the Yuba River through this canal to serve customers south of the Yuba River.

The calculated average groundwater level declines when considering both the Yuba River and YCWA Main Canal as recharge boundaries after 50 years is 5.1 feet at the lakes and 2.1 feet at one-half mile from the center of the lakes. The estimated drawdown due to 100 acres of reclamation (combined emergent wetlands and settling pond area) will be about 10 percent of this. If only the 12-acres of shoreline are reclaimed, the estimated drawdown would be a little more than 1 percent of the listed values. For an unlined canal with a surface elevation equal to the groundwater elevation, this would represent the maximum declines in surface water elevation that might be expected if flows are not increased to compensate for losses.

However, an 8,400 foot section of the canal passes in close proximity (within 350 feet) to the margins of planned Reclamation Lake No. 1, on the eastern side of the mine. Youngdahl estimated the evaporation loss for Lake No. 1 to be 1,330 acre-feet per year on an annual basis, and 363 acre-feet for the month of July. This translates to approximately 1.2 mgd on a yearly basis and approximately 3.8 mgd for July. Youngdahl calculated the estimated drawdown using the Papadopulos-Cooper solution for large diameter wells using the Yuba River as a recharge boundary as above and the Yuba County Water Agency Main Canal as a recharge boundary at 350 feet east of the edge of the lake (1,477 feet from the center of the lake). For all time frames (31 days, 92 days, 1 year, 5 years, and 50 years) the drawdown in Lake No. 1 was negligible.

Reference No. 8 describes the groundwater hydrology of the Yuba Gold Fields (Section 2.1 above). The Daguerre Point Dam diverts Yuba River Water through the dredger tailings that are crossed by the channels and ponds of the canal. It is likely that water lost from the Yuba County Water Agency Main Canal to Lake No.1 would be quickly replenished by inflow from the section of the canal with northeast adjoining gravels.

The section of unlined canal can be evaluated as a one sided trench dewatering the adjoining aquifer. Powers (Reference No. 5) provides the Dupuit equation for steady state flow into a trench from an unconfined aquifer. Assuming a hydraulic conductivity of 2,250 gpd/ft^2, a ½-foot drop in groundwater height as it drains into the canal, a lateral drainage distance (where the effective aquifer thickness drops from 20 feet to 19.5 feet) into the adjoining aquifer of 50 feet, a canal depth of twenty feet (effective aquifer thickness), and a trench length of 8,400 feet, the unit drop would result in an estimated inflow of more than 7.5 million gallons per minute from the dredger tailings adjoining the 8,400-foot stretch of canal. The winding canal length and pond shores through the tailings are much longer than this 8,400-foot stretch (at least an additional 6,100 feet) and so would probably have significantly more groundwater available from the dredger tailings.

The canal flow would only be affected where the inflow to the canal causes the water surface to exceed the groundwater elevation adjoining the canal. Under normal conditions, we would expect significant losses from the canal to the adjoining dredger tailings whenever flows are introduced that exceed groundwater elevations. If drawdowns are increased due to evaporation losses from the lakes, then larger volumes of water may be required to sustain flows when the water surface of the canal is above the adjoining groundwater elevations.

If the water flow is increased into the canal to compensate for evaporative losses from the lakes, drawdown of the canal water surface will likely become negligible. If the flow is not increased, drawdown of the canal water surface will likely occur with the surface falling to somewhere well above the maximum lake drawdown value of 5.9 feet after 50 years for the entire lake systems or well above the 2 foot drawdown estimate if only Lake No. 1 is considered. The inflow of water to the unlined canal from the adjoining saturated dredger tailings and the Yuba River (through the dredger tailings) will substantially compensate for the evapotranspiration losses.

The impact will be that when higher flows are needed for irrigation (such as in summer), the amount of water diverted through the canal may have to be increased to compensate for slightly lower groundwater levels. It is likely that the drawdown affects due to reclamation will not be measurable and therefore will not be significant.

Impact on Yuba River Water Flows and Temperatures

According to the Yuba County Water Agency, they have documented some of the effects that water flowing through the Yuba Goldfields has on flows and water temperatures in the river. The lakes planned by Western Aggregates are as close as 3,500 feet south of the Yuba River, and would be unlikely to have a direct significant effect on the Yuba River other than drawing groundwater flow from the river (and thus reducing river flows) to compensate for water lost to evapotranspiration.

Section 2.1 above discusses the groundwater hydrology of the Yuba Goldfields. Water that passes through the Yuba Goldfields is at least partially drained back into the Yuba River via an outlet canal. Reference No. 8 reported that water quality conditions for fish within the Yuba Goldfields, especially temperature, is poor.

The impact of increased evapotranspiration losses from the reclamation lakes would be to reduce the amount of outflow via the outlet canal back into the Yuba River. At times of year when water temperatures in the Yuba Goldfields might be expected to become elevated relative to the Yuba River, this could reduce temperature impacts on the Yuba River, possibly improving water quality conditions for fish. However, overall reduced flows in the Yuba River may also allow more warming, which would be an adverse effect on water quality conditions for fish.

Reference No. 21 is Technical Memorandum 2-6 prepared by the Yuba County Water Agency regarding water temperature models for the Yuba River Development Project. Page 110 provides a discussion of the comparison of the water temperature model for the stretch of Yuba River below Daguerre Point Dam. Their simulated temperatures were cooler than the historical temperatures. This implies that the prediction of impacts on temperatures due to changing flows in the stretch of Yuba River flowing through the Goldfields below Daguerre Point Dam may be difficult with the available information.

The average annual evapotranspiration loss from all of the Western Aggregates LLC lakes (including currently existing lakes and projected future lakes) is estimated to be approximately 3.8 mgd, equating to approximately 6 cfs. The peak monthly (July) evapotranspiration loss is estimated to be 12.3 mgd, equating to approximately 19 cfs. This would be the amount drawn in from the gravels surrounding the lakes, the Yuba River, and the Yuba County Water Agency Main Canal.

There are four (4) other nearby aggregate mines in the Yuba Goldfield gravels that also contribute to evapotranspiration. According to Reference No. 10 the Hallwood Mine, on the north side of the Yuba River from Western Aggregates, will have a mining area of 520 acres. Upon the completion of proposed mining operations, the Baldwin Hallwood mine site is expected to contain approximately 202 acres of open ponds with vegetated shorelines. Reference No. 11 indicates that the Marysville aggregate mining site southwest of and adjacent to Western Aggregates will have a mining area of 420 acres. Youngdahl is of the understanding that the Dantoni Pit on the west side and adjoining

Western Aggregates will be 180 acres in size upon the completion of mining. The combined acreage of ponds would be 2,582 acres, not including emergent marsh that might be associated with each project. The combined annual loss to evapotranspiration is estimated to be 6.2 mgd, equating to about 9.6 cfs. The peak monthly (July) evapotranspiration loss is estimated to be 19.9 mgd, equating to approximately 31 cfs.

The average annual evapotranspiration loss from 100 acres of combined reclaimed emergent wetlands and settling pond area would be approximately .24 mgd equating to approximately 0.37 cfs due to reclamation. The peak monthly (July) evapotranspiration loss is estimated to be 0.77 mgd, equating to approximately 1.2 cfs due to reclamation. If the reclaimed emergent marsh is only 12 acres in extent with no settling pond, then the average annual evapotranspiration loss would be approximately 0.03 mgd equating to 0.04 cfs. The July evapotranspiration loss is estimated to be 0.09 mgd or 0.14 cfs.

Youngdahl downloaded mean daily flow data from the California Data Exchange Data for the Yuba River near Marysville collected at Station MRY, approximately 15,000 feet downstream from Western Aggregates, for the period January 1, 1993 through September 15, 2013. The range of recorded flows was 90 cfs to 83,958 cfs. The 1st quartile flow was 696 cfs and the median flow was 1220 cfs. The 90 cfs flow on November 29, 2000 was preceded by an average daily flow of 357 cfs on November 28, and followed by an average daily flow of 523 cfs on November 30th, so this is probably not representative of typical low flow conditions. The most consistent low flow conditions appeared to be flows of from 286 cfs to 406 cfs for the months of May and June of 2001. The median flow for those months was 353 cfs. For the 100-acre emergent marsh scenario, a peak reduction of 1.2 cfs is approximately a 0.34 percent reduction in flow for median low flow conditions. The peak reduction would be 0.10 percent under median flow conditions. An annual average flow reduction of 0.37 cfs would be 0.10 percent under median low flow conditions and a 0.030 percent under median flow conditions. If only 12 acres are reclaimed as emergent marsh, the annual average flow reduction of 0.04 cfs would be 0.011 percent under median low flow conditions and 0.00033 percent for median flow conditions. The peak reduction for 12 acres would be 0.040 percent for median low flow and 0.01 percent for median flow conditions.

Table 4 – Estimated Impact of Evapotranspiration on Yuba River Flows

	100 Reclaimed Acres		**12 Reclaimed Acres**		**All Mine Pond Areas**[3]	
	Reduction	**Percentage**	**Reduction**	**Percentage**	**Reduction**	**Percentage**
Average Annual Flow Reduction (Median Flow)[1]	0.37cfs	0.030	0.04 cfs	0.0033	9.6 cfs	0.79
Peak (July) Flow Reduction (Median Flow)[1]	1.2 cfs	0.10	0.14 cfs	0.011	31 cfs	2.5
Average Annual Flow Reduction (Median Low Flow)[2]	0.37cfs	0.10	0.04 cfs	0.011	9.6 cfs	2.7
Peak (July) Flow Reduction (Median Low Flow)[2]	1.2 cfs	0.34	0.14 cfs	0.040	31 cfs	8.8

[1]1220 cfs, [2]353 cfs, [3]Includes Western Aggregates, Teichert Hallwood, Baldwin Hallwood, Teichert Marysville, and Dantoni Pit.

According to Reference No. 8, the Goldfield's outlet canal flows are 5 to 50 cfs during the summer and fall months. It is likely that most of the flow reduction for the Yuba River would be expressed in reduced flows from the outlet canal draining into the Yuba River.

4.2 Three Rivers Levee Improvement Authority

The Three Rivers Levee Improvement Authority (TRLIA) indicates that they have been working on the Reclamation District 784 levee systems since 2004 to meet both 100-year and 200-year flood protection requirements. TRLIA stated that both United States Army Corps of Engineers and TRLIA evaluations have determined that erosion on the south bank of the Yuba River Tailings Mounds are increasing the risk of flooding from the Yuba River through the Goldfields. TRLIA indicated that they looked forward to working with Western Aggregates to ensure that the Reclamation Plan is consistent with TRLIA's flood protection goals in the future.

TRLIA issued and Interim Findings of Flood Risk Analysis of the Yuba Goldfields document on 18 October 2011 (Reference No. 16). In this, they describe that past and current activities of dredging and aggregate mining in the Yuba Goldfields. The history and status of training walls along the north and south sides of the active Yuba River main channel is discussed. Reference No. 16 discusses a 2010 presentation by the United States Army Corps of Engineers indicating that the Yuba Goldfields do not present a 100-year flood risk but do present a flood risk from a 200-year storm event.

TRLIA analyzed the effects of a breach of the training wall on the south side of the Yuba River to identify the most likely pathways for a flood through the Yuba Goldfields. TRLIA then identified potential breach sites and landform changes that would make it easier for flood water to pass through the mine tailings. TRLIA developed a work plan to mitigate the areas posing the greatest risks.

Phase 1 of the work plan consisted of modifying locations within the mining areas identified as being flow paths and completing agreements with mining operators to establish maintenance responsibilities for these features. Reference No. 16 indicated that TRLIA signed contracts with the mining companies in the Goldfields to construct high ground mounds and the time of document preparation, this work was under way.

Phase 2 of the work plan included modification of any additional mining areas as necessary to certify meeting FEMA's criteria for a 100 year flood event. Phase 3 of the work plan is the development of a sustainable 200-year plan involving all stakeholders that:

1) Ensures future mining operations do not increase flood risk;
2) Provides 200-year flood protection;
3) Repairs the South Training Wall and other land features identified that are needed for 200-year flood protection; and
4) Maintains the South Training Wall and other land features identified that are needed for 200-year flood protection.

Youngdahl understands that Western Aggregates LLC has been working with TRLIA in implementing portions of the work plan (Reference No. 22).

5.0 Impact Summary

The increased average evapotranspiration from the reclamation may reach as much about 0.24 mgd, assuming 100 acres of reclaimed emergent wetlands. The peak summer evapotranspiration rates for 100 acres of reclaimed areas may range as high as 0.77 mgd. The peak summer evapotranspiration rates for 12 acres of reclaimed areas may range as high as 0.09 mgd. The losses to evapotranspiration will be replenished mostly by inflows from the Yuba River and the Yuba County Water Agency Main Canal through the gravels to the lakes. Groundwater level impacts will likely be less than a ½-foot drop after 50 years at the reclaimed lakes and less than a ¼-foot drop ½-mile from the lakes due to the hydraulic connections of the Yuba Gold Fields gravels with the river, the Daguerre Point Dam impoundment, and the Yuba County Water Agency Main Canal. Peak evapotranspiration from 100 acres of reclaimed area during low flow conditions in the Yuba River may result in as much as a 0.34 percent reduction in median low flow and for 12 acres of reclaimed area as much as a 0.01 percent reduction in median low flow. This peak reduction in flow is probably not a significant impact.

The impacts of reclamation on Yuba River water temperatures cannot be precisely estimated from the available information. The Yuba County Water Agency Temperature Model for the lower Yuba River below the Daguerre Point Dam (Reference No. 21) would have to be adjusted to accurately predict the water temperatures. However, such a detailed analysis is not warranted. The analysis presented above indicates there could be reduction in Yuba River flows under cumulative conditions, and the project would contribute to that impact. To reduce the project's contribution, mitigation that would avoid reclaiming the settling pond as emergent marsh would be sufficient to minimize the flow reduction to just 0.01 percent associated with the 12 acres of reclaimed shoreline. Because the reduction in flow would be negligible, with mitigation, the effect on temperature would likely not be measurable.

6.0 Closure

This assessment of hydrogeologic conditions and the potential impacts of mine reclamation have been performed using existing data. This assessment meets the current standard of practice common to the hydrogeology and environmental geology professions at the time of the study and for the location of the Western Aggregates mine. No warranties are expressed or implied.

Very truly yours,
Youngdahl Consulting Group, Inc.

CERTIFIED HYDROGEOLOGIST
DAVID C. SEDERQUIST
NO. 619
EXPIRATION DATE 9/30/2014
STATE OF CALIFORNIA

David C. Sederquist, C.E.G., C.HG.
Senior Engineering Geologist/Hydrogeologist

Attachments:

References
Figures
Appendix A – Aqtesolv Calculation Sheets

7.0 References

1) Theis, C.V., 1935. The Relation between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well using Ground-Water Storage, Trans. Am. Geophys. Union, v. 16, pp. 519-524.
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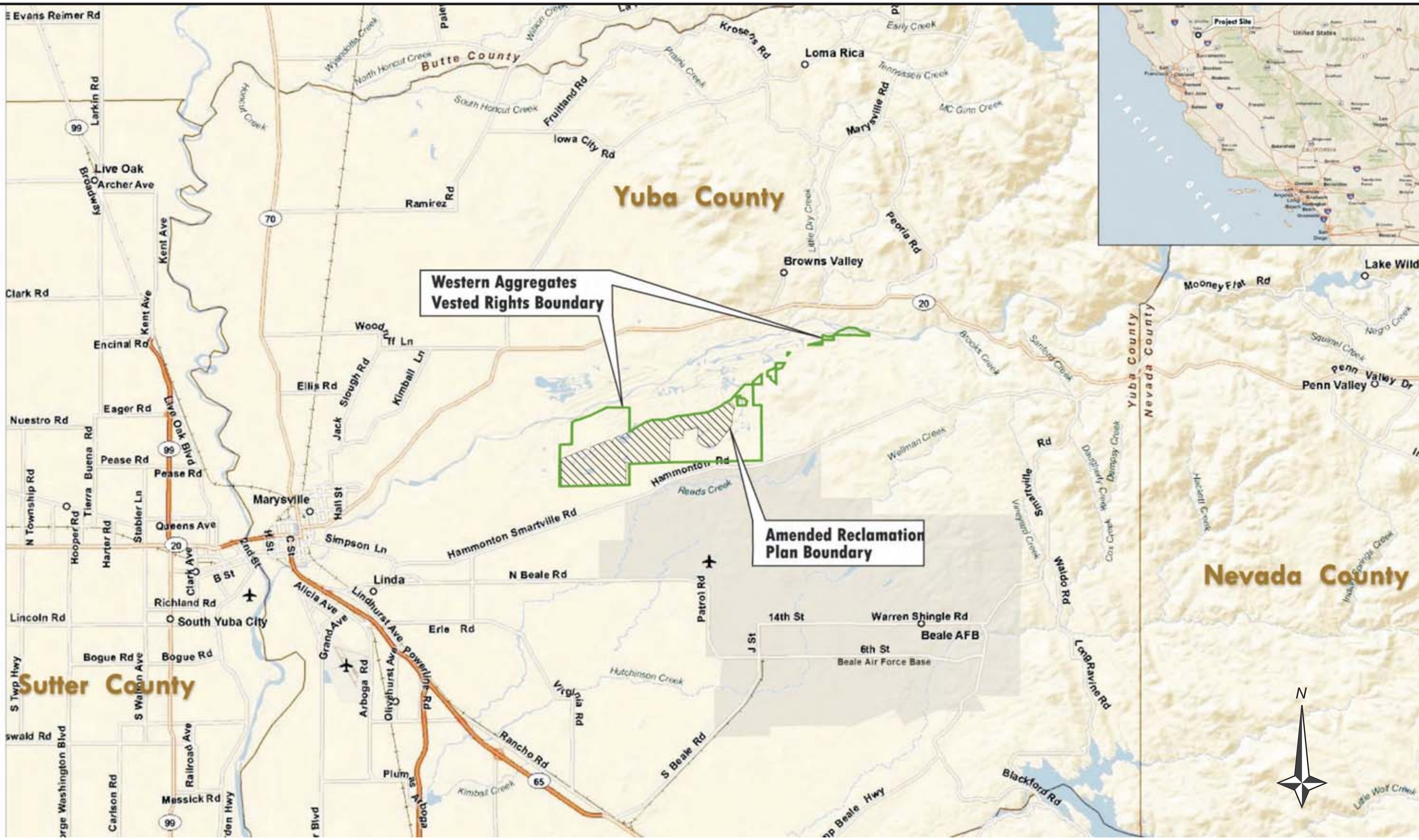
15) Yuba County Water Agency, 2010, Groundwater Management Plan.
16) Background Information for Briefing on TRLIA Interim Findings of Flood Risk Analysis of the Yuba Goldfields at CVFPB October 28,2011 meeting., prepared by Three Rivers Levee Improvement Authority, dated 18 October 2011.
17) Lilburn Corporation, 2012. Amended Reclamation Plan for Western Aggregates LLC.
18) Yuba County Water Agency, 2012. Annual Monitoring and Measuring Report 2011-1012.
19) Yuba County Water Agency, Agricultural Water Management Plan, December 2012.
20) Monitoring and Reporting Program No. 5-00-107 Western Aggregates, LLC, January 2013 through July 2013 Monthly Monitoring Reports.
21) Technical Memorandum 2-6, Water Temperature Models, Yuba River Development Project, FERC Project No. 2246, prepared by Yuba County Water Agency, dated October 2013.
22) Verbal communication with Lloyd Burns of Western Aggregates LLC, 12 June 2013.

Figures



Area Map

Western Aggregates LLC
Yuba County, California

LEGEND

- Vested Rights Boundary
- Amended Reclamation Plan Boundary and Operating Area for Aggregates

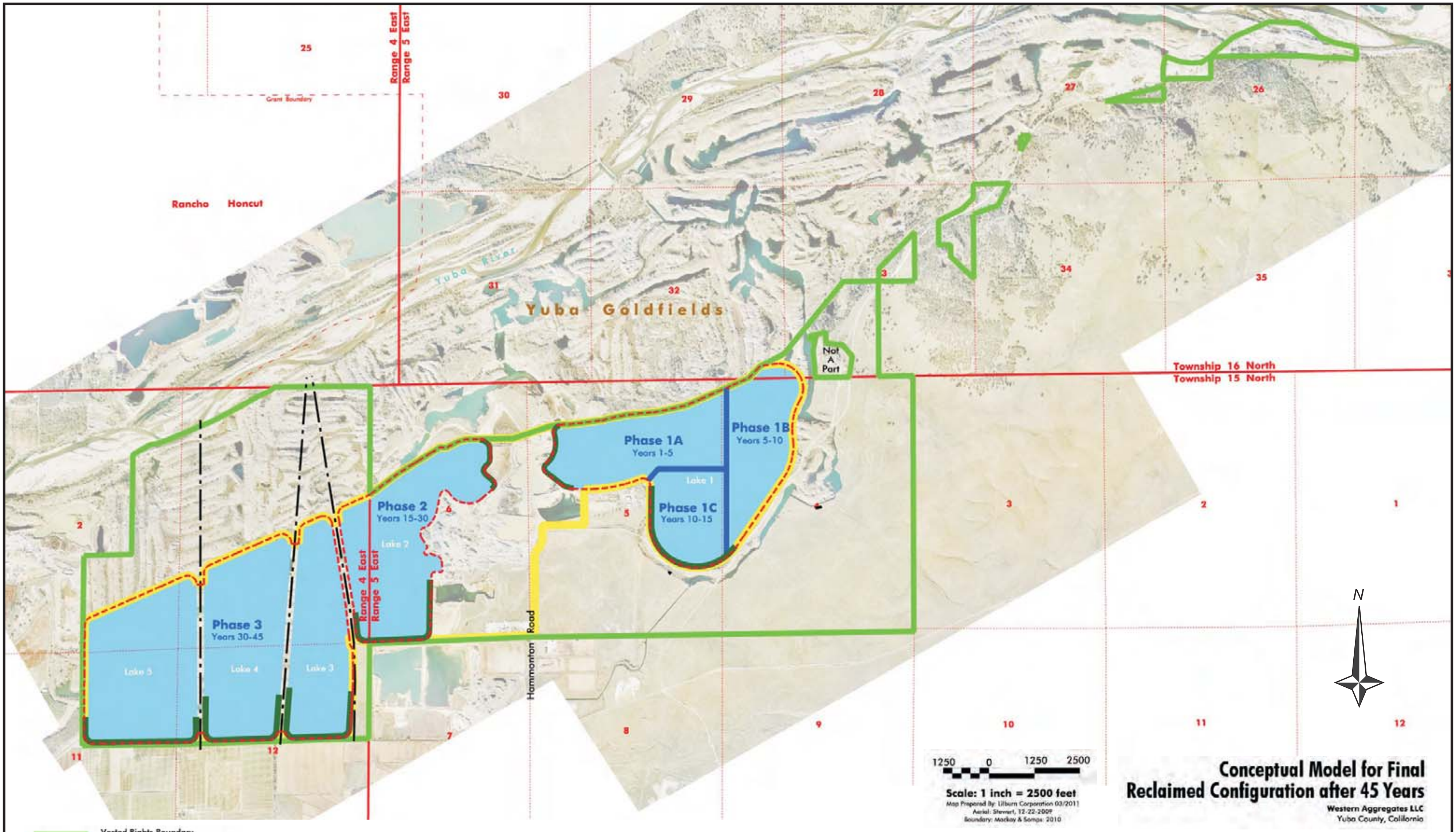
0 — 3 Miles

Source: Lilburn Corp., 03/2011 (TAG)

LILBURN CORPORATION

YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING

Project No.: E07085.004	AREA MAP	FIGURE
October 2013	Western Aggregates EIR Yuba County, California	1



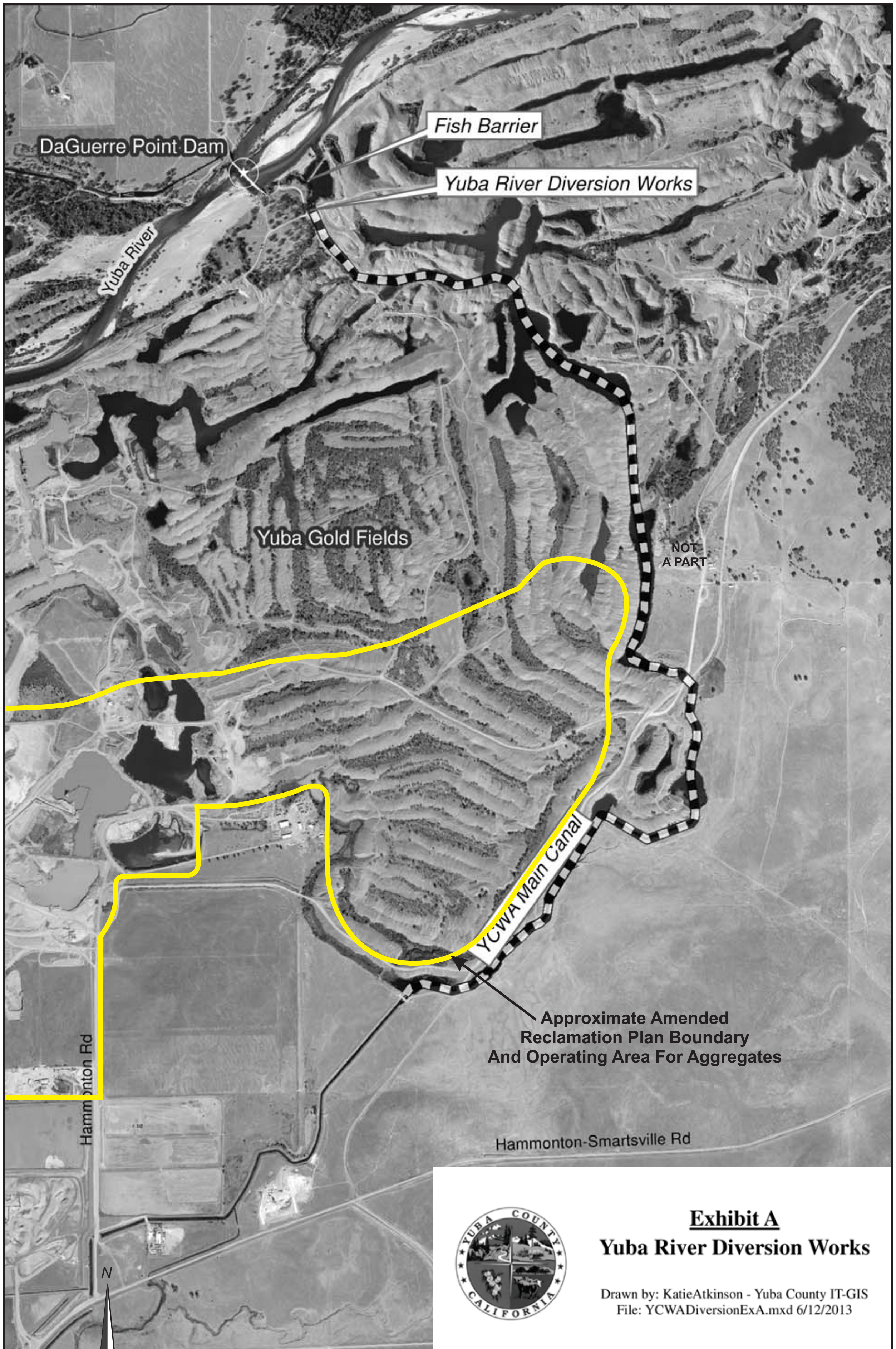
YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING

Project No.: E07085.004

October 2013

RECLAMATION CONCEPTUAL MODEL
Western Aggregates EIR
Yuba County, California

FIGURE 2



No Scale

YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING

Project No.: E07085.004

October 2013

RIVER DIVERSION

Western Aggregates EIR
Yuba County, California

FIGURE 3

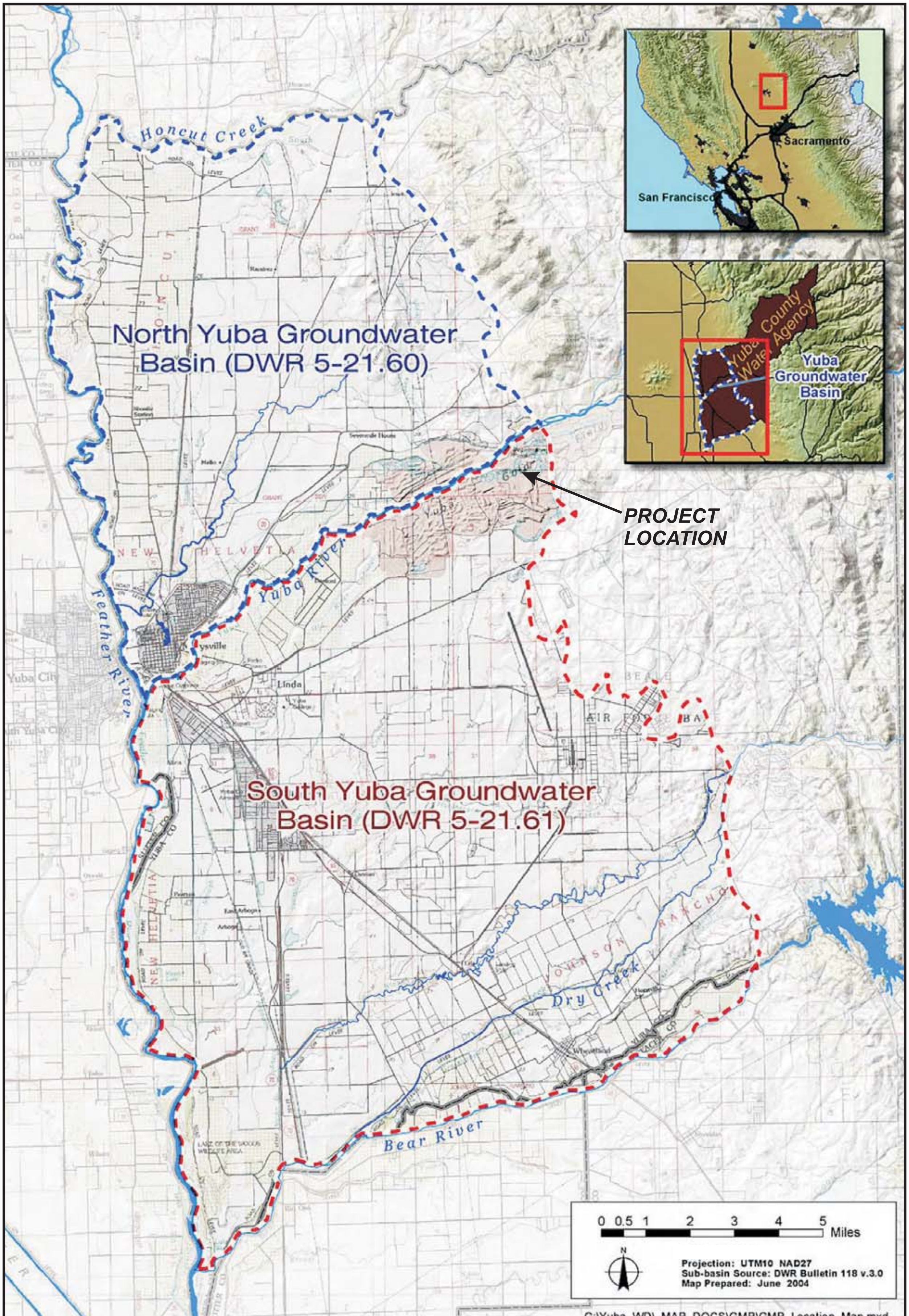


Figure 1-1. Location of Yuba County, Yuba County Water Agency, and Yuba Groundwater Basin (Groundwater Management Plan Area)

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E07085.004	**YUBA GROUNDWATER BASINS**	**FIGURE**
	October 2013	**Western Aggregates EIR** Yuba County, California	**4**

REFERENCE: *California Department Of Water Resources*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E07085.004 **October 2013**	***HYDROGRAPH FOR WELL NO. 15N04E23A001M*** **Western Aggregates EIR** Yuba County, California	**FIGURE** **5**

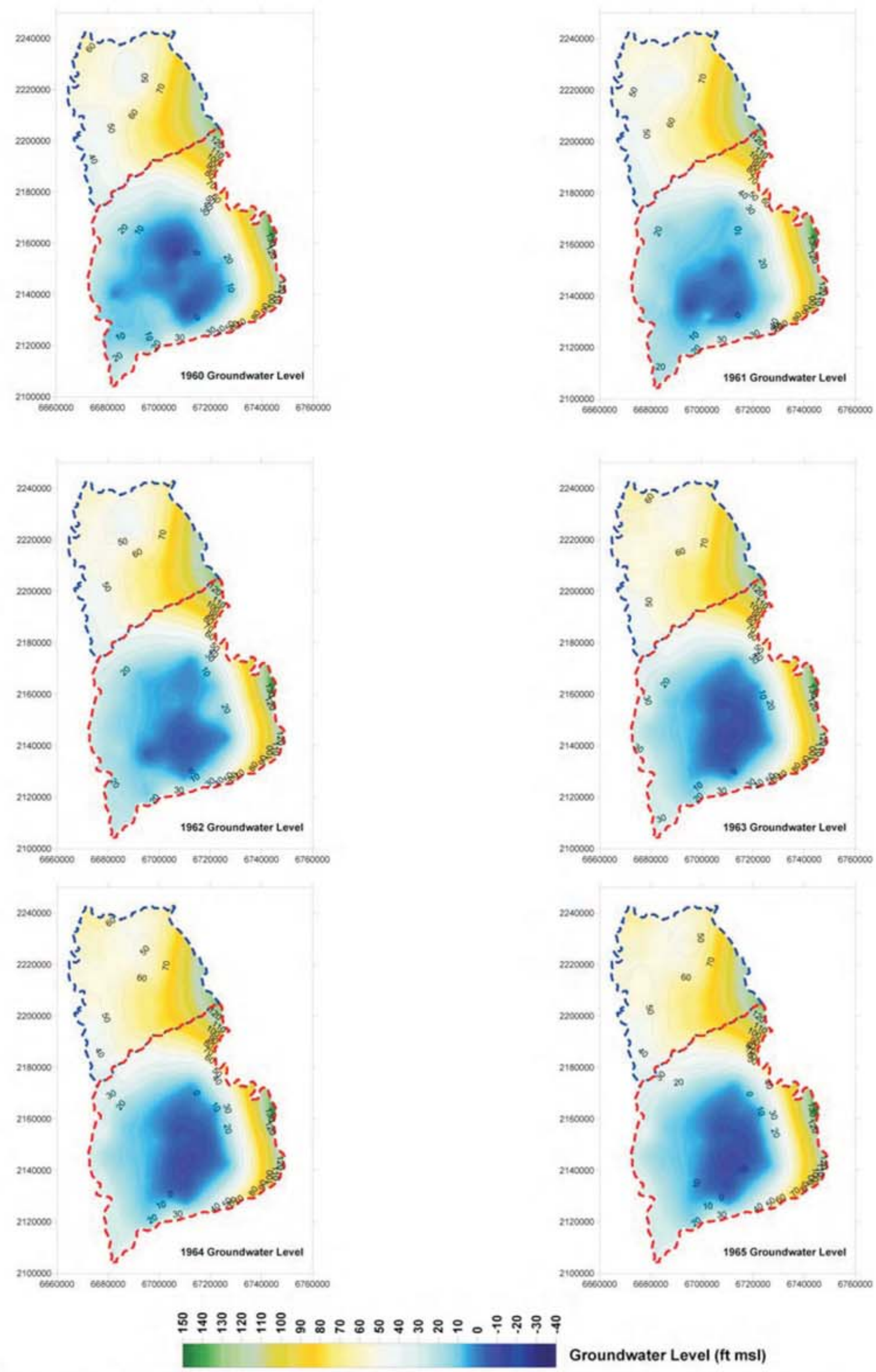


Figure C-5. Groundwater Surface Elevation Contour Maps from 1960 to 1965

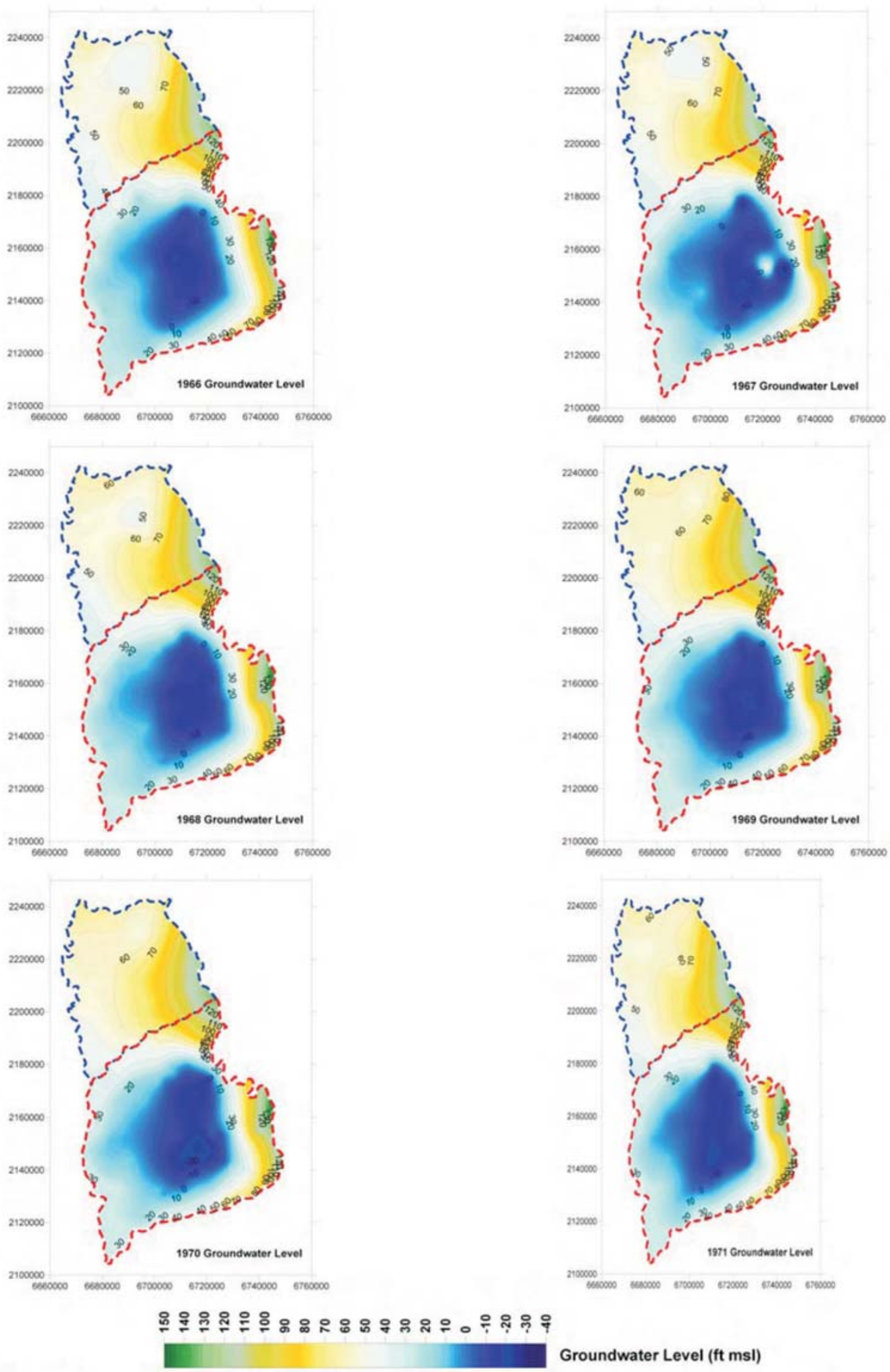


Figure C-6. Groundwater Surface Elevation Contour Maps from 1966 to 1971

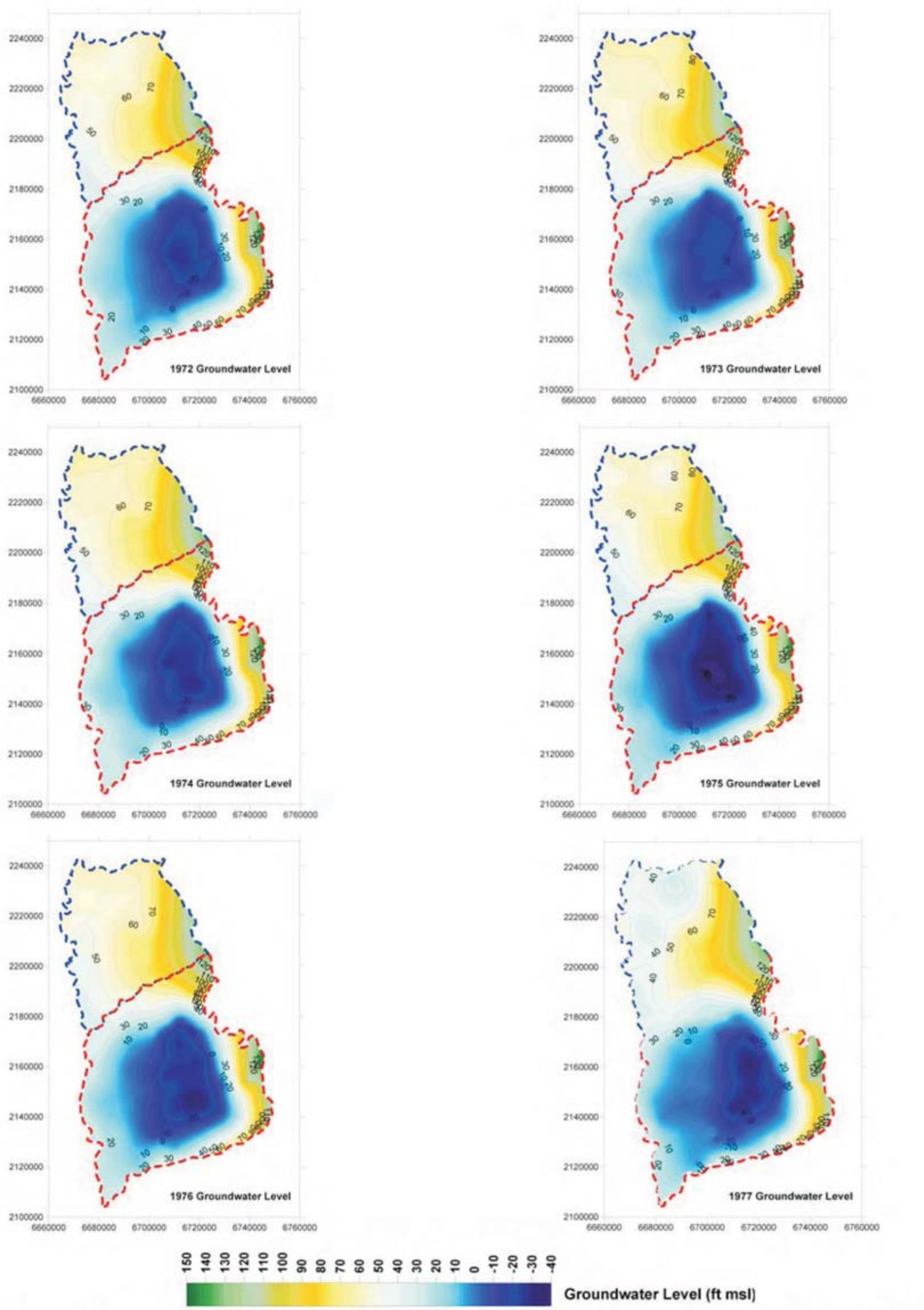


Figure C-7. Groundwater Surface Elevation Contour Maps from 1972 to 1977

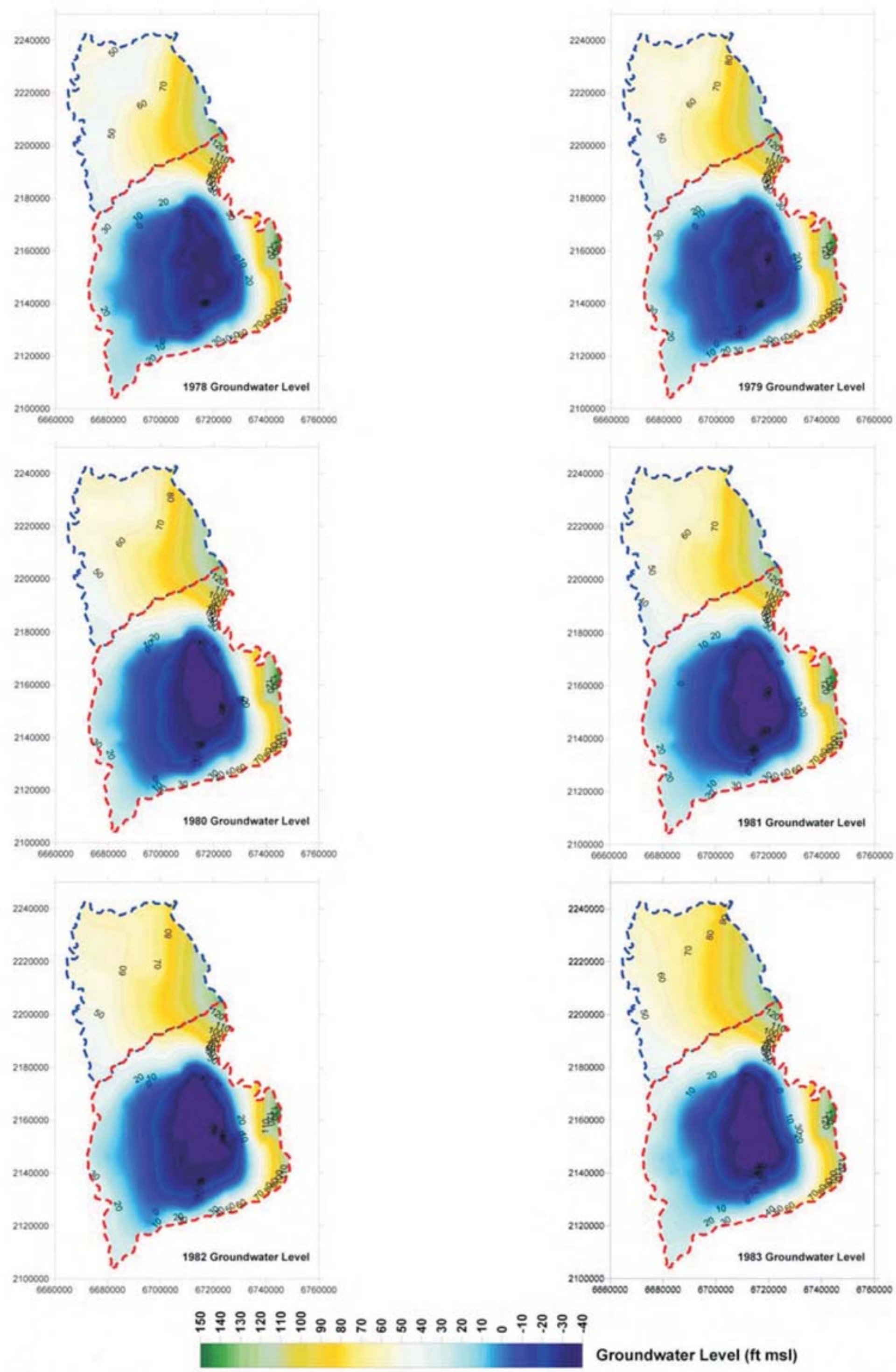


Figure C-8. Groundwater Surface Elevation Contour Maps from 1978 to 1983

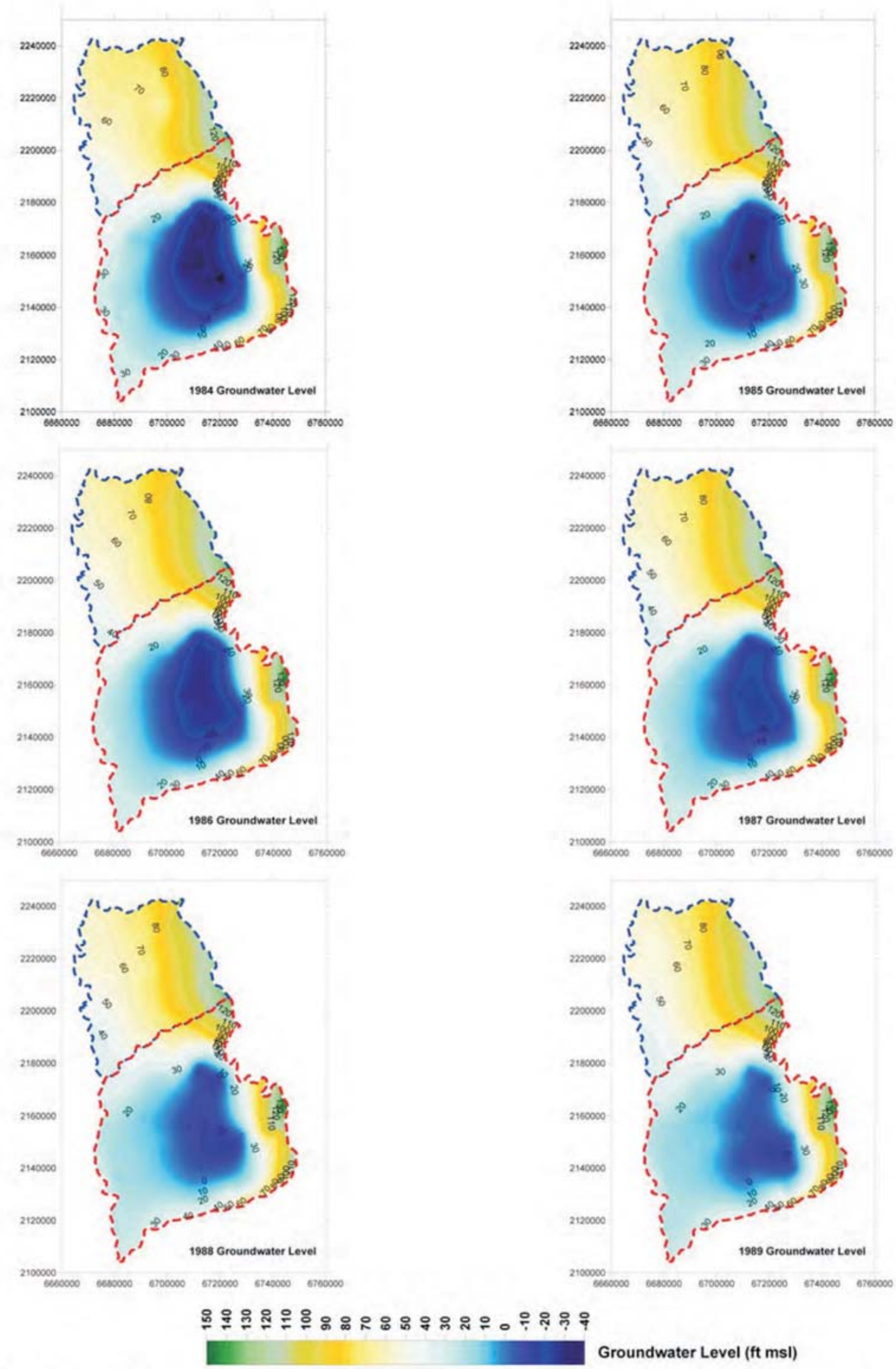


Figure C-9. Groundwater Surface Elevation Contour Maps from 1984 to 1989

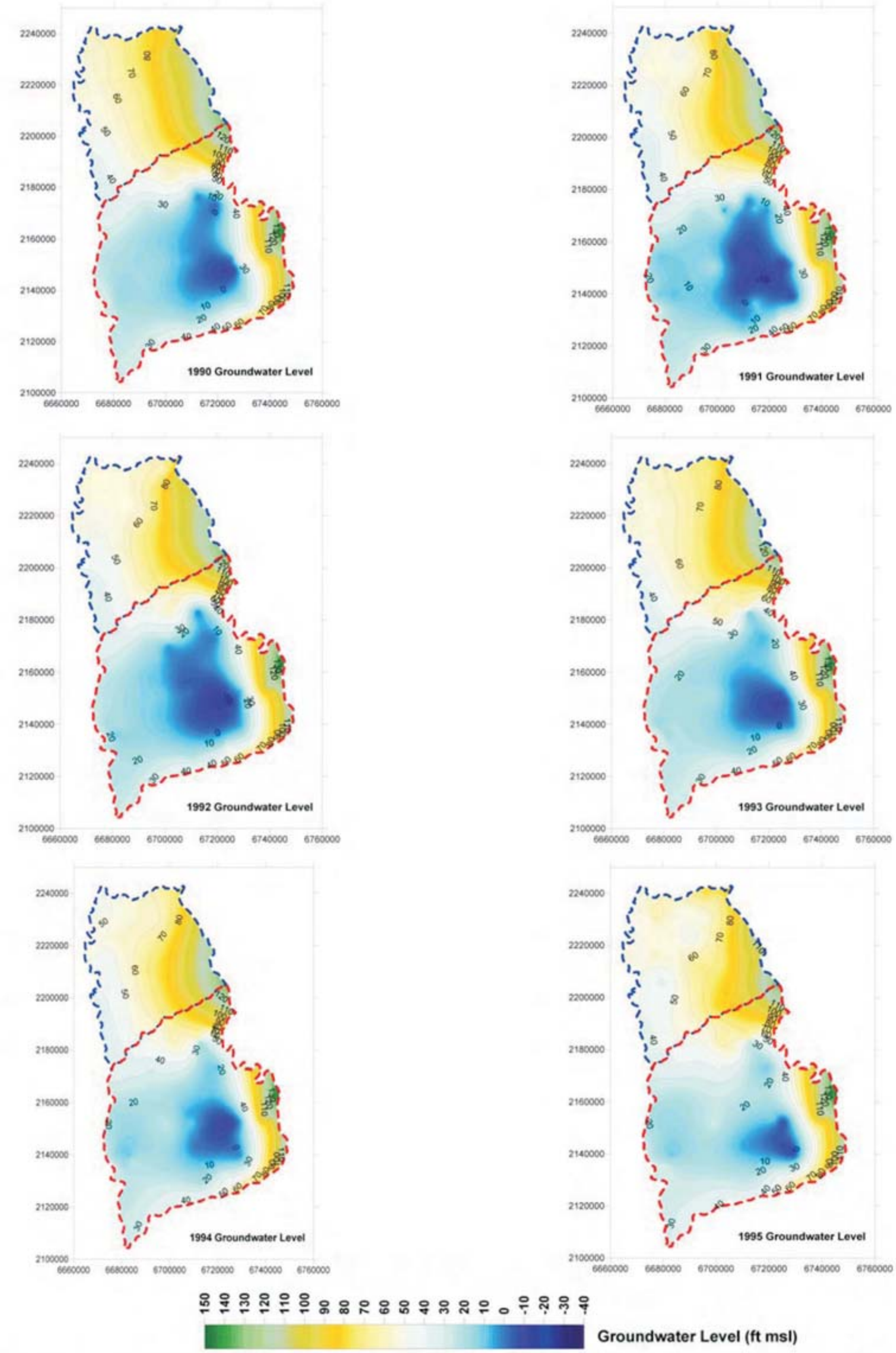


Figure C-10. Groundwater Surface Elevation Contour Maps from 1990 to 1995

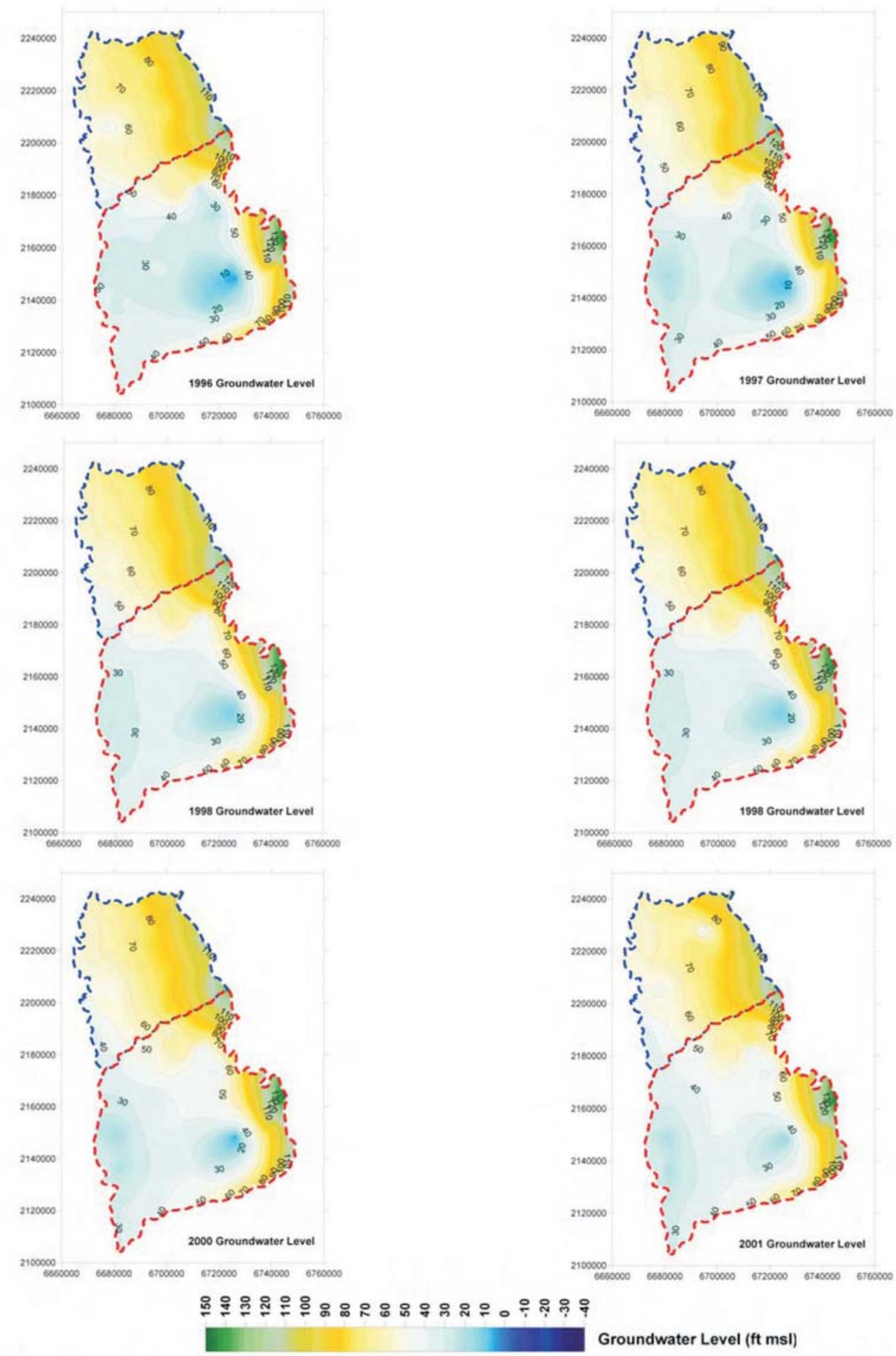


Figure C-11. Groundwater Surface Elevation Contour Maps from 1996 to 2001

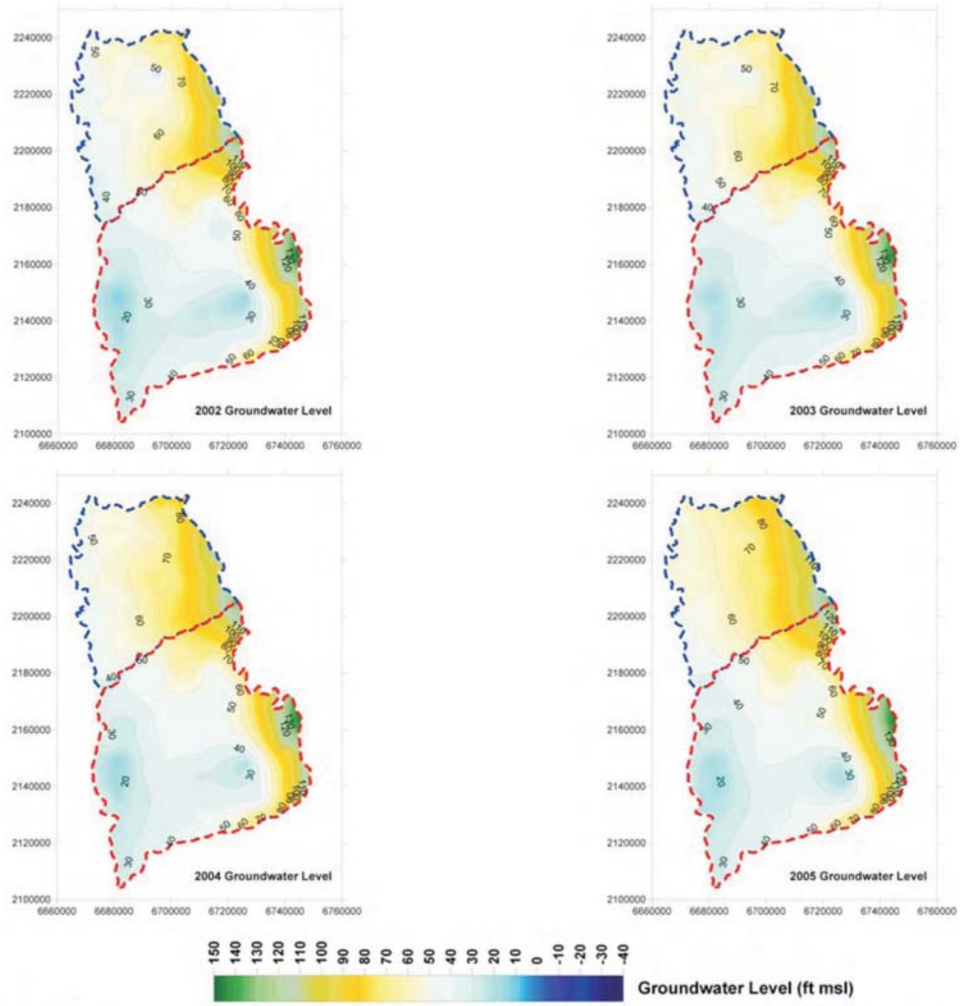
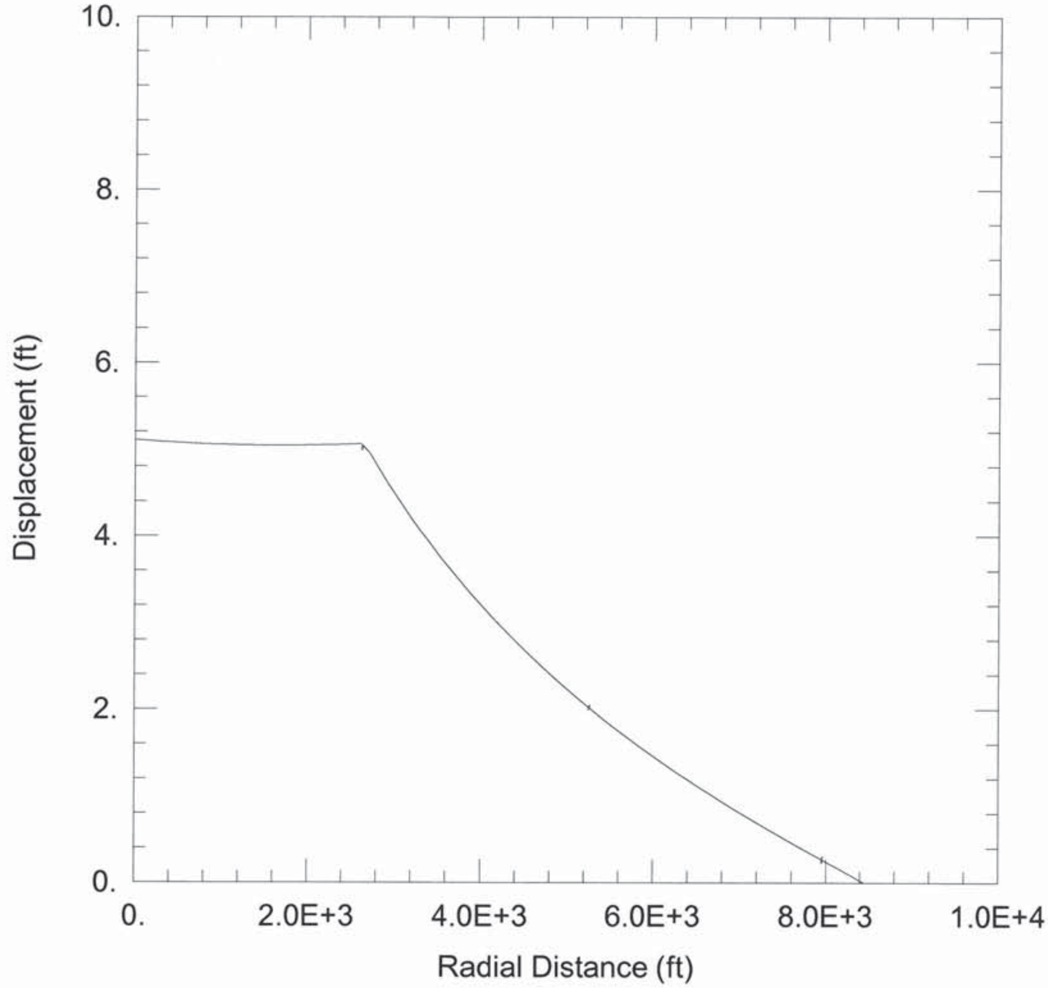


Figure C-12. Groundwater Surface Elevation Contour maps from 2002 to 2005

Appendix A
Aqtesolv Calculation Sheets



WESTERN AGGREGATES 50 YEARS

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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

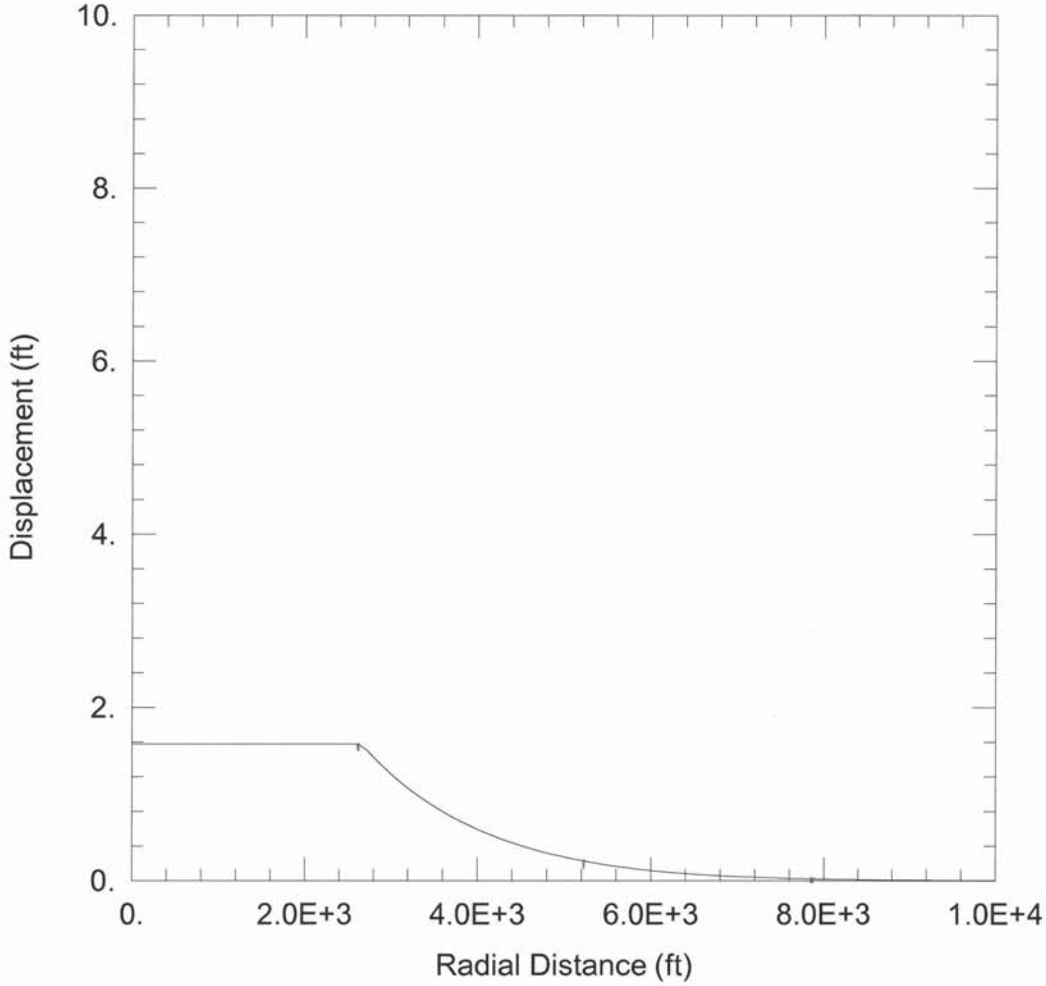
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Obs. Well 2	9980	0
▫ Obs. Well 1	7630	0
▫ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES JULY AFTER 31 DAYS - YUBA RIVER ONLY

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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

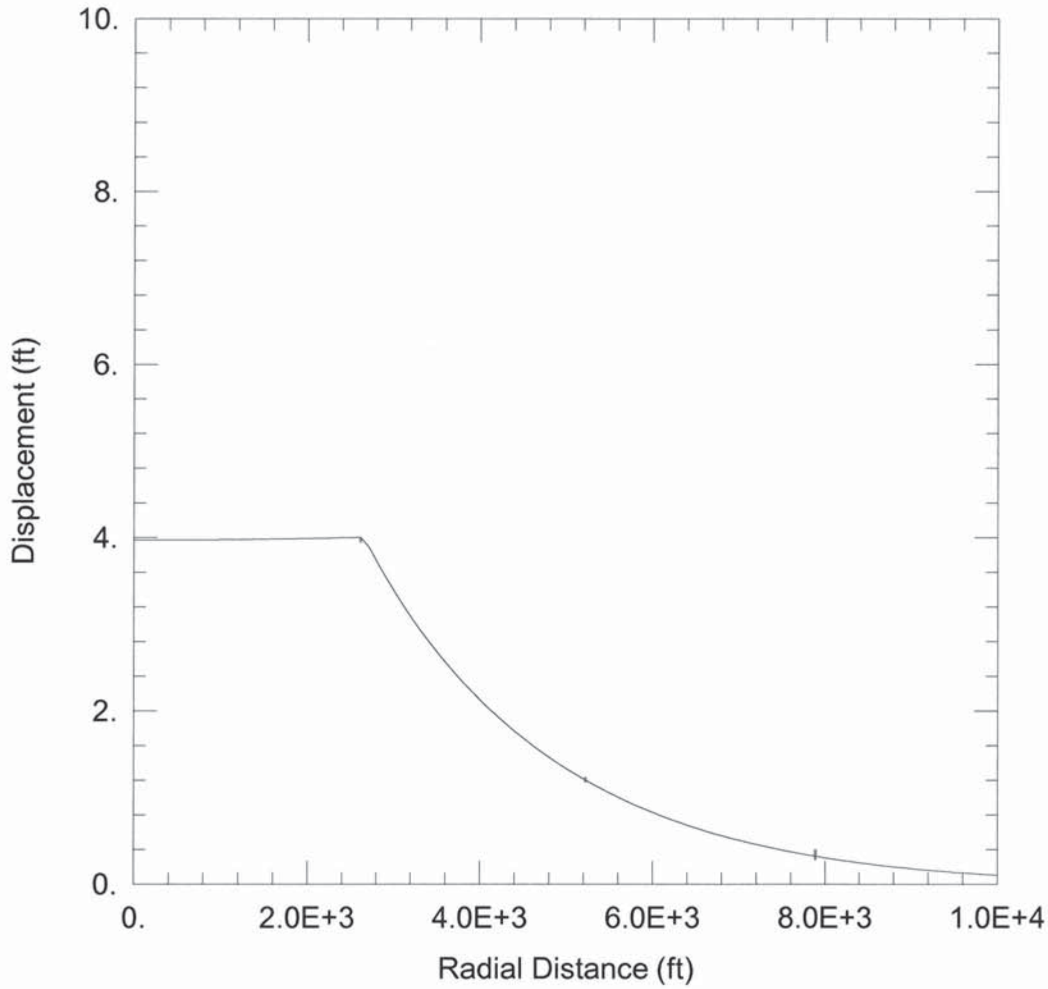
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



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PROJECT INFORMATION

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Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

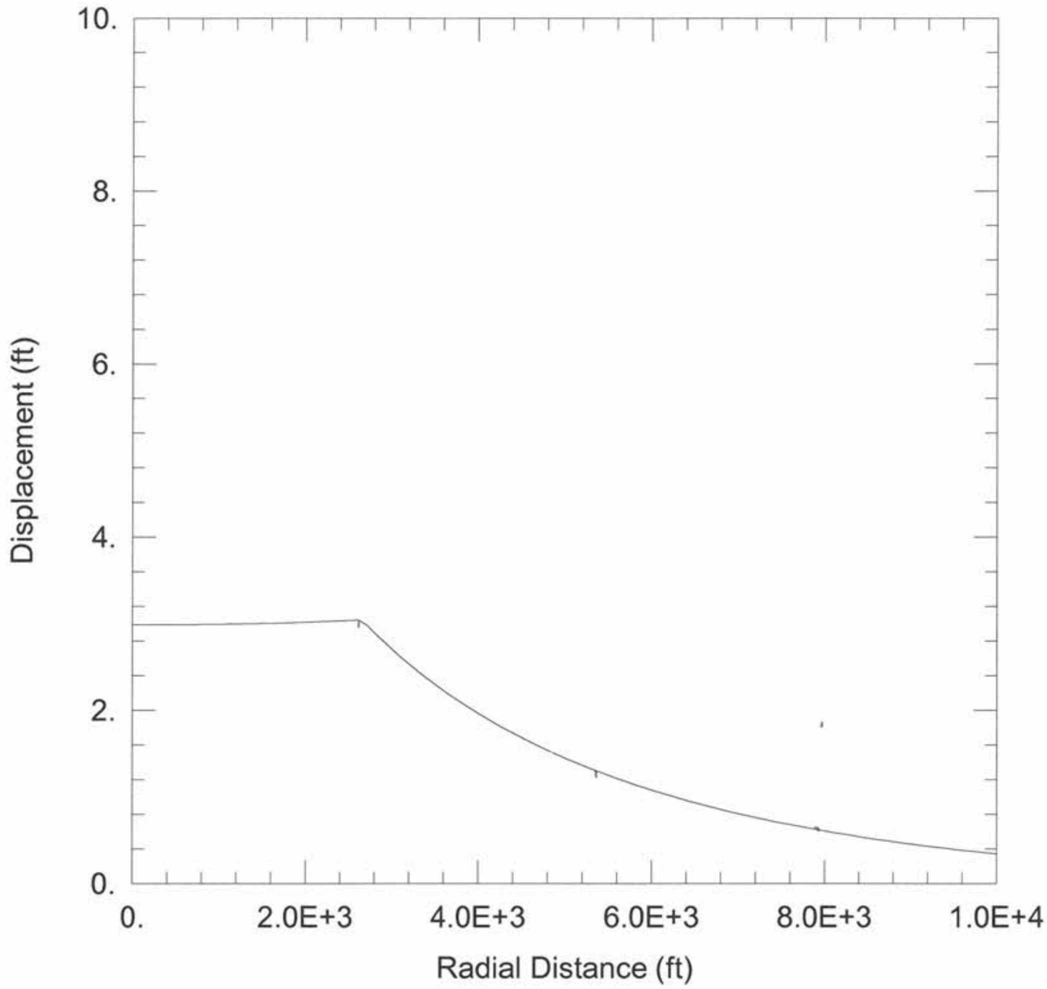
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 1 YEAR- YUBA RIVER ONLY

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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
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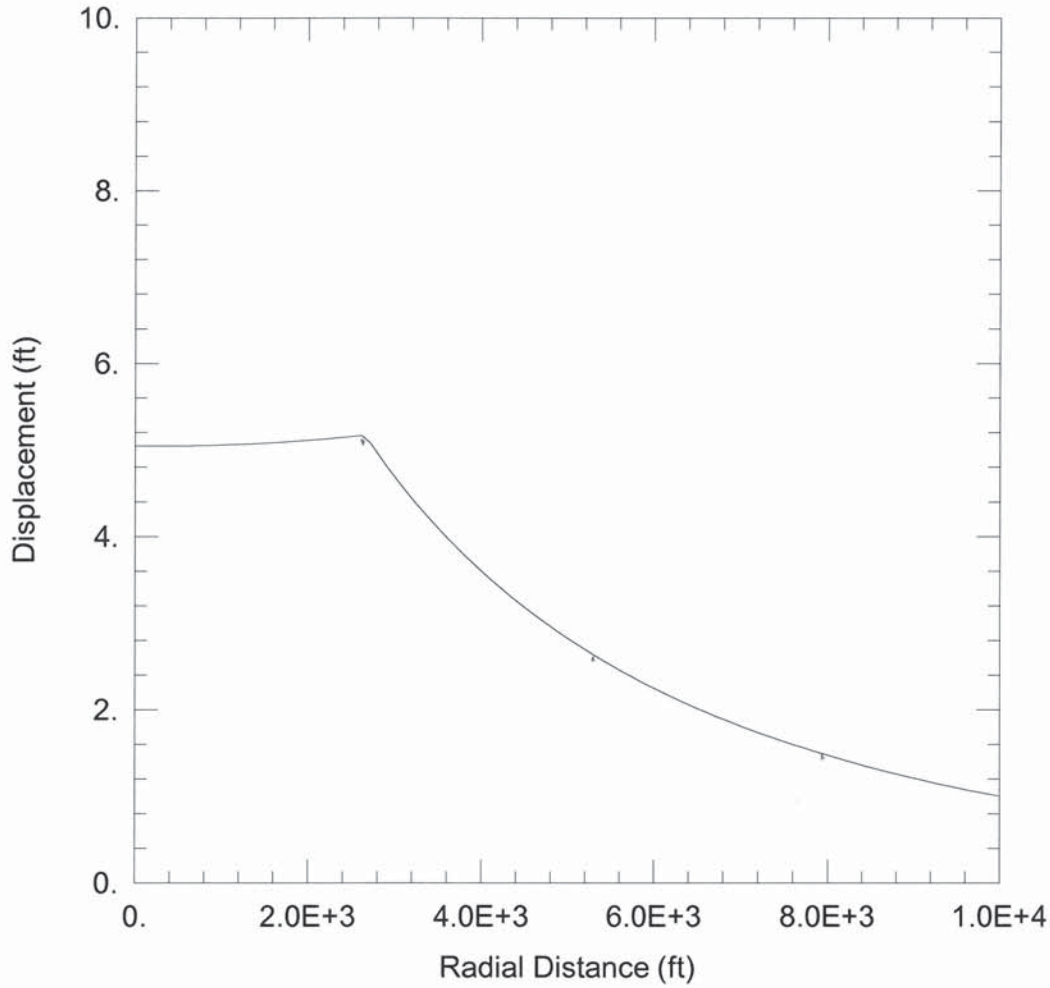
SOLUTION



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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

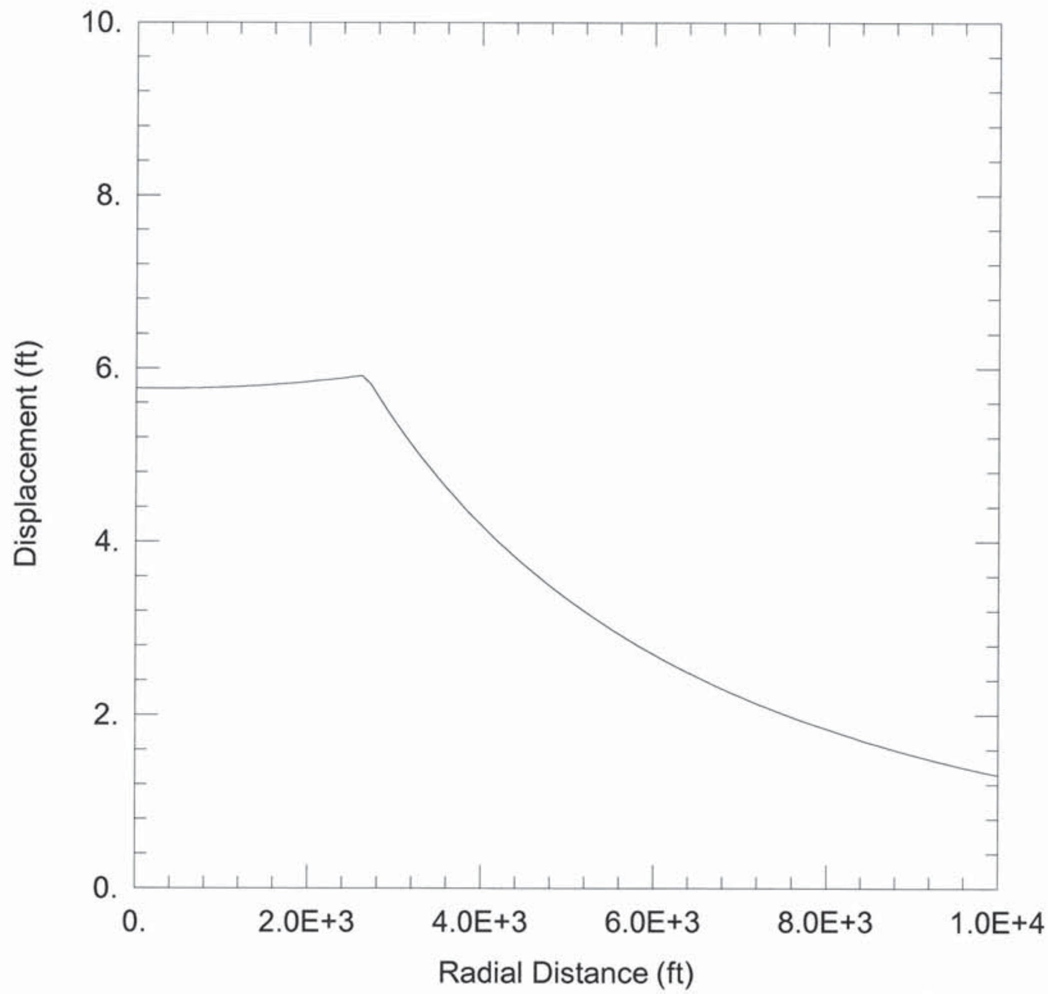
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
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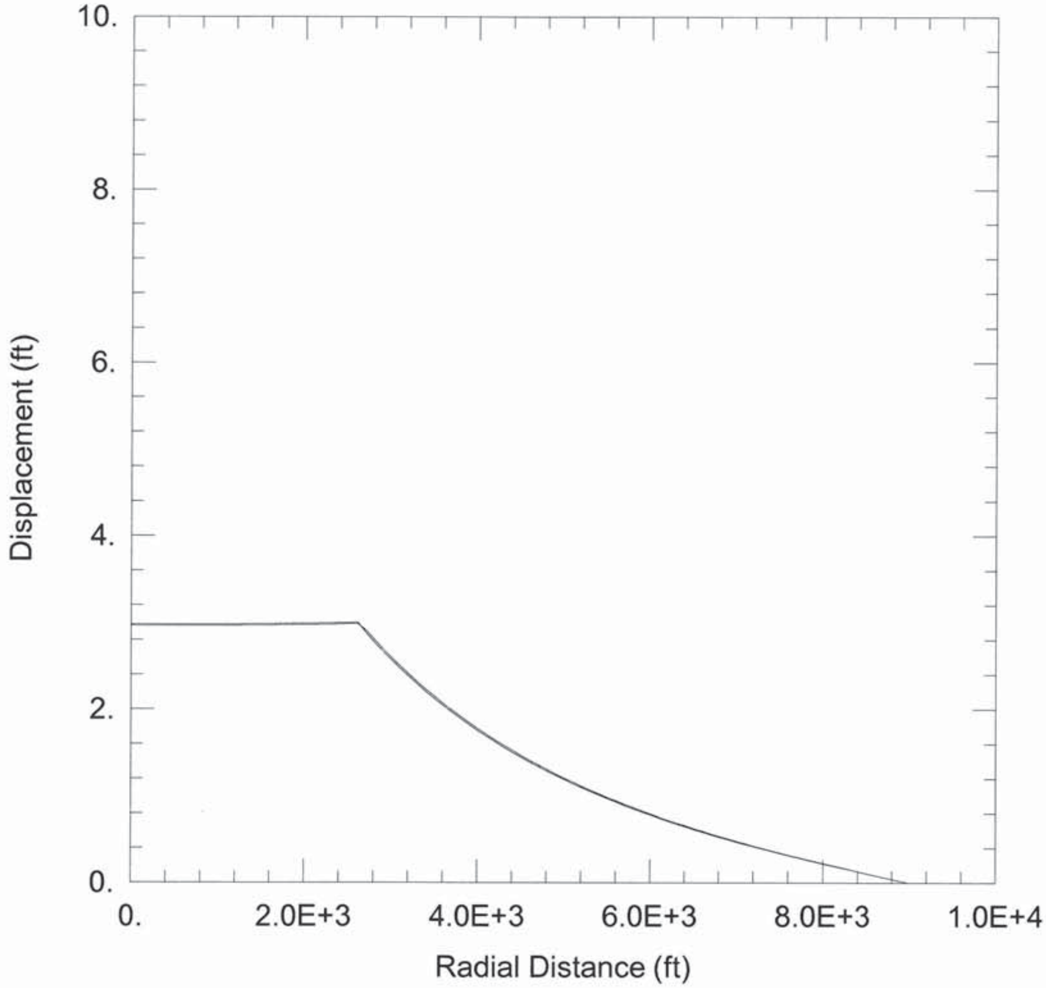
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 1 YEAR - MOENCH 1997

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PROJECT INFORMATION

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Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

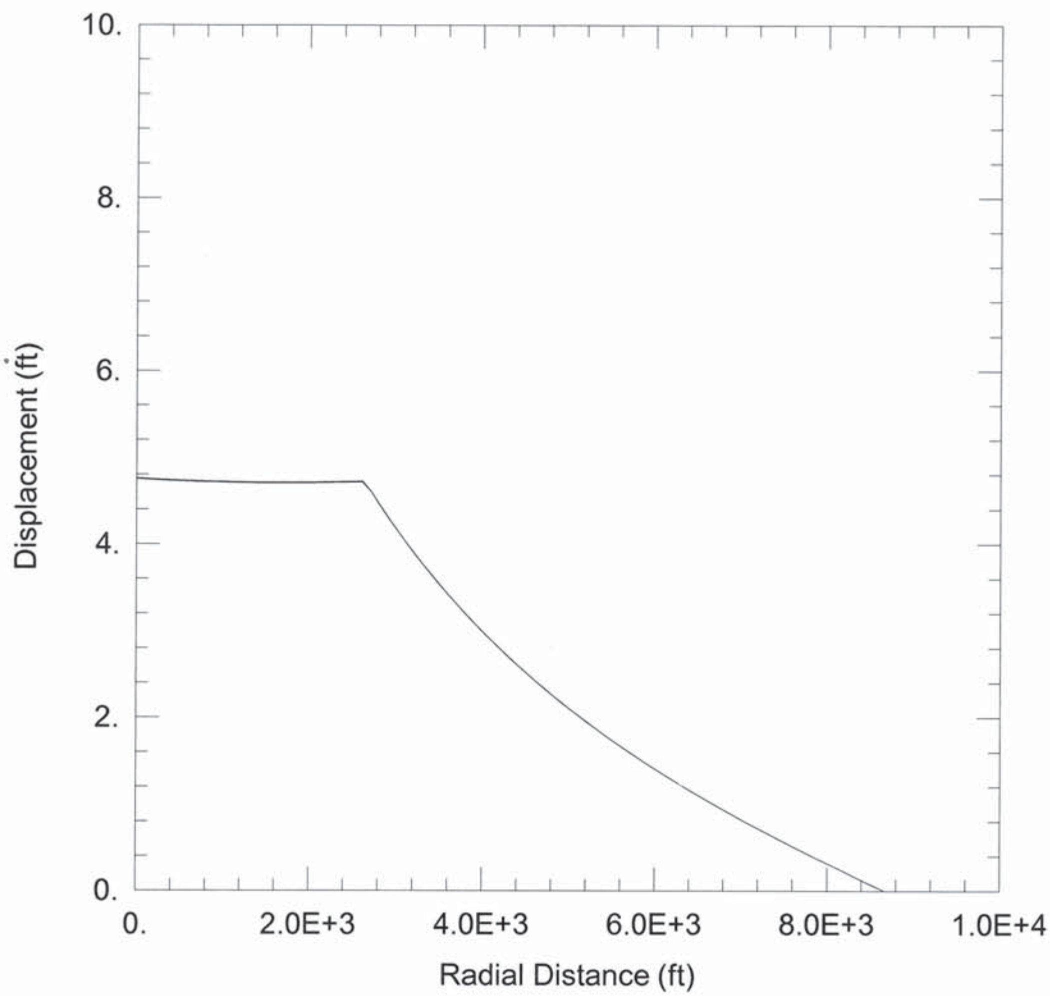
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

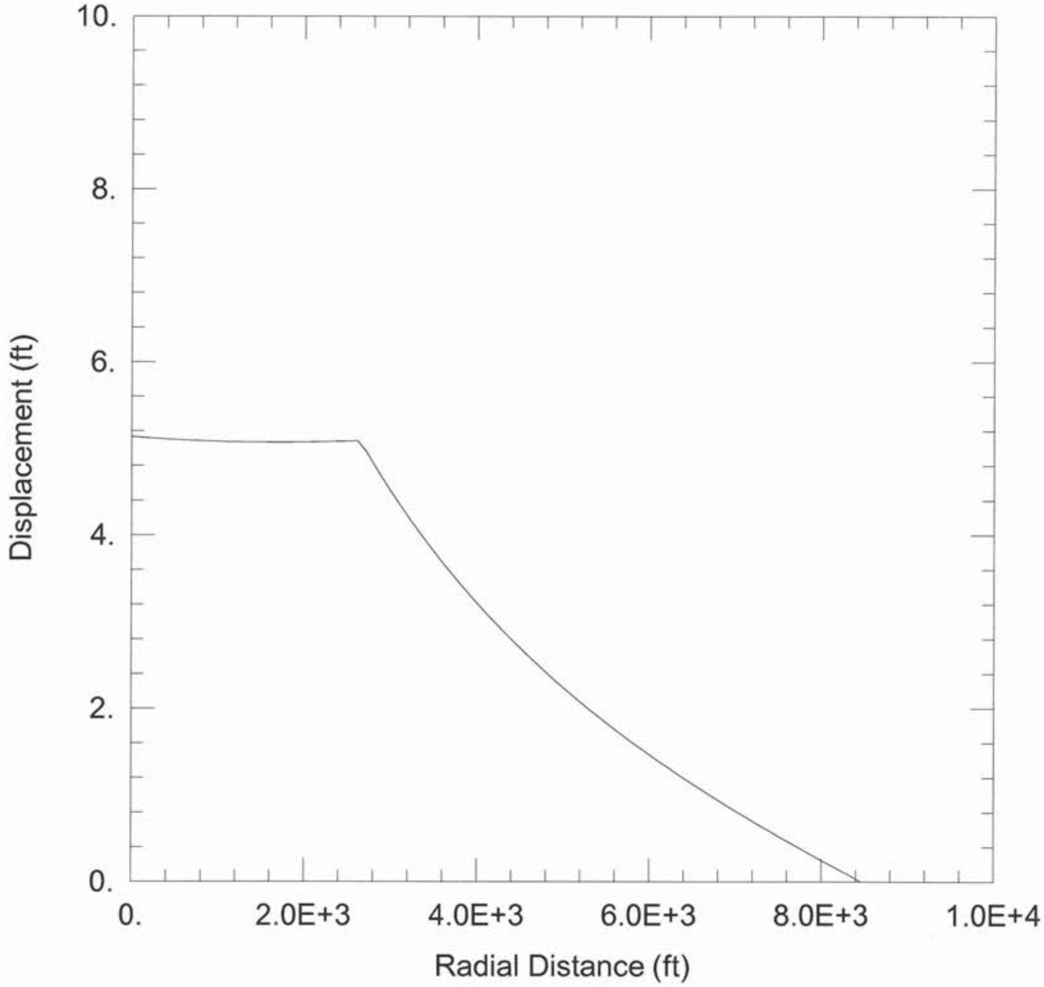
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



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PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

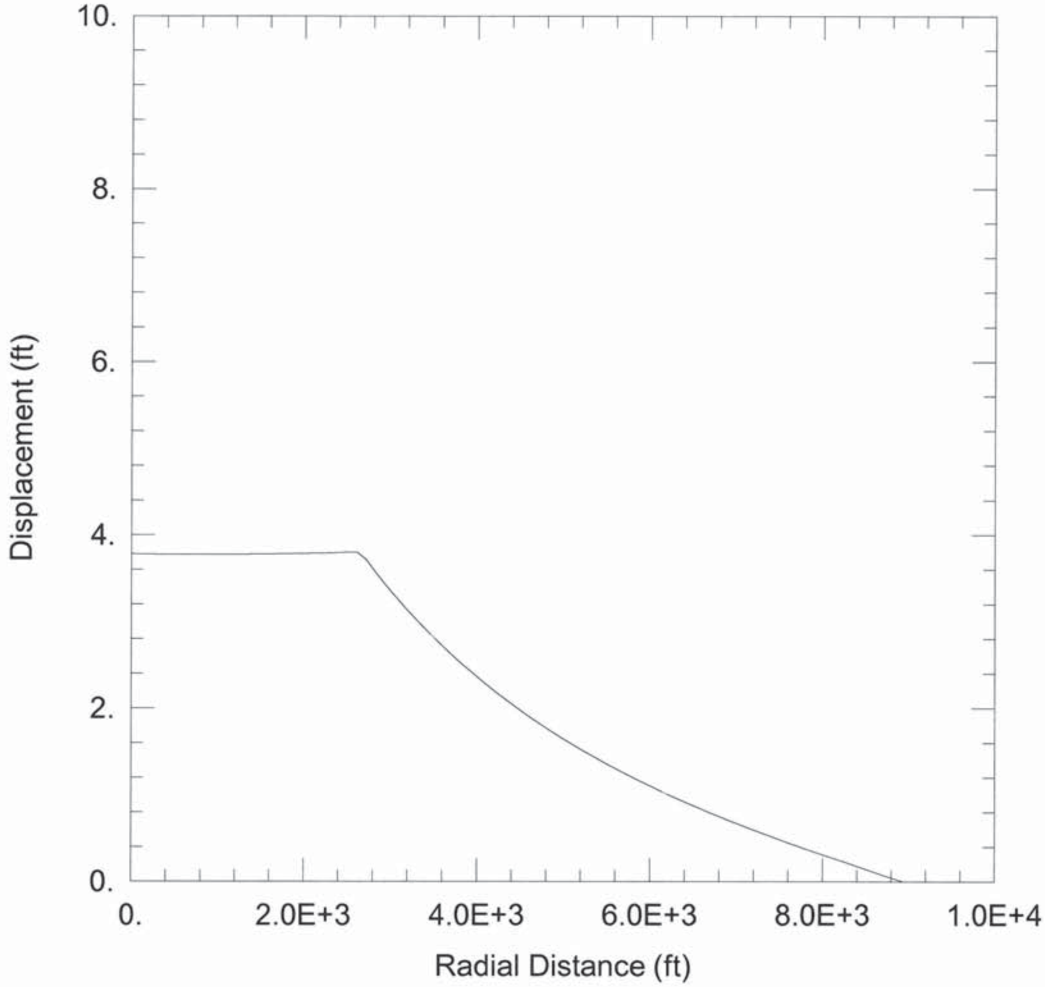
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 1 YEAR - TARTAKOVSKY-NEUMAN 2007

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\1 year.aqt
Date: 09/17/13 Time: 16:25:23

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

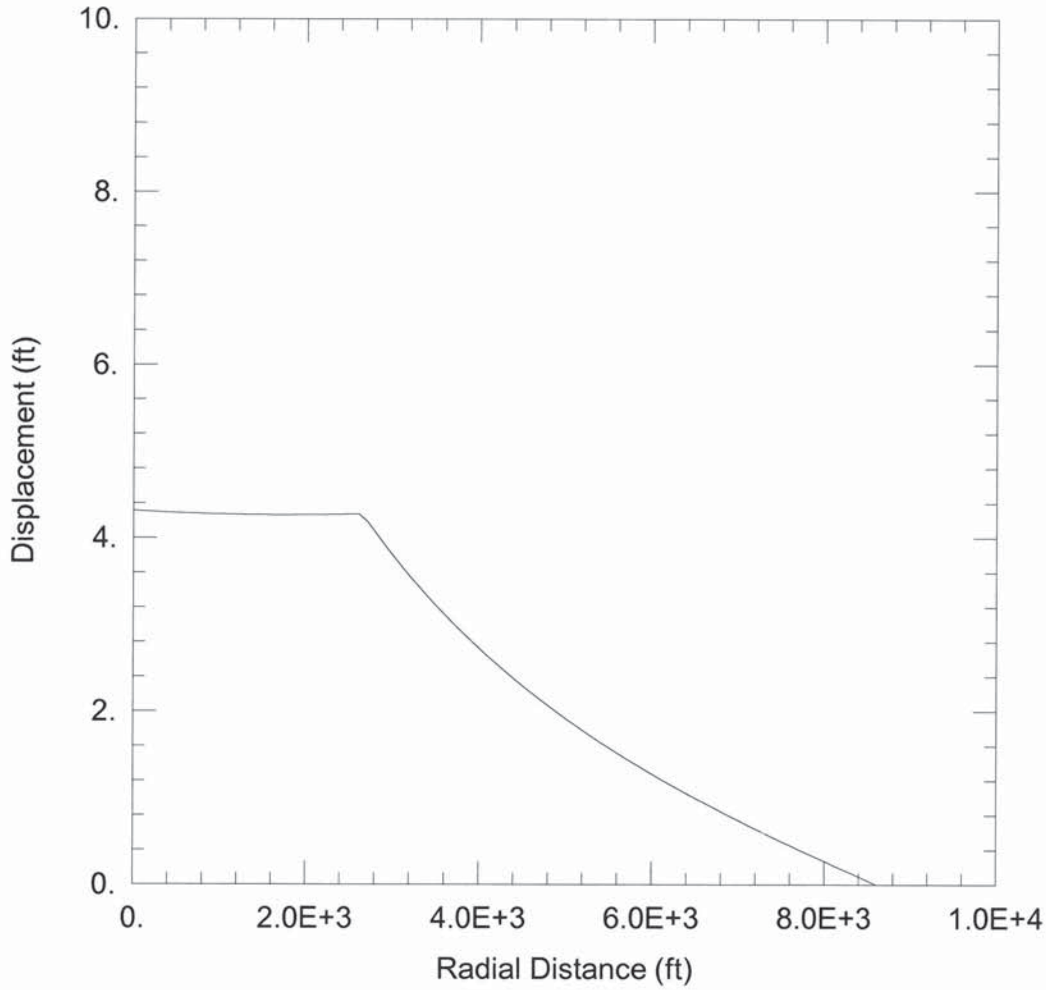
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 5 YEARS - TARTAKOVSKY-NEUMAN 2007

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\1 year.aqt
Date: 09/17/13 Time: 16:23:36

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

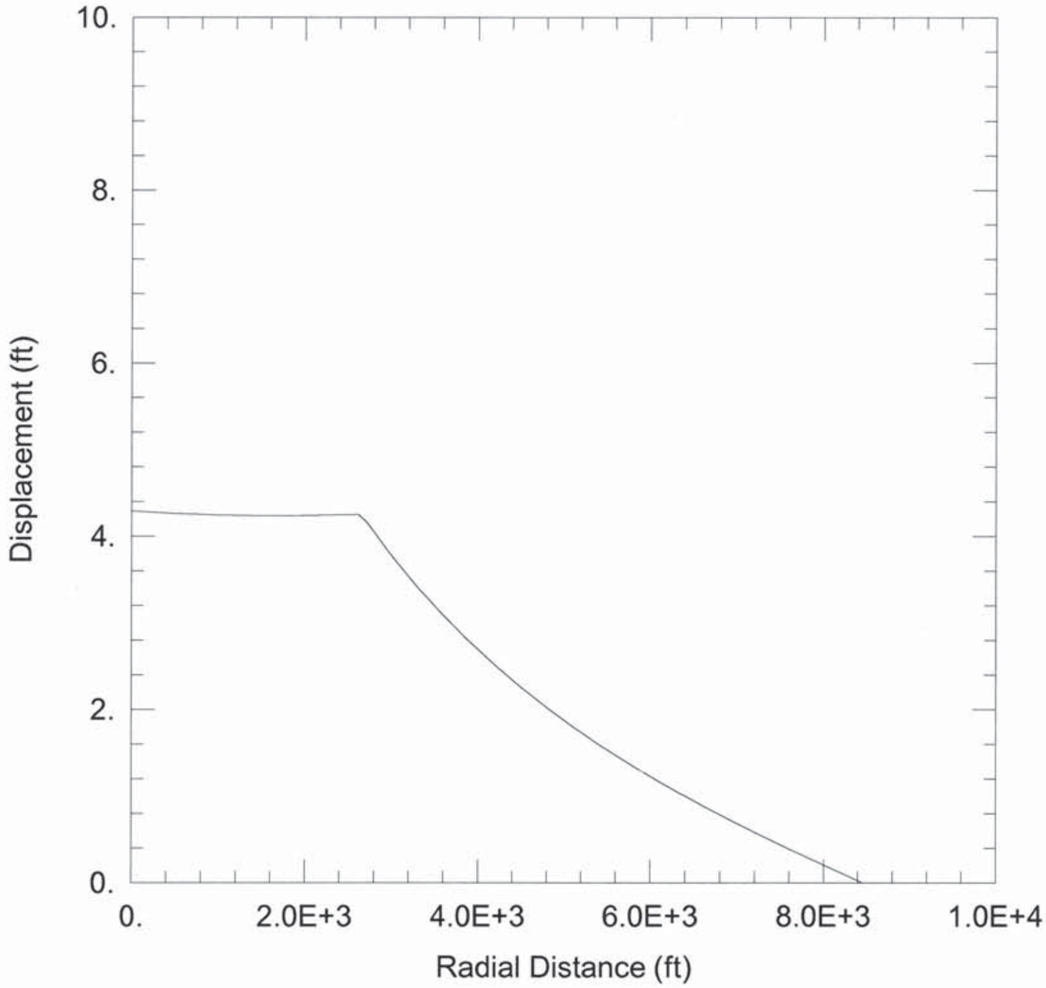
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 50 YEARS - TARTAKOVSKY-NEUMAN 2007

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\1 year.aqt
Date: 09/17/13 Time: 16:24:26

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

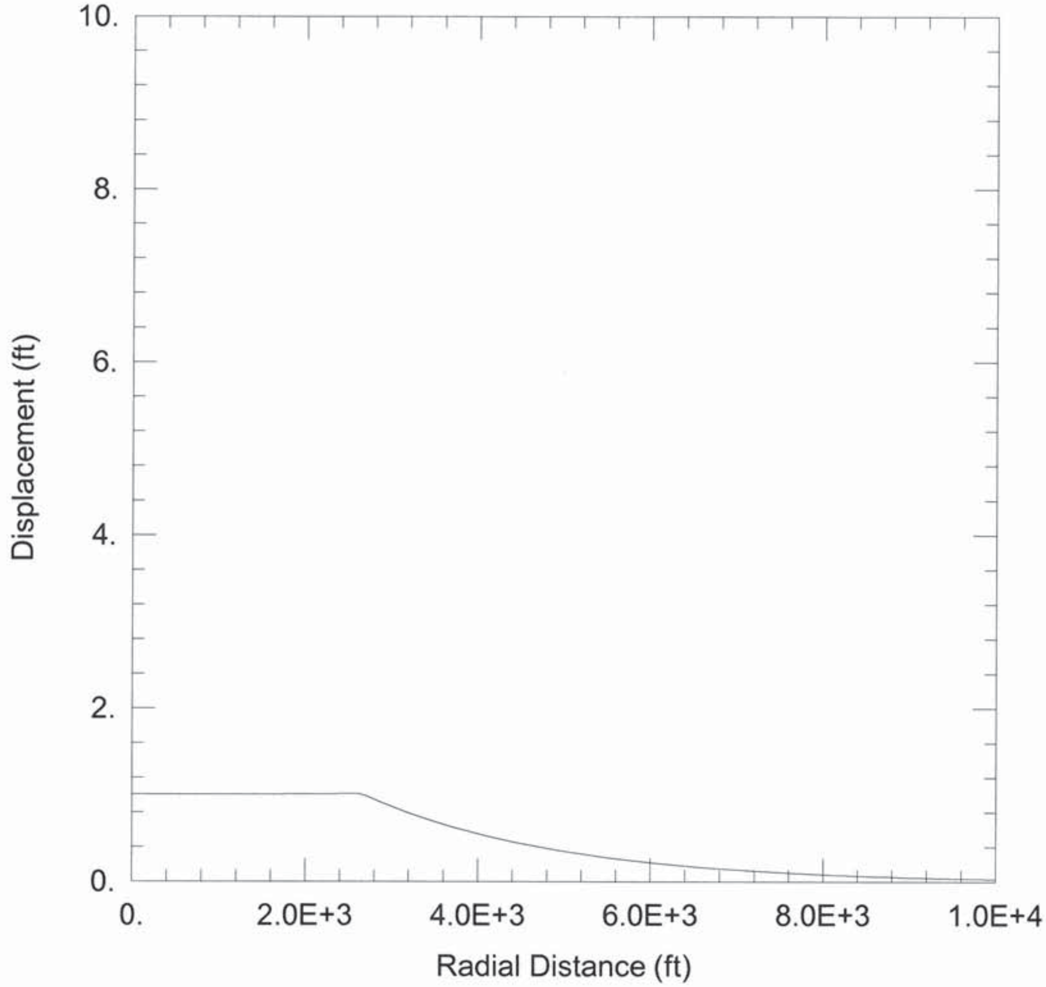
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES JULY AFTER 31 DAYS - LAKE 1 YUBA RIVER RECHARGE BOUNDARY ONLY

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\Lake 1 with Canal only 350 feet away 92 days.aqt
Date: 09/20/13 Time: 11:27:45

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

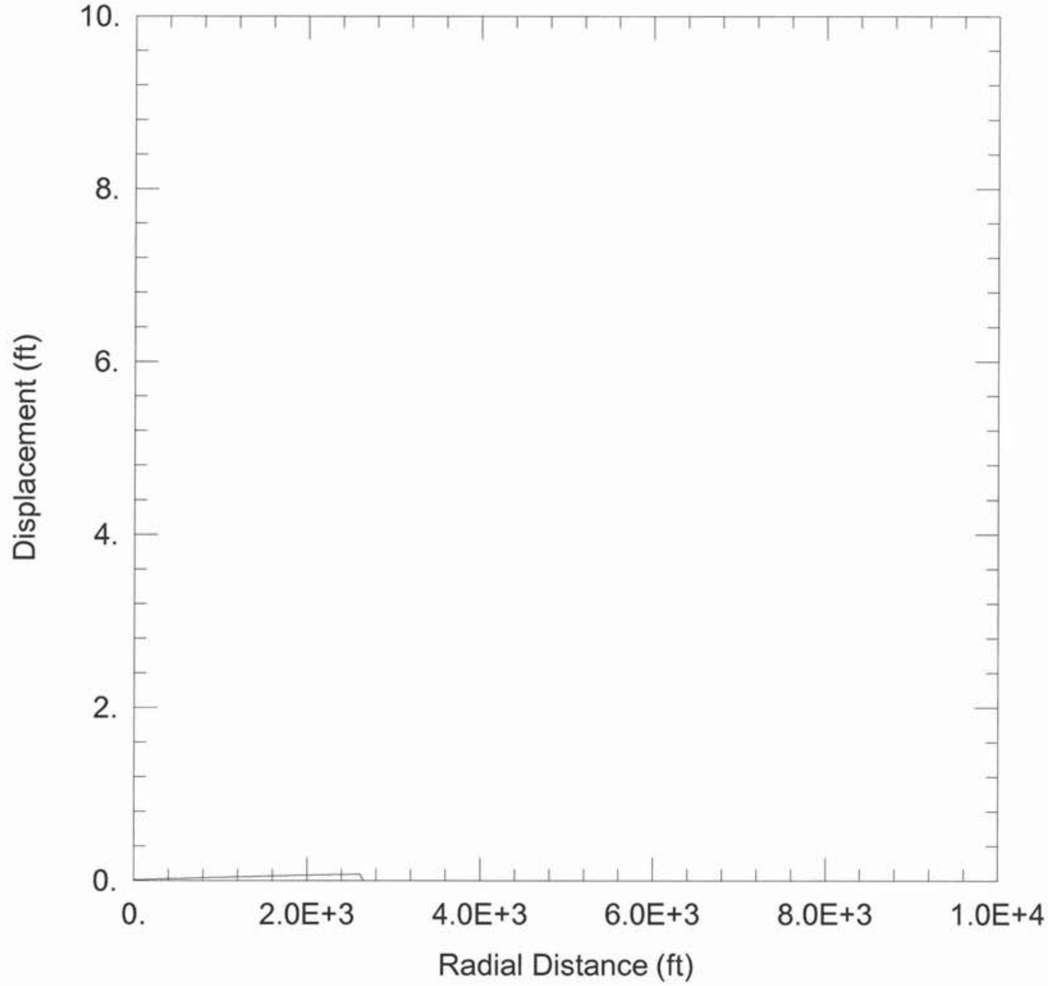
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES JULY AFTER 31 DAYS - LAKE 1 AND CANAL ONLY (350 FEET AWAY)

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\Lake 1 with Canal only 350 feet away 92 days.aqt
Date: 09/19/13 Time: 13:34:33

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

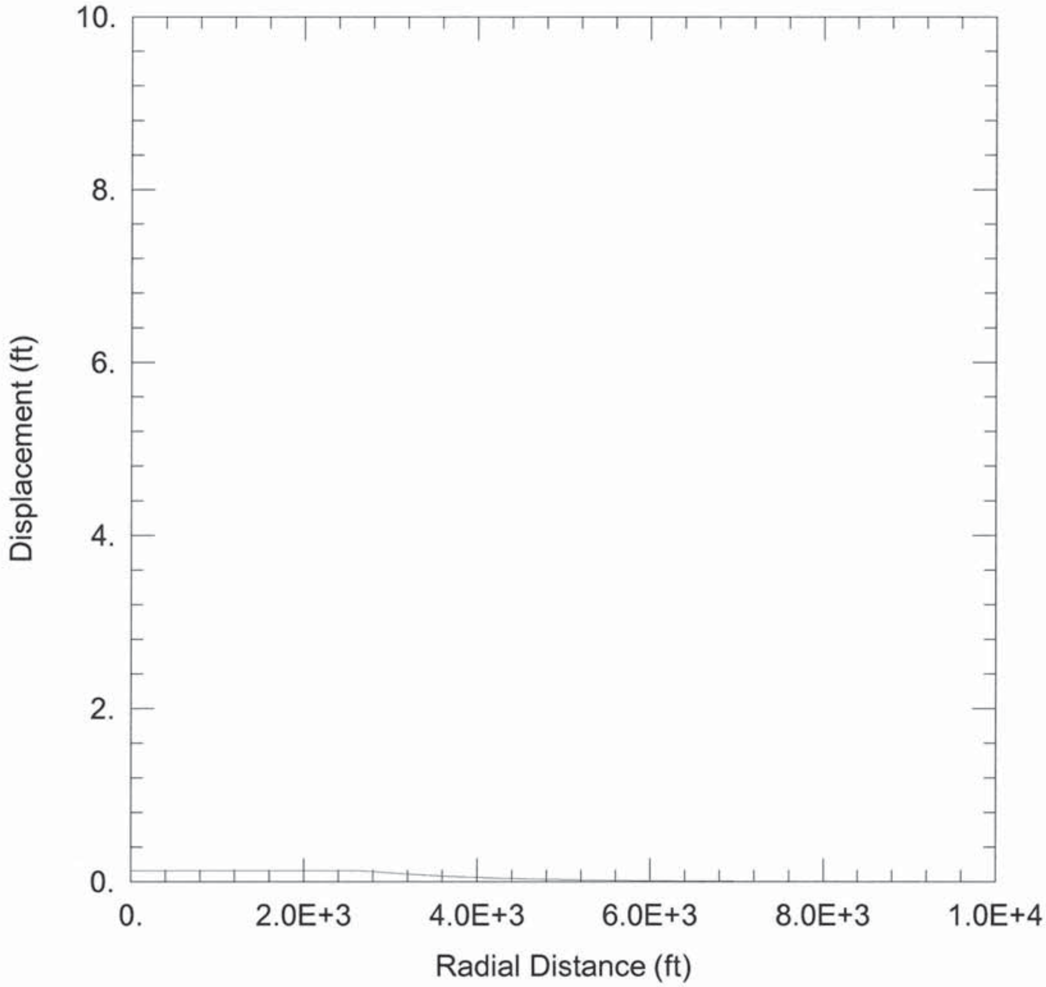
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



RECLAIMED AREAS IMPACT JULY

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\50 years.aqt
Date: 10/01/13 Time: 11:00:19

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

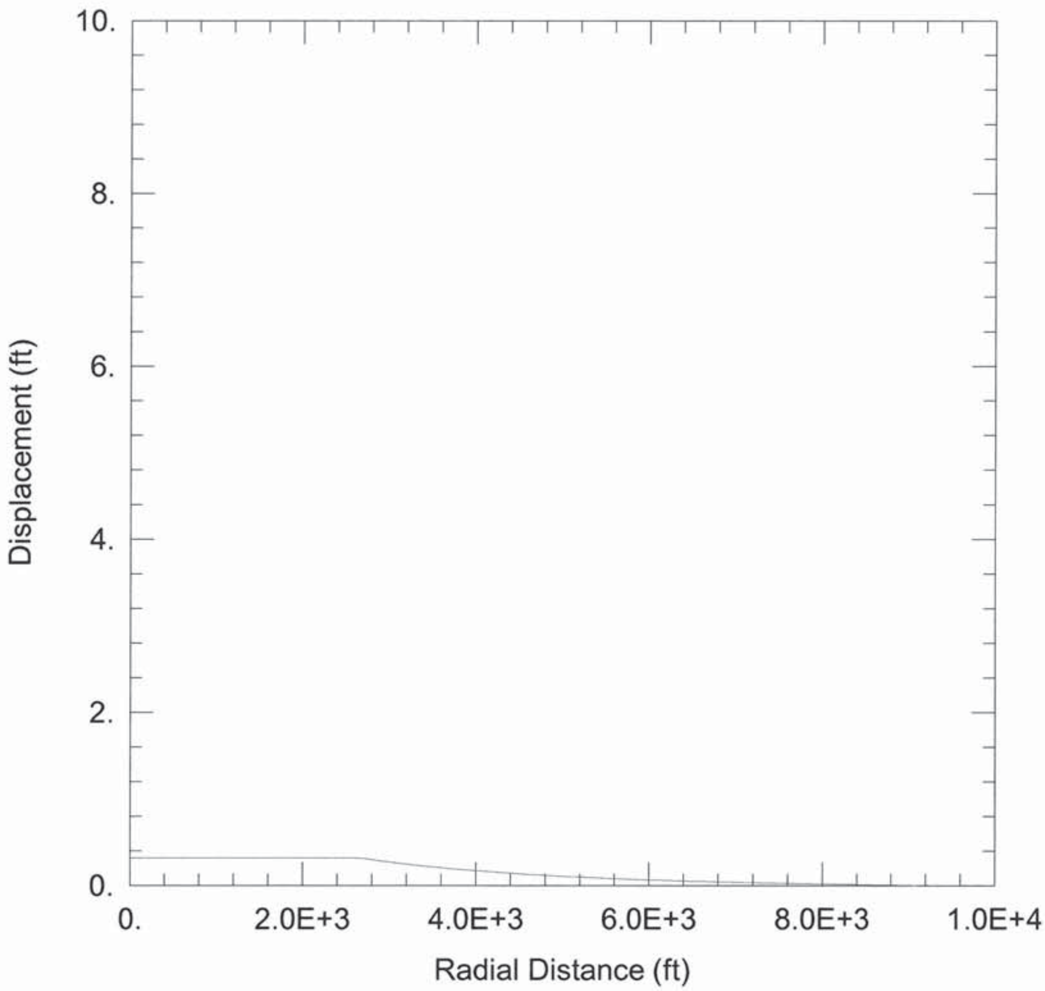
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Obs. Well 2	9980	0
▫ Obs. Well 1	7630	0
▫ Main Pit	0	0

SOLUTION



RECLAIMED AREAS IMPACT 92 DAYS SUMMER

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\50 years.aqt
Date: 10/01/13 Time: 11:00:59

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

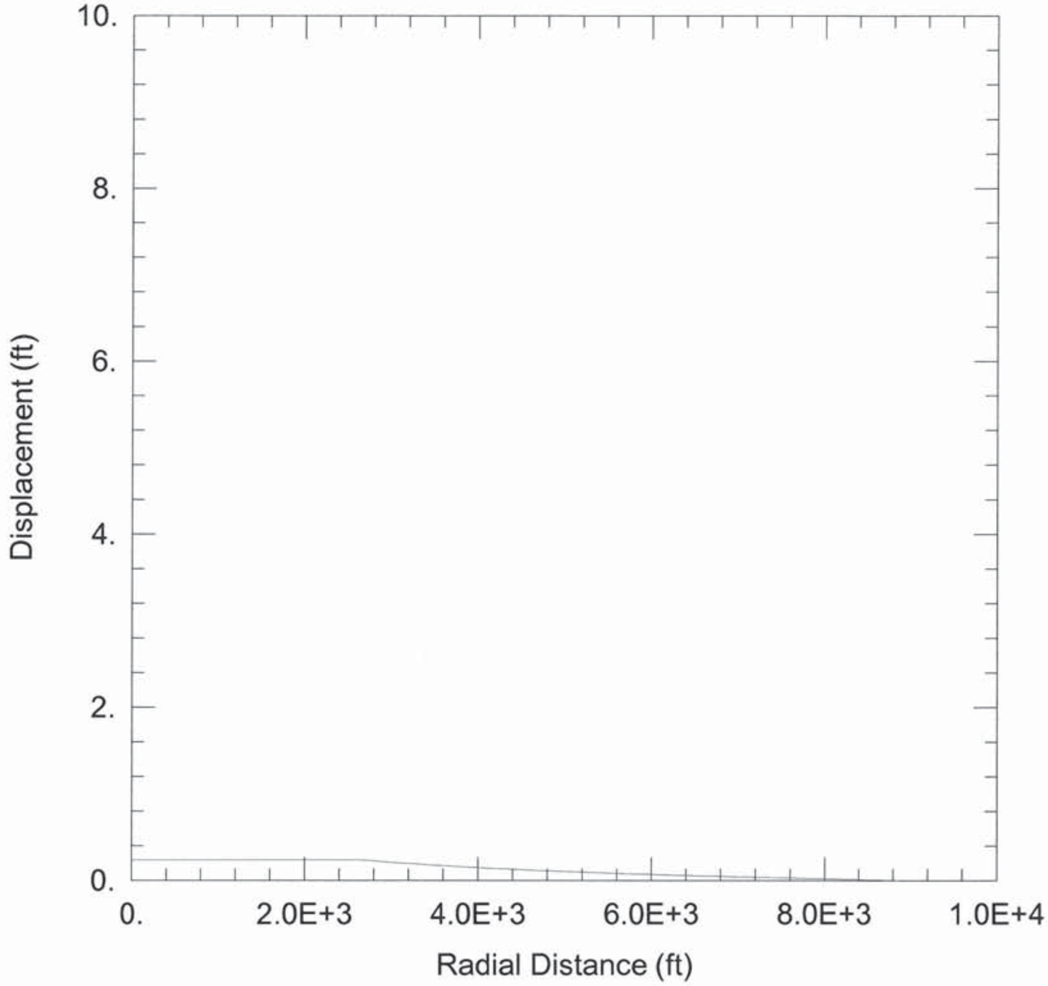
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Obs. Well 2	9980	0
▫ Obs. Well 1	7630	0
▫ Main Pit	0	0

SOLUTION



RECLAIMED AREAS IMPACT 1 YEAR

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\50 years.aqt
Date: 10/01/13 Time: 10:58:34

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

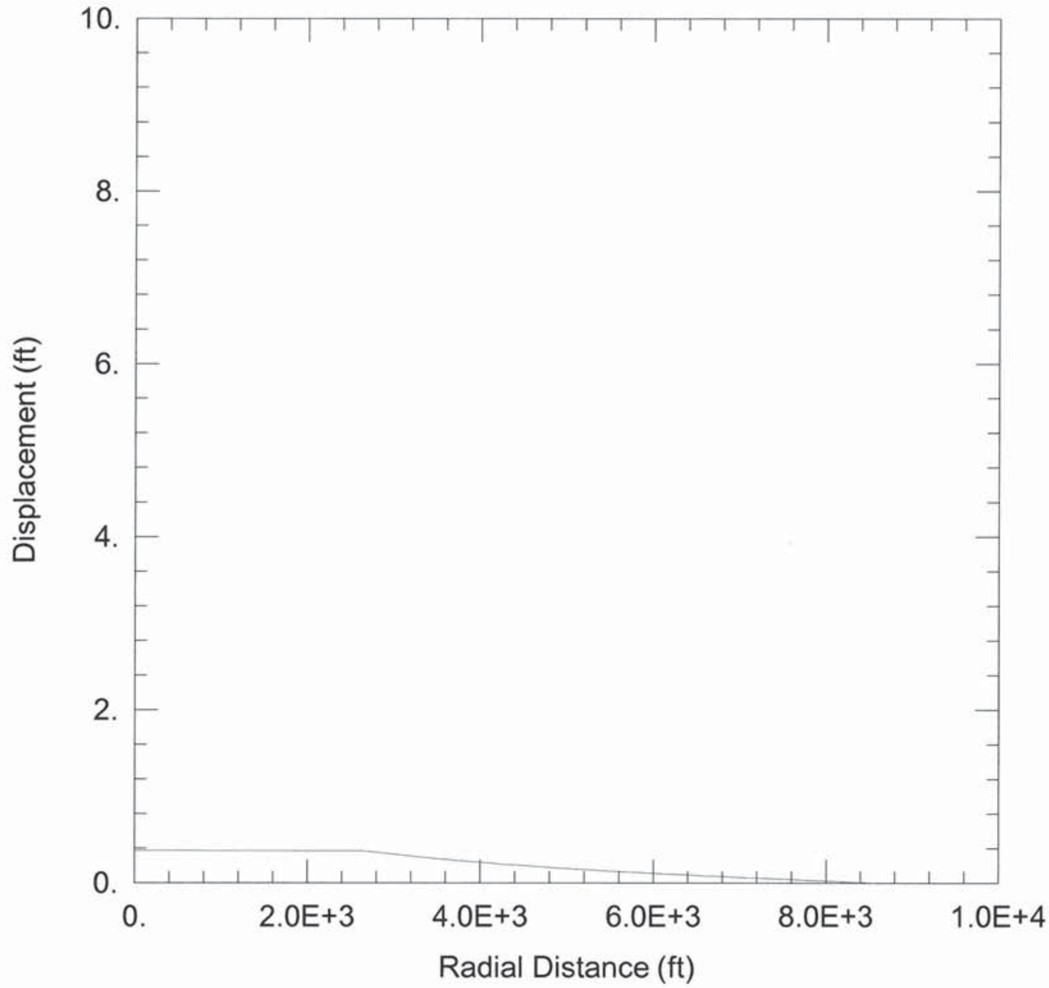
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



RECLAIMED AREAS IMPACT 5 YEARS

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\50 years.aqt
Date: 10/01/13 Time: 10:58:00

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

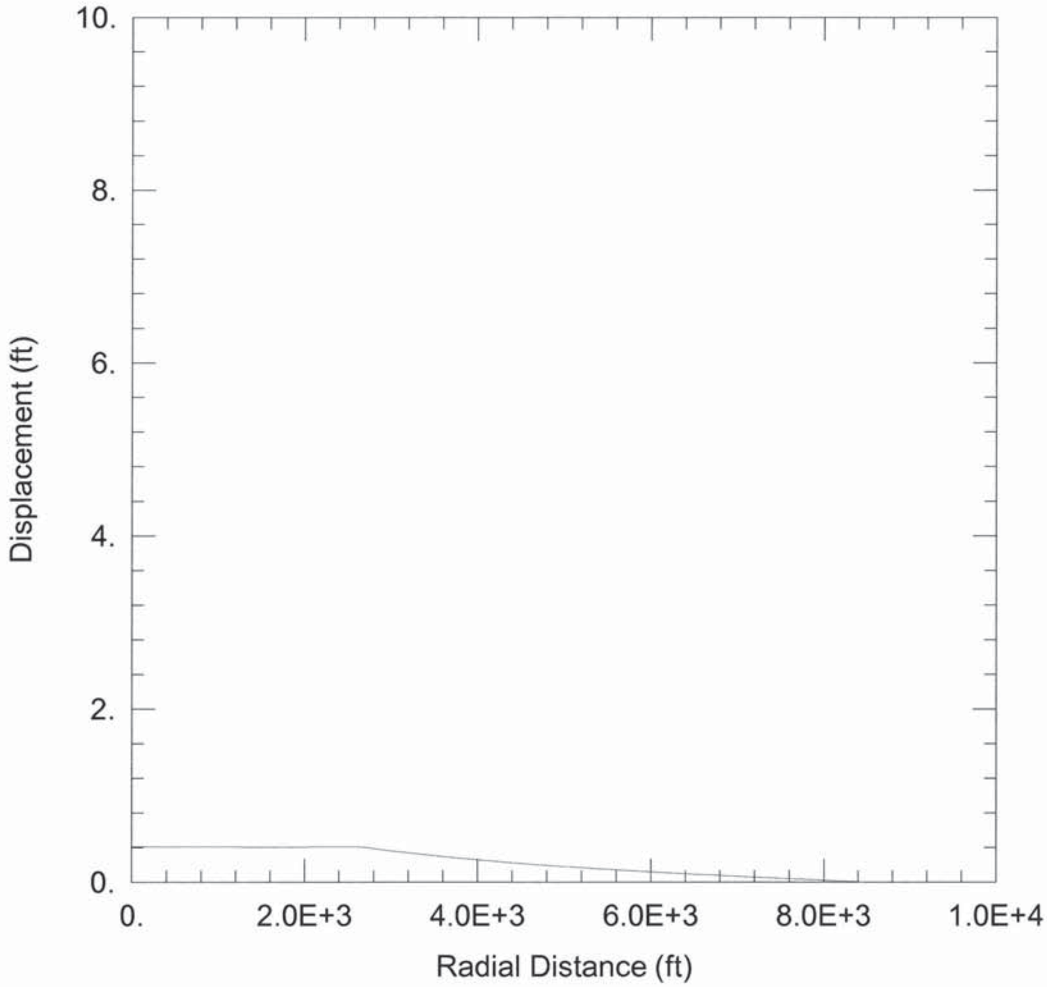
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Obs. Well 2	9980	0
▫ Obs. Well 1	7630	0
▫ Main Pit	0	0

SOLUTION



RECLAIMED AREAS IMPACT 50 YEARS

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\50 years.aqt
Date: 10/01/13 Time: 10:55:52

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

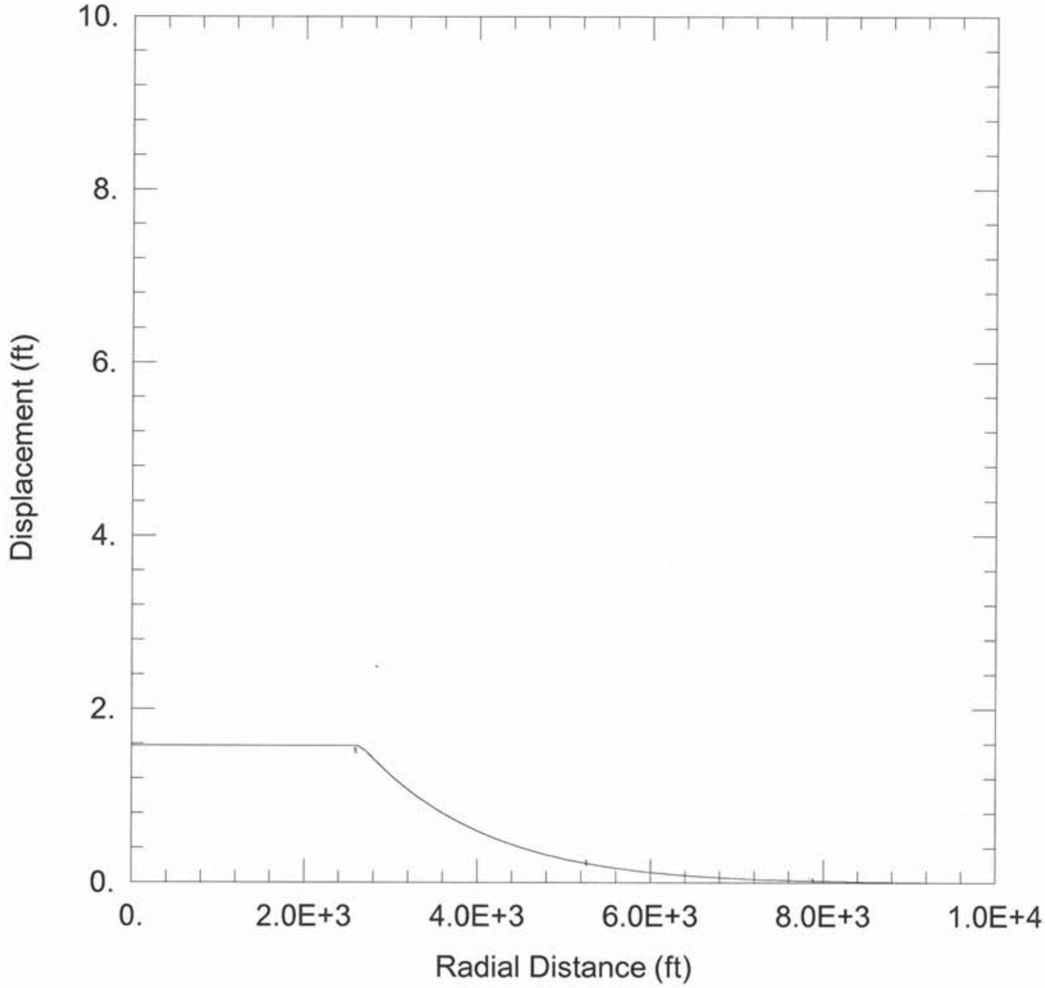
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES JULY AFTER 31 DAYS

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\July 31 days.aqt
Date: 09/17/13 Time: 13:18:46

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

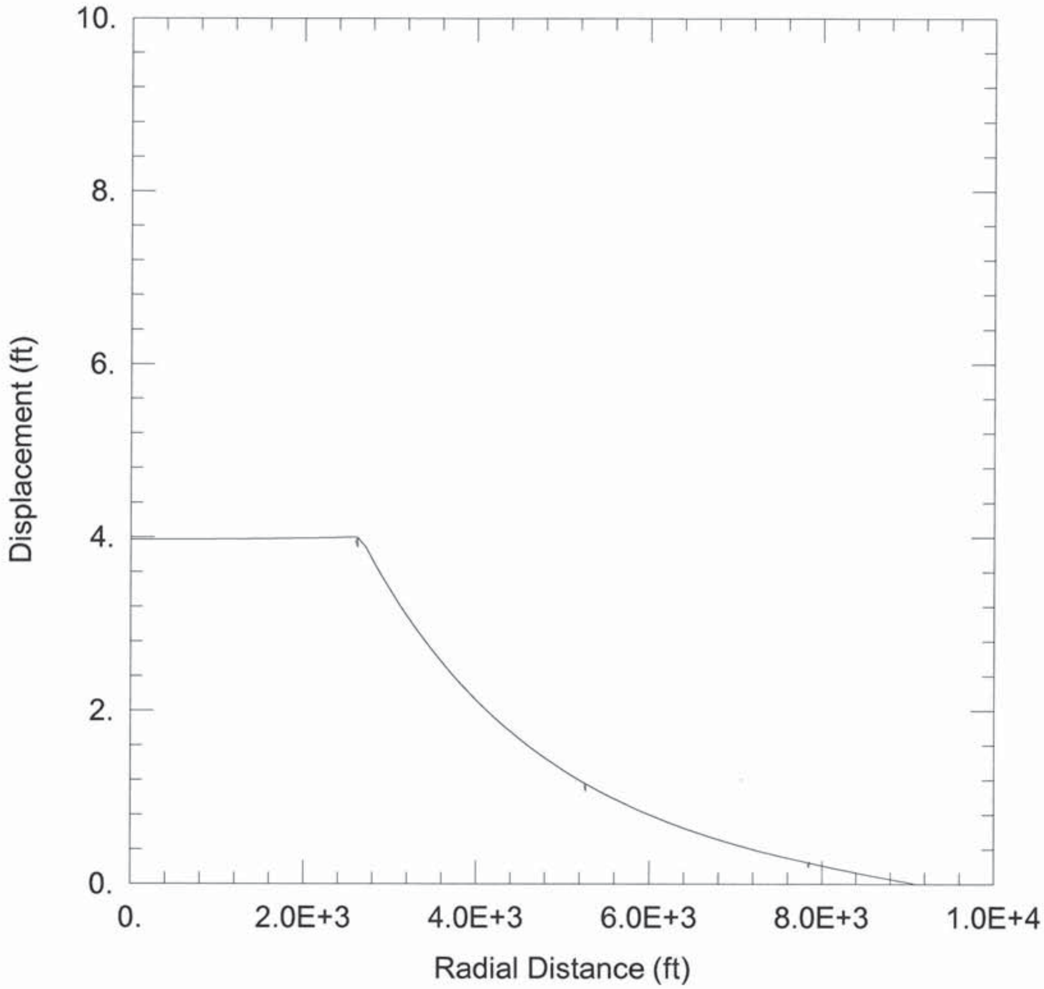
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Obs. Well 2	9980	0
▫ Obs. Well 1	7630	0
▫ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES SUMMER AFTER 92 DAYS

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\Summer 92 days.aqt
Date: 09/17/13 Time: 13:24:56

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

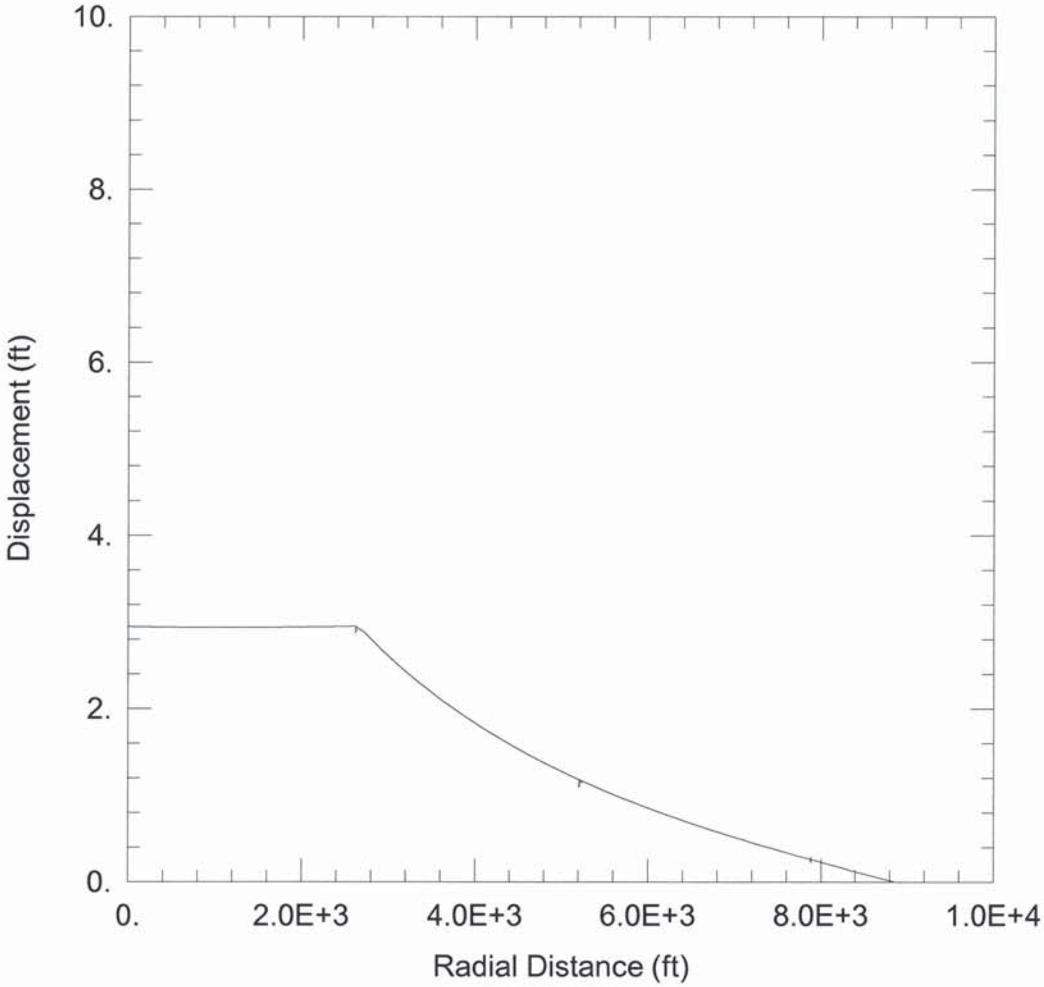
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 1 YEAR

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\1 year.aqt
Date: 09/17/13 Time: 13:27:51

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

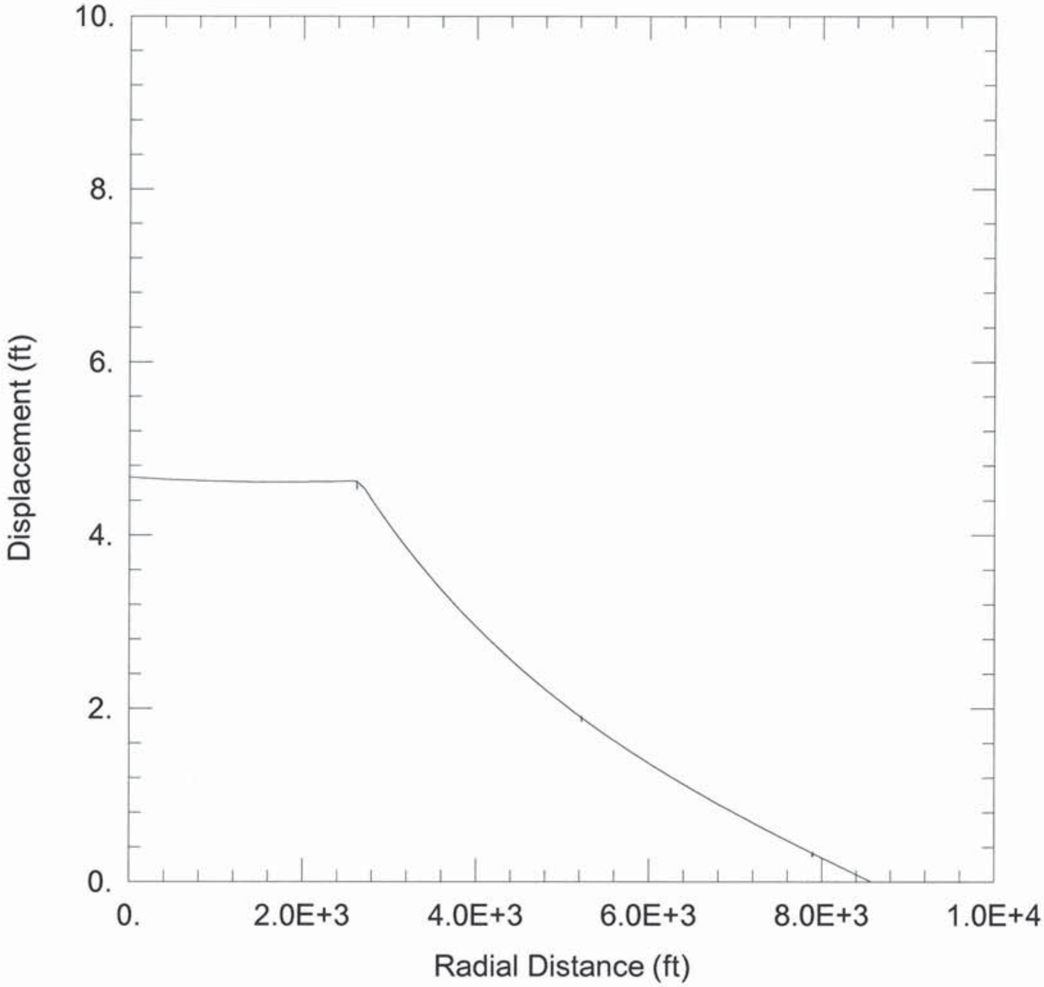
Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION



WESTERN AGGREGATES 5 YEARS

Data Set: G:\07\07085\E07085.004 GW EIR\Aqtesolv\5 years.aqt
Date: 09/17/13 Time: 13:29:36

PROJECT INFORMATION

Company: Western Aggregates
Client: Sate of California
Project: E07085.004
Location: Marysville
Test Well: Pit
Test Date: 4/26/2013

AQUIFER DATA

Saturated Thickness: 145. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Main Pit	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Obs. Well 2	9980	0
□ Obs. Well 1	7630	0
□ Main Pit	0	0

SOLUTION