APPENDIX Q

Sunquest Properties, Inc.
Former Bayshore Railyard – OU2

<u>Proposed Caltrain Culvert Preliminary Evaluation</u>

December 2006

Burns and McDonnell Project Number 40723

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I. INTRODUCTION

A. PURPOSE

This report evaluates the potential means of installing a new culvert under the existing Caltrain tracks at the former Bayshore Railyard in Brisbane, California. The proposed culvert crossing is located at the south end of the former Bayshore Railyard, just north and west of the Kinder Morgan tank farm. The purpose of the new culvert is to provide adequate hydraulic capacity for future storm water conveyance from the railyard to the Central Drainage Channel.

In addition to the proposed culvert crossing, this report evaluates the rehabilitation of the existing brick arch sewer for long term use (see Section III of this report). The existing brick arch sewer is located just to the south of the proposed culvert alignment and carries storm drain flows from Brisbane under the Caltrain tracks, to the existing Central Drainage Channel, which ultimately discharges to the San Francisco Bay.

Preliminary drawings of some of the options that have been evaluated as part of this study are enclosed in Appendix A.

B. CALTRAIN FACILITIES AND CURRENT OPERATIONS

The new culvert will cross under five existing Caltrain tracks. Starting from the west, the tracks are identified as the Visitation Lead, MT4, MT2, MT1 and MT3. With the exception of the Visitation Lead, all the tracks are mainline tracks that carry commuter rail traffic.

Caltrain operates commuter rail service on the weekdays and a more limited passenger service on the weekends. As of October 10, 2005, the weekday schedule included 48 northbound and 48 southbound trains passing the proposed culvert crossing location each day. The earliest commuter train passes the site at slightly after 5AM and the last commuter train passes the site at approximately 12:15AM. The weekend schedule has 16 northbound and southbound trains on Saturdays and 14 northbound and southbound trains on Sundays. Additional trains are sometimes added on Giants' game days and for other special events.

Union Pacific also transports freight on these tracks (sometimes in the overnight hours). Other miscellaneous trains (such as trains supporting Caltrain construction projects) periodically operate on the tracks as well.

Caltrain has reviewed their operations and determined that only two mainline tracks (either MT2 and MT4 or MT1 and MT3) can be shut down over a limited number of weekends in the vicinity of the proposed culvert crossing. During these weekend track outages (each of which would have a total duration of between about 48 and 52 hours) train traffic would operate on only two of the mainline tracks.

In order for Caltrain to temporarily operate on only the two eastern or western mainline tracks over a weekend, a temporary platform will be needed at the Bayshore Station (the station immediately to the north of the proposed culvert crossing). The cost of this platform is considered in this evaluation.

The limitations on track closures and the requirement for a temporary platform at the Bayshore Station were confirmed during a December 2005 meeting with Caltrain. Based on discussion with Caltrain, the Visitacion Lead can be taken out of service for a limited period of time to accommodate the culvert construction. The one time of year (varies from year to year) when this track may not be taken from service is when the circus is in town and the track is needed for storage of the circus trains. The maximum period of time that this track will be permitted to be out of service is not yet defined, but should not pose a major impediment to the culvert construction.

C. BRIEF SUMMARY OF GEOTECHNICAL CONDITIONS IN VICINITY OF PROPOSED CULVERT

Geotechnical exploration has been performed by Michelucci & Associates, Inc. in the vicinity of the proposed culvert crossing. The report is included in Appendix B. It appears that, in general, the site is underlain by about 10 feet of fill. The fill under the Railyard is a heterogeneous mixture of soil, refuse, and debris that was generated by the clean up after the 1906 earthquake. Fill may also consist of materials deposited in the old Brisbane Landfill which occupies the area to the east of the Railyard. In some areas the fill is underlain by Bay Mud (very soft to soft gray silty clay) and some sandy alluvial deposits. The soils are underlain by Franciscan Formation bedrock (commonly sandstone with some siltstone). In general, the thickness of the Bay Mud and the depth to bedrock appear to increase to the north and east.

There is limited evidence that the existing brick arch culvert is founded on the Franciscan Formation bedrock, and that bedrock is present at or quite near the ground surface just to the south of the existing brick arch culvert.

Obstructions are known to be present in the fills that underlie the site. Pile driving at Caltrain's Bayshore Station (located at the north end of the Railyard) proved to be very difficult due to encountering obstructions. The potential for obstructions to be encountered in the fill along the culvert alignment at the proposed crossing presents one of the biggest challenges for installing a shallow culvert through the fill soils.

Additionally, Burns and McDonnell drilled 3 soil borings in the vicinity of the proposed culvert to primarily locate bedrock in this area. The results are presented in the "Bedrock Investigation Report" included in Appendix C of this report.

Due to the possibility of obstructions in the immediate vicinity of the proposed crossing and the precise depth and configuration of the top of bedrock, additional geotechnical investigation is necessary to complete this project. Scope of such work is to be determined in the future.

II. Summary of Options Evaluated

Two basic options for installing the new culvert have been considered in this study. The first option consists of a shallow culvert (either a box or pipe culvert). The second option is a deeper inverted siphon.

The proposed shallow culvert installation is the option that was proposed by Caltrain in fall of 2004. Per Caltrain staff recommendation, under this option the plan would be to create a "cleared path" for jacking a box or pipe(s) under the tracks. The path for the jacking would be cleared of obstructions by excavating out the existing materials and backfilling with an engineered material that would provide a stable medium through which the jacked conduit installation would be performed. The engineered material would be capped with geotextile reinforced base material and then the ballasted track would be restored. The culvert box or pipe(s) would then be jacked through the engineered material between pits located on either side of the tracks. Weekend track outages would be employed to excavate and replace the existing fill soil. This option is discussed in more detail in Section V below.

The second option consists of a deeper, lined tunnel under the Caltrain tracks that would be driven between two vertical shafts (inverted siphon). The vertical alignment of the shaft will be chosen to ensure that the tunnel is excavated in the Franciscan Formation bedrock that underlies the site. Based on our current understanding of the project, this option requires no track outages for construction of the culvert; therefore, there would be minimal impact on Caltrain's operations. This option is discussed in more detail in Section VI below.

Each of the options outlined above has been evaluated with and without the existing brick arch culvert in service.

The following table summarizes the options that have been evaluated in this report.

TABLE 1- LIST OF OPTIONS

Option No.	Description
1A	Shallow box culvert with rehabilitated brick arch
1B	Shallow box culvert with brick arch abandoned
2A	Shallow pipe culvert with rehabilitated brick arch
2B	Shallow pipe culvert with brick arch abandoned
3A	Inverted siphon with rehabilitated brick arch
3B	Invert siphon with brick arch abandoned

III. REHABILITATION (SLIP LINING) OF EXISTING BRICK ARCH SEWER

A. DESCRIPTION OF EXISTING BRICK ARCH SEWER

The existing brick arch sewer currently passes under the existing Caltrain tracks on an alignment that is skewed at about 40 degrees to the tracks. The approximate alignment of the existing brick arch culvert is illustrated on enclosed Drawing DC-1. A typical section through the existing brick arch sewer is shown on Drawing DC-2. The sewer has a U-shaped concrete invert and a semi-circular brick arch. Per an original construction drawing for the sewer, the existing conduit is 8 feet wide and 7 feet-6 inches high.

Based on a video inspection of the sewer performed in 2002-2003, the existing brick arch appears to be in reasonably sound structural condition. Previously, Caltrain has expressed concern about the anticipated long-term performance of the brick arch if it were to remain in service. Given the age of the structure, structural rehabilitation of the existing brick arch sewer is recommended it is it to remain in service for the long-term.

Slip lining is a relatively commonly used and straight-forward process used to rehabilitate buried conduits. The process of slip lining is discussed in more detail in the following section.

B. SLIP LINING PROCESS

Slip lining is a process that is used to rehabilitate buried conduits. The process involves lining the existing conduit with a smaller diameter pipe. Pipes fabricated from several different materials are used for slip lining: the choice of pipe material depends on the size of the conduit being lined, the type of conduit being lined, and the performance characteristics required of the completed installation. For this application, the most appropriate slip lining material will likely be either high-density polyethylene (HDPE) or centrifugally cast, glass-fiber-reinforced, polymer mortar (CCFRPM) pipe. Both of these pipe types are extremely smooth, so they provide excellent hydraulic performance.

The liner pipe is either pushed or pulled into place through an access opening into the existing conduit. The slip lining process can be performed with some flow in the existing culvert, so diversion pumping should not be needed during the rehabilitation process. After the liner pipe has been installed, the annular space between the liner pipe and the host conduit is grouted. Lightweight cellular grout is typically used for this purpose.

For this application, the liner pipe would likely be limited to a maximum nominal diameter of 78 inches to allow placement within the existing 8 foot brick arch culvert. As shown on Drawing DC-1, the length of the existing brick arch culvert that will be slip lined is estimated to be approximately 180 feet long. Sections showing the geometry of the existing brick arch and the slip lined brick arch are provided on Drawing DC-2.

Our December 2005 meeting, Caltrain indicated that slip lining is an appropriate means of rehabilitating the existing brick arch for long term use.

C. PRELIMINARY HYDRAULIC ANALYSIS OF REHABILITATED BRICK ARCH SEWER

Preliminary hydraulic analysis indicated that the reduction of flow area resulting from the slip lining will not reduce the flow capacity of the existing brick arch culvert because the liner pipe is so much smoother than the existing culvert. As a result, the flows that are currently handled by the brick arch can continue to be carried in this culvert without a need to shunt a portion of the flows to the new culvert.

D. CONCEPTUAL LEVEL COST ESTIMATE FOR SLIP LINING

Based on discussions with contractors that perform slip lining work, preliminary construction cost estimates based on the conceptual plans for rehabilitating the brick arch vary from about \$1,200 to \$2,000 per lineal foot of slip lining completed in-place. For an approximate slip lined length of 180 feet, the probable construction cost for the rehabilitation of the existing brick arch culvert ranges from \$220,000 to \$360,000, plus engineering and construction administrative costs of approximately 20 percent.

IV. PRELIMINARY HYDRAULIC ANALYSES

Hydraulic analyses for this project were based on design flows calculated in Burns & McDonnell's "Central Drainage Channel Mitigation Design Storm Water Report" dated July 15, 2004 (Appendix D).

Based on calculations presented in the above mentioned report, 25-year design flows are estimated at 509 cubic feet per second (cfs), and 100-year flows are estimated at 625 cfs at the location of the proposed culvert. Design flows are estimated based on a worst case approach that assumes that the majority of the Railyard is fully developed and that the proposed "River Park" provides little or no storage for flood attenuation.

A. PRELIMINARY CONDUIT SIZES

Preliminary hydraulic analyses performed in the "Central Drainage Channel Mitigation Design Storm water Report" dated July 15, 2004, determined the approximate size of the culverts that will be required to convey the design flows for the 25 and 100 year storms for the various alternatives. As mentioned above, if the brick arch is rehabilitated and remains in service, the flows that are currently carried by the brick arch will continue to be carried by the brick arch sewer, and the proposed culvert will not have to be sized to accommodate any portion of those flows.

Based on the above, the following table summarizes the culvert sizes required for each of the options:

TABLE 2

SUMMARY OF CULVERT SIZES

DESIGN FLOW = 625 CFS (100 Year)		
Option No.	**Preliminary Conduit Sizes**	**Status of Brick Arch Sewer**
1A	One (1) 8' wide by 7' high box	Rehabilitate
1B	Two (2) 9' wide by 7' high boxes	Abandon
2A	Two (2) 72" diameter pipes	Rehabilitate
2B	Three (3) 84" diameter pipes	Abandon
3A	11' inside diameter lined tunnel	Rehabilitate
3B	16' inside diameter lined tunnel	Abandon

B. INITIAL EVALUATION OF OPTIONS BASED ON PRELIMINARY HYDRAULIC ANALYSIS

The results of the preliminary hydraulic analyses indicated that the size and/or number of the new culvert conduit(s) will need to be increased significantly if the existing brick arch is abandoned. For example, if the shallow box culvert option is chosen, abandoning the brick arch will require two larger boxes in lieu of a single smaller box. With the shallow pipe culvert option, three larger pipes will be required in lieu of two smaller pipes. The net cost of installing two larger box culverts in lieu of a single box culvert is estimated to exceed the cost of slip lining the existing brick arch. Similarly, the net cost of installing three larger pipes in lieu of two smaller pipes is estimated to exceed the cost of slip lining the existing brick arch.

Similarly, the size of the inverted siphon tunnel will need to be increased significantly if the brick arch were to be abandoned. In this case, the size of the excavated tunnel will have to be increased from about 15 to 16 feet high and wide to about 20 to 21 feet high and wide. This will impact the mining method, the requirements for initial ground support, the final tunnel lining, the size of the shafts, and perhaps even the required depth of the tunnel. The increased costs associated with the larger tunnel are estimated to greatly exceed the cost of slip lining the existing brick arch.

Based on the above, it was concluded that the options that include rehabilitating the existing brick arch will be more cost-effective than the options in which the brick arch is abandoned. Therefore, in the discussions below, our evaluation is limited to those options where the brick arch sewer is proposed to be rehabilitated, namely, options 1A, 2A, and 3A.

V. SHALLOW CULVERT UNDER TRACKS (OPTIONS 1A AND 2A)

A. CONSTRUCTION APPROACH

As outlined previously, Caltrain suggested that one possibility is to construct a new shallow culvert by first creating a “cleared path” through which the new culvert can be jacked. The reason for the “cleared path” is to minimize complications during pipe jacking due to obstructions.

For this option, the culvert could consist of either a precast concrete box or reinforced concrete pipes (RCP). The culvert will be installed using trenchless techniques (by jacking) rather than by standard cut and cover construction due to the limited windows in which the mainline Caltrain tracks can be removed from service. A plan view and typical section of the box culvert option (Option 1A) are illustrated on enclosed Drawings DC-10 and DC-11. The pipe culvert option (Option 2A) is illustrated on enclosed Drawings DC-20 and DC-21.

As indicated on the enclosed drawings, the invert of the culvert will be level at elevation 0, as referenced to mean sea level (msl). The base of rail at the existing tracks is at about elevation +13 feet msl, meaning that the distance from the top of the box culvert (7 feet high) to the base of rail will only be about 5 feet (13-7- culvert wall thickness). The distance from top of pipe to base of rail will be between 6 and 6.5 feet.

Ideally, the engineered backfill material through which the culvert will be jacked will be designed to have sufficient strength to provide a stable face during culvert jacking and low permeability to provide effective groundwater cut off. The material will also need to gain strength quickly enough after it is placed so that it will form a stable sub-base for the tracks.

A conceptual construction sequence for Options 1A and 2A is shown on Drawings DC-22 through DC-24. The proposed steps in the culvert installation would be as follows:

- Temporary shoring will be installed between tracks MT1 and MT2 to support the active MT1 track during the first phase of excavation and backfilling. This shoring will need to be installed during work windows that have been coordinated with Caltrain (weekends or possibly nights).
- Over a weekend during which train traffic moved to the eastern tracks (MT1 and MT3), the Visitation Lead, MT4, and MT2 will be removed from service. Pre-bolted track panels will have been created in advance of the weekend work window to permit the tracks to be removed and replaced more easily. Excavation will be performed starting from the temporary shoring between MT1 and MT2 and will extend to about 20 feet west of the centerline of track MT4. The temporary excavation will need to be dewatered to permit the placement of the engineered material backfill. After the engineered material has been placed, MT2 and MT4 will be restored. It is assumed that the Visitation Lead can remain out of service until the culvert installation is complete.) This stage is illustrated on Drawing DC-22.

- During a subsequent weekend, train traffic will be moved to the western tracks (MT2 and MT4) and MT1 and MT3 will be removed from service. Excavation will start from the east end of the previously placed engineered material and will extend to about 20 feet east of the centerline of MT3. The portion of the shoring wall between MT1 and MT2 that would interfere with the future culvert jacking will need to be cut out or otherwise be removed at this time. It is assumed that the previously placed engineered fill will be sufficiently competent that no shoring will be needed to support MT2 at this stage. The excavation will be dewatered and the engineered material will be placed. MT1 and MT3 will then be restored to service. This stage is illustrated on Drawing DC-23.
- As illustrated conceptually on Drawing DC-24, a jacking pit and a receiving pit will be constructed on opposite sides of the tracks. The sizes of the jacking and receiving pits shown on DC-24 are approximate. It is anticipated that these pits will need to be constructed with watertight shoring so that the quantity of groundwater to be treated and discharge will be minimized. The pipes (or box) will then be jacked from the jacking pit to the receiving pit.
- After the pipes (or box) have been jacked, the concrete headwall structures will be constructed and the Visitation Lead will be restored.

B. EVALUATION AND DISCUSSION OF OPTIONS 1A AND 1B – NEW SHALLOW PIPES OR BOX CULVERT WITH BRICK ARCH SEWER REHABILITATED

Based on the evaluation of Options 1A and 2A, some significant risks and technical obstacles have been identified that will need to be overcome for this approach to be successful. Major areas of concern are:

- There may not be sufficient time to perform the required excavation and backfill during the weekend work windows. Based on the assumed trench cross-section geometry shown on Drawings DC-11 and DC-21 the excavation and backfill volume is about 15 cubic yards per lineal foot of trench for the box culvert option and about 20 cubic yard per lineal foot of trench for the pipe culvert option. It is thought that the geometry of the trench excavations shown on the concept plans (with 1:1 side slopes) may actually be optimistic given the poor quality of the existing fill soils that will be excavated. Flatter side slopes may be required, which would increase the cut and fill volumes. Caltrain has suggested that the amount of material to be excavated and replaced might be reduced by shoring the sides of the excavated trench or pregrouting the soils to permit the side slopes of the trench to be dug closer to vertical. However, shoring or grouting would require additional work directly within Caltrain's operating envelope. Additionally, it is not reasonable to assume that shoring or grouting will provide satisfactory results given the soil and groundwater conditions that must be addressed.

- This option for the culvert installation will require the control of groundwater in the trenched excavations. Large groundwater inflows were encountered in test pits that were excavated in the vicinity of the proposed culvert location. See “Test Pit Report” dated September 2003, presented in Appendix E. Achieving drawdown sufficient to permit the engineered material to be placed in dry conditions could be problematic and costly. Groundwater elevation at this site ranges in depth from 5-6 feet to 10-11 feet below grade, depending on specific locations and time of the year. It is anticipated that high volumes of groundwater (potentially contaminated) will be encountered during excavation. Dewatering and disposal of groundwater will be challenging and costly.
- Developing an engineered material that has the desired properties will require research, and the cost of the material may be high depending on its constituents.
- Contractors were contacted and they expressed serious reservations about jacking a box culvert with only 5 feet of cover between the top of box and base of rail. Their concern is that it will not be feasible to jack the box without disturbing the tracks. Track disturbance is obviously a major concern due to its potential impact on Caltrain’s operations. Their concern with jacking the smaller pipes with slightly less cover is less than that for the box installation, but still significant.
- It is unclear at this time, if any of the above issues can be addressed sufficiently to satisfy Caltrain.

C. CONCEPTUAL LEVEL COST ESTIMATE FOR OPTIONS 1A AND 2A

The following table summarizes conceptual level opinions of construction costs for some of the major elements associated with these options:

TABLE 3 – OPTIONS 1A and 2A

Item Description	**Unit Cost ($)**	**Quantity**	**Total Cost ($)**
Temporary platform at Bayshore Station	500,000- 600,000	1 platform	500,000-600,000
Trackwork – Removal and replacement of tracks during two weekend outages and restoration of Visitation Lead at completion of construction. Amtrak and contractor crew.	50,000-60,000	2 weekends	100,000 – 120,000
Excavate existing soil and replace with engineered fill - Approximately 15-20 cubic yards per lineal foot of trench	$250-300/cubic yard	1350-1800 cubic yards	337,500-540,000
Shoring between MT3 and MT4 to be installed during night work windows or weekend work windows as approved by JPB	150,000- 250,000	1	150,000-250,000
Jacking and Receiving pits – Shoring and Excavation	150,000-250,000	2	300,000-500,000
Jacking Conduit(s) – Box Culvert Option 1A	8000/ft	1 box -90 feet	720,000
Jacking Conduit(s) – Pipes Option 2A	5000/ft	2 pipes - 180 feet	900,000
Cut and cover box or pipes out to headwall location	1000-1500/ft	100 ft	100,000-150,000
JPB engineering, inspection, and signals, and Amtrak flagging costs during construction	250,000-300,000	Lump sum	250,000-350,000
Total			2.45-3.4 Mil

The following items common to all options are excluded in the cost estimate at this time:

- Design engineering
- Concrete headwall structures at the ends of the conduit(s)
- Handling and disposal of contaminated soils – Unit cost for disposal ranges from $30 to $200 per cubic yard of soil
- Groundwater handling, treatment and disposal costs
- Connection between the brick arch sewer and the proposed culvert
- Miscellaneous earthwork and grading
- Geotechnical investigation
- Contingencies

VI. INVERTED SIPHON (OPTION 3A)

A. CONSTRUCTION APPROACH - OPTION 3A

Under this option, the culvert would be constructed using a deeper vertical alignment with the culvert functioning as an inverted siphon. The culvert would be constructed as a tunnel through the bedrock which underlies the site.

Conceptual horizontal and vertical alignments of the inverted siphon are shown on enclosed Drawings DC-30 through DC-32. A horizontal alignment that is skewed to the tracks is being shown because, although the required tunnel length is greater, the depth to the bedrock is anticipated to be less than an alignment perpendicular to the tracks. Preliminarily, it is estimated that the shafts at either end of the tunnel will need to be excavated to about elevation minus 40 msl (about 50 feet below existing grade) to ensure that the entire tunnel excavation will be in rock with at least 10 feet of rock cover at the east end of the tunnel. For simplicity, a level tunnel is shown, but in all likelihood the siphon will be constructed with a slope from west to east. The length of the excavated tunnel appears that it will be in the 160 to 170 foot range.

In order for there to be sufficient room to install the permanent 11 foot -0 inch inside diameter pipe lining in the tunnel, the clear distance to the inside of the initial tunnel supports will need to be about 14 feet in the horizontal and vertical directions.

Key items involved in the construction of the inverted siphon are the following:

- Temporary Shafts.

  Two temporary shafts would be constructed (see drawing DC-30 for conceptual shaft locations). Due to potential for high groundwater inflows (particularly in the upper fill soils) and groundwater contamination, it appears that the shafts should be constructed in a manner that will produce a relatively watertight excavation. Conceptually, a secant pile shoring system could be used for this purpose. A secant pile shoring wall system is constructed of interlocked concrete-filled drilled shafts. Typically, every other secant pile is reinforced with a wide flange steel beam. When properly constructed, this type of shoring can provide good groundwater cut-off.

  The shafts may be constructed in either a circular or rectangular configuration, although rectangular shafts are shown on the conceptual plans. The tunnel would be driven from one of the shafts (driving shaft) toward the other shaft (receiving shaft). The driving shaft will likely need to be larger than the receiving shaft in order to allow sufficient room for the contractor to operate his equipment and handle the material excavated from the tunnel.

- Tunnel Excavation and Initial Ground Support

  Based on the limited geotechnical information on the bedrock that is available, it is believed that the tunnel will be excavated using standard tunneling techniques. Most likely, excavation would be performed using a roadheader. A roadheader is a piece of mining equipment that has a rotating cutter head capable of effectively excavating soft to medium strong rock. The excavated material (muck) is carried back to the driving shaft using a loader that is specially designed to be operated in a tunnel or via a conveyer system. The muck is collected at the shaft in a muck bucket that is hoisted and dumped by a crane.

  Various types of initial ground support may be suitable for the ground conditions that will be exposed during tunneling, but for conceptual level planning, it has been assumed that steel ribs and timber lagging will be used. The ribs are steel wide flange members that are fabricated in a number of pieces (in this case probably 4 pieces) and erected in the tunnel to form an arch-shaped support. The ribs are typically installed at a fixed spacing of between 3 and 5 feet on center as the tunnel excavation is advanced. The ground between the ribs is supported by wood lagging and blocking that is installed behind the rear flange of the rib. Tie rods and pipe collar braces are use to connect the adjacent ribs together for stability.

- Final Tunnel and Shaft Lining

  For conceptual design purposes, it has been assummed that the tunnel will be lined with pre-stressed concrete cylinder pipe (PCCP). PCCP has gasketed joints for water tightness. The pipe will be installed in the tunnel and the annular space will be backfill grouted to produce tight contact between the installed pipe and the surrounding ground. Lightweight cellular grout is commonly used for this purpose.

  Fabricated elbows will be required at each end of the lined tunnel. Concrete pipe could also be used to line the shafts. Alternatively, cast-in-place concrete shaft linings could be constructed.

- Connections to Open Channels

  A transition structure will be required at the tops of the shafts. The structure will funnel the flow from the channel into the upstream shaft and return the flow to the channel at the downstream shaft. These will be cast-in-place concrete box-type structures that will be structurally tied to the shaft lining system. The upstream entrance to the siphon will need to include screens to prevent debris from being carried down into the tunnel.

B. EVALUATION AND DISCUSSION OF OPTION 3A

Major issues:

- This option has the significant advantage over the shallow culvert option because it will have minimal to no impact on Caltrain's operations. The tracks will remain in service throughout the entirety of the construction. Caltrain has indicated that this makes this option desirable to them.

- Additional geotechnical exploration will be required to develop the final alignment of the siphon and evaluate the requirements for excavation and ground support at the shafts and tunnel. The depth to rock along the proposed horizontal alignment, the quality of the rock through which the tunnel will be excavated, and the anticipated amount of water that will be encountered during tunnel excavation will be key items to evaluate during this exploration.

- Just as for the shallow culvert option, the construction of the temporary shafts and the tunnel will require specialty contractors to perform the work.

- This option will require more maintenance than the shallow culvert options. The upstream debris screens will need to be cleaned on a regular basis, and the tunnel will also need to periodically be cleared of material that will tend to build up over time.

C. CONCEPTUAL LEVEL COST ESTIMATE FOR OPTION 3A

The following table summarizes conceptual level opinions of construction costs for some of the major elements for this option:

TABLE 4 – OPTION 3A

Item Description	**Unit Cost ($)**	**Quantity**	**Total Cost ($)**
Tunnel excavation, initial ground support, and final lining	$5,000-$6,000/LF	170 Feet of Tunnel	850,000-1,020,000
Watertight temporary shafts – final cost will depend on actual depth of excavation required and geotechnical (soil/rock/groundwater) conditions at the chosen shaft locations.	$250,000 - $400,000	2	500,000-800,000
Concrete transition structures at tops of shafts	$400-500/cubic yard	250 cubic yards	100,000-125,000
Shaft excavation	20-35/cubic yard	5000-6000 cubic yards	100,000-210,000
Shaft lining and backfill – assuming 2 shafts Each 40 feet deep	$2,000-$3,000 per lineal foot of lined and backfilled shaft	80 feet	160,000-240,000
*Maintenance Costs	*$50,000	Per 10 yrs. For 50 years	50,000*
JPB engineering and inspection, and Amtrak flagging costs during construction: This assumes a watchman will be required for about 80 working days during the inverted siphon construction.	$100,000- $150,000.	Lump Sum	100,000-150,000
Total			Mil 1.85-2.6

* Maintenance cost is calculated at Present Value of maintenance cost of $50,000 every 10 years for 50 years at an interest rate of 7 percent.

The following items common to all options are excluded from the cost estimate at this time:

- Design Engineering
- Handling and disposal of contaminated soils – Unit cost for disposal ranges from $30 to $200 pr cubic yard of soil.
- Groundwater handling, treatment and disposal costs
- Connection between the brick arch sewer and the proposed siphon
- Miscellaneous earthwork and grading
- Geotechnical investigation
- Contingencies

VII. Summary and Recommendations

Key summary points and recommendations are as follows:

It appears that retrofitting (slip lining) the existing brick arch culvert will be a cost-effective approach of reducing the required size of the new culvert, no matter which method of new culvert construction is selected.

Comparison of shallow culvert versus inverted siphon on key issues:

- Caltrain involvement: The involvement of Caltrain during the design and construction of the project will be much greater for the shallow culvert options as opposed to the inverted siphon option because the shallow culvert option will have an unavoidable impact on Caltrain's operations.
- Cost: At the current conceptual design stage it appears that the construction cost of the deep inverted siphon option is likely to be less than for either the shallow box culvert or pipe culvert option.
- Maintenance: The inverted siphon option will require more maintenance than the shallow culvert option. The maintenance requirements and anticipated cost associated with this maintenance need further evaluation.
- Risk/Unknowns: Although additional geotechnical exploration is needed to confirm the inverted siphon alignment and to get a better idea regarding the construction means and methods that will be required for shafts and tunnel, we believe that there is less risk associated with the inverted siphon option than the shallow culvert option. As noted above, we have some concern about the technical feasibility of constructing the shallow culvert using the means and methods presented above. Also, the potential for the shallow culvert construction to inadvertently impact Caltrain's operations is much greater than for the inverted siphon option.

DRAWINGS

Universal Paragon Corp.

Central Drainage Channel Mitigation

Brisbane, CA

Contract 1

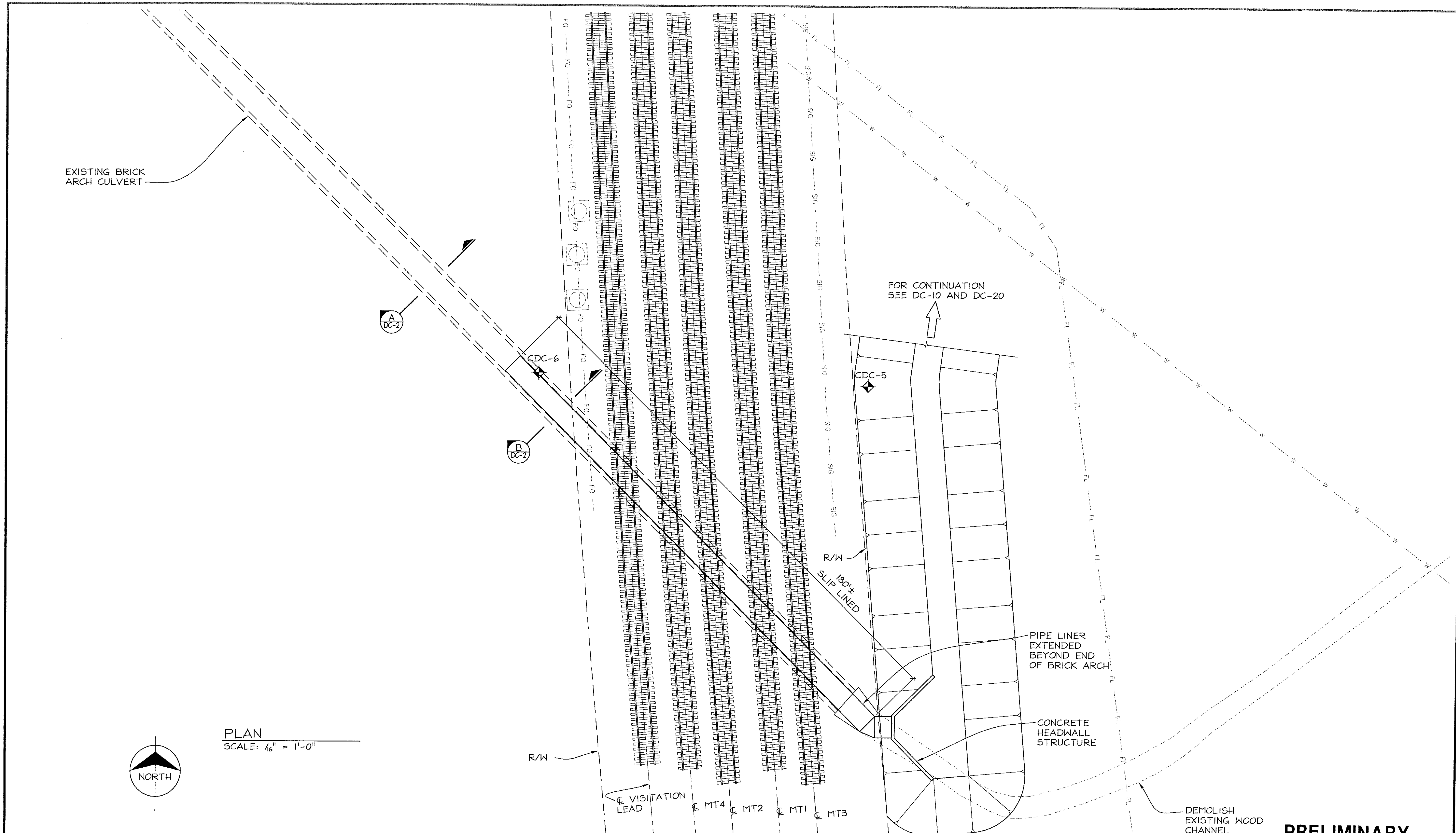
UPGRADE DRAINAGE CULVERT

Concept Drawings

DECEMBER 13, 2006

PRELIMINARY

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010



PLAN
SCALE: 1/16" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE: 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell — SINCE 1898

APPROVED | DATE

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA. 94556
(925) 247-9000 FAX (925) 247-9010

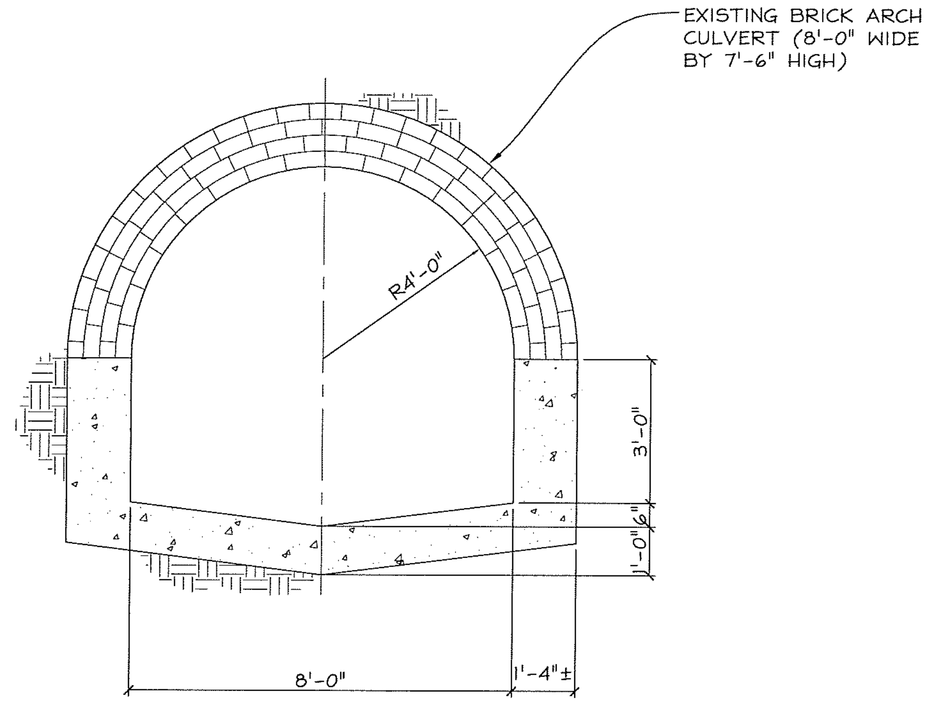
DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER
E.S. LINDQUIST
NO. 056713
EXP. 6-30-07
CIVIL
STATE OF CALIFORNIA

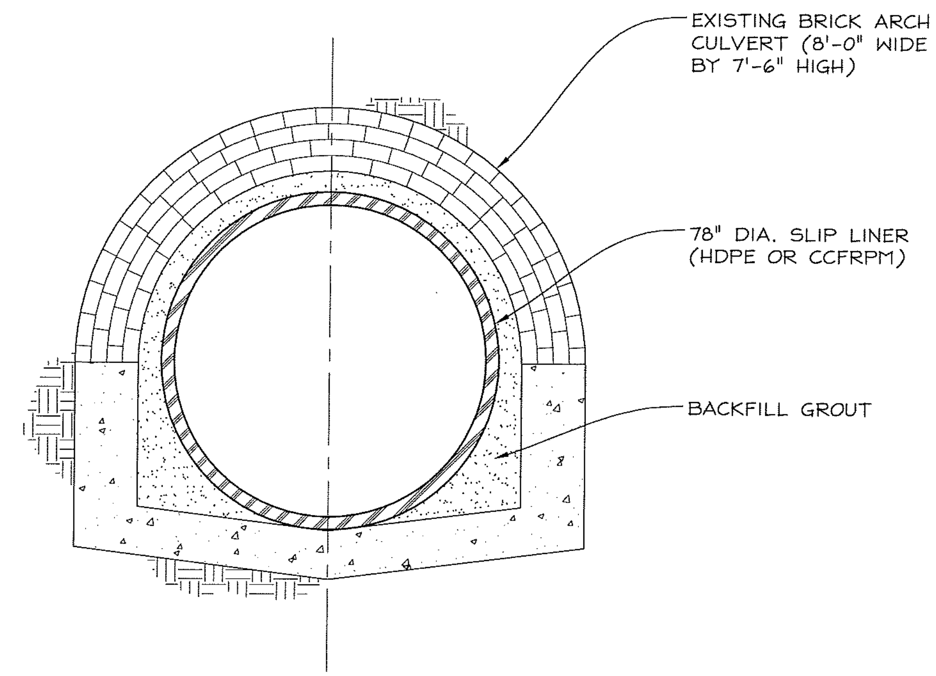
CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
REHABILITATION OF
BRICK ARCH CULVERT
PLAN

SHEET DC-1
DRAWING NO. 2 OF 13
REVISION 0

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE 1/16" = 1'-0"



A/DC-1 TYPICAL SECTION - EXISTING BRICK ARCH
SCALE: ½" = 1'-0"



B/DC-1 TYPICAL SECTION - SLIPLINED BRICK ARCH
SCALE: ½" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

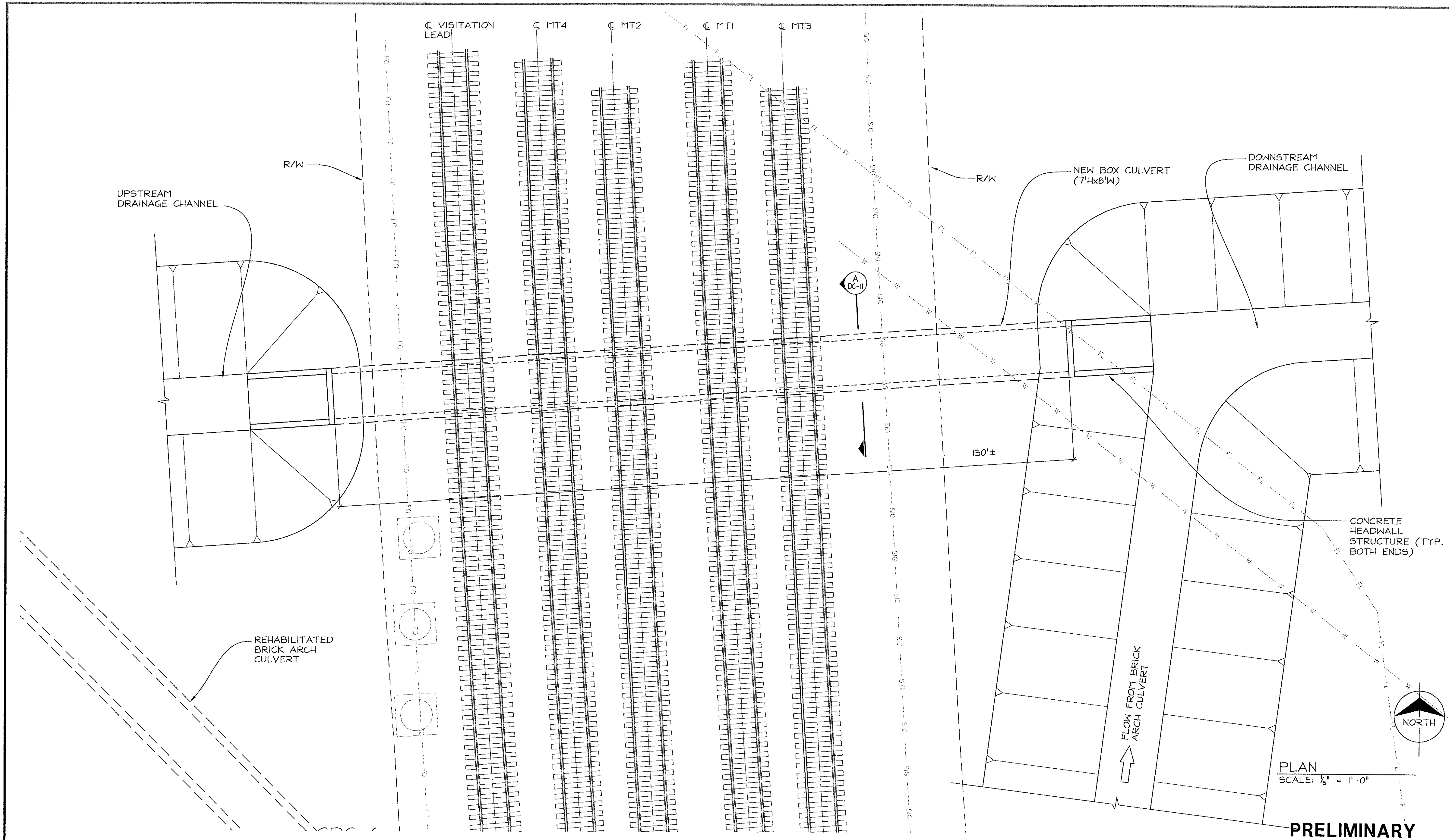
BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010

DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
REHABILITATION OF
BRICK ARCH CULVERT
TYPICAL SECTIONS

SHEET DC-2
DRAWING NO. 3 OF 13
REVISION 0
CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE 1/2" = 1'-0"



PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA. 94556
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DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
BOX CULVERT OPTION #1A
PLAN

SHEET DC-10 OF
DRAWING NO. 4 OF 13
REVISION 0

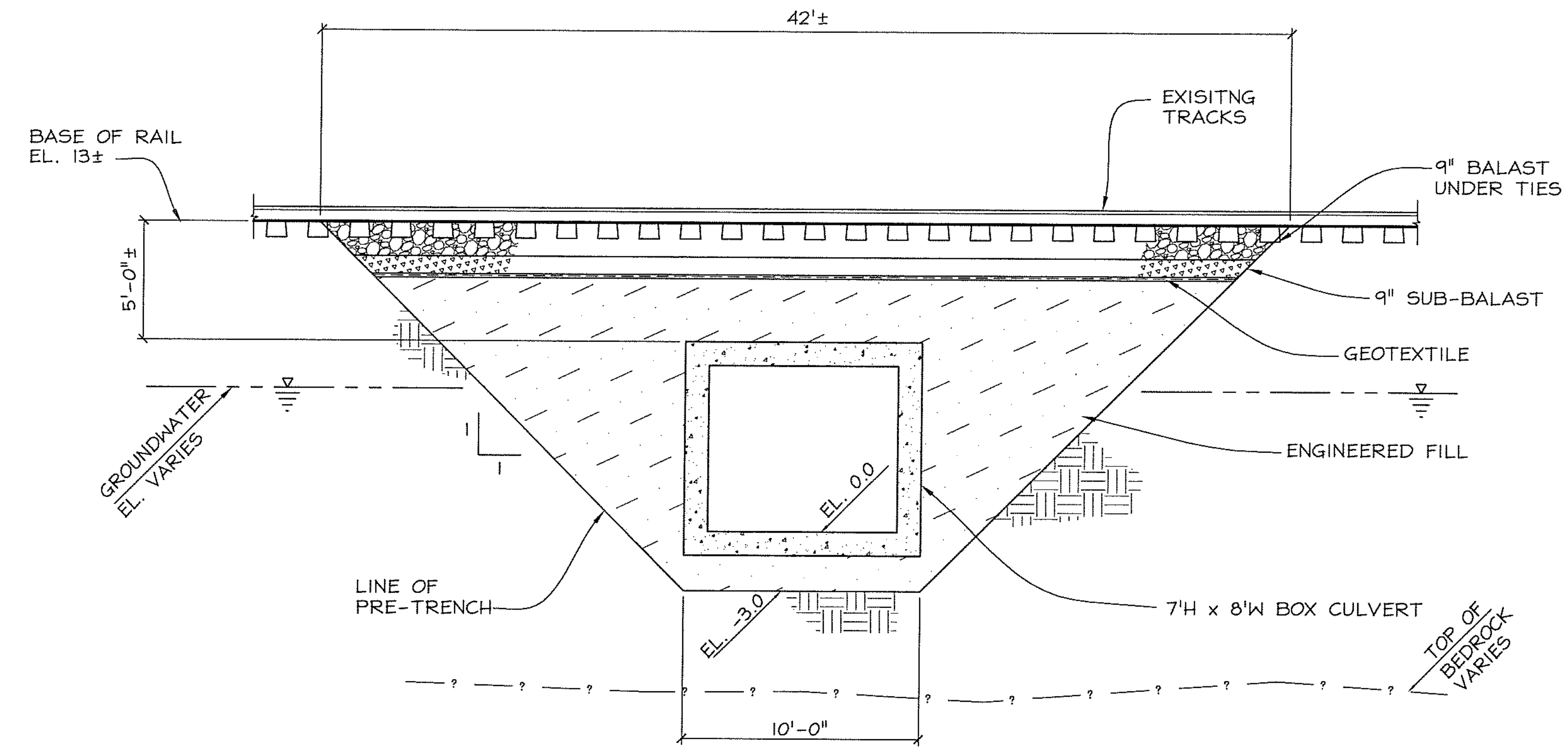
CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE 1/8" = 1'-0"

NOTES:

1. SEE DRAWINGS DC-22, DC-23 AND DC-24 FOR CONSTRUCTION SEQUENCE.

2. VOLUME OF FILL TO BE EXCAVATED AND REPLACED WITH ENGINEERED MATERIAL IS APPROXIMATELY 15 CUBIC YARDS PER LINEAL FOOT OF TRENCH BASED ON TRENCH EXCAVATION GEOMETRY SHOWN.

3. ENGINEERED MATERIAL TO HAVE THE FOLLOWING PROPERTIES: SUFFICIENT COHESIVE STRENGTH TO PROVIDE A STABLE EXCAVATION FACE DURING BOX JACKING, LOW PERMEABILITY FOR GROUNDWATER CUT-OFF.



A
DC-10
SECTION
SCALE: 1/4" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010

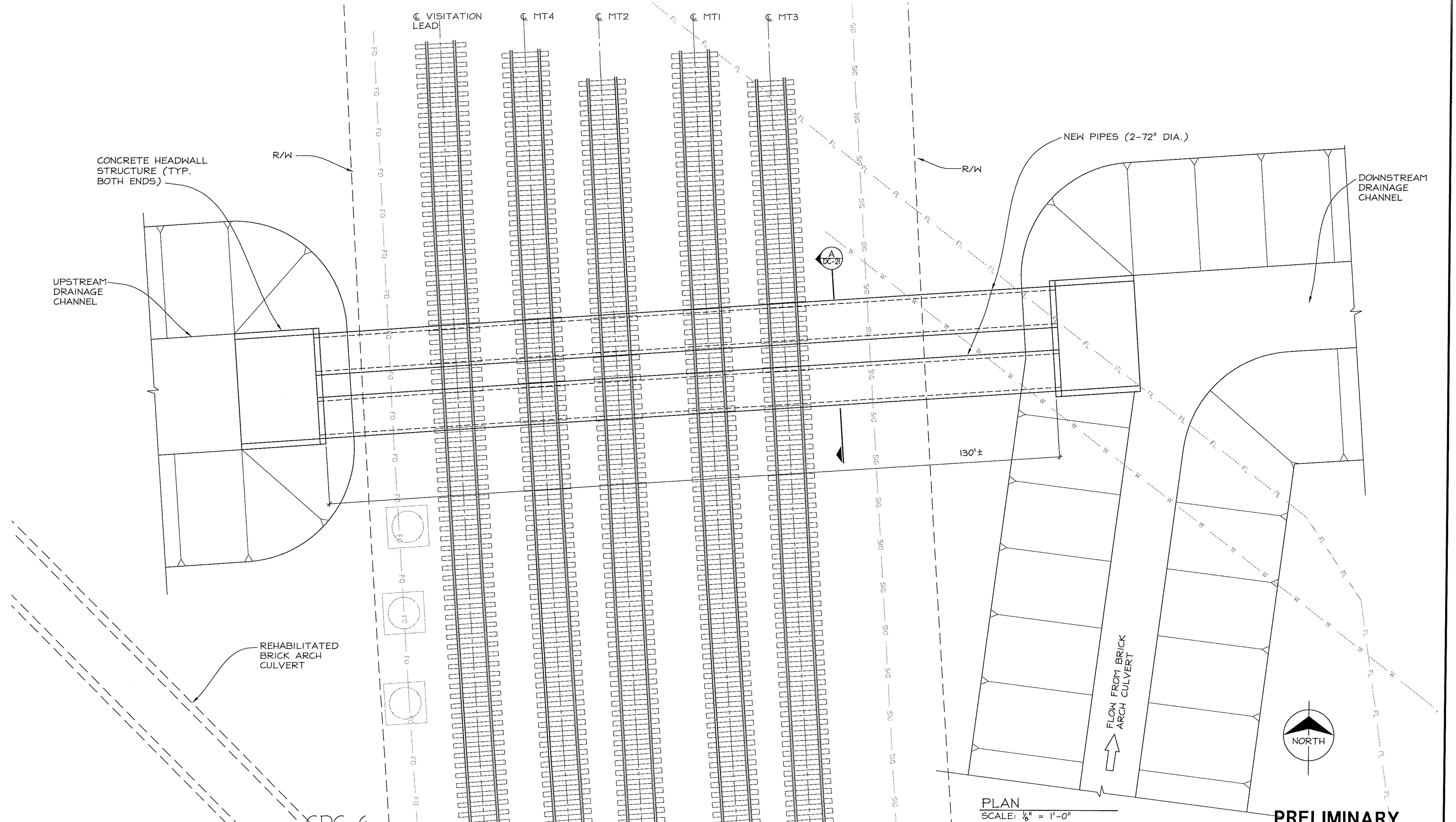
DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E.S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
BOX CULVERT OPTION #1A
SECTION

SHEET DC-11
DRAWING NO. 5 OF 13
REVISION 0

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE 1/4" = 1'-0"



PLAN
SCALE: 1/8" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 1/2" 1" 1 1/2" 2" 2 1/2" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010

DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER
E. S. LINDQUIST
NO. 056713
EXP. 6-30-07
CIVIL
STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
PIPE CULVERT OPTION #2A
PLAN

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046

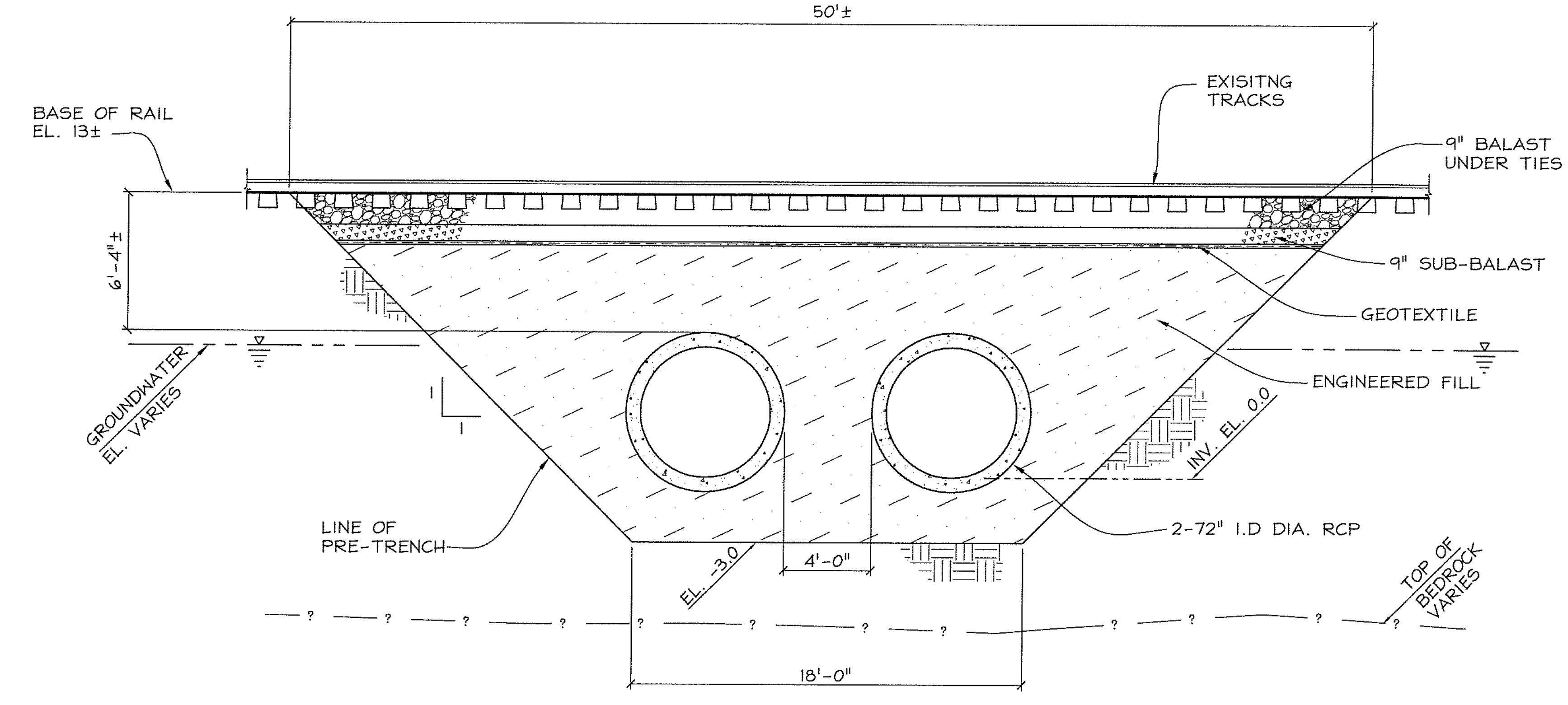
SHEET DC-20
OF
DRAWING NO. 6 OF 13
REVISION 0
SCALE 1/8" = 1'-0"

NOTES:

1. SEE DRAWINGS DC-22, DC-23 AND DC-24 FOR CONSTRUCTION SEQUENCE.

2. VOLUME OF FILL TO BE EXCAVATED AND REPLACED WITH ENGINEERED MATERIAL IS APPROXIMATELY 20 CUBIC YARDS PER LINEAL FOOT OF TRENCH BASED ON TRENCH EXCAVATION GEOMETRY SHOWN.

3. ENGINEERED MATERIAL TO HAVE THE FOLLOWING PROPERTIES: SUFFICIENT COHESIVE STRENGTH TO PROVIDE A STABLE EXCAVATION FACE DURING PIPE JACKING, LOW PERMEABILITY FOR GROUNDWATER CUT-OFF.



A
DC-20
SECTION
SCALE: ¼" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010

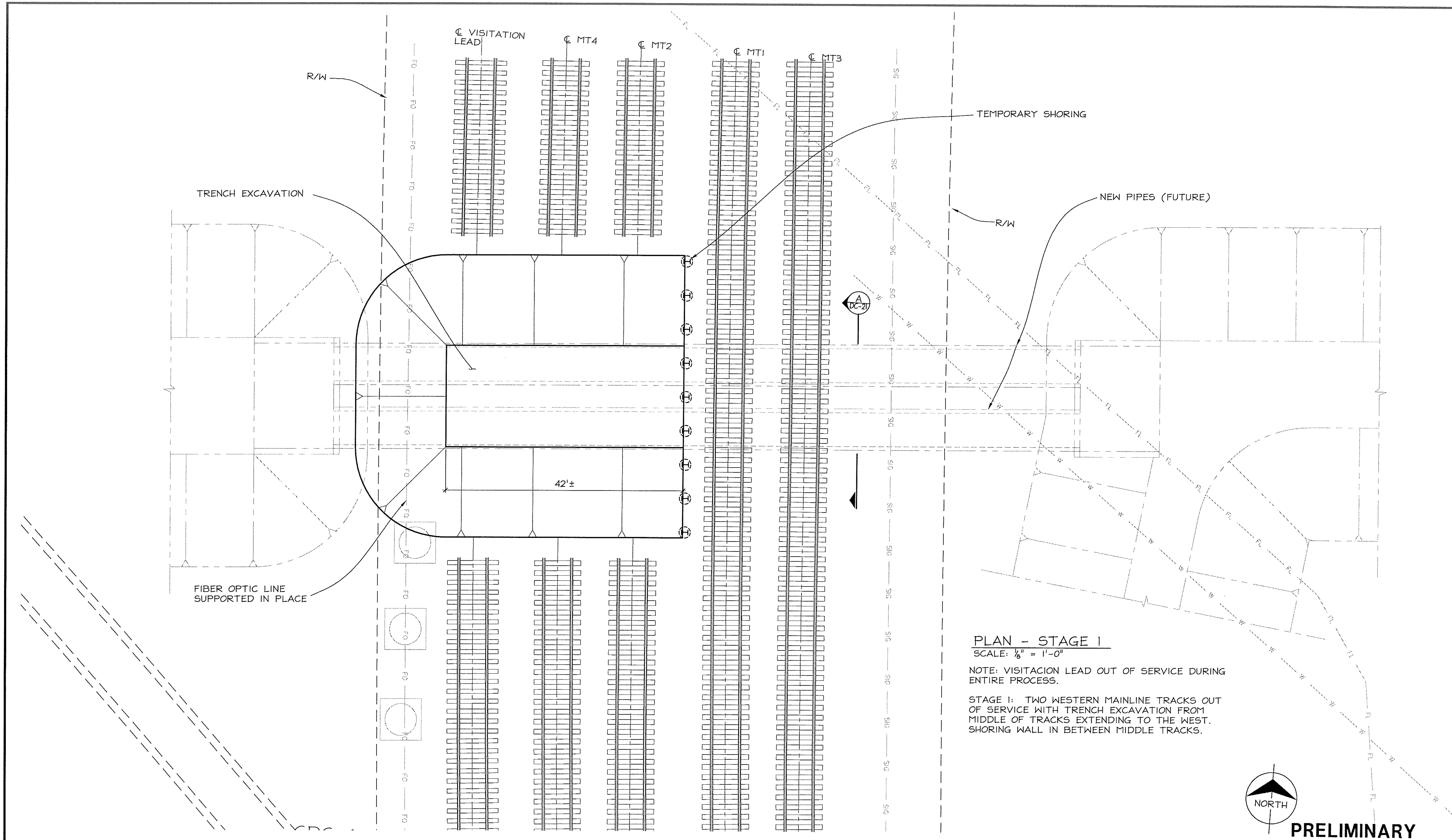
DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
PIPE CULVERT OPTION #2A
SECTION

SHEET DC-21
OF
DRAWING NO. 7 OF 13
REVISION 0

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE 1/4" = 1'-0"



PLAN - STAGE 1
SCALE: 1/8" = 1'-0"

NOTE: VISITACION LEAD OUT OF SERVICE DURING ENTIRE PROCESS.

STAGE 1: TWO WESTERN MAINLINE TRACKS OUT OF SERVICE WITH TRENCH EXCAVATION FROM MIDDLE OF TRACKS EXTENDING TO THE WEST. SHORING WALL IN BETWEEN MIDDLE TRACKS.

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

BLCE
BERTI-LINDQUIST CONSULTING ENGINEERS, INC.
920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010

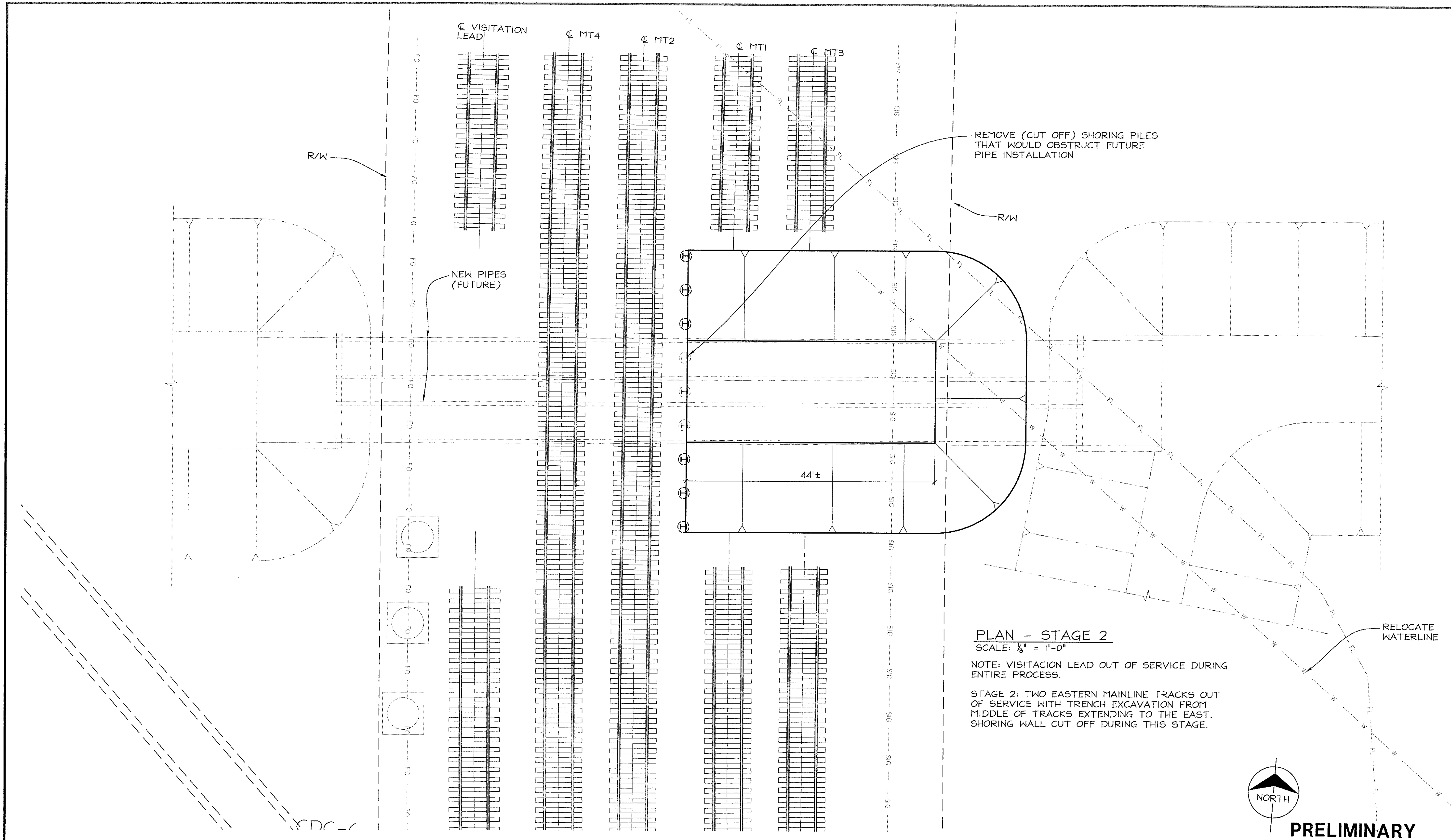
DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
PIPE CULVERT OPTION #2A
PLAN
CONSTRUCTION SEQUENCE

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046

SHEET DC-22
DRAWING NO. 8 OF 13
REVISION 0
SCALE 1/8" = 1'-0"



PLAN - STAGE 2
SCALE: 1/8" = 1'-0"

NOTE: VISITACION LEAD OUT OF SERVICE DURING ENTIRE PROCESS.

STAGE 2: TWO EASTERN MAINLINE TRACKS OUT OF SERVICE WITH TRENCH EXCAVATION FROM MIDDLE OF TRACKS EXTENDING TO THE EAST. SHORING WALL CUT OFF DURING THIS STAGE.

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	DESIGN CONCEPT	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 1/2" 1" 1 1/2" 2" 2 1/2" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

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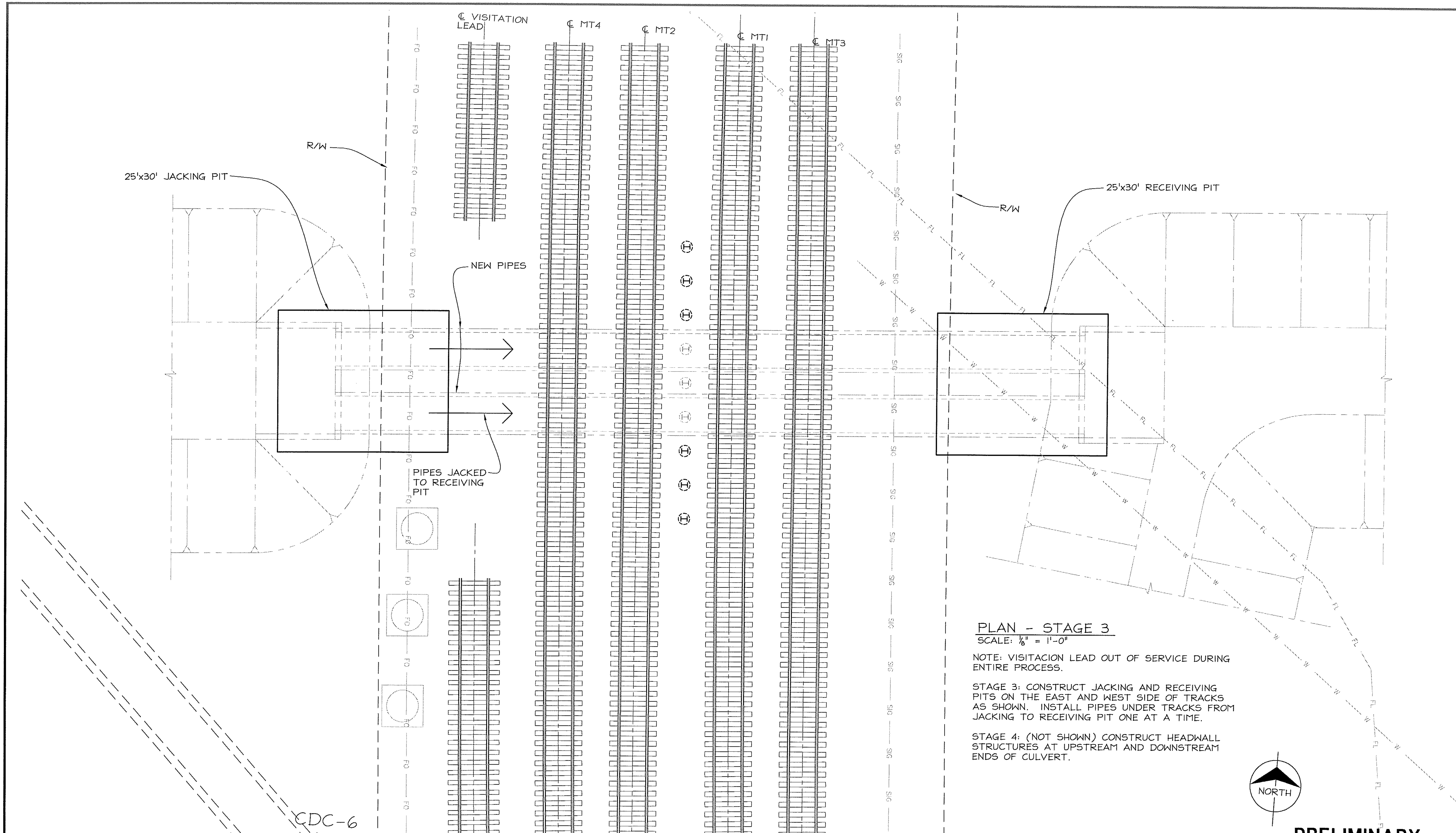
REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
PIPE CULVERT OPTION #2A
PLAN
CONSTRUCTION SEQUENCE

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046

SHEET DC-23
DRAWING NO. 9 OF 13
REVISION 0
SCALE 1/8" = 1'-0"



PLAN - STAGE 3
SCALE: 1/8" = 1'-0"

NOTE: VISITACION LEAD OUT OF SERVICE DURING ENTIRE PROCESS.

STAGE 3: CONSTRUCT JACKING AND RECEIVING PITS ON THE EAST AND WEST SIDE OF TRACKS AS SHOWN. INSTALL PIPES UNDER TRACKS FROM JACKING TO RECEIVING PIT ONE AT A TIME.

STAGE 4: (NOT SHOWN) CONSTRUCT HEADWALL STRUCTURES AT UPSTREAM AND DOWNSTREAM ENDS OF CULVERT.

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	DESIGN CONCEPT	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED | DATE

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(925) 247-9000 FAX (925) 247-9010

DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

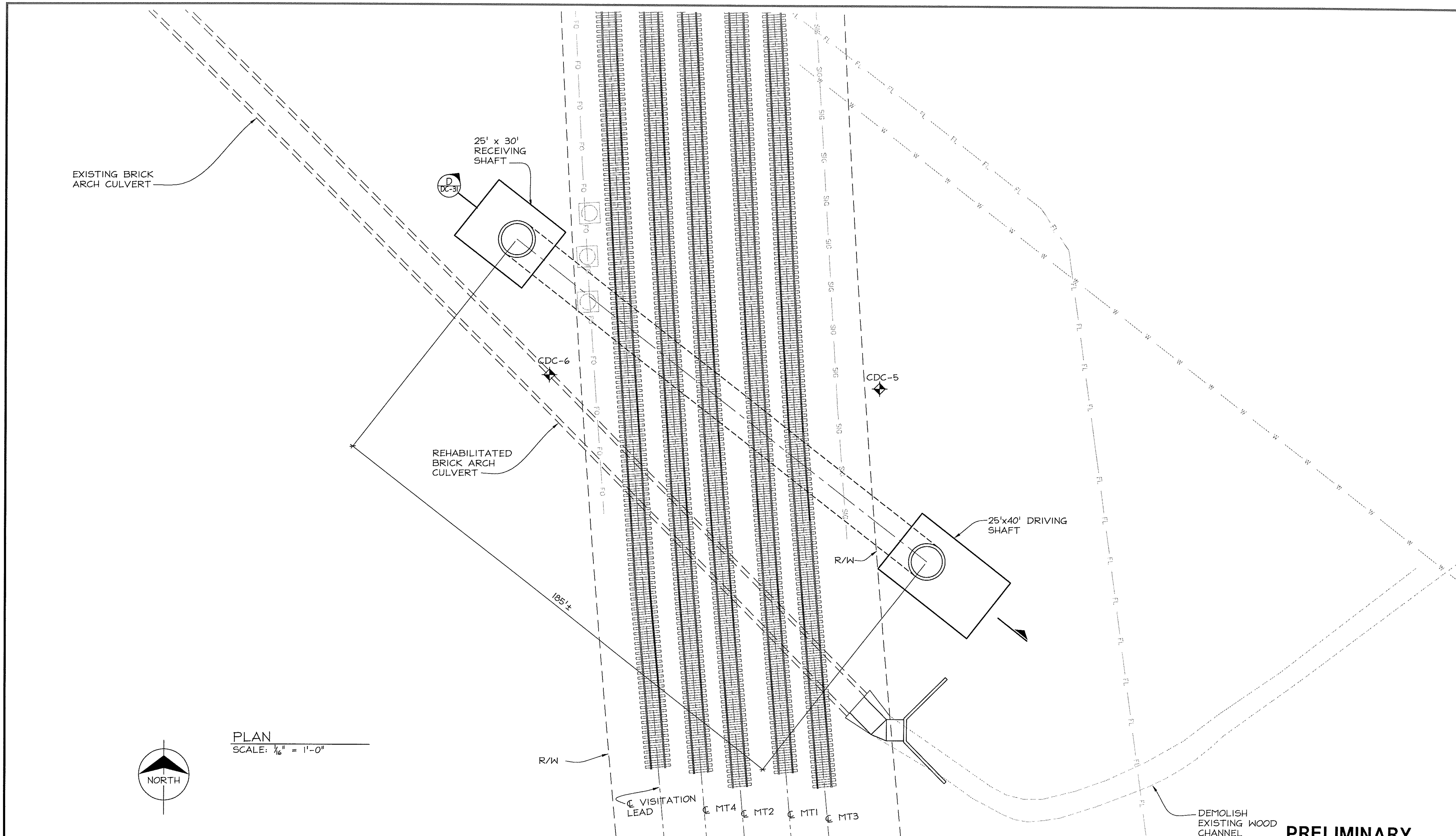
CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
PIPE CULVERT OPTION #2A
PLAN
CONSTRUCTION SEQUENCE

SHEET DC-24

DRAWING NO. 10 OF 13

REVISION 0

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE 1/8" = 1'-0"



PLAN
SCALE: 1/16" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE: 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT: Burns & McDonnell — SINCE 1898

APPROVED | DATE

BLCE
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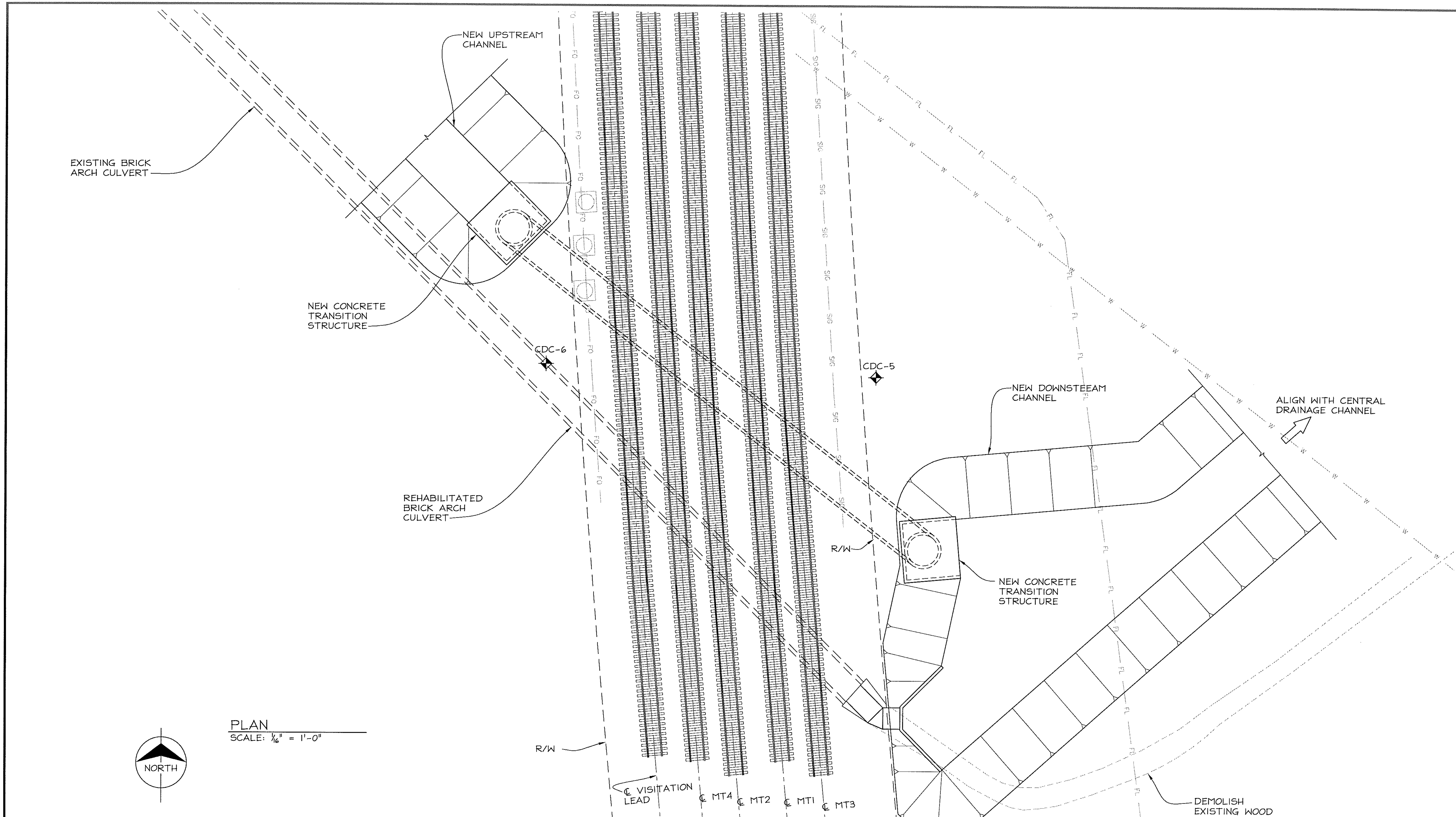
(925) 247-9000 FAX (925) 247-9010

DESIGNED: ESL | CHECKED: DJB | DRAWN: HC

REGISTERED PROFESSIONAL ENGINEER — E. S. LINDQUIST — NO. 056713 — EXP. 6-30-07 — CIVIL — STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
INVERTEDSIPHON OPTION #3A
PLAN DURING COSTRUCTION

SHEET: DC-30
DRAWING NO. 11 OF 13
REVISION 0
CONTRACT 1
DATE DEC. 13, 2006
JOB 5046
SCALE 1/16" = 1'-0"



PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER
UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME | PLOT DATE

CLIENT
Burns & McDonnell
SINCE 1898

APPROVED | DATE

BLCE
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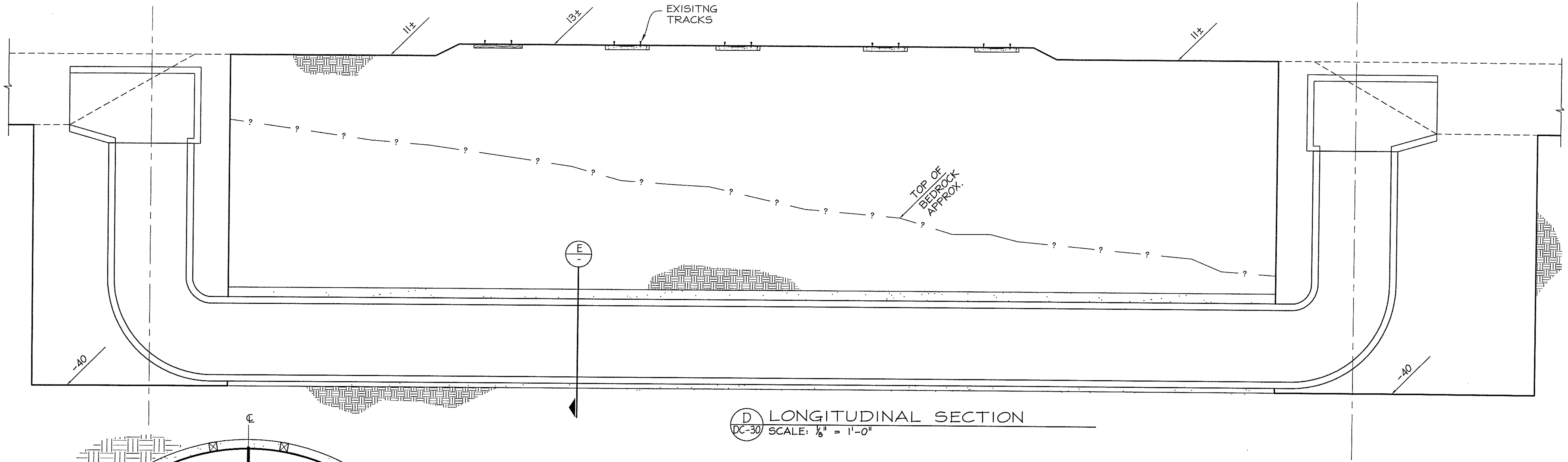
(925) 247-9000 FAX (925) 247-9010

DESIGNED	CHECKED	DRAWN
ESL	DJB	HC

REGISTERED PROFESSIONAL ENGINEER
E.S. LINDQUIST
NO. 056713
EXP. 6-30-07
CIVIL
STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
INVERTED SIPHON OPTION #3A
PLAN FINAL CONDITION

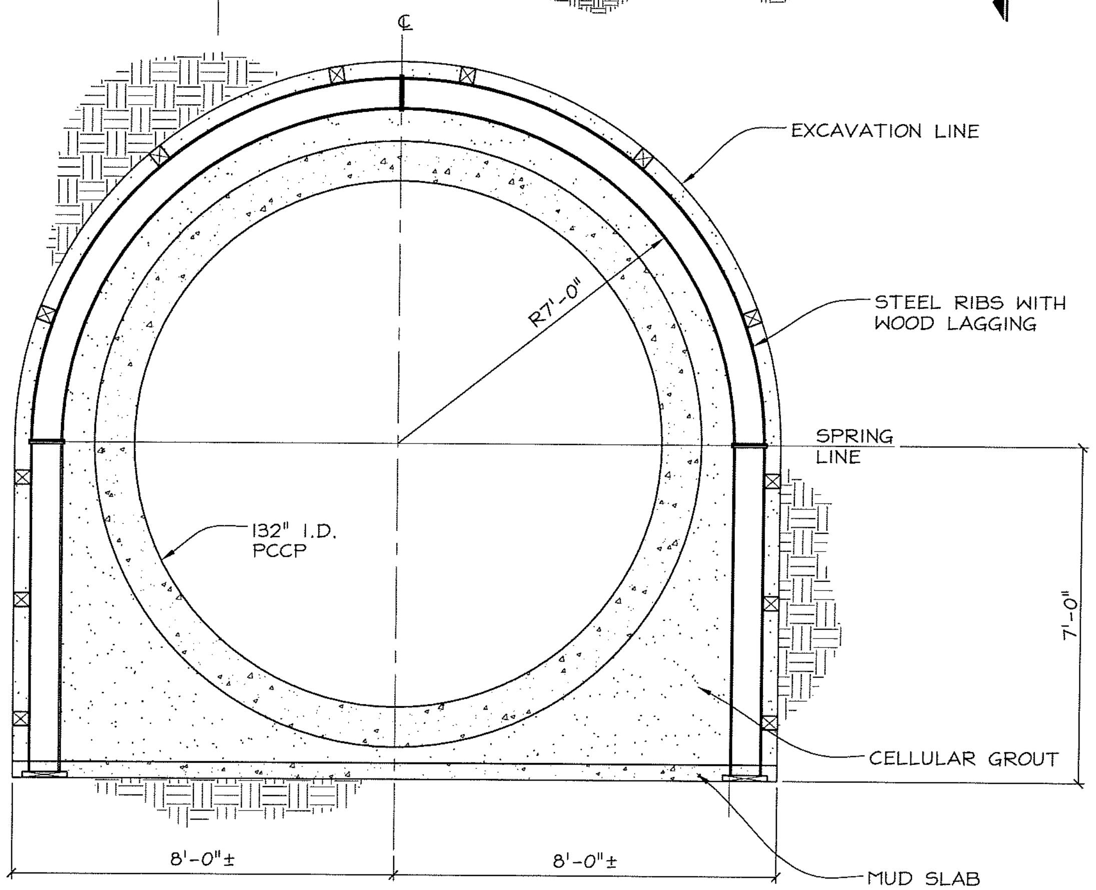
SHEET	DC-31
DRAWING NO.	12 OF 13
REVISION	0
CONTRACT	1
DATE	DEC. 13, 2006
JOB	5046
SCALE	1/16" = 1'-0"



D
DC-30

LONGITUDINAL SECTION

SCALE: 1/8" = 1'-0"



E
-

TYPICAL SECTION

SCALE: 1/2" = 1'-0"

PRELIMINARY

NO.	DATE	REVISIONS	BY	CK
	12-13-06	CONCEPT DESIGN	HC	ESL

OWNER: UNIVERSAL PARAGON CORP.

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME

PLOT DATE

CLIENT: Burns & McDonnell SINCE 1898

APPROVED

DATE

BLCE

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920 COUNTRY CLUB DRIVE, SUITE 2A, MORAGA CA, 94556
(925) 247-9000 FAX (925) 247-9010

DESIGNED ESL | CHECKED DJB | DRAWN HC

REGISTERED PROFESSIONAL ENGINEER E. S. LINDQUIST NO. 056713 EXP. 6-30-07 CIVIL STATE OF CALIFORNIA

CENTRAL DRAINAGE CHANNEL MITIGATION
BRISBANE, CA
INVERTED SIPHON OPTION #3A
SECTIONS

SHEET DC-32

OF

DRAWING NO. 13 OF 13

REVISION 0

CONTRACT 1 | DATE DEC. 13, 2006 | JOB 5046 | SCALE AS SHOWN

APPENDIX A
Geotechnical Investigation – Proposed Future Grading
Former Railyard, prepared by Michelucci & Associates, Inc.
January 27, 2004

GEOTECHNICAL INVESTIGATION

Proposed Future Grading
Former Bayshore Railyard
Brisbane, California

Prepared for:
Burns & McDonnell
January 27, 2004

Michelucci & Associates, Inc.
Geotechnical Consultants

Joseph Michelucci, G.E.
Daniel S. Caldwell, G.E.
Richard Quarry

January 27, 2004
Job No. 03-3324

Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114

Attn: Mr. David Silverstein

Re: Geotechnical Investigation
Proposed Future Grading
Former Bayshore Railyard
Brisbane, California

Dear Mr. Silverstein:

As authorized, we have completed a general geotechnical investigation of the site of the former Bayshore Railyard in Brisbane, California. We understand that the first phase of the project will involve importing and placing varying depths of fill over portions of the site.

In our opinion, the project is feasible from a geotechnical viewpoint. General recommendations along with an evaluation of the future ground settlement are included in the accompanying report. Additional site-specific geotechnical studies will be necessary in the future for other items such as building foundations for individual building sites.

We are pleased to have been of service to you on this project. Please call with any questions or comments.

Very truly yours,
MICHELUCCI & ASSOCIATES, INC.

David Karson
Civil Engineer #58042
(Expires 6/30/06)

Joseph Michelucci
Geotechnical Engineer #593
(Expires 3/31/07)

505 Tunnel Avenue, Suite #1 • **Brisbane, California 94005** • **(415) 330-0170 Fax: (415) 330-0370**
2455 Bennett Valley Rd., Suite B104 • Santa Rosa, California 95404 • (707) 527-7434 Fax: (707) 527-5664
P.O. Box 230 • Sunol, California 94586 • (925) 862-0544 Fax: (925) 862-0556

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION

Proposed Future Grading
Former Bayshore Railyard
Brisbane, California

INTRODUCTION

This report covers a geotechnical investigation undertaken for the planned future grading of the former Bayshore Railyard in Brisbane, California. The location of the project area is shown on the Site Vicinity Map, Figure 1. The regional geologic setting is illustrated on Figure 2.

An overview of the site, including the locations of the exploratory borings completed in conjunction with this study, is included on the Site Plan, Figure 3. Our interpretation of the subsurface strata at various site locations is depicted on the typical profiles included on Figure 4. A map depicting the postulated thickness of Bay Mud across the site is included as Figure 5.

The purpose of our study was to evaluate the general geotechnical engineering characteristics of the site soils, and to provide recommendations and design criteria for site preparation and grading. We also evaluated the differential settlement that can be expected from the weight of the new fill that will cause the underlying soft bay sediments to consolidate. Since the soil conditions across the site are not uniform, the amount of consolidation and settlement that can be expected will also vary.

DESCRIPTION OF PROJECT

The subject property was once a railyard that was owned and operated by the Southern Pacific Transportation Company. It is our understanding that Southern Pacific sold the site to Sunquest, the current property owner, in 1989. The property consists of a relatively level area with remnants of past railyard activities. The site is approximately 180 acres in area. We understand that areas of soil and groundwater contamination exist on the subject site. The various areas of contamination have reportedly been investigated by other consulting firms over the past several years and are not a part of our study.

Due to the placement of artificial fill at the subject site dating back to the late 1800s and early 1900s, much of the ground surface has settled to varying degrees creating localized low spots and somewhat uneven topography. This has resulted in poor drainage conditions throughout much of the property. Thus, in order to improve the overall site drainage and cap any contaminated soil, it is currently proposed to place approximately 2 to 11 feet of artificial fill throughout the site area. Additional fills may also be placed in certain areas for roadway extensions. We understand that preliminary plans call for extending Geneva Avenue through the site, ultimately tying in with the Bayshore Freeway (State Highway 101).

We understand that the proposed fill placement is considered the first phase of a larger development that will proceed once the fill is placed. Initially, the fill will be placed in order to both cap the noted contamination and raise the grades within the area to provide positive surface drainage. Following this rough grading of the site, additional investigations will be required for other geotechnical items, such as building foundation requirements, roadway and embankment construction, and any additional grading.

SCOPE OF SERVICES

Our study included:

1. Detailed site inspections by our personnel.

2. A review of our files for other projects completed in the site vicinity and a review of information available at the City of Brisbane offices and the Brisbane Library.

3. A review of various reports and a preliminary grading plan made available to us for our review by Burns & McDonnell.

4. Discussions with representatives of Burns & McDonnell.

5. A review of available geologic maps and literature.

6. The examination of eighteen sets of black and white, vertical, stereo-paired aerial photographs of the site area.

7. The excavation of eleven exploratory borings with a truck-mounted drill rig, the recovery of relatively undisturbed and bulk samples of soil, and laboratory testing of samples to evaluate relevant engineering properties. Laboratory testing included unconfined compressive strength, dry density, moisture content, plasticity and consolidation.

8. The compilation of the data acquired from the above work, the preparation of report figures, geotechnical engineering analysis, and the preparation and submittal of this final report.

BACKGROUND AND PREVIOUS STUDIES

As noted, our study included researching available geotechnical and other records at the City of Brisbane Building Department for the subject site and nearby areas. We also examined records at the Brisbane Library which included several oblique photographs within the collection of the Brisbane Historical Society. In addition, portions of engineering reports and other data pertaining to the site area were provided to us by Burns & McDonnell for our review.

Portions of the following reports were reviewed at the City of Brisbane offices:

* "Proposed Specific Plan for Bayshore Office Park and Baylands Development Area, Brisbane, California," prepared by Primani-Weaver, Architects, et al., dated July, 1982,

* "Proposed Rail Maintenance Facility for Peninsula Commute Service, Environmental Assessment of Alternative Sites, Hazardous Facilities and Waste Deposits," prepared by The State of California Department of Transportation, dated March, 1988,

* "Proposed Rail Maintenance Facility for Peninsula Commute Service, Environmental Assessment of Alternative Sites, Geology, Soils and Seismicity," prepared by The State of California Department of Transportation, dated March, 1988,

* "Proposed Rail Maintenance Facility for Peninsula Commute Service, Environmental Assessment of Alternative Sites, Historic Property and Archaeological Survey," prepared by The State of California Department of Transportation, dated April, 1988,

* "Remedial Investigation, Data Study Report for Southern Pacific Transportation Company, Bayshore Facility, Brisbane, California," prepared by Hydrologic Consultants, Inc., dated May 16, 1989,

* "Feasibility Study Report, Bayshore Railyard, Brisbane, California," prepared by Levine Fricke, dated December 1, 1991,

* "Draft Remedial Action Plan, Bayshore Railyard, Brisbane, California," prepared by Levine Fricke, dated July 27, 1992,

* "Bayshore Railyard, North Area Remediation Report," prepared by IT Corporation, dated October, 1994, and

* "City of Brisbane Agenda Report to the City Council," prepared by the Community Development Director, dated April 28, 2003.

The Primiani-Weaver Architects, et al. report dated July, 1982 discussed the history of filling that had taken place for both the Bayshore Railyard and the Brisbane Landfill up to the publication date of the report. The report also contained several cross sections detailing the thickness of the various fill and soil layers as well as a schematic depicting the existing water, sewer, and drainage systems surrounding both the Bayshore Railyard and the Brisbane Landfill.

The three reports prepared by the State of California Department of Transportation provided historical, geologic and past industrial land-use information regarding the Railyard site area. It was noted that the Southern Pacific Transportation Company owned and operated the Bayshore facility beginning in 1896, and that major railroad operations began in 1914. One of the reports also noted that the eastern limit of fill had reached present-day Tunnel Avenue by 1935.

The Hydrologic Consultants, Inc. report also presented information regarding the historical development and past industrial operations at the site; Figure 2-2 of the report shows a schematic depiction of San Francisco Bay margins prior to approximately 1896, the limits of artificial fill in 1896 and the approximate eastern link of artificial fill prior to 1935.

The December 1, 1991, Levine Fricke report details the regional and site geology of the Railyard area and the July 27, 1992 report discusses four chemically affected areas of the Bayshore Railyard.

The IT Corporation report contained background information on the site and information pertaining to the proposed clean-up of the northwest corner of the Railyard where the soil had been contaminated with hydrocarbons.

The City of Brisbane Agenda Report contained an overall conceptual plan of how the former Bayshore Railyard and Central Drainage Channel may appear when future developments are completed.

The information reviewed at the Brisbane Library included various black and white oblique view photographs, a "Draft Remedial Action Plan, Bayshore Railyard North Area, Brisbane, California," prepared by the California Environmental Protection Agency, Department of Toxic Substances Control, dated October, 1993 and a report titled, "Five-Year Review, Groundwater Extraction and Treatment System, Former Bayshore Railyard, Brisbane, California, prepared by Burns and McDonnell Waste Consultants, Inc., dated October, 1999. Both reports discuss the site location and history and discuss the subsurface conditions such as the bedrock, bay mud and various fills that blanket the site area.

The black and white photographs that we viewed dated back to the early 1900s and showed various stages of development of the site area. These photos will be discussed in greater detail later in the report.

Finally, we reviewed preliminary grading plans and portions of a report prepared by Burns & McDonnell dated April, 2002 regarding the physical characteristics of the Railyard site area. Topics in the report included site topography, climate, site drainage, geology, pre- and post-filling and site hydrology. Burns & McDonnell also provided us with several cross sections and various site plans prepared by Levine Fricke detailing the locations of previous test borings and piezometers (or monitoring wells) installed across the Railyard site during past studies completed within the last 20 years. Many of the cross sections depicted the thickness of man-placed fill/refuse, Younger Bay Mud and Older Bay Mud that underlie the site area.

The preliminary grading plans were prepared by Burns & McDonnell and are dated August 12, 2003. In general, the plans show two large fill areas planned both to the north and to the south of the Round House structure existing at the westernmost portion of the site. The northern fill area is shown to be a "crowned" area of fill with a high point of elevation 18 traversing in a north and south direction across the proposed fill. Storm runoff water will then be directed to both the west and east where it will be collected within a system of stormdrain ditches.

The southern fill area will create a pad that will drain surface water towards the east and towards a new ditch at the southeast edge of the proposed fill. Approximately 5 to nearly 10 feet of fill will be placed within the southern fill area and where the fill will meet the surrounding grades, fill slopes inclined at 3 horizontal to 1 vertical are planned. As for the above noted northern fill area, approximately 2 to 11 feet of fill is planned within this area and fill slope inclinations no steeper than 3 horizontal to 1 vertical are planned where the proposed fill is to meet the surrounding grades.

FIELD EXPLORATION AND LABORATORY TESTS

In order to evaluate the general geotechnical engineering characteristics of the surface and subsurface soil layers across the Bayshore Railyard site, eleven exploratory borings were excavated at the approximate locations shown on Figure 3. The borings were drilled with a truck-mounted CME 75 drill rig to depths ranging between 20 and 68 feet below the existing grades. Relatively undisturbed and bulk samples of soil were recovered from the borings at selected intervals (samples were generally taken every 5 feet). The samples were collected within brass tubes placed inside the steel-walled samplers that were driven 18 inches into the ground by a 140-pound automatic hammer. The number of blows needed to drive the various samplers the final 12 inches was observed and recorded as the in-situ "blow count".

The samples were visually classified at the time of drilling, trimmed, and then sealed with plastic caps to preserve the natural moisture content. The samples were later transported to our laboratory where a variety of engineering tests were conducted. The tests included the evaluations of moisture content, dry density and unconfined compressive strength. The results of these tests, along with the penetration resistance of the samplers in blows per foot, are listed opposite the corresponding sample location on the Boring Logs, Figures 6 through 17. The final logs reflect the field logs with occasional modifications made after additional laboratory examinations and the results of engineering tests.

In addition to the above-listed tests, we performed six plasticity index tests to aid in the classification of the site soils and to supplement our analysis. The results of these tests are shown on Figure 18. We also completed six consolidation tests upon representative samples of Bay Mud that were utilized in evaluating the settlement and time-rate settlement potential of various site areas. The results of these tests are shown on Figures 19 through 24.

GEOLOGIC SETTING

The site has been mapped (Bonilla, 1971; Brabb and Pampeyan, 1983) to be underlain by artificial fill (Qaf). The fill material is described as loose to very well consolidated gravel, sand, silt, clay, rock fragments, organic matter, and man-made debris in various combinations.

Nichols and Wright, 1971, in their publication, "Preliminary Map of Historic Margins of Marshland, San Francisco Bay, California," also indicate that the western portion of the site is located within a former marshland area. It is noted in their accompanying report that former marshland areas are immediately underlain by "young bay mud". They generally describe this material as mostly soft clay and silt (mud) with minor amounts of sand and gravel. They further note that this material generally possesses a high water content, low bearing strength, and high compressibility (among other properties). These properties, along with varying thickness, often result in local differential and regional settlement.

Others (Helly and Lajoie, 1979) have also described the Bay Mud as unconsolidated, water-saturated, dark plastic carbonaceous clay and silty clay.

The San Andreas Fault is located approximately 5 miles (8.0 kilometers) to the southwest of the site. This fault system is active and the source of numerous earthquakes throughout California. The Hayward Fault is located approximately 13 1/2 miles (21.7 kilometers) to the northeast of the site, and the Calaveras Fault several miles (kilometers) further to the northeast. The site will likely experience high intensity ground shaking in the future during a moderate to large nearby earthquake on the San Andreas fault system. Transient peak and repeatable horizontal ground accelerations of 0.5g and 0.35g, respectively, can be anticipated in a maximum credible nearby earthquake on the San Andreas Fault (Joyner and Boore, 1988). Furthermore, Nichols and Wright, 1971, noted that earthquake vibrations in thick soft Bay Mud are believed to be larger in amplitude and tend to have longer periods of vibration than those in firm soil or rock.

Liquefaction is defined as the transformation of a loose, water-saturated granular material (such as sand) from a solid state to a liquefied state as a consequence of increased pore-water pressure (Youd and others, 1973). The major cause of liquefaction is strong ground shaking during an earthquake. The geologic materials most likely to liquefy during an earthquake are loose, water-saturated, well-sorted (i.e., little or no clay-size material present) silt, sand, and clean gravel. As will be discussed in the "Soil Conditions" section, such materials were not generally encountered during our study.

AIR PHOTO INTERPRETATION

Several oblique, ground level, black and white photos along with eighteen sets of black and white, vertical, stereo-paired aerial photographs, taken between 1935 and 2000, were examined for this study to supplement our on-site engineering geologic observations. The specific stereo-paired photos that were viewed are listed in the "References" section at the end of this report, along with the corresponding photo dates and scales.

The oblique photos, taken in the early 1900's, provided some indication as to how the shoreline appeared prior to significant land filling of the Railyard area, and the vertical aerial photos illustrate the evolution of the surrounding area and eventually the abandonment of the Railyard.

Oblique Ground Level Photos

We viewed several historical, oblique, ground level photographs that were on file at the Brisbane Public Library. The photos showed the pre-landfill development of the Railyard site. Library records indicate that most of the photographs were taken in the early 1900's, some dating as far back as 1905. In a photo dated November 21, 1905, it appears that a strip of rocky fill for the Southern Pacific mainline track causeway was placed within the Bay waters from the mouth of Visitacion Valley southward through Visitacion Bay towards Visitacion Point. Based on another photo dated in the early 1900's, the aforementioned strip of fill appears to have originated from the south at Visitacion Point progressing in a northerly direction towards the mouth of Visitacion Valley. Material excavated for a north-south trending slot-cut through Visitacion Point was used as fill to create the raised causeway for the tracks across Visitacion Bay. A lagoon was created west of the causeway; it is unclear whether or not any man-placed fill is present along the western shore of the lagoon at the time the photos were taken.

The prominent slot-cut that was excavated through the ridge at Visitacion Point was created to allow for the passage of the Southern Pacific railroad tracks. We viewed an undated photo showing the in-progress excavation of the slot-cut; it appears that the strip of fill for the tracks continued on the south side of Visitacion Point east of Guadalupe Valley. It appears that material excavated from the south side of the slot cut was used to create the causeway for the tracks south of Visitacion Point. There is evidence that a second lagoon was created west of the fill for the causeway south of Visitacion Point.

Vertical Air Photos

1935

The 1935 images show that the lagoon created in the tidal flats west of the main line of tracks through Visitacion Bay has been completely filled in with man-placed fill. Historical records indicate that fill for the 180-acre Railyard site consisted of general soil, refuse, and debris that had accumulated during the clean-up after the 1906 San Francisco earthquake and fire. All of the buildings for the Southern Pacific Railyard have been constructed upon this aforementioned fill and are operable. Only half of the ground surface area between the "Round House" and the main line tracks is covered with switch-line tracks.

The Railyard is bounded on the west by Bayshore Boulevard which is visible in the photos. It appears that the only paved portion of Bayshore Boulevard is the northern part in San Francisco County.

The 1935 photos show the beginning of the "Brisbane Landfill" being placed east of the mainline tracks extending south from the mouth of Visitacion Valley.

A plume of sediment is visible extending into San Francisco Bay adjacent to the northern terminus of the slot-cut excavated through Visitacion Point. The plume of sediment appears to emerge from the opening of a culvert that passes under the mainline tracks and empties into the Bay.

1938

The Brisbane Landfill continues to grow from north to south adjacent to and east of the Southern Pacific mainline tracks. The aforementioned plume of sediment within the Bay north of Visitacion Point is visible in the photos.

1946

The Brisbane Landfill is shown extending approximately 4000 feet to the south of the mouth of Visitacion Valley and approximately 1200 feet east of the mainline tracks. Many trains are visible occupying the tracks in the Railyard. Additional switch-line tracks have been added to the Railyard east of the Round House.

The plume of sediment visible in the previous two sets of photos appears to extend into the Bay approximately 3700 feet towards the south-southeast.

1955-1958

Highway 101 is constructed and in use in the 1958 photos. The Brisbane Landfill has progressed further towards the south along the mainline tracks and east to the Highway 101 causeway. Most of the remaining portion of Visitacion Point east of the mainline tracks has been excavated, and the area appears to be an abandoned quarry. The Southern Pacific Railyard continues to be active.

1961-1969

The Brisbane Landfill continues to progress towards the south between the mainline tracks and the Highway 101 causeway; in the 1969 photos the Brisbane Landfill has reached its present day lateral extent. A "tank farm" has been constructed atop the easternmost area once occupied by Visitacion Point, immediately east of the mainline tracks.

The northern and southern portions of Tunnel Avenue have been constructed atop the Brisbane Landfill. An overpass was constructed along the southern portion of Tunnel Avenue allowing for passage of the road over the mainline tracks. An open channel, referred to as the "Central Drainage Channel," is visible extending across the Brisbane Landfill trending in a northeast-southwest direction; the channel enters a culvert approximately 550 feet to the east of the mainline tracks just north of the tank farm. The southern terminus of the northern portion of Tunnel Avenue appears to be at the intersection with this aforementioned open channel. The Southern Pacific Railyard continues to be active.

1972-1981

Tunnel Avenue has been completed as of the 1977 photos; a culvert consisting of twin pipes and soil fill is visible passing under Tunnel Avenue where the Central Drainage Channel intersects the road. West of Tunnel Avenue, the channel enters a box culvert that passes under the mainline railroad tracks. Additional tanks have been added to the tank farm. The Railyard continues to be active.

1985-2000

The Southern Pacific Railyard remains active through the 1987 photos. The Railyard appears to be abandoned in the 1991 photos. Most of the switch-line tracks and the buildings associated with the railyard have been removed. The 2000 photos show that the Round House and an adjacent building remain standing, however, they appear to have been gutted by fire. Additional buildings have been constructed adjacent to the tank farm.

SOIL CONDITIONS

In order to evaluate the general soil conditions within the former Bayshore Railyard, a total of eleven exploratory borings were excavated at the approximate locations shown on the Site Plan, Figure 3. In general, the borings encountered several feet (6 to 22 feet) of man-placed fill material underlain by native Bay Mud. In general, the fill consisted of a loose to medium dense clayey and silty sands with abundant rock fragments and some debris (such as glass, plastic, etc.). The fill was underlain by soft, generally dark to very dark grey silty clay (Bay Mud). Sand lenses and abundant shell fragments were encountered within the Bay Mud. Most of the borings were advanced until either stiff Older Bay Mud or dense sand was encountered. In the case of Boring RRG-12, the boring was terminated in dense bedrock.

Based upon the exploratory borings and field measurements, our interpretation of the soil layering across portions of the project area are depicted on the cross-sections shown on Figure 4.

Groundwater was encountered at the time of drilling our exploratory borings at depths ranging from 2 1/2 to 9 feet below the ground surface. We measured the groundwater levels both during and after the completion of the drilling. Our measurements are recorded on the Boring Logs, Figures 6 through 17. Groundwater levels, however, tend to fluctuate seasonally and could rise to higher depths in the future.

For a more complete description of the soil layers encountered in the borings, refer to the logs shown on Figures 6 through 17.

SETTLEMENT ANALYSIS

In order to evaluate the potential settlement that may take place at the site, we completed settlement analysis utilizing computer-aided methods developed by Duncan, Smith, Brandon and Wong.

The method generally involved using the information (soil strata and laboratory testing) depicted on the boring logs to develop pressure diagrams of the existing conditions. This information, along with the results of the consolidation tests and the planned future grades as depicted on the preliminary grading plans were then used as input data for the computer-aided analysis and settlement predictions.

During the analysis, we assumed that all of the consolidation of the Bay Mud caused by the placement of the original Railyard fill (some 100 years ago) has taken place, though it is possible that some relatively minor on-going settlement continues to occur as a result of the original fill loads. Of most significance, however, will be the new settlement that will occur as a result of the planned new fill. Thus, analysis was generally completed where thick new fills were planned or where thick deposits of Bay Mud exist. Settlement analysis was completed at borings RRG-1, RRG-6, RRG-7, RRG-10 and RRG-11. We have included the results of our analysis on the attached Figures 25 through 29 which are settlement charts that estimate the amount of total settlement (and time-rate settlement predications) that can be expected at various points throughout the site verses thicknesses of future fills and underlying Bay Mud. Compression indexes, C_C, of 1.29, 0.84, 1.05, 1.16 and (1.03 and 0.57), respectively, were used for the settlement analysis of borings RRG-1, RRG-6, RRG-7, RRG-10 and RRG-11.

The results of our analysis varied depending on the various factors at each boring location such as existing fill and Bay Mud thicknesses and the amount of proposed new fill planned at each boring location. Figure 25 depicts the results of settlement analysis at Boring RRG-1. At this location, only about 2.6 feet of new fill is planned which will result in about 5 inches of settlement induced by the weight of the new fill. Nearly all of the settlement will occur within the initial 7 or 8 years after the fill is placed.

The results of our analysis at borings RRG-6 and RRG-7 are similar in that the settlement at these two locations will occur relatively quickly due to the relatively thin layer of Bay Mud at each of these locations. The main difference is that the total settlement expected at RRG-6 is less than that expected at RRG-7 since nearly twice as much new fill is planned at Boring RRG-7. Conversely, greater total settlements that will occur over longer periods of time are expected in the vicinity of borings RRG-10 and RRG-11. This is primarily due to the thicker nature of the Bay Mud deposits in this area.

It should be noted, that when future grading and structures are planned along portions of the property that site specific studies and recommendations will be necessary in order to “fine tune” the settlement predications.

CONCLUSIONS

Based upon our study, it is our opinion that the grading can proceed as planned provided the recommendations contained in the following section are followed during construction. Differential settlement due to the consolidation of the underlying soft Bay Mud induced by the placement of new engineered fill on the site will occur. As the thickness of compressible Bay Mud varies across the site as well as the thickness of planned new fill, so too will the amount of new anticipated settlement.

As discussed in the preceding section and as depicted on the Bay Mud Thickness Map (Figure 5), significantly thicker deposits of Bay Mud exists across the southern half of the subject site. Thus, as the proposed grading involves a northern fill area and a southern fill area, it is noted that the southern fill area will experience greater settlement due to the thicker deposits of Bay Mud. The thicker deposits of Bay Mud will also compress more slowly than thinner deposits of Bay Mud as the drainage path for water to escape the Bay Mud is much longer.

In order to shorten the amount of time it will take to consolidate the Bay Mud within the southern fill area and possibly the southern tip of the northern fill area, consideration to placing items such as "wick" drains or surcharge loading could be utilized. Similarly, once the grading portion of the project commences, it may be beneficial to begin the filling process at the southern fill area and work in a northerly direction.

The following section includes our recommendations pertaining to site grading.

RECOMMENDATIONS

The following recommendations are contingent upon our firm being retained to review the development plans and to observe the geotechnical aspects of construction, such as the placement and compaction of fill.

A. Site Preparation and Grading

All grading should be performed in accordance with attached Guide Specifications for Engineered Fill and under the direct observation of our field representative. Our representative should observe the grading operations to verify the placement and compaction of any new fill. Field density tests should be taken as the fill is being placed to verify the minimum relative degree of compaction is being achieved.

In areas where excavations are created to remove any existing structures or foundations, it will be necessary to carefully backfill the excavations with engineered fill. Underground features (utility lines, etc.) should be located and removed if not to be reused.

Prior to placing any fill, the site should be stripped to remove any organic material including brush, trees, and their root systems. The existing debris piles that are currently scattered across the site should also be removed as they contain wood scraps, pieces of metal debris and other unsuitable fill material. After the site has been stripped, the ground surface should be scarified to a minimum of 6 inches, brought to a moisture content that will allow proper compaction, and then compacted to a minimum degree of 95 percent based upon ASTM D 1557, latest revision.

Following the subgrade preparation, fill may then be imported to the site. The fill should be approved by our office and consist of soil that meets the requirements set forth in the attached specifications for engineered fill. Any fill that is composed of cohesive type material should be placed in thin lifts, moisture conditioned 1 to 3 percent above optimum, and compacted to a minimum degree of 90 percent based upon ASTM D 1557, latest revision. Any fill that consists of granular material should be placed in thin lifts, moisture conditioned and compacted to a minimum degree of 95 percent as designated by ASTM D 1557.

As discussed in "Conclusions" section, wick drains or surcharge loading will aid in the time it takes for the thicker deposits of Bay Mud to consolidate and could be considered for this project.

Final fill slope inclinations should not exceed 3 horizontal to 1 vertical in any area where fill is placed above Bay Mud. It is also important that any temporary slopes be no steeper than 3 horizontal to 1 vertical.

B. Review of Plans and Construction Observations

It is recommended that all of the plans related to our recommendations be submitted to our office for review. The purpose of our review will be to verify that our recommendations are understood and reflected on the plans, and to allow us to provide supplemental recommendations, if necessary.

It is important that our firm be retained to provide observation and testing services during construction. Our observations and tests will allow us to verify that the materials encountered are consistent with those found during our study, and will allow us to provide supplemental, on-site recommendations, as necessary.

LIMITATIONS

The conclusions and opinions expressed in this report are based upon the exploratory borings that were drilled on the site, spaced as shown on the Site Plan, Figure 3. While, in our opinion, these borings adequately disclose the general soil conditions across the site, the possibility exists that abnormalities or changes in the soil conditions, which were not discovered by this investigation, could occur between borings.

This study was not intended to disclose the locations of any existing utilities, septic tanks, leaching fields, hazardous wastes, or other buried structures. The contractor or other people should locate these items, if necessary.

The passage of time may result in significant changes in technology, economic conditions, or site variations that could render this report inaccurate. Accordingly, Burns & McDonnell, nor any other party, shall rely on the information or conclusions contained in this report after 12 months from its date of issuance without the express written consent of Michelucci & Associates, Inc. Reliance on this report after such period of time shall be at the user's sole risk. Should Michelucci & Associates, Inc. be required to review the report after 12 months from its date of issuance, Michelucci & Associates, Inc. shall be entitled to additional compensation at then-existing rates or such other terms as may be agreed upon between Michelucci & Associates, Inc. and Burns & McDonnell, or the new client.

This report was prepared to provide engineering opinions and recommendations only. It should not be construed to be any type of guarantee or insurance.

REFERENCES

Aerial Photographs

Pacific Aerial Surveys (PAS) black and white stereo pairs

Film I.D.	Scale	Date
PAS-AV-248-08-01-86/87/88	1:16,500	1935
PAS-AV-08-04-11/12	1:20,000	3-21-38
PAS-AV-09-10-5/6	1:23,600	7-29-46
PAS-AV-170-07-13/14/15	1:10,000	5-5-55
PAS-AV-279-09-17/18/19/20	1:7200	4-23-58
PAS-AV-432-06-11/12	1:12,000	6-20-61
PAS-AV-710-06-25/26/27	1:36,000	4-14-66
PAS-AV-933-07-11/12	1:12,000	10-30-69
PAS-AV-1045-07-14/15	1:12,000	5-10-72
PAS-AV-1188-06-12/13/14/15	1:12,000	5-12-75
PAS-AV-1356-06-10/11/12	1:12,000	6-2-77
PAS-AV-1075-06-14/15/16	1:12,000	5-30-79
PAS-AV-2020-06-14/15	1:12,000	6-19-81
PAS-AV-2670-06-13/14/15	1:12,000	10-14-85
PAS-AV-3048-07-1/2	1:9,600	3-24-87

PAS-AV-4075-07-12/13/14	1:12,000	7-1-91
PAS-AV-4916-07-10/11/12/13	1:12,000	9-7-95
PAS-AV-6600-07-13/14	1:12,000	8-15-00

GUIDE SPECIFICATIONS
FOR ENGINEERED FILL

A. GENERAL

1. Definition of Terms

FILL...is all soil or soil/rock materials placed to raise the grade of the site or to backfill excavations.

ON-SITE MATERIAL...is that which is obtained from the required excavations on the site.

IMPORT MATERIAL...is that hauled in from off-site areas.

SELECT MATERIAL...is a soil material meeting the requirements set forth in "C(2)" below.

ENGINEERED FILL...is a fill upon which the Geotechnical Engineer has made sufficient tests and observations to enable him to issue a written statement that in his opinion the fill has been placed and compacted in accordance with the specification requirements.

AASHTO SPECIFICATIONS...are the Standard Specifications of the American Association of State Highway Officials, latest revision.

ASTM SPECIFICATIONS...are the Annual Book of ASTM Standards (Part 19), American Society for Testing and Materials, latest revision.

MAXIMUM LABORATORY DENSITY...is the maximum density for a given fill material that can be produced in the laboratory by the Standard procedure ASTM D1557, "Moisture-Density Relations of Soils Using a 10-Pound (4.5 kg) Hammer and an 18-Inch (457 mm) Drop" (AASHTO Test T-180, "Moisture-Density Relations of Soils Using a 10-Pound Hammer and an 18-Inch Drop").

OPTIMUM MOISTURE CONTENT...is the moisture content at which the maximum laboratory density is achieved using the standard compaction procedure ASTM Test Designation D1557 (AASHTO Test T-180).

DEGREE OF COMPACTION... is the ratio, expressed as a percentage, of the dry density of the fill material as compacted in the field to the maximum dry density for the same material.

2. Responsibility of the Geotechnical Engineer

The Geotechnical Engineer shall be the Owner's representative to observe the grading operations, both during preparation of the site and compaction of any engineered fill. He shall make enough visits to the site to familiarize himself generally with the progress and quality of the work. He shall make a sufficient number of field observations and tests to enable him to form an opinion regarding the adequacy of the site preparation, the acceptability of the fill material, and the extent to which the degree of compaction meets the specification requirements. Any fill where the site preparation, type of material, or compaction is not approved by the Geotechnical Engineer shall be removed and/or recompacted until the requirements are satisfied.

3. Soil Conditions

A soil investigation has been performed for the site by Michelucci & Associates, and a report has been prepared. The Contractor shall familiarize himself with the soil conditions on the site, whether covered in the report or not, and shall thoroughly understand all recommendations associated with the grading.

B. SITE PREPARATION

1. Stripping

Prior to any cutting or filling, the site shall be stripped to a sufficient depth to remove all grass, weeds, roots, and other vegetation. The minimum stripping depth shall be 3 inches. The site shall be stripped to such greater depth as the Geotechnical Engineer in the field may consider necessary to remove materials that in his opinion are unsatisfactory. The stripped material shall either be removed from the site or stockpiled for reuse later as topsoil, but none of this stripped material may be used for engineered fill.

2. Preparation for Filling

After stripping, the weak soils in areas to be filled shall be overexcavated to the minimum depth called for on the plans or that is required by the Soil Engineer in the field. The overexcavated soils that are clean and free from organic material can be used later as general engineered fill.

After stripping the surface vegetation and overexcavating the weak soils to the required depths, the exposed surface shall be scarified to a minimum depth of 6 inches, watered or aerated as necessary to bring the soil to a moisture content that will permit proper compaction, and recompacted to the requirement of engineered fill as specified in "D" below. Prior to placing fill, the Contractor shall obtain the Geotechnical Engineer's approval of the site preparation in the area to be filled. The requirements of this section may be omitted only when approved in writing by the Geotechnical Engineer.

C. MATERIAL USED FOR FILL

1. Requirements for General Engineered Fill

All fill material must be approved by the Geotechnical Engineer. The material shall be a soil or soil/rock mixture that is free from organic matter or other deleterious substances. The fill material shall not contain rocks or lumps over 6 inches in greatest dimension, and not more that 15% by dry weight. Gravels or rock materials in the soil shall not be larger than 2 1/2 inches in greatest dimension. A portion of or all soils from the site, except the surface strippings, may be suitable for use as fill if they meet engineered fill requirements.

2. Requirements for Select Fill Material

In addition to the requirements of "C(1)" above, select material, when called for on the plans and for use under floor slabs, must conform to the following minimum requirements:

Maximum Plasticity Index	10

In addition to the requirements of "C(1)" above, the select material shall be non-plastic and shall have an "R" value of at least 25. Select material shall be approved by the Geotechnical Engineer.

D. PLACING AND COMPACTING FILL MATERIAL

All fill material shall be compacted as specified below or by other methods, if approved by the Geotechnical Engineer, so as to produce a minimum degree of compaction of 95% for granular material and 90% for cohesive material (ASTM D1557). Fill material shall be spread in uniform lifts not exceeding 6 inches in thickness. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction by either aerating the material if it is too wet or spraying the material with water if it is too dry. Each lift shall be thoroughly mixed before compaction to ensure a uniform distribution of water content. Where native soils are used within 3 feet of the finished ground surface, they shall be placed and compacted at a moisture content that is 1% to 3% above optimum.

E. EXCAVATION

All excavations shall be carefully made true to the grades and elevations shown on the plans. The excavated surfaces shall be properly graded to provide good drainage during construction and to prevent ponding of water.

F. TREATMENT AFTER COMPLETION OF GRADING

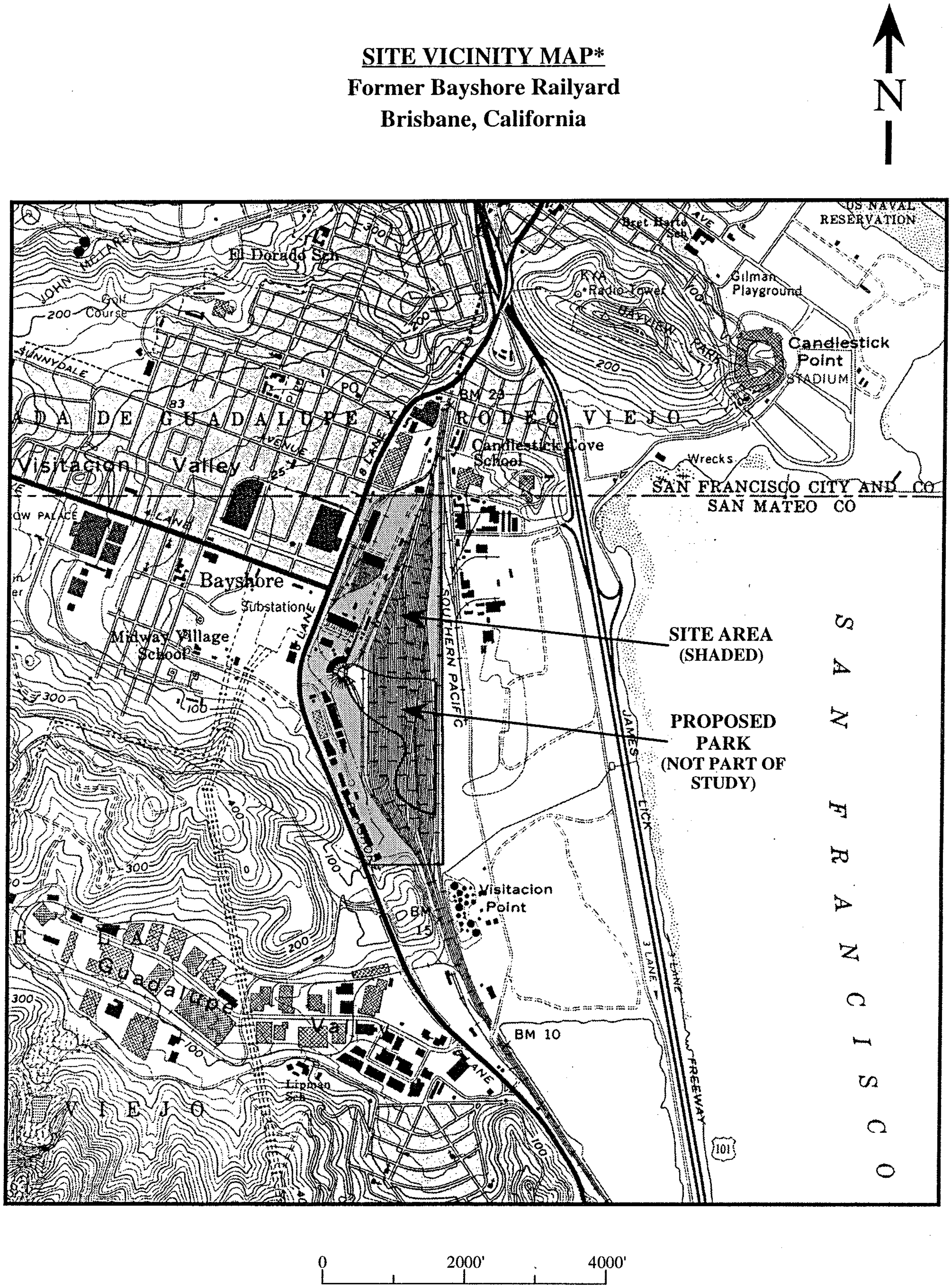
After grading is completed and the Geotechnical Engineer has finished his observation of the work, no further excavation or filling shall be done except with the approval of and under the observation of the Geotechnical Engineer.

It shall be the responsibility of the Grading Contractor to prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

<u>**SITE VICINITY MAP***</u>

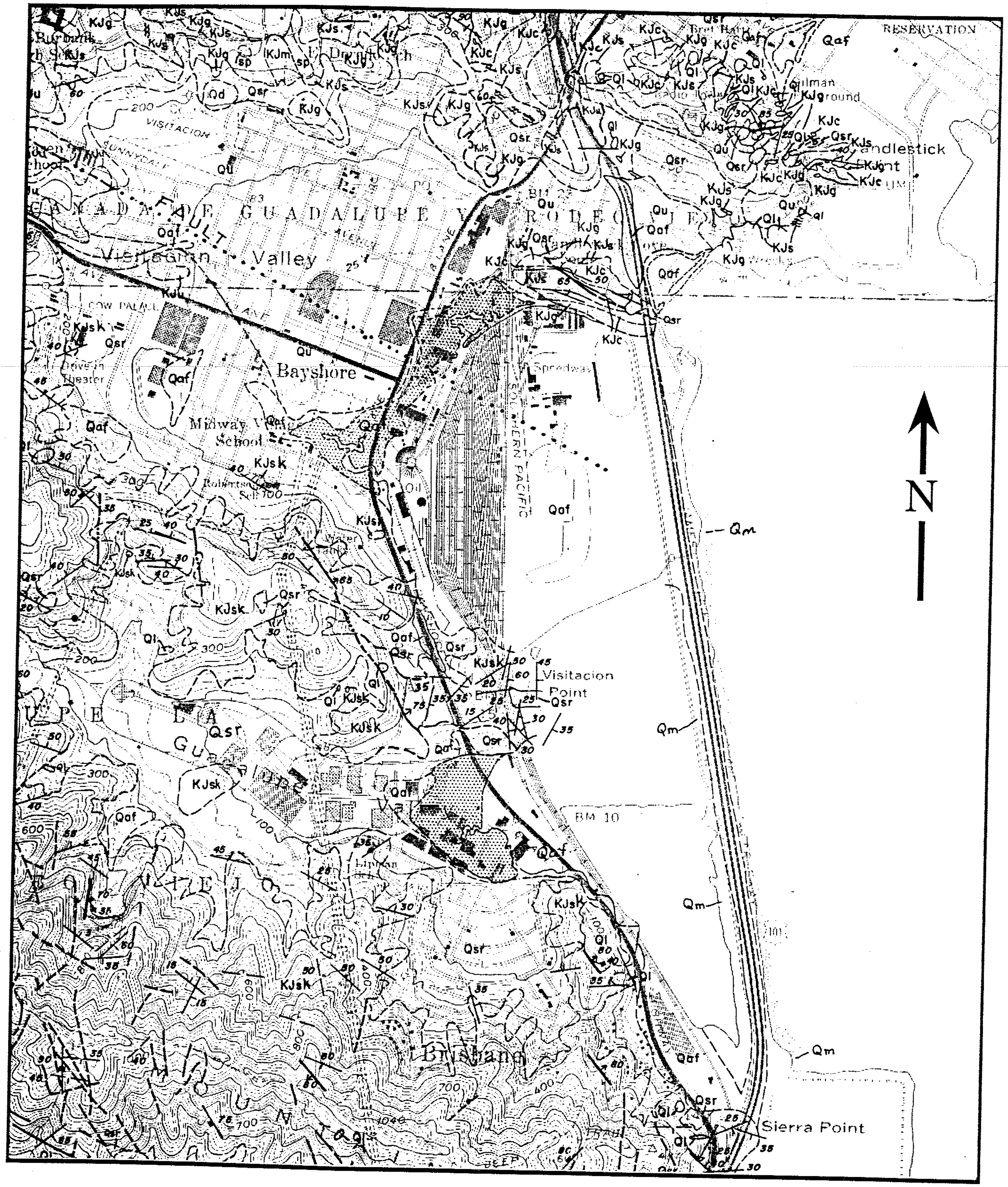
Former Bayshore Railyard

Brisbane, California



*BASE MAP FROM U.S.G.S. SAN FRANCISCO SOUTH 7.5' TOPOGRAPHIC QUADRANGLE (1956, PHOTOREVISED 1980).

Job No. 03-3324	Michelucci & Associates, Inc.	Figure 1



UNITS:

Qafs-Qaf Artificial fill

Qm Bay mud

Qt Marine terrace deposits

sp Serpentine

KJc Chert

Ql Landslide deposits

Qd Dune sand

Qc Colma Formation

KJu Sheared rocks

KJg Greenstone

Qal Alluvium

Qsr Slope debris and ravine fill

QTm Merced Formation

KJs KJsk Sandstone and shale

KJm Metamorphic rocks

Qb Beach deposits

Qu Sedimentary deposits, undifferentiated

SYMBOLS:

Contact
Dashed where approximately located

70 35
Fault
Showing dip, and bearing and plunge of grooves, striations, or slickensides. Dashed where approximately located; short dashed where inferred; dotted where concealed. Most faults on San Bruno Mountain inferred from study of air photos

50
Strike and dip of beds
Includes original structures in tuffaceous greenstone

Approximate strike and direction of dip of foreset beds

Indefinite contact
Includes inferred contacts and gradational contacts; dotted where concealed

90
Vertical fault

90
Strike of vertical beds

60
Strike and dip of foliation

40
Thrust fault, showing dip
T indicates upper plate

Horizontal beds

80
Strike and dip of joints

Approximate boundary of former shoreline and tidal flat, and location of stream channel now filled or concealed
After U.S. Coast Survey map number 3055, 1869, and unpublished U.S. Coast Survey maps T.352, 1852, and T 460, 1854. Because old maps could not be matched exactly with the modern maps, lines may be off as much as one eighth of an inch

Fault showing relative horizontal movement
Dashed where approximately located; dotted where concealed. Trace of 1906 surface-rupture of San Andreas fault is shown; limits of San Andreas fault zone are not shown, but zone of most intense brecciation, shearing, and gouge formation is indicated by shear zone symbol

Approximate strike and direction of dip of beds

Quarry

25
Strike and dip of foreset beds

Top of landslide scarp

Approximate area of old tidal flats
After U.S. Coast Survey maps listed above

Hypothetical fault

Shear zone
Showing generalized dip of shear planes

****Based map from the Preliminary Geologic Map of the San Francisco South Quadrangle and Part of the Hunters Point Quadrangle, California (Bonilla, 1971)***

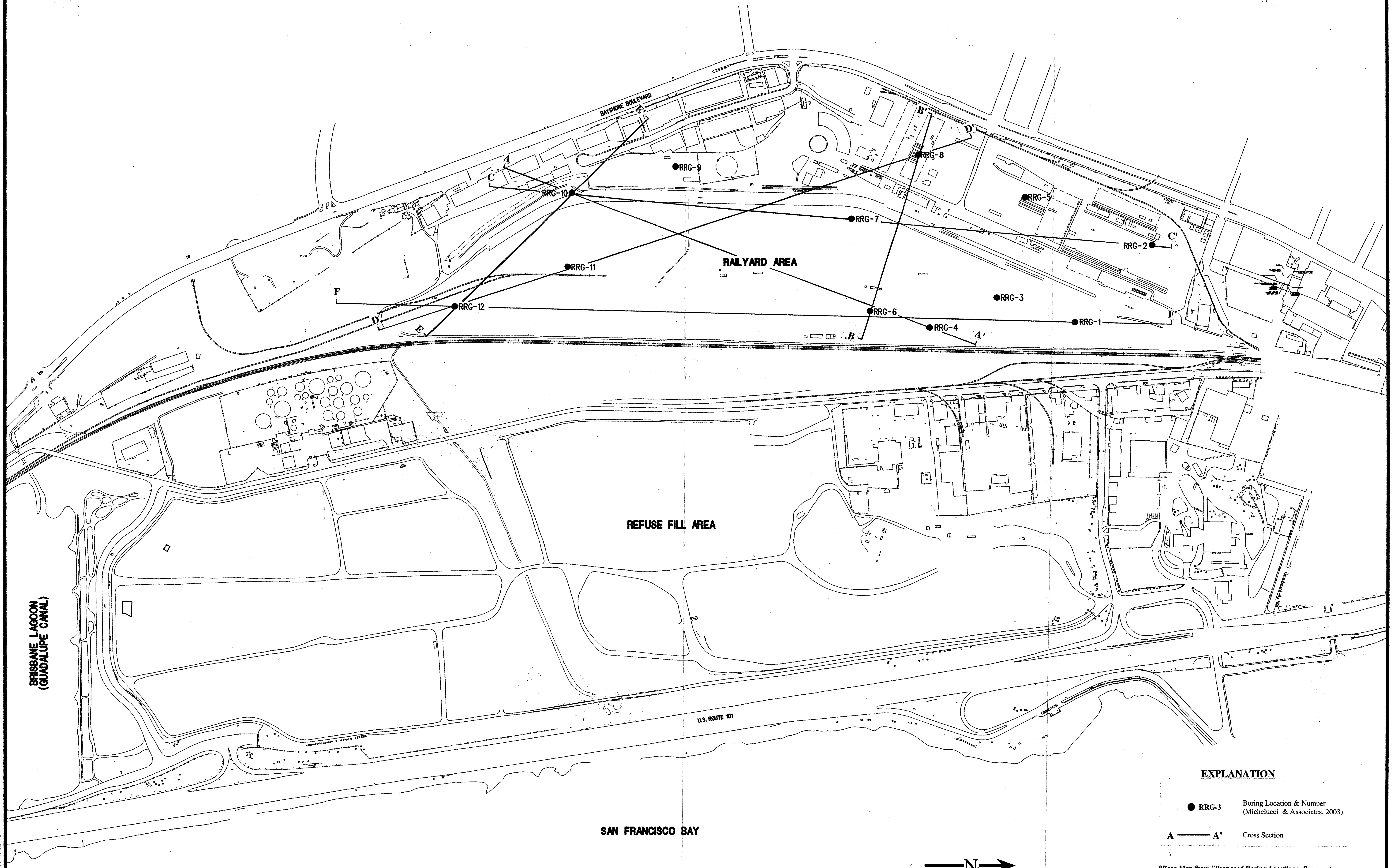
REGIONAL GEOLOGIC MAP*

Former Bayshore Railyard
Brisbane, California

Scale: 1"= 2000'±	Approved: D.K.	Drawn By: D.K.
Date: 5-15-03		Revised:

Michelucci & Associates, Inc.

Job No. 03-3324		Figure 2



EXPLANATION

● RRG-3 Boring Location & Number (Michelucci & Associates, 2003)

A ——— A' Cross Section

**Base Map from "Proposed Boring Locations, Sunquest Properties, Inc." dated 3-21-03 provided by Burns & McDonnell.*

SITE PLAN*

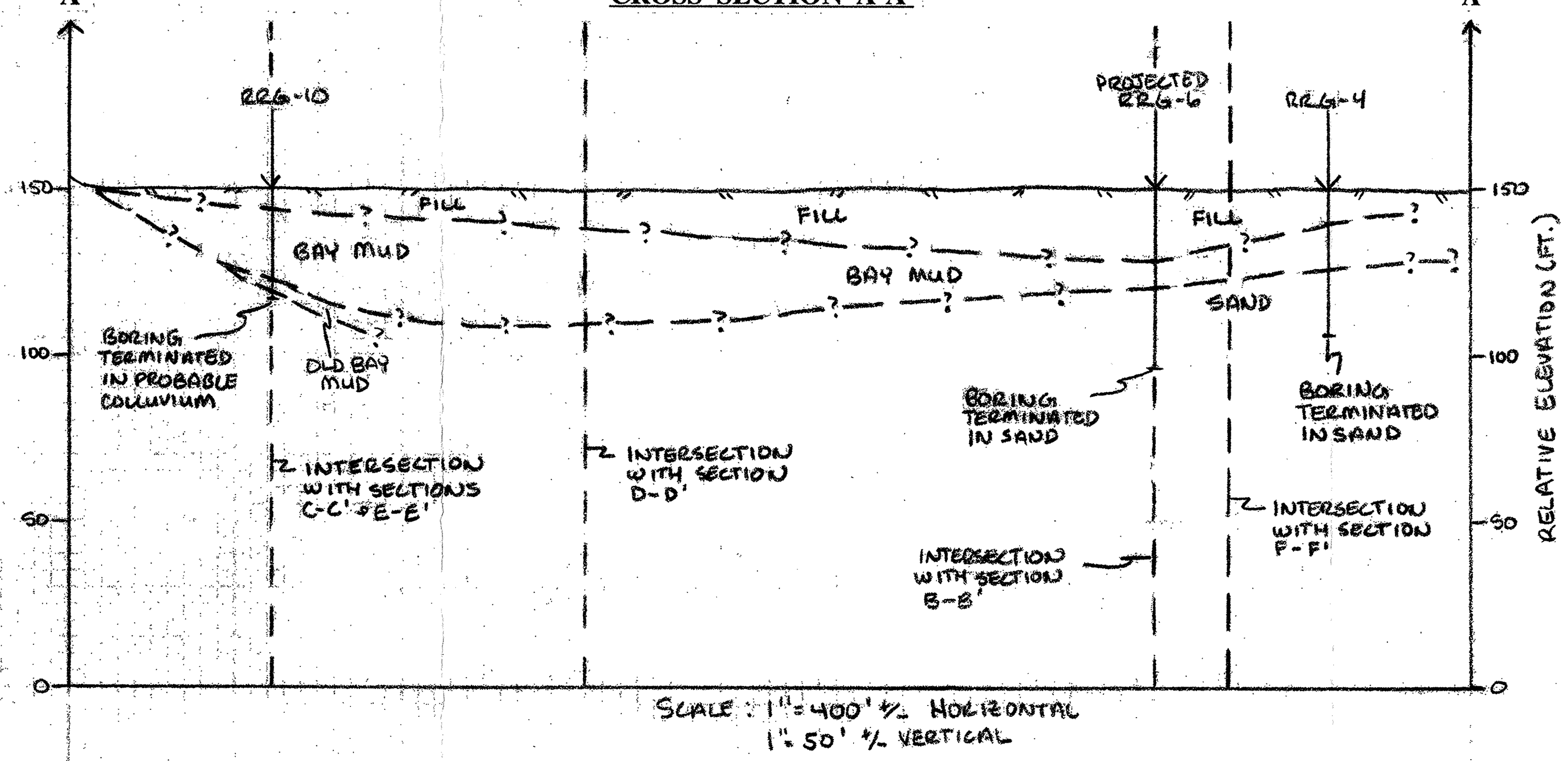
Former Bayshore Railyard
Brisbane, California

Scale: 1"=400'±	Approved: D.K.	Drawn By: D.K.
Date: 11-17-03		Revised:
Michelucci & Associates, Inc.		
Job No. 03-3324		Figure 3

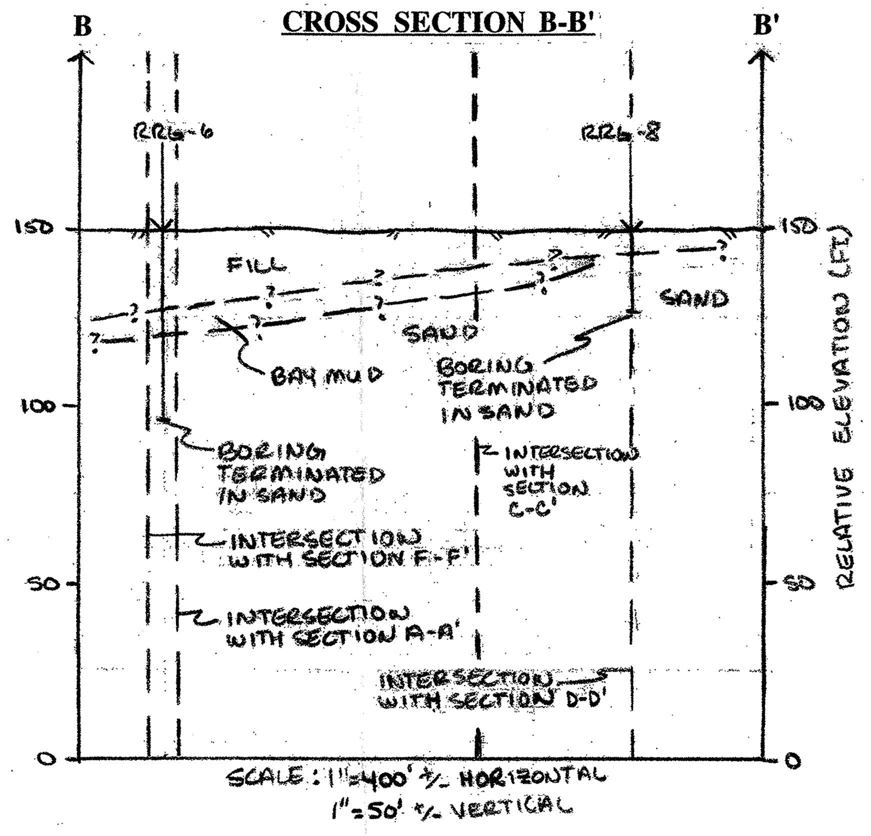
K:\SUNQUEST\USTN\GRADING_PLAN

BORINGS032003-1.DGN/ 3-21-2003 15:52/FB

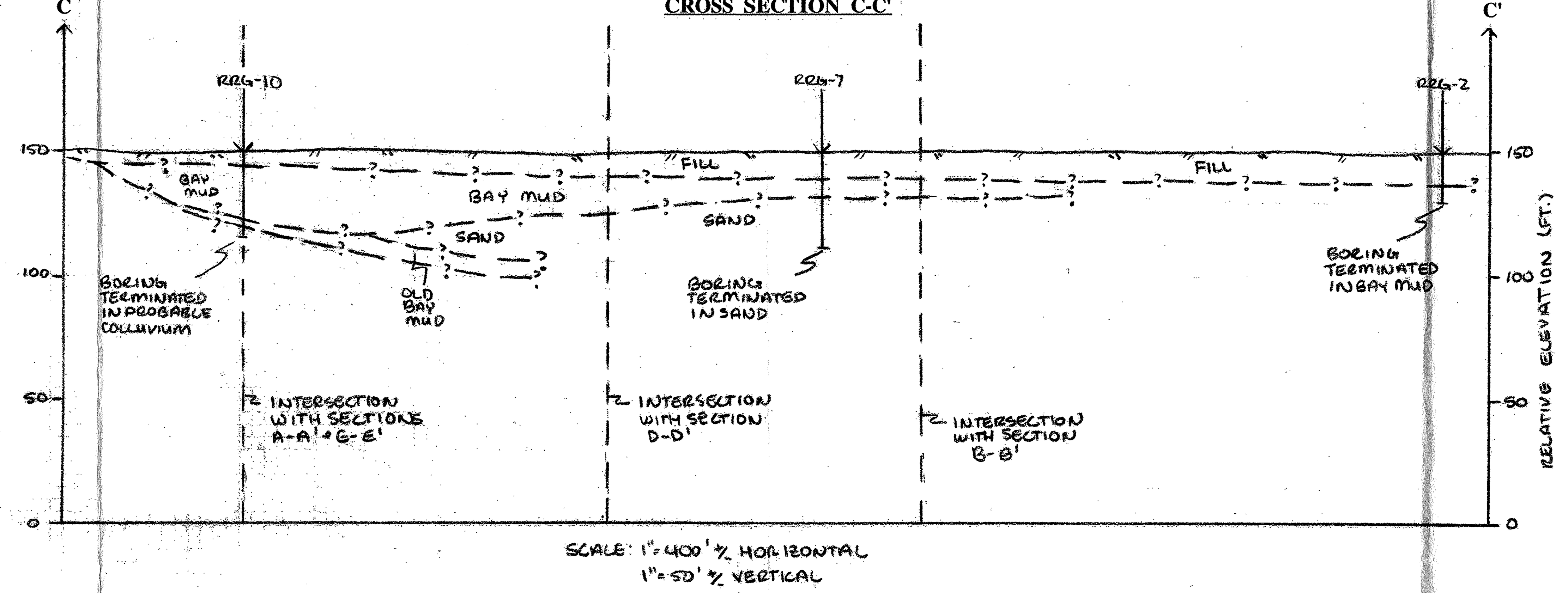
CROSS SECTION A-A'



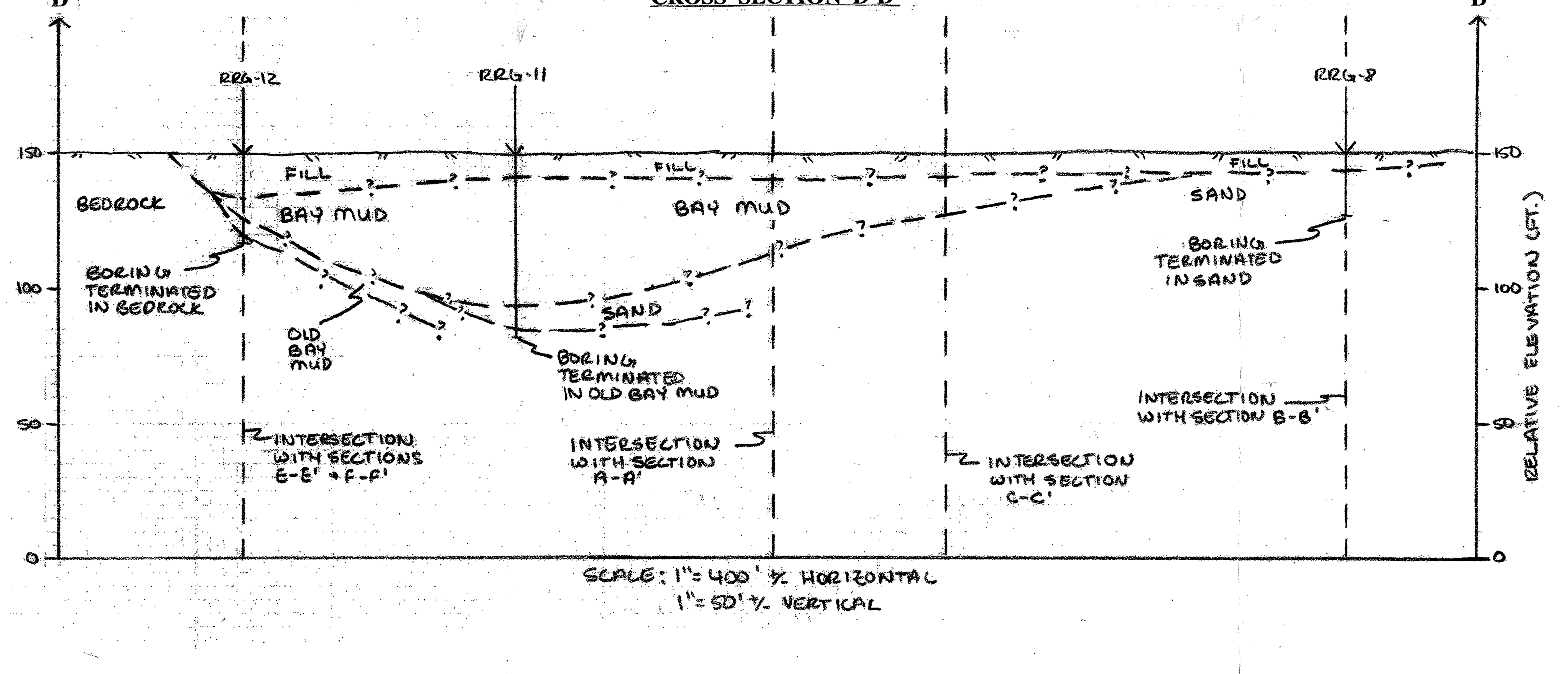
CROSS SECTION B-B'



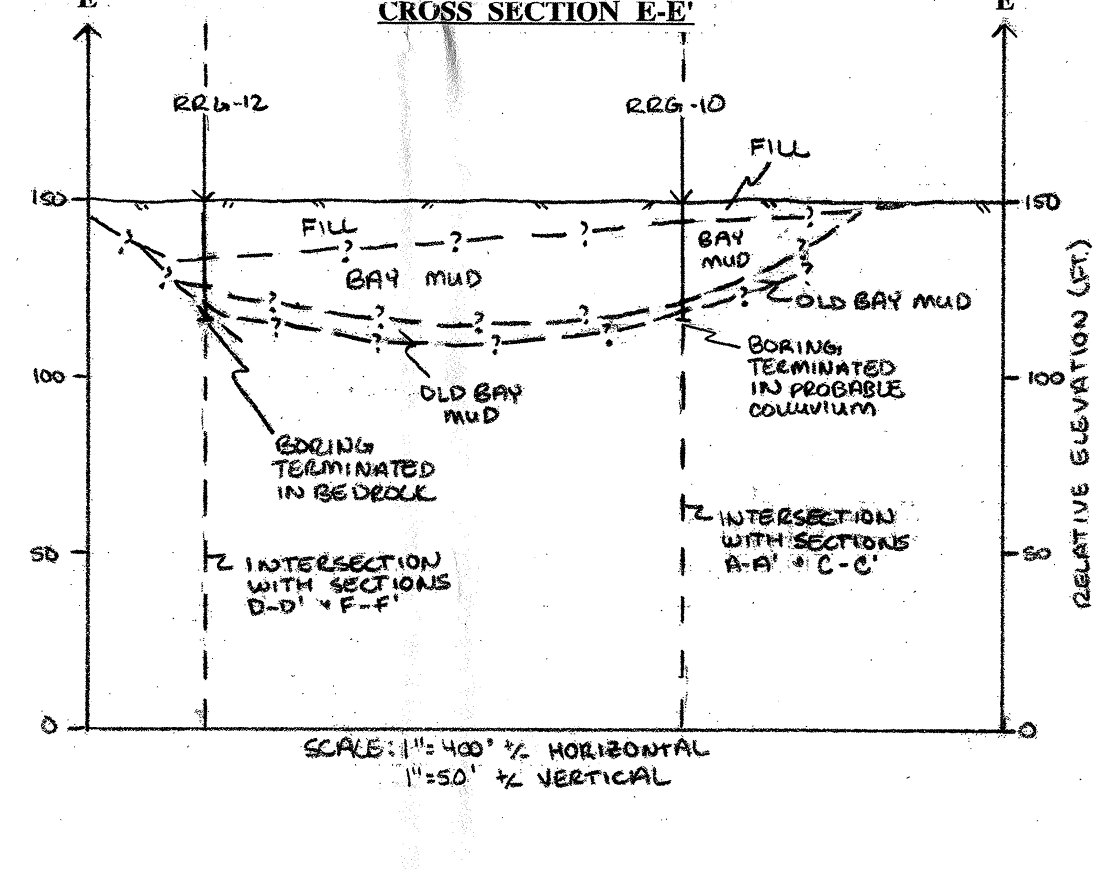
CROSS SECTION C-C'



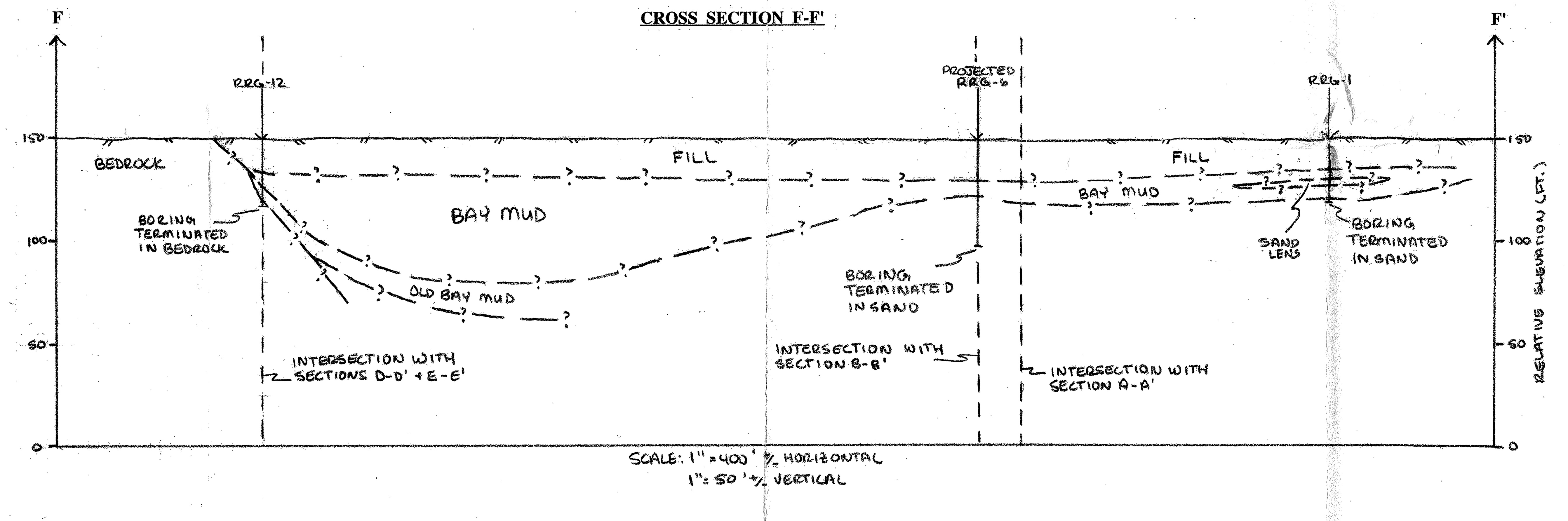
CROSS SECTION D-D'



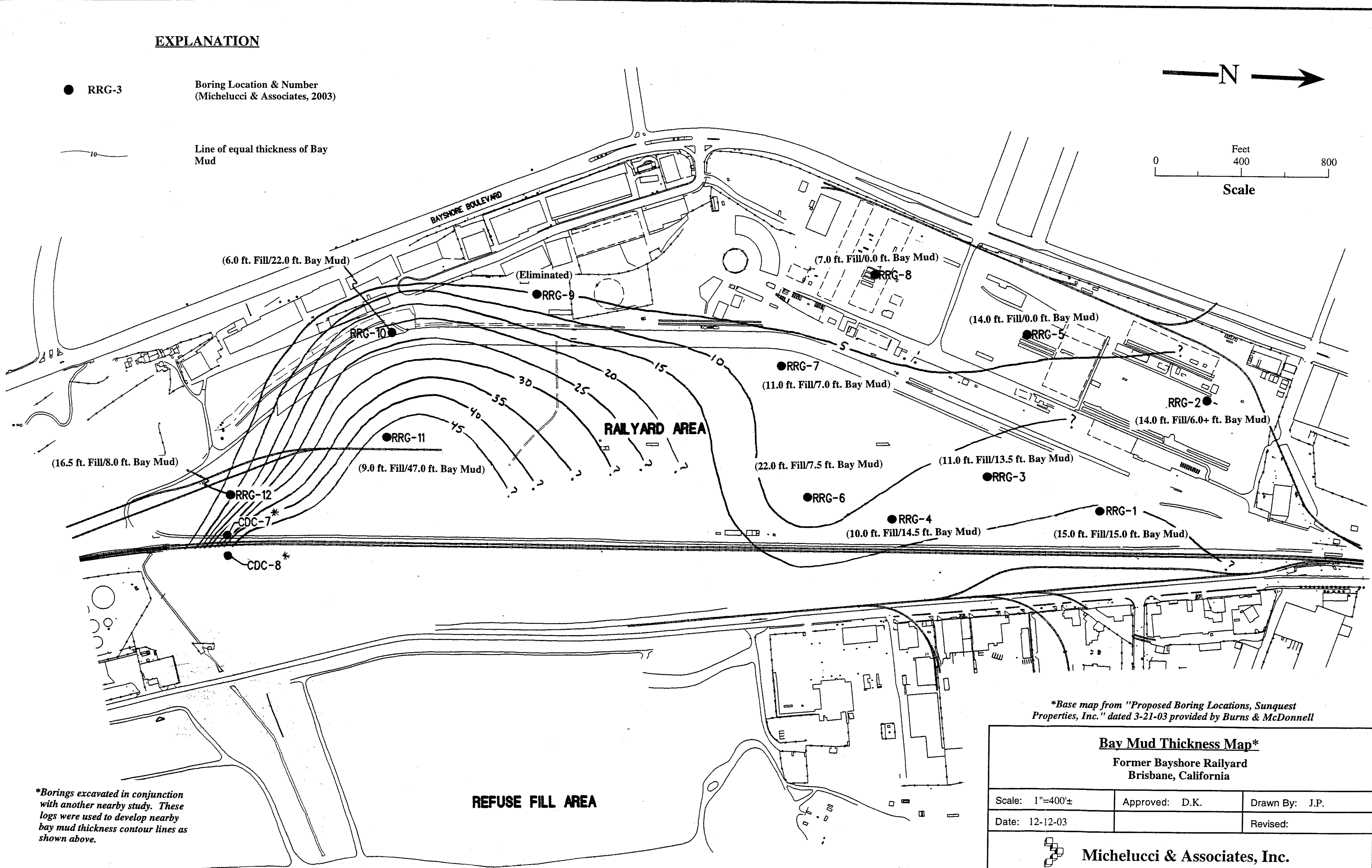
CROSS SECTION E-E'



CROSS SECTION F-F'



GEOLOGIC CROSS-SECTIONS*		
Former Bayshore Railyard Brisbane, California		
Scale: 1"=400'±	Approved: D.K.	Drawn By: J.P.
Date: 12-10-03		Revised:
Michelucci & Associates, Inc.		
Job No. 03-3323		Figure 4



*Borings excavated in conjunction with another nearby study. These logs were used to develop nearby bay mud thickness contour lines as shown above.

*Base map from "Proposed Boring Locations, Sunquest Properties, Inc." dated 3-21-03 provided by Burns & McDonnell

Bay Mud Thickness Map*		
Former Bayshore Railyard Brisbane, California		
Scale: 1"=400'±	Approved: D.K.	Drawn By: J.P.
Date: 12-12-03		Revised:
Michelucci & Associates, Inc.		
Job No. 03-3324		Figure 5

PROJECT	Former Bayshore Railyard, Brisbane, California	**BORING NO.** RRG-1

BORING SUPERVISOR DK/JP	TYPE OF BORING 8" Hollow Stem Auger	DATE OF BORING 3-27-03

HAMMER WEIGHT 140 lb. Automatic Hammer

SURFACE ELEVATION ---

GROUNDWATER DEPTH	3-27-03	9 feet

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, brown, sandy silty clay with rootlets and organics, damp **(Fill)**			1) 2.5"	5	---	14	----	
Loose, grey to dark grey, slightly clayey silty sand with pebbles, rock fragments and minor debris (brick, glass, etc.), moist **(Fill)**	5		2) 2.5"	37	102	6	----	
Firm to medium dense, brown to reddish brown, clayey fine sandy silt to silty fine sand with abundant rock fragments and pieces of debris (glass, plastic, etc.), damp to moist **(Fill)**	10		3) 2.5"	6	---	21	----	
Soft, olive brown to olive grey with minor orange brown, fine sandy clayey silt with rock fragments, very moist to wet **(Fill)**	15							
Very soft, very dark grey, silty clay with minor decomposing organics, very moist to wet **(Bay Mud)**			4) 2.5"	1	60	67	490	**PI (Fig. 18)**
Loose, dark grey, silty medium grained sand, wet **(Sand)**	20		5) 2.5"	7	45	89	880	
Very soft to soft, grey to light grey, organic rich layer with abundant shells and other decomposing materials, wet			6) spt*	5	96	22	----	
Very soft to soft, very dark grey, silty clay with minor decomposing organics, very moist to wet **(Bay Mud)** - slight color change to dark olive brown with depth	25		7) 2.5"	4	41	99	1610	
Loose, dark grey to black, silty fine sand with minor organics, wet **(Sand)**	30		8) 2.5"	7	93	23	1230	
Boring terminated at 31 feet 6 inches								
* spt denotes Standard Penetration Test	35							

Job No. **03-3324**	**Michelucci & Associates, Inc.**	Figure **6**

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-2

BORING SUPERVISOR	DK/JP
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	3-27-03: 5 feet

TYPE OF BORING: 8" Hollow Stem Auger

DATE OF BORING: 3-27-03

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, dark brown, sandy silty clay with rootlets and rock fragments, damp **(Fill)**		1) 2.5"	19	---	7	----	
Loose, mottled greyish brown, slightly clayey silty sand with rock fragments, pebbles and coarse sand, moist **(Fill)**	5	2) 2.5"	8	97	19	----	
Loose, greyish brown, silty sand with rock fragments and pebbles, wet **(Fill)**	10						
Very soft, dark grey to very dark grey, silty clay with minor decomposing organics, very moist to wet **(Bay Mud)**		3) 2.5"	10	117	15	----	
Boring terminated at 20 feet	15	4) 2.5"	3	41	97	----	
	20	5) 2.5"	2	42	97	----	**PI (Fig. 18)**
	25						
	30						
	35						

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-3

BORING SUPERVISOR	DK/JP
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	3-27-03 — 2 feet 6 inches
TYPE OF BORING	8" Hollow Stem Auger
DATE OF BORING	3-27-03

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, brown, sandy silty clay with rootlets and organics, damp to moist **(Fill)**		1) 2.5"	3	92	23	----	
Soft, brown, sandy silt with rock and brick fragments, minor pebbles, moist **(Fill)**	5	2) 2.5"	46	---	8	----	
Loose to medium dense, olive brown, silty fine sand with rock fragments, wet **(Fill)**	10						
Firm to medium dense, olive brown, slightly clayey fine sandy silt to silty fine sand with abundant rock fragments, moist to wet **(Fill)**		3) 2.5"	4	---	46	----	
Very soft, very dark grey, silty clay with orange brown decomposing organics, very moist to wet **(Bay Mud)**	15	4) 2.5"	2	54	75	840	**PI (Fig. 18)**
Loose, very dark grey to black, slightly silty fine sand with abundant shell fragments, very moist to wet **(Sand)**	20	5) 2.5"	4	---	--	----	**Consolidation (Fig. 19)**
Very soft to soft, very dark grey, silty clay with minor orange brown decomposing organics, very moist to wet **(Bay Mud)** - dark grey slightly silty fine sand layer with minor shells and decaying organics at 20 feet 6 inches	25	6) 2.5"	12	103	19	850	
Loose to medium dense, dark olive grey, silty fine sand, wet **(Sand)**	30						
Medium dense, olive brown to yellowish brown, slightly silty fine sand, mottled with grey fine sand, very moist to wet **(Sand)**		7) 2.5"	33	103	18	1520	
	35						

Boring continued on Figure 8A

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-3 (cont'd)

BORING SUPERVISOR	DK/JP	TYPE OF BORING: 8" Hollow Stem Auger	DATE OF BORING: 3-27-03
HAMMER WEIGHT	140 lb. Automatic Hammer		
SURFACE ELEVATION	---		
GROUNDWATER DEPTH	3-27-03	2 feet 6 inches	

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
- Continued from Figure 8			8) 2.5"	38	103	18	470	
- sand color gradually grades to olive grey with depth	40							
Boring terminated at 43 feet			9) 2.5"	40	110	19	790	
			10) spt*	46	---	20	----	
* spt denotes Standard Penetration Test	45							
	50							
	55							
	60							
	65							
	70							

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-4

BORING SUPERVISOR	DK/JP
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	3-28-03 — 8 feet
TYPE OF BORING	8" Hollow Stem Auger
DATE OF BORING	3-28-03

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, dark brown, sandy silty clay with rootlets and rock fragments, damp to moist **(Fill)**		1) 2"	29	---	7	----	
Medium stiff to stiff, olive brown to olive grey, sandy clayey silt with abundant rock fragments, damp to moist **(Fill)**	5	2) 2"	6	118	18	800	
Loose to medium dense, reddish brown, clayey silty fine sand, very moist **(Fill)**	10	3) 2.5"	1/18"	48	87	680	**Consolidation (Fig. 20)**
Loose, orange brown, slightly clayey silty fine sand, very moist **(Fill)**							
Very soft, very dark grey, silty clay, very moist to wet **(Bay Mud)** - minor shell fragments at 15 feet	15	4) 2.5"	3	---	67	----	**PI (Fig. 18)**
Medium dense, olive brown to olive grey, slightly silty fine sand, very moist to wet **(Sand)** - minor rock fragments and organics present in Sample 6 - grades to yellowish brown to orange brown in color at 30 feet - minor orange brown iron staining at 31 feet	20	5) 2.5"	2	56	67	1180	
	25	6) 2.5"	37	107	16	840	
	30	7) 2"	28	111	20	1220	
	35						

Boring continued on Figure 9A

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-4 (cont'd)
BORING SUPERVISOR	DK/JP	
HAMMER WEIGHT	140 lb. Automatic Hammer	
SURFACE ELEVATION	---	
GROUNDWATER DEPTH	3-28-03	8 feet
TYPE OF BORING	8" Hollow Stem Auger	
DATE OF BORING	3-28-03	

DESCRIPTION OF MATERIALS

DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
		8) 2"	26	110	21	2330	
40							
		9) 2"	36	115	18	5350	
		10) spt*	29	118	19	----	
45							
50							
55							
60							
65							
70							

- Continued from Figure 9
- slight increase in clay content beyond 37 feet
- grades to light olive brown in color at 40 feet

Boring terminated at 43 feet

* spt denotes Standard Penetration Test

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-5

BORING SUPERVISOR	DK/JP	TYPE OF BORING: 8" Hollow Stem Auger	DATE OF BORING: 3-31-03
HAMMER WEIGHT	140 lb. Automatic Hammer		
SURFACE ELEVATION	---		
GROUNDWATER DEPTH	3-31-03	4 feet	

DESCRIPTION OF MATERIALS

Firm, brown to dark olive brown, sandy clayey silt to sandy silty clay with rootlets and rock fragments, damp to moist
(Fill)

Firm to stiff, olive brown to olive grey, sandy clayey silt to sandy silty clay with abundant rock fragments, damp to moist
(Fill)

- dark brown silty clay lense with strong brown fine sand at 2 feet
- seepage at 4 feet
- abundant rock fragments at 5 feet

Soft, very dark grey to black, sandy silty clay with rock fragments, wood chips, glass and pottery pieces, minor organics, very moist to wet
(Fill)

Medium dense to dense, olive grey to grey, silty fine sand with minor organics, very moist to wet
(Sand)

- rock fragments within Sample 4
- color changes to olive brown and orange brown at 20 feet
- dense at 20 feet
- very dense at 31 feet

Boring terminated at 33 feet

* spt denotes Standard Penetration Test

SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
1) 2"	47	120	10	----	
2) 2"	12	---	--	----	
3) 2"	4	76	43	490	
4) 2.5"	17	100	19	310	
5) 2.5"	36	101	20	1480	
6) 2"	32	109	19	1100	
7) 2"	24	110	21	2350	
8) spt*	58	116	23	----	

DEPTH IN FT.: 5, 10, 15, 20, 25, 30, 35

Job No. 03-3324	Michelucci & Associates, Inc.	Figure 10

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-6

BORING SUPERVISOR	DK/JP	TYPE OF BORING: 8" Hollow Stem Auger	DATE OF BORING: 3-28-03
HAMMER WEIGHT	140 lb. Automatic Hammer		
SURFACE ELEVATION	---		
GROUNDWATER DEPTH	3-28-03	4 feet	

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER- SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, olive grey to olive brown, sandy silty clay to sandy clayey silt with rootlets and rock fragments, damp to moist **(Fill)**		1) 2"	33	123	8	1870	
Firm to medium stiff, olive grey and olive brown, sandy clayey silt with lenses of orange brown and reddish brown sand and silt and abundant rock fragments, damp **(Fill)** - seepage at 4 feet	5	2) 2"	11	---	9	----	
Firm to medium stiff, dark grey, silty clay with abundant rock fragments, wet **(Fill)**	10	3) 2.5"	6	---	--	----	
Medium stiff, olive brown, sandy clayey silt with abundant rock fragments, wet **(Fill)**	15	4) 2.5"	23	---	15	----	
Very soft to soft, very dark grey, silty clay with shell fragments, very moist to wet **(Bay Mud)**	20	5) 2.5"	17	---	13	----	
Medium dense to dense, mottled orange brown to strong brown, clayey silty fine sand, very moist **(Sand)** - lenses of olive grey to grey silty fine sand in Sample 8	25	6) 2.5"	4	64	53	1450	
	30	7) 2.5"	26	109	16	3960	
	35						

Boring continued on Figure 11A

Job No. **03-3324**

Michelucci & Associates, Inc.

Figure **11**

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-6 (cont'd)

BORING SUPERVISOR DK/JP	TYPE OF BORING 8" Hollow Stem Auger	DATE OF BORING 3-28-03

HAMMER WEIGHT 140 lb. Automatic Hammer

SURFACE ELEVATION ---

GROUNDWATER DEPTH	3-28-03	4 feet

DESCRIPTION OF MATERIALS

- Continued from Figure 11

Medium dense to dense, olive grey and olive brown, silty fine sand, very moist
(Sand)

Boring terminated at 53 feet

* spt denotes Standard Penetration Test

DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
		8) 2"	43	110	20	3860	
40							
		9) 2"	27	108	21	900	
45							
		10) 2"	48	108	20	1550	
50							
		11) 2"	32	112	19	2770	
		12) spt*	26	111	21	----	
55							
60							
65							
70							

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-7

BORING SUPERVISOR	DK/JP
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	3-31-03 / 5 feet
TYPE OF BORING	8" Hollow Stem Auger
DATE OF BORING	3-31-03

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Medium dense, olive grey to olive brown, silty clayey very fine sand with abundant rock fragments, moist to very moist **(Fill)**		1) 2"	21	---	9	----	
Soft, dark brown, sandy silt with abundant rock fragments, very moist to wet **(Fill)**	5	2) 2"	7	---	--	----	
Very soft to soft, very dark grey, silty clay with minor decomposing organics, very moist to wet **(Bay Mud)** - minor shell fragments at 15 feet	10	3) 2.5"	3	50	77	420	
Loose, mottled olive grey and minor brown, slightly clayey silty fine sand with minor organics, very moist to wet **(Sand)**	15	4) 2.5"	2/18"	42	98	490	**Consolidation (Fig. 21)**
Medium dense, dark olive grey, slightly clayey silty fine sand, very moist **(Sand)** - grades to yellowish brown in color at 30 feet - minor pebbles in Sample 8	20	5) 2.5"	6	105	18	1650	
	25	6) 2"	36	122	15	4880	
	30	7) 2"	30	107	21	2290	
	35						

Boring continued on Figure 12A

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-7 (cont'd)

BORING SUPERVISOR	DK/JP	TYPE OF BORING: 8" Hollow Stem Auger	DATE OF BORING: 3-31-03
HAMMER WEIGHT	140 lb. Automatic Hammer		
SURFACE ELEVATION	---		
GROUNDWATER DEPTH	3-31-03 / 5 feet		

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
- Continued from Figure 12			8) 2"	30	101	23	270	
Boring terminated at 38 feet			9) spt*	50	---	21	----	
* spt denotes Standard Penetration Test	40							
	45							
	50							
	55							
	60							
	65							
	70							

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-8

BORING SUPERVISOR	DK/JP
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	3-31-03 — 5 feet
TYPE OF BORING	8" Hollow Stem Auger
DATE OF BORING	3-31-03

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Medium dense to firm, brown to very dark brown, silty very fine sand to fine sandy silt with abundant rock fragments, rootlets and pieces of wood debris, damp **(Fill)** - lenses of black fine sand in Sample 1 - fragments of concrete debris		1) 2"	19/3"	98	13	----	
	5	2) 2"	9	---	12	----	
Firm, olive grey, sand and silt with abundant rock and concrete fragments, wet **(Fill)** - heavy seepage at 5 feet	10						
Loose, very dark grey to black, very clayey and silty fine sand with abundant shell fragments, very moist to wet **(Sand)**		3) 2"	1/18"	86	35	500	
Loose, very dark grey, silty fine sand with minor shells, very moist to wet **(Sand)**	15	4) 2.5"	17	101	20	4320	
Medium dense, mottled olive and strong brown, clayey silty fine sand with dark yellowish brown mottling, minor decomposing rootlets and organics, very moist to wet **(Sand)**	20	5) 2.5"	41	106	17	2390	
		6) spt*	46	121	17	----	
Dense, olive brown and dark yellowish brown, slightly clayey silty fine sand, very moist to wet **(Sand)**	25						
Boring terminated at 23 feet	30						
* spt denotes Standard Penetration Test	35						

Job No. **03-3324** | **Michelucci & Associates, Inc.** | Figure **13**

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-9

BORING SUPERVISOR	TYPE OF BORING	DATE OF BORING
HAMMER WEIGHT		
SURFACE ELEVATION ---		
GROUNDWATER DEPTH		

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
	5							
	10							
	15							
	20							
	25							
	30							
	35							

BORING ELIMINATED

Job No. 03-3324	Michelucci & Associates, Inc.	Figure 14

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-10

BORING SUPERVISOR	DK/JP	TYPE OF BORING: 8" Hollow Stem Auger	DATE OF BORING: 4-2-03
HAMMER WEIGHT	140 lb. Automatic Hammer		
SURFACE ELEVATION	---		
GROUNDWATER DEPTH	4-2-03	7 feet	

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, olive grey to grey, sandy clayey silt with gravel, rock fragments and minor rootlets, damp **(Fill)**			1) 2"	21	---	3	----	
Medium dense, olive brown to brown, silty clayey fine sand with abundant rock fragments and pieces of debris (brick, concrete, etc.), damp **(Fill)**	5		2) 2"	12	72	51	540	
Firm, very dark brown to black, sandy silt with gravel, moist **(Fill)** - glass fragments at the bottom of Sample 1	10		3) 2.5"	2	49	75	620	**PI (Fig. 18)**
Soft, mottled dark grey, silty clay, moist to very moist **(Bay Mud)** - increase in moisture content at 7 feet - grades to very dark grey at 15 feet - minor shell fragments in Sample 4 - grades to dark grey at 20 feet - dark brown decomposing organics in Sample 6	15		4) 2.5"	1/18"	48	82	550	
Stiff, greenish grey, sandy silty clay with minor olive brown mottling and minor rock fragments, damp to moist **(Older Bay Mud)**	20		5) 2.5"	2/18"	46	86	840	**Consolidation (Fig. 22)**
Very stiff, olive brown to olive grey, silty clay with minor yellowish brown fine sand and strong brown mottling and scattered rock fragments, damp to moist **(Probable Colluvium)**	25		6) 2.5"	5	40	103	950	
Boring terminated at 33 feet	30		7) 2"	35	113	19	4490	
* spt denotes Standard Penetration Test			8) spt*	33	106	21	----	
	35							

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-11

BORING SUPERVISOR	DK/JP	TYPE OF BORING: 8" Hollow Stem Auger	DATE OF BORING: 4-1-03
HAMMER WEIGHT	140 lb. Automatic Hammer		
SURFACE ELEVATION	---		
GROUNDWATER DEPTH	4-1-03	2 feet 6 inches	

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Medium dense to firm, brown, slightly clayey silty fine sand to fine sandy silt with abundant rock fragments, damp **(Fill)**		1) 2"	16	130	10	1210	
Loose, mottled greyish brown, silty sand with rock fragments, very moist to wet **(Fill)** - seepage at 2 feet 6 inches - sand grades coarser in Sample 2 and increase in rock fragment content - brick fragments also present in Sample 2	5	2) 2"	3	---	14	----	
Very soft, very dark grey, silty clay, very moist to wet **(Bay Mud)** - abundant shell fragments in Sample 4	10	3) 2"	1/18"	62	65	550	
	15	4) 2.5"	1/18"	62	62	440	
	20	5) 2.5"	1/18"	54	69	1000	**Consolidation (Fig. 23)**
	25	6) 2.5"	2	54	71	370	
- minor shell fragments in Samples 6 to 8	30	7) 2.5"	3	52	74	430	**PI (Fig. 18)**
	35						

Boring continued on Figure 16A

PROJECT	Former Bayshore Railyard, Brisbane, California
BORING NO.	RRG-11 (cont'd)
BORING SUPERVISOR	DK/JP
TYPE OF BORING	8" Hollow Stem Auger
DATE OF BORING	4-1-03
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	4-1-03: 2 feet 6 inches

DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
- Continued from Figure 16		8) 2.5"	3	54	68	370	
- minor orange brown mottling in Sample 9	40	9) 2.5"	6	58	64	390	**Consolidation (Fig. 24)**
- grades to dark greyish brown in color and sandier within top of Sample 12	45	10) 2"	4	59	67	740	
Medium dense, mottled very dark grey with olive grey, clayey silty fine sand, moist to very moist **(Sand)**	50	11) 2.5"	8	56	64	630	
Dense, greyish brown to olive brown, slightly silty fine sand, moist **(Sand)** - sand grades coarser with depth	55	12) 2.5"	6	111	18	470	
Stiff to very stiff, very dark greyish brown, fine sandy clayey silt, moist **(Older Bay Mud)** - dark greyish brown sand lens from 66 feet 6 inches to 67 feet 6 inches	60	13) 2.5"	53	108	16	790	
	65	14) 2"	17	102	26	1920	
		15) 2"	31	102	26	950	
Boring terminated at 68 feet	70						

Job No. **03-3324**

Michelucci & Associates, Inc.

Figure **16A**

PROJECT	Former Bayshore Railyard, Brisbane, California	BORING NO. RRG-12

BORING SUPERVISOR	DK/JP
HAMMER WEIGHT	140 lb. Automatic Hammer
SURFACE ELEVATION	---
GROUNDWATER DEPTH	4-1-03: 5 feet
TYPE OF BORING	8" Hollow Stem Auger
DATE OF BORING	4-1-03

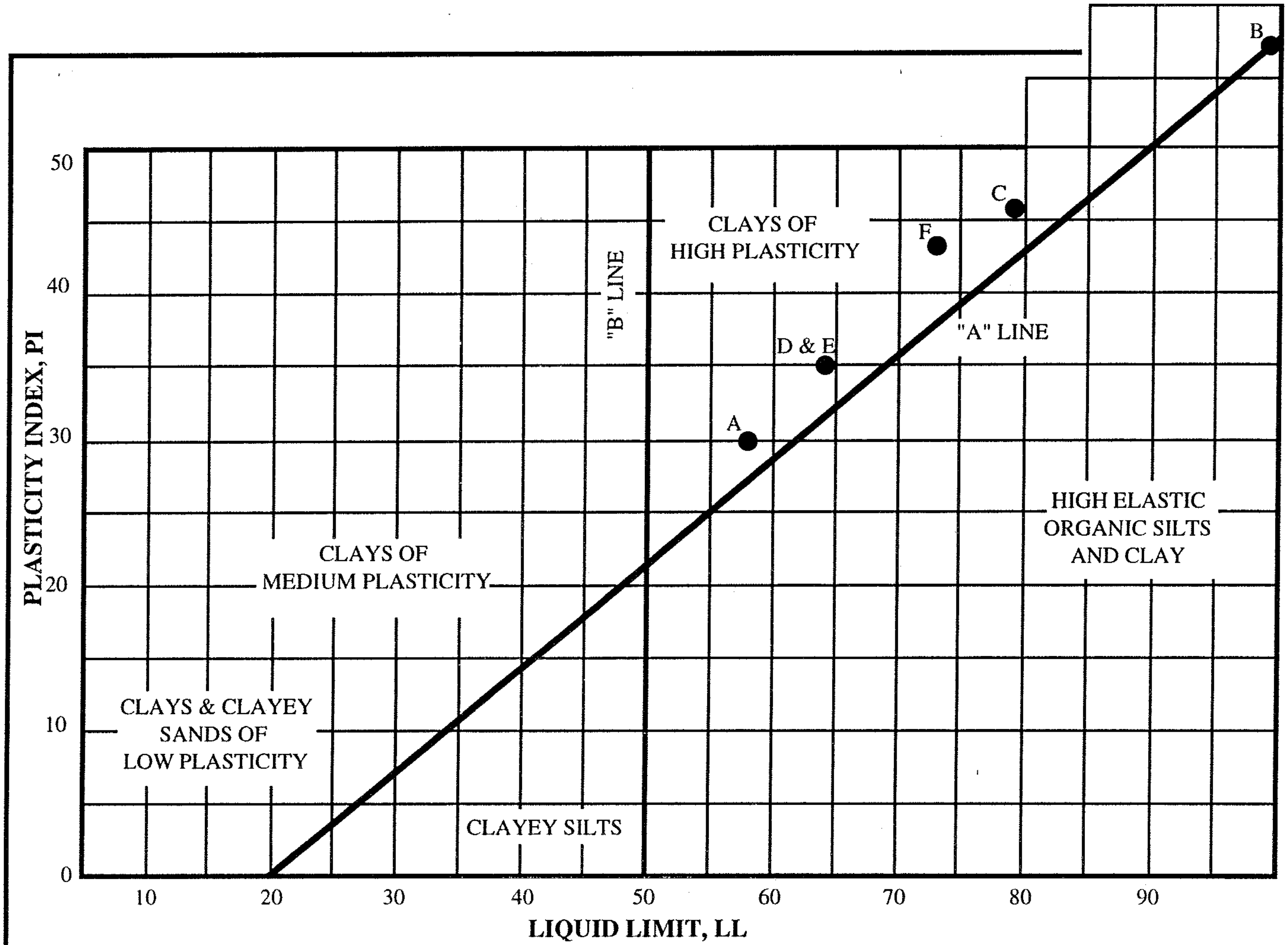
DESCRIPTION OF MATERIALS	DEPTH IN FT.	SAMPLE NUMBER-SAMPLE DIAMETER	DRIVING RESISTANCE BLOWS PER FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT %	UNCONFINED COMPRESSIVE STRENGTH P.S.F.	OTHER TESTS
Firm, olive brown, fine sandy clayey silt with abundant rock fragments, damp **(Fill)**		1) 2"	42	---	3	----	
Firm, dark greyish brown to olive brown, sandy silty clay to clayey silt with abundant rock fragments, moist **(Fill)** - heavy seepage at 5 feet - abundant rock fragments between 7 feet and 11 feet	5	2) 2"	17	---	18	----	
Firm, mottled dark grey, silty clay with rock fragments, moist to wet **(Fill)**	10	3) 2"	20	---	10	----	
Soft, very dark grey, silty clay with minor decaying organics, wet **(Bay Mud)**	15	4) 2"	28	100	27	----	
Very soft, very dark grey, silty clay with minor sand, very moist to wet **(Older Bay Mud)** - grades sandier with depth - grades into dark grey silty clayey fine sand with minor shells and decaying brown organics at 26 feet	20	5) 2.5"	19	74	41	330	
Very dense, greenish grey to olive grey, silty fine sand, moist to wet **(Sand)** - grades to yellowish brown to olive brown in color	25	6) 2.5"	2/18"	63	56	1150	
Very dense, yellowish brown, deeply weathered siltstone with grey clayey veins, damp **(Weathered Bedrock)**	30	7) 2.5"	81	99	23	320	
Boring terminated at 33 feet 1 inch		8) 2"	50/4"	121	14	6370	
		9) spt*	50/3"	---	--	----	
	35						

* spt denotes Standard Penetration Test

Job No. **03-3324**

Michelucci & Associates, Inc.

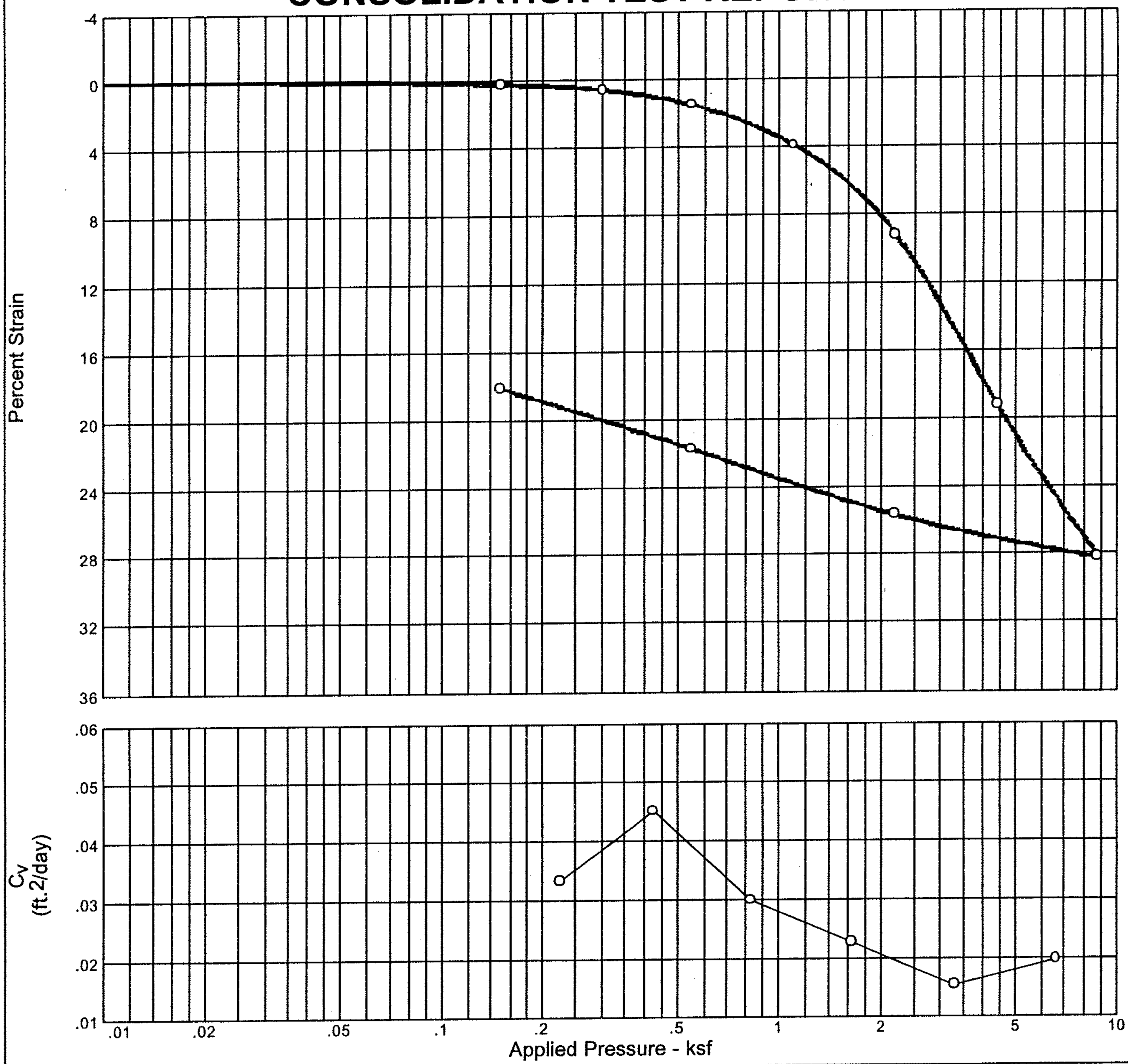
Figure **17**



CLASSIFICATION TEST RESULTS										
SAMPLE IDENTIFICATION			ATTERBERG LIMITS			GRAIN SIZES % DRY WT.				
SAMPLE	LETTER DESIGNATION	DESCRIPTION	LIQUID LIMIT	PLASTICITY INDEX	SHRINKAGE LIMIT	SAND	SILT	CLAY	COLLOIDAL	
1-4	A	Dark grey silty clay	58	30	--	--	--	--	--	
2-5	B	Very dark grey silty clay	99	57	--	--	--	--	--	
3-4	C	Very dark grey silty clay	79	46	--	--	--	--	--	
4-4	D	Very dark grey silty clay	64	35	--	--	--	--	--	
10-3	E	Dark grey silty clay	64	35	--	--	--	--	--	
11-7	F	Dark grey silty clay	73	43	--	--	--	--	--	

PLASTICITY CLASSIFICATION

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
96.5 %	94.1 %	46.4			2.7			2.634

MATERIAL DESCRIPTION

gray CLAY

Project No. 073-025 **Client:** Michelucci

Project: 03-3324

Source: 03-3324 **Sample No.:** 3-5-4

CONSOLIDATION TEST REPORT

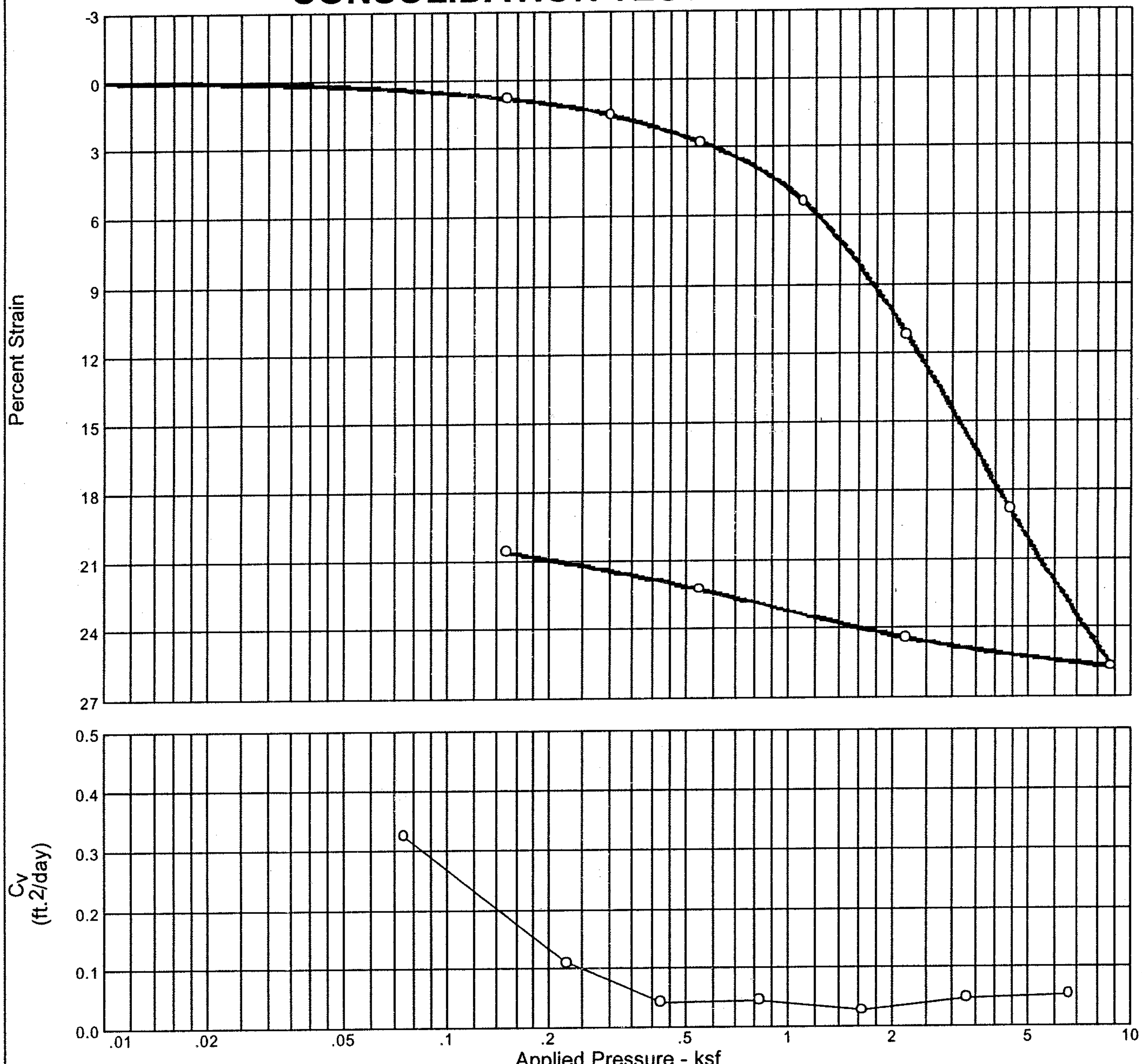
COOPER TESTING LABORATORY

Remarks:

Plate

Job No. **03-3324**	Michelucci & Associates, Inc.	Figure **19**

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.9 %	71.4 %	57.6			2.7			1.928

MATERIAL DESCRIPTION
gray CLAY, bay mud

Project No. 073-025 **Client:** Michelucci

Project: 03-3324

Source: 03-3324 **Sample No.:** 4A-1-3

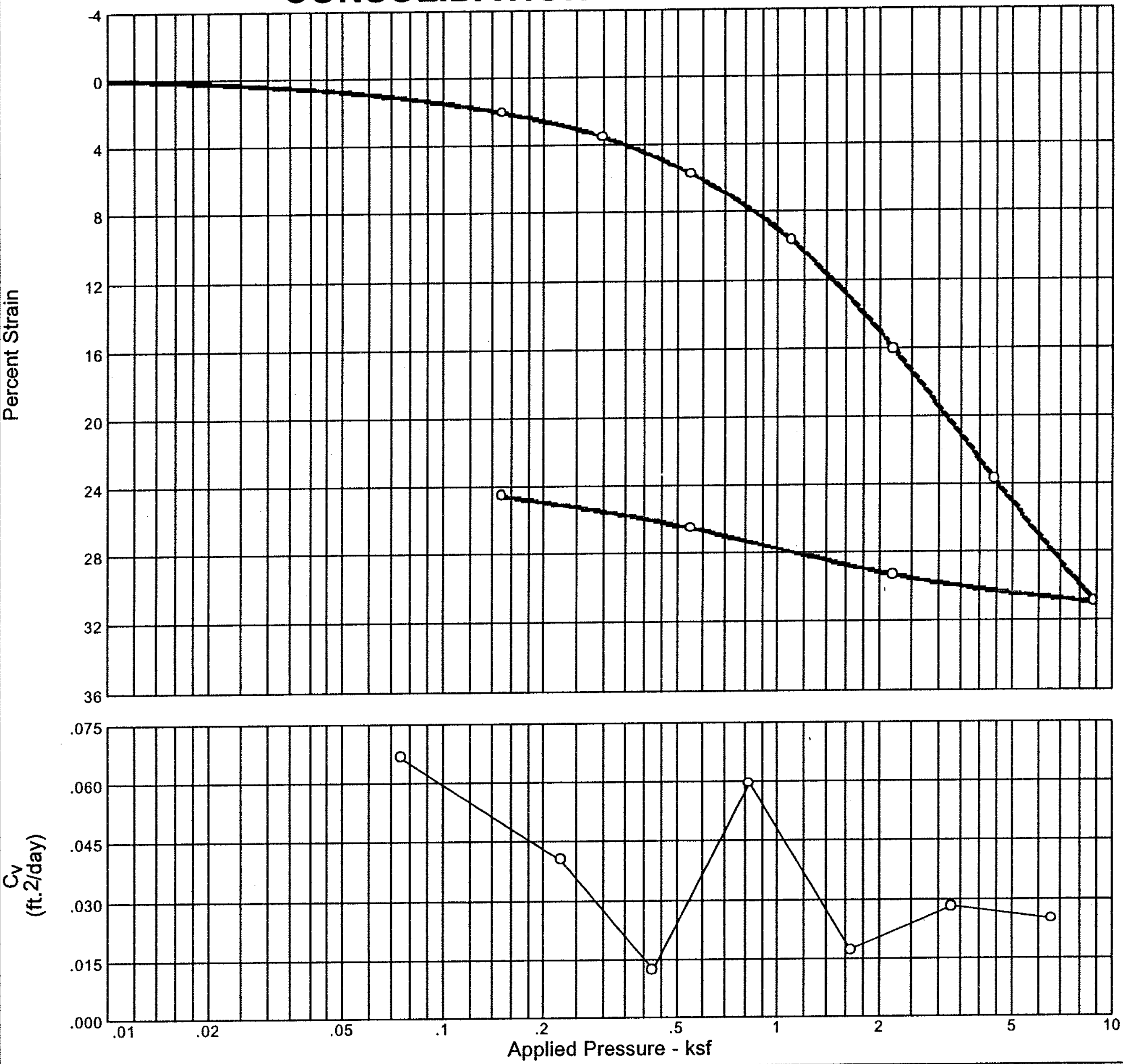
CONSOLIDATION TEST REPORT

COOPER TESTING LABORATORY

Remarks:
Sample disturbed. Sampled with mod Cal?

Plate

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
97.7 %	90.5 %	48.1			2.7			2.503

MATERIAL DESCRIPTION

gray CLAY, bay mud

Project No. 073-025 **Client:** Michelucci

Project: 03-3324

Source: 03-3324 **Sample No.:** 7-4-3

Remarks:

Sample disturbed, taken with mod Cal?

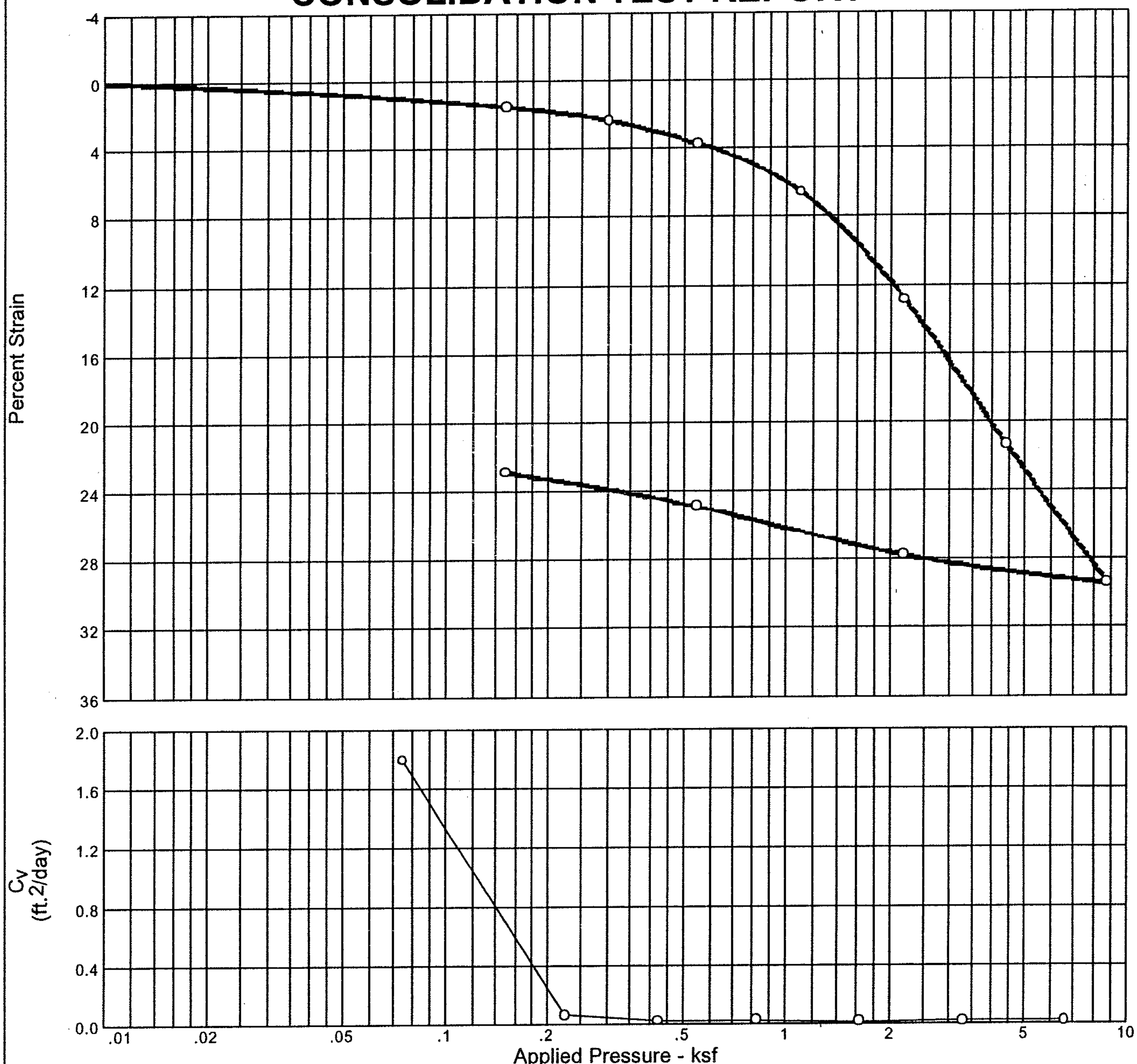
CONSOLIDATION TEST REPORT

COOPER TESTING LABORATORY

Plate

Job No. **03-3324** Michelucci & Associates, Inc. Figure **21**

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
97.9 %	89.4 %	48.6			2.7			2.467

MATERIAL DESCRIPTION

gray CLAY, bay mud

Project No. 073-025 **Client:** Michelucci

Project: 03-3324

Source: 03-3324 **Sample No.:** 10-5-3

Remarks:
Sample disturbed, sampled with mod Cal sampler?

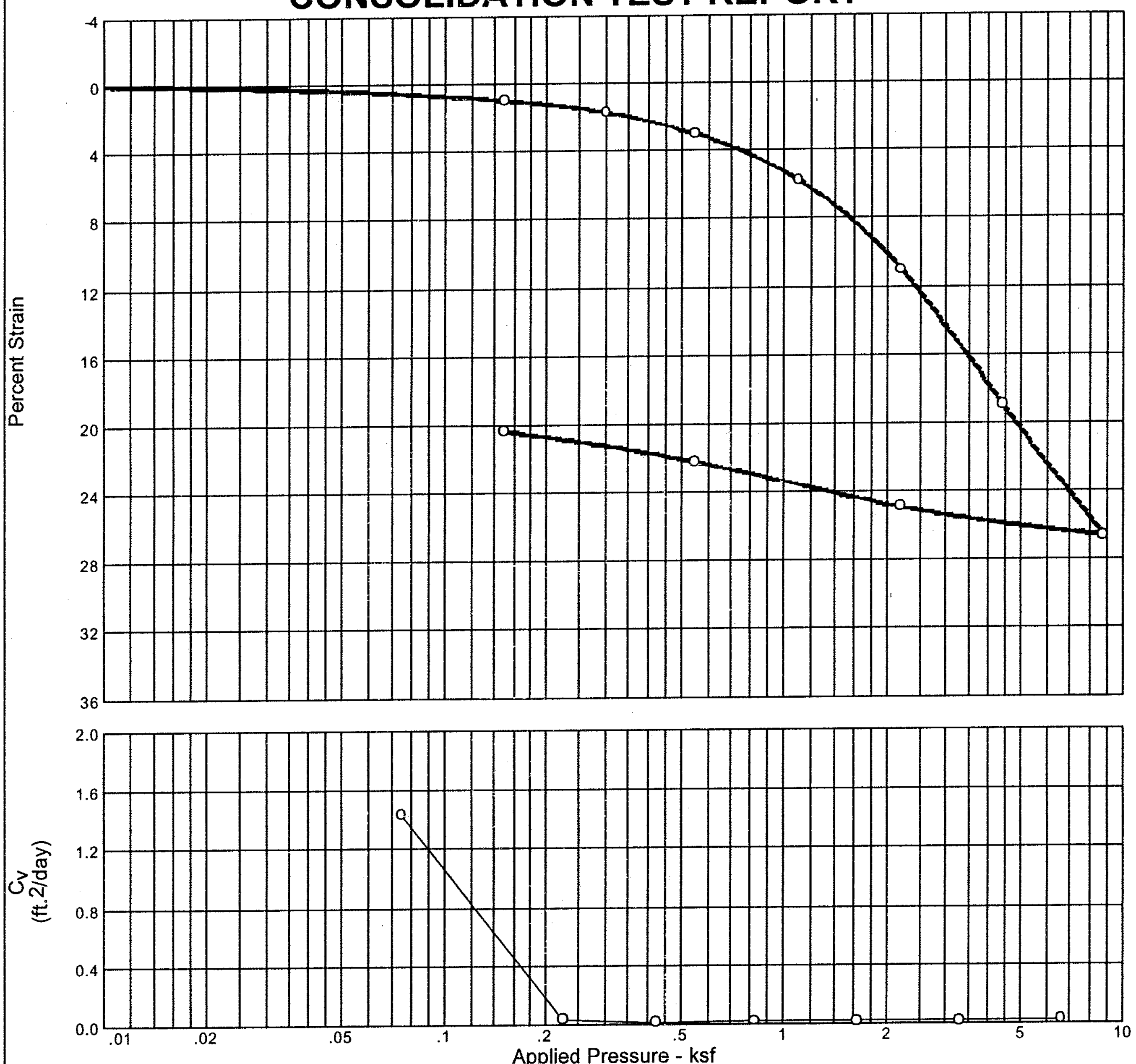
CONSOLIDATION TEST REPORT

COOPER TESTING LABORATORY

Plate

Job No. **03-3324** | Michelucci & Associates, Inc. | Figure **22**

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
97.9 %	80.7 %	52.3			2.7			2.225

MATERIAL DESCRIPTION

gray CLAY

Project No. 073-025 **Client:** Michelucci

Project: 03-3324

Source: 03-3324 **Sample No.:** 11-5-3

CONSOLIDATION TEST REPORT

COOPER TESTING LABORATORY

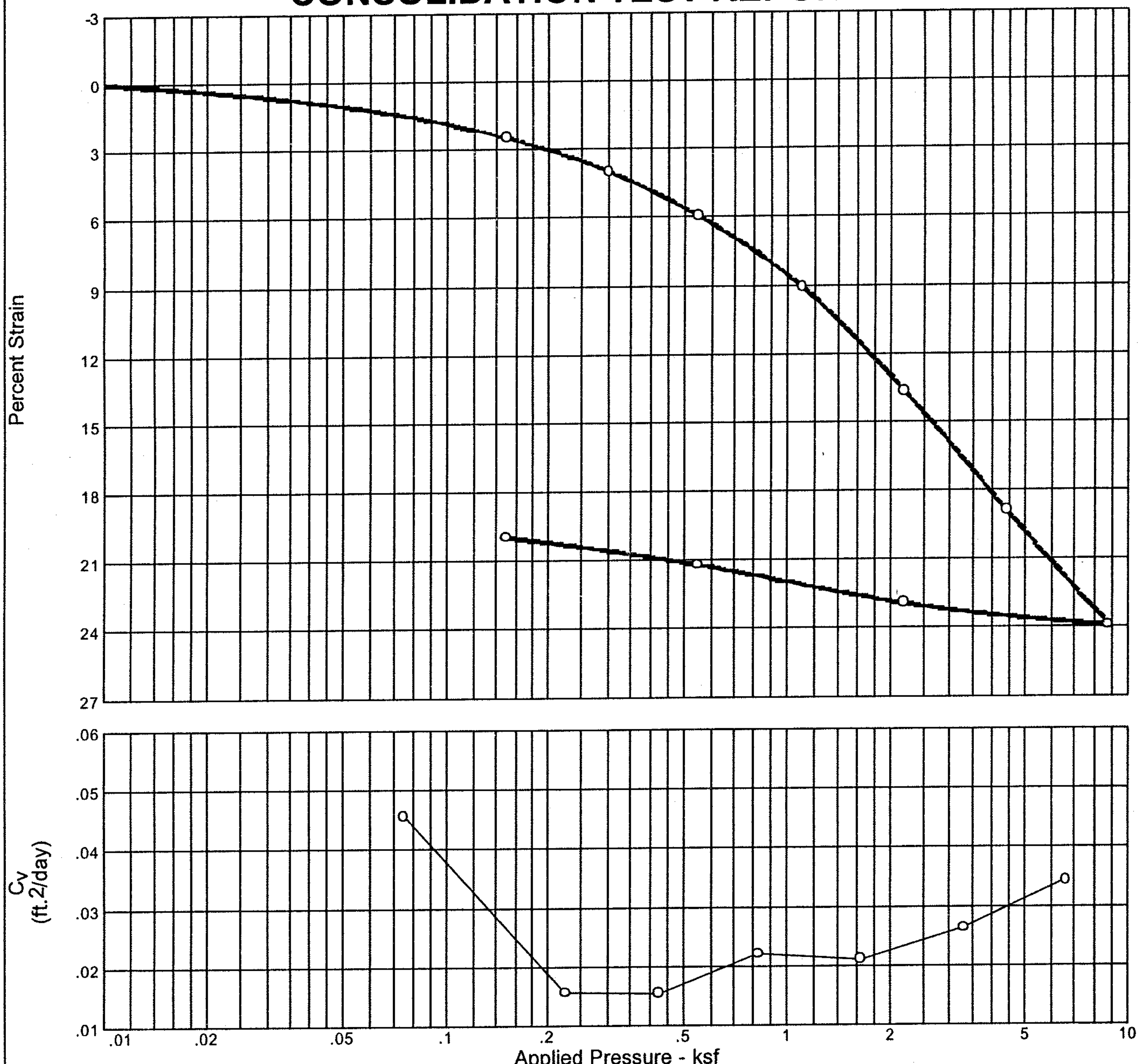
Remarks:

Sample disturbed, sampled with mod Cal sampler?

Plate

Job No. **03-3324**	Michelucci & Associates, Inc.	Figure **23**

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
94.2 %	56.2 %	64.5			2.7			1.612

MATERIAL DESCRIPTION
gray CLAY, bay mud

Project No. 073-025 **Client:** Michelucci

Project: 03-3324

Source: 03-3324 **Sample No.:** 11-9-3

Remarks:
Sample disturbed, taken with mod Cal sampler? The sample may indicate underconsolidation due to disturbance.

CONSOLIDATION TEST REPORT

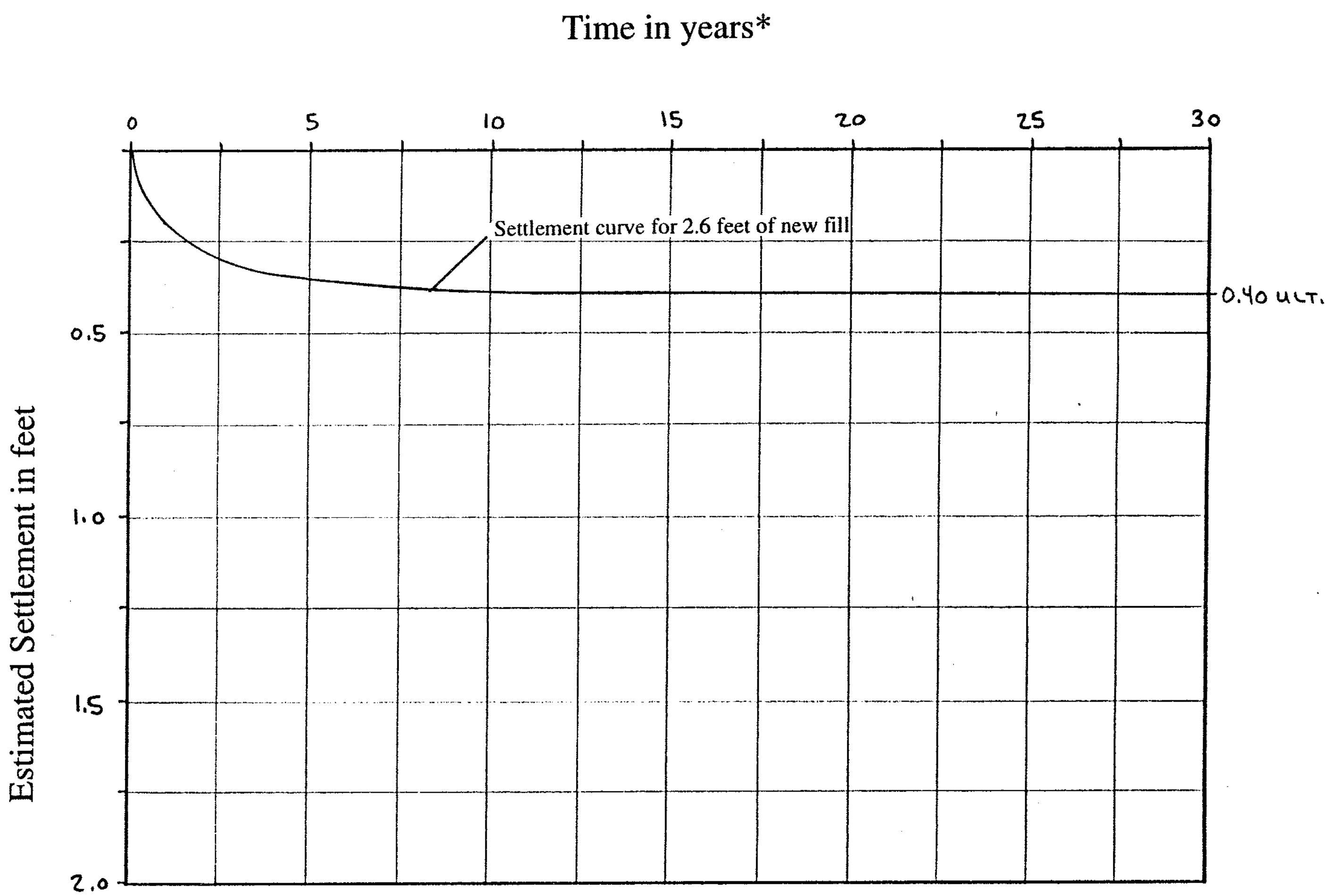
COOPER TESTING LABORATORY

Plate

Job No. **03-3324** Michelucci & Associates, Inc. Figure **24**

SETTLEMENT vs TIME CHART AT RRG-1

EXISTING CONDITIONS: FILL: 15 ft.
BAY MUD: 15 ft.
DRAINAGE: Double

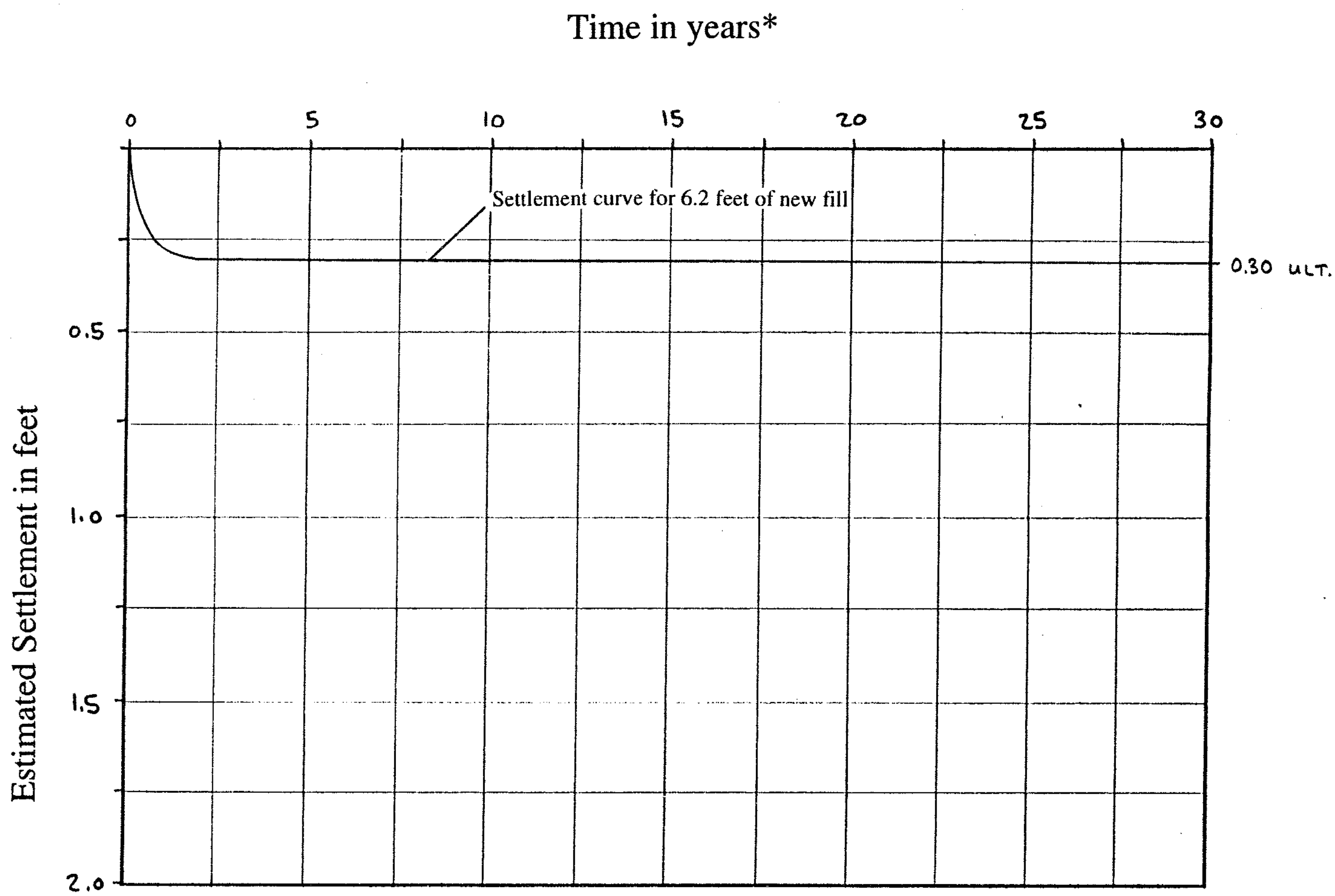


*where "0" represents the time when the new fill is placed
Note: The amount of new fill was based upon the 8-12-2003 grading plan by Burns & McDonnell (Sheet 3 of 14)

Job No. **03-3324**	Michelucci & Associates, Inc.	Figure **25**

SETTLEMENT vs TIME CHART AT RRG-6

EXISTING CONDITIONS: FILL: 22 ft.
BAY MUD: 7.5 ft.
DRAINAGE: Double

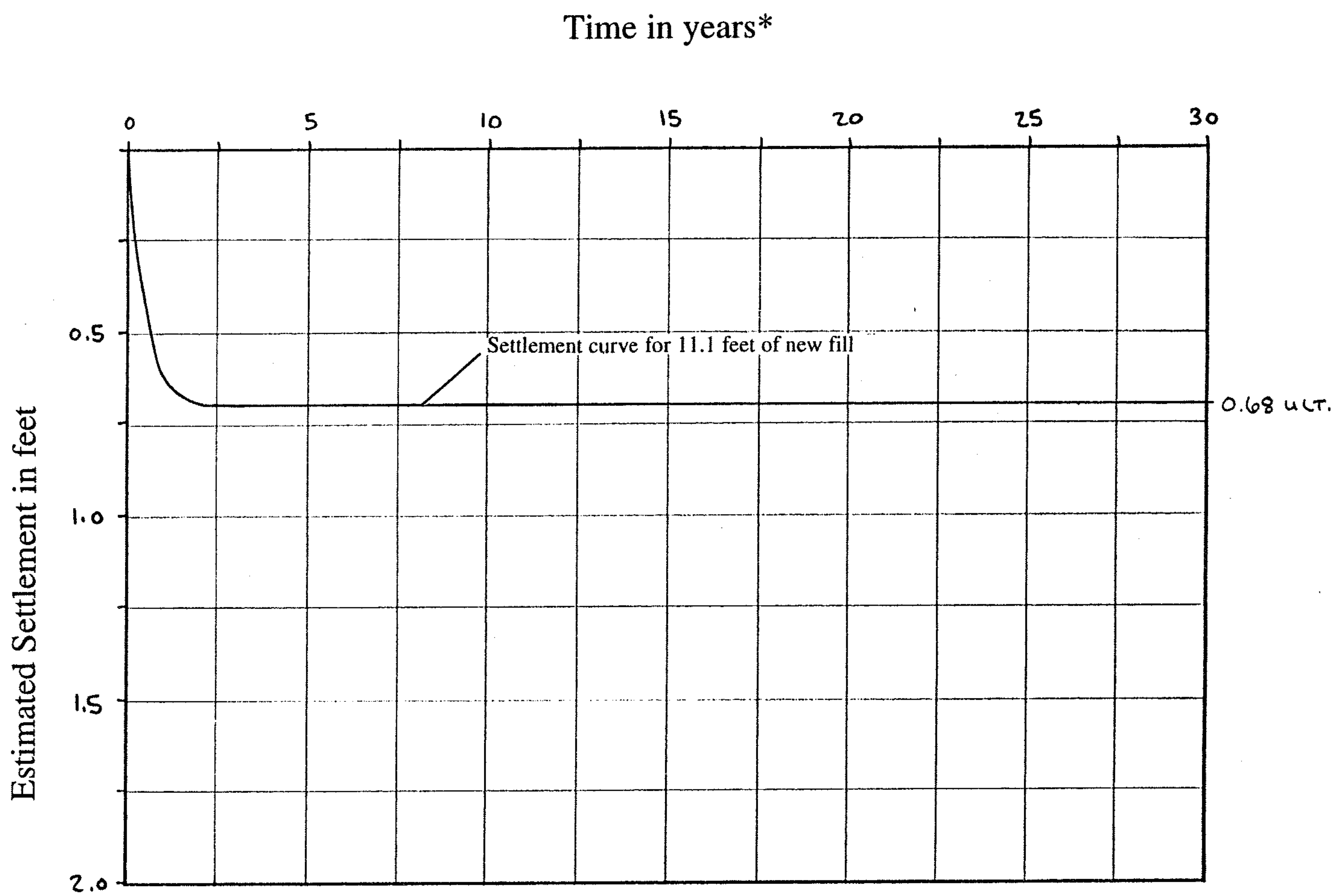


*where "0" represents the time when the new fill is placed
Note: The amount of new fill was based upon the 8-12-2003 grading plan by Burns & McDonnell (Sheet 3 of 14)

Job No. **03-3324**	Michelucci & Associates, Inc.	Figure **26**

SETTLEMENT vs TIME CHART AT RRG-7

EXISTING CONDITIONS: FILL: 11 ft.
BAY MUD: 7 ft.
DRAINAGE: Double



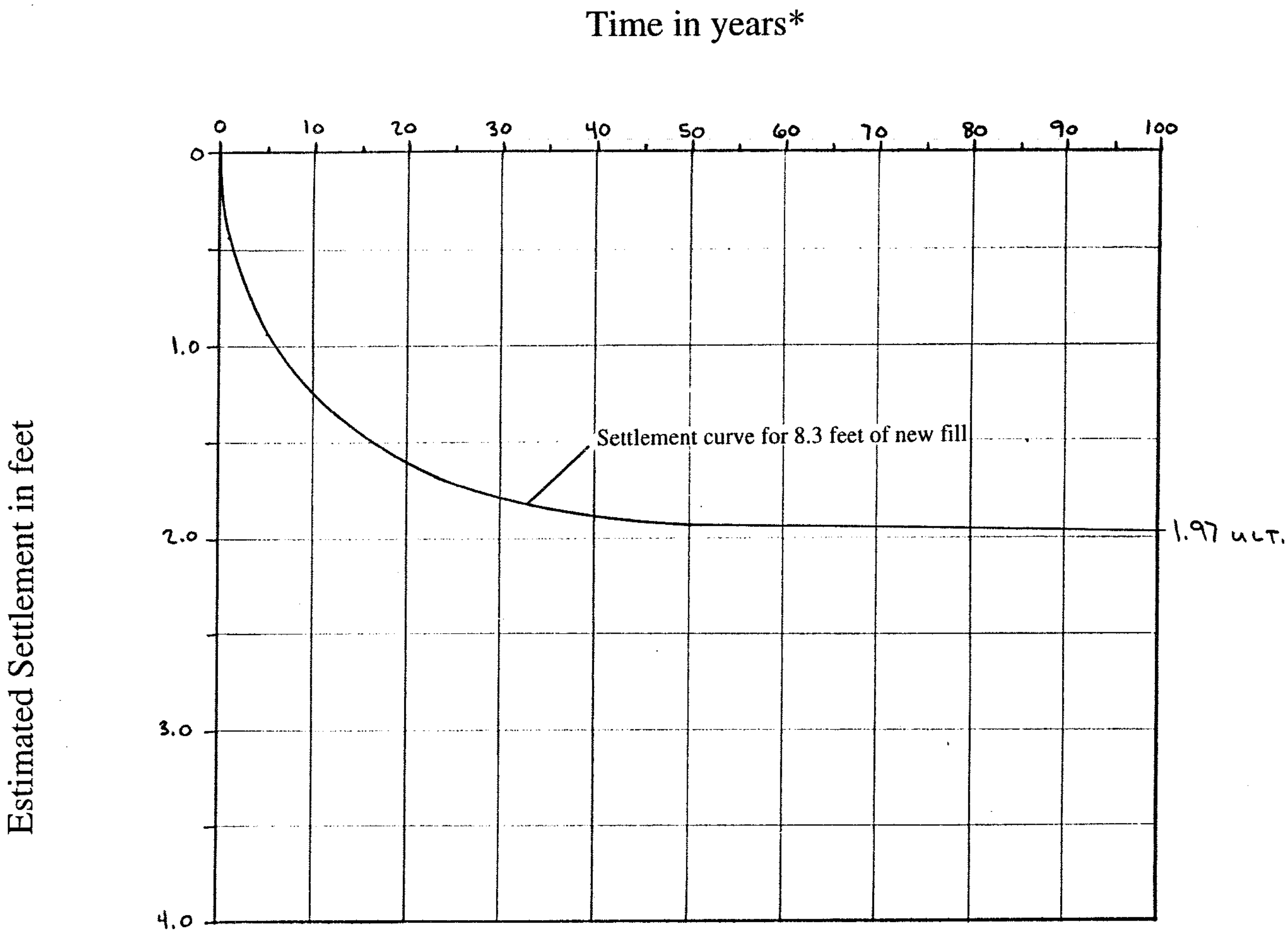
*where "0" represents the time when the new fill is placed

Note: The amount of new fill was based upon the 8-12-2003 grading plan by Burns & McDonnell (Sheet 3 of 14)

Job No. **03-3324**	Michelucci & Associates, Inc.	Figure **27**

SETTLEMENT vs TIME CHART AT RRG-10

EXISTING CONDITIONS: FILL: 6 ft.
BAY MUD: 22 ft.
DRAINAGE: Single



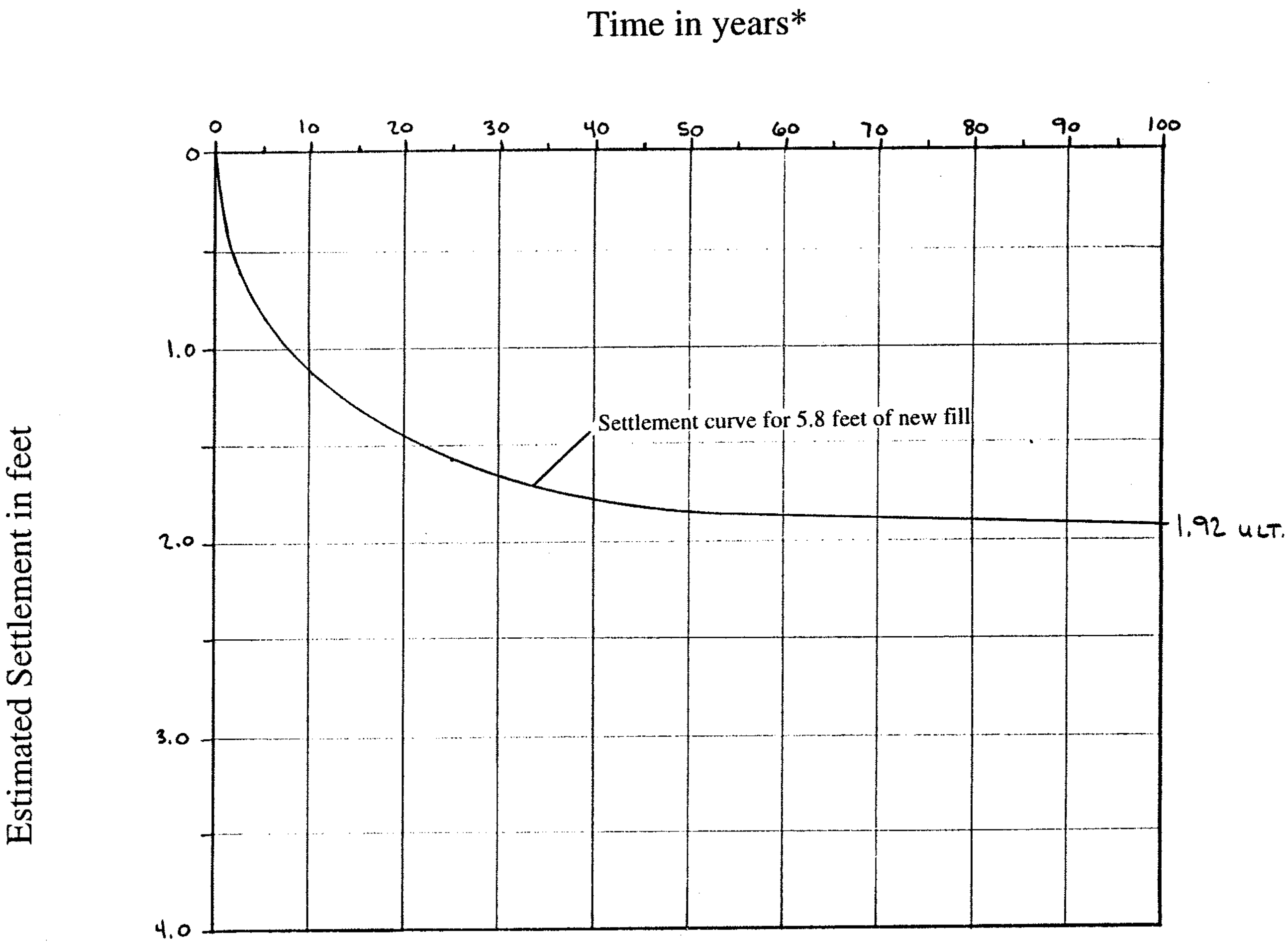
*where "0" represents the time when the new fill is placed

Note: The amount of new fill was based upon the 8-12-2003 grading plan by Burns & McDonnell (Sheet 3 of 14)

Job No. **03-3324**	Michelucci & Associates, Inc.	Figure **28**

SETTLEMENT vs TIME CHART AT RRG-11

EXISTING CONDITIONS: FILL: 9 ft.
BAY MUD: 47 ft.
DRAINAGE: Double



*where "0" represents the time when the new fill is placed

Note: The amount of new fill was based upon the 8-12-2003 grading plan by Burns & McDonnell (Sheet 3 of 14)

Job No. 03-3324	Michelucci & Associates, Inc.	Figure 29

APPENDIX B
Bedrock Investigation Report
December 16, 2003

Burns & McDonnell
SINCE 1898

December 16, 2003

Mr. Hubert Chan
SamTrans Engineer
Peninsula Corridor Joint Powers Board
P.O. Box 3006
San Carlos, CA 94070-1306

Subject: **Workplan for Geotechnical Borings near MP 6.18**
Former Bayshore Railyard and Landfill, Brisbane, California

Dear Mr. Chan:

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) has prepared this workplan to describe proposed drilling activities at the former Bayshore Railyard property located in Brisbane, California (Figure 1). The geotechnical borings will be drilled in between the Peninsula Corridor Joint Powers Board (PCJPB) railroad tracks, along the alignment of the new culvert just north of MP 6.18 (Figure 2). The primary objective of this investigation is to supplement information already obtained from recent geotechnical drilling activities.

1.0 SITE DESCRIPTION

The site is the former Bayshore Railyard and Landfill property located in Brisbane, California. As shown in Figure 1, the railyard is generally bounded by Sunnydale Avenue to the north, the PCJPB railroad to the east, Ice House Hill to the south, and Bayshore Boulevard to the west. The landfill is bounded on the east by U.S. Highway 101, on the west by the PCJPB railroad, and on the south by the Guadalupe Lagoon. The northern edge of the landfill lies approximately midway between a row of properties located directly north of Beatty Avenue. Tunnel Avenue subdivides the 275-acre landfill into a 240-acre parcel that lies to the east and a 35-acre parcel that lies to the west of the road.

The railyard is currently vacant, except for several commercial businesses along Industrial Way. Various concrete foundations, utility poles, abandoned subsurface utilities and miscellaneous railyard infrastructure are located at the site. An active City of Brisbane water line and an out-of-service fuel line are present at the site. After landfilling of wastes was discontinued at the Brisbane Landfill in 1967, a cover of undocumented depth and soil type was placed over the site. Subsequently, and continuing to the present day, additional clean soil fill has been placed over much of the landfill.

393 East Grand
Suite J
South San Francisco, California 94080
Tel: 650 871-2926
Fax: 650 871-2653
www.burnsmcd.com
California Contractor #709602

Currently, a surface water drainage ditch (CDC), brick arch sewer and timber box culvert convey storm water from the site and portions of the watershed west of Bayshore Boulevard out to the San Francisco Bay. A new culvert under the PCJPB railroad is being designed to accommodate future storm water flows.

2.0 TECHNICAL APPROACH

Burns & McDonnell propose to drill three to four borings, depending on field observations, between the tracks to the top of bedrock. Previous drilling activities indicated that bedrock was encountered at 40 feet below ground surface (bgs) on the east side of the tracks and 10 feet bgs on the west side, CDC-5 and CDC-6, respectively. The additional borings will more precisely determine the elevation of the top of bedrock across the proposed culvert alignment and determine the properties of the subsurface materials to aid with the design of shoring and dewatering systems for the future box culvert construction project.

Burns & McDonnell will hire a drilling subcontractor to perform the investigation using a standard track-mounted drill rig that can easily maneuver on railroad tracks. All drilling within the right-of-way will be performed in accordance with a PCJPB approved workplan and subsurface conditions will be restored in accordance with PCJPB guidelines.

2.1 Permitting

Burns & McDonnell understands that before any field activities performed in the right-of-way can proceed the following agreements must be in place:

- Sunquest has to submit a Service Agreement with the PCJPB;
- Sunquest has to submit a License Agreement with the PCJPB, if required;
- Sunquest has to submit a Right-of-Entry Agreement with the PCJPB;
- Sunquest has to submit a Standard Encroachment Permit Application; and
- Sunquest has to submit a Construction and Maintenance Agreement with the PCJPB.

In addition, it is Burns & McDonnell's understanding that no work can proceed without written approval from the PCJPB, which may involve meetings to discuss the approach, timing, and methods described in this workplan.

The San Mateo County Department of Health Services requires that a drilling permit be submitted prior to any field activities. Burns & McDonnell will also obtain the necessary approval for this agency.

2.2 Utility Clearance

In an effort to minimize track disruption and protect workers, the planned drilling locations will be marked in the field with white paint from the east and west sides of the railroad tracks. After marking the location, Burns & McDonnell will notify Underground Service Alert (USA), who, in turn, will notify utility companies that may have underground utilities extending from the property boundaries into the planned drilling area. The utility companies will mark their locations adjacent to property boundaries, as necessary, and may notify Burns & McDonnell of any additional concerns that may extend into the planned excavation area.

As shown in Figure 2, the only known utilities that are in the vicinity of the drilling locations are an active City of Brisbane water line and an out-of-service fuel line. The drilling locations have been adjusted, so as to avoid these areas completely.

2.3 Timing of Activities

PCJPB railroad tracks are currently only active during the business week (Monday through Friday), with resumption of weekend service in March 2004. In order to avoid track disruption and passenger service, any field activities described herein that will take place within the PCJPB right-of way will occur on weekends only, prior to resumed weekend train service.

Burns & McDonnell understands that freight train service is still active during weekend shutdown service, and would request that PCJPB provide staff to conduct field oversight and flagman protection. It is also Burns & McDonnell's understanding that these services will be billed directly to Sunquest's Service Agreement contract with PCJPB.

2.4 Training Requirements

In order to conform with PCJPB safety requirements, all field personnel will complete the Roadway Worker Protection training program and have a sticker appropriately displayed on their hard hat as evidence of the training.

All individuals entering and working within the PCJPB right-of-way will wear necessary personal protective equipment (PPE), including hard hats, safety glasses, and reflective vests.

2.5 Subcontractor Oversight

Burns & McDonnell will hire a drilling subcontractor to perform all drilling operations, but will have constant oversight over all activities. In the interest of track and worker safety, Burns & McDonnell is requesting that an Amtrak flagman and anyone else PCJPB deems necessary to be present for all drilling activities as well.

2.6 Manning and Track Protection Plan

Burns & McDonnell is proposing to access all boring locations from the railyard (west side), as this is the most convenient and safest approach. When moving the drilling rig over rail lines, the drilling subcontractor will use a planking system to avoid direct contact with the tracks.

It is the express belief of Burns & McDonnell and the drilling subcontractor that the tracks will not be impacted or damaged in any way during drilling activities.

2.6.1 Planking Plan

Burns & McDonnell understands that planking is necessary to protect the tracks while moving equipment, and to effectively distribute the equipment weight. There are many types of planking sequences that would work for these activities. Burns & McDonnell is proposing a method that will allow activities to proceed efficiently, and which do not require an additional outside contractor to complete the system.

The planking plan proposed includes the use of blocks and standard lumber. This system will be placed over rail lines anytime the drilling equipment is moved. Railroad tie block that are in good condition will be placed parallel to the track lines. It is our understanding that the site has several piles of used railroad ties near the proposed drilling location. Careful attention will be taken to ensure that high quality materials are used in the support block system. Lumber that is at least as wide as the drilling rig tracks will then be placed on top of the blocks and secured. Given the distance between rail lines and the width of tracks on the drilling rig, Burns & McDonnell is suggesting to use a minimum of 2-inch by 12-inch by 6-foot (H x W x L) board for each side in order to move the equipment across the tracks. Since the railroad ties are taller than the rail lines, the rig will never come into contact with the tracks. This type of planking plan was chosen as it easily moveable and efficient for the onsite crew, while maintaining protection for the underlying tracks.

2.6.2 Drilling Equipment

The drilling equipment chosen to complete the geotechnical borings is the 6610DT Geoprobe® system. It is a compact, track-mounted version of the standard 6600, which is truck-mounted drill rig. This type of rig is ideal, as it is track-mounted and has a narrow profile, meaning it can easily maneuver in confined areas.

The 6610DT specifications are as follows:

- Dimensions (H x W x L): 6.2 feet x 4 feet x 7.6 feet
- Weight: 4,900 lbs.
- Track Width: 10 inches on either side
- Clearance: 13 feet
- Typical Depth: 60 to 80 feet

The rig moves using a thick grade rubber mounted over the track frame, much like the wheels on the truck-mounted rig. The total weight of the 6600-DT is evenly distributed over both of its tracks, meaning the rig can easily maneuver over all types of terrain. This even distribution is also an advantage in minimizing impact to any one section of the rail line when crossing. In addition, it weighs approximately one quarter of the weight of the standard truck-mounted rig, which should significantly minimize impact to any PCJPB right-of-way equipment.
Once the equipment has been moved over the rail lines, it will need to be aligned and anchored over the boring. The 6600-DT has hydraulic movement in all three axes, which allows for easily

alignment with the boring from a variety of angles and positions. This option, along with the other features, allows the drilling subcontractor to setup the rig in the allowable clearance, even if it varies from track to track.

2.7 **Drilling Activities**

The borings will be completed to evaluate the thickness of the fill and bay mud layers and the depth of the bedrock that underlie the new culvert alignment. The borings will be drilled with a track-mounted drill rig, using hollow stem auger technology. The borings will be completed at a ninety-degree angle to an estimated maximum depth of 40 feet. The auger hole is approximately 4 inches in diameter. Drilling depths and locations relative to the PCJPB Zone of Influence specifications are presented in Figure 3.

2.7.1 **Setup Plan**

The proposed boring locations are between the tracks of the four main lines (MT1 through MT4) and the Visitacion Lead, as presented in Figure 3. In order to access these borings, Burns & McDonnell is proposing to place restrictions (PCJPB's Form B) over this section of rail for an eight to ten hour period over the weekend shutdown. Under this restriction, it is Burns & McDonnell's understanding that the tracks will be active, but all trains will need the authorization of the Amtrak flagman to pass through the designated section of rail.

Exact boring locations will be marked in white paint, while under Form B protection. The crew will setup at each location in such a way that the rig will not be on top of or touching any track line while drilling. Should an emergency situation arise, the drilling rig has the ability to be unhooked from the boring location and moved out of the way quickly.

Setup of the drilling equipment requires minimal effort. The operator, once over the boring, will anchor the rig in place by lowering the footings, raise the mast, and attach augers to the hammer system. From setup to completion, one boring is expected to take approximately one and one-half to two hours to finish.

2.7.2 **Schedule**

This schedule presents a tentative plan for how the drilling equipment will be moved across the PCJPB right-of-way. This plan lays out a conservative estimate of how drilling activities will be completed. In the event that the borings are completed ahead of schedule, a fourth boring will be added to the plan. This boring will completed between MT4 and the Visitacion Lead. The order presented below will not change, the additional boring, TR-4, will be completed at the end of the sequence as noted below.

As evidenced in this schedule, each track, with the exception of MT3, will be crossed over twice. MT3 does not need to be crossed at any point in the drilling sequence, as it is the easternmost track, and Burns & McDonnell is not proposing to complete any borings east of this line.

800 Lay wooden planks over Visitacion Lead and MT4 and move rig.

900 Setup boring between MT2 and MT4.

915 Drill TR-1

1045 Complete TR-1. Lay down planks and move across MT2.

1100 Setup boring between MT1 and MT2.

1115 Drill TR-2

1245 Complete TR-2. Lay down planks and move across MT1.

1300 Setup boring between MT1 and MT3.

1315 Drill TR-3

1445 Complete TR-3. Setup planks to move back over MT1, MT2, and MT4.

1500 Move back over tracks. If time permits, drill rig will setup and complete TR-4 between the Visitacion Lead and MT4 (Time would have to be about 1400).

1530 Grout borings and move drill rig out of PCJPB right-of-way.

1630 Restore to original conditions. Ensure that tracks have been cleared of any debris, etc.

1700 Off site.

3.0 REPORT PREPARATION

A formal report will not be prepared for this investigation. Burns & McDonnell will collect pertinent information, including drilling locations, sketches of the boring logs, and tabulated drilling data. This supplemental information will be used during the preparation of detailed construction cost estimates and specifications for the new culvert.

Burns & McDonnell trusts this information will serve your needs at this time. If you have any questions or comments regarding this report, please contact me at (650) 871-2926.

Sincerely yours,

Gary P. Messerotes. RG
Senior Project Manager

Attachments:	Figure 1	Site Location Map
	Figure 2	Site Plan Showing Drilling Location
	Figure 3	Zone of Influence Showing Drilling Location

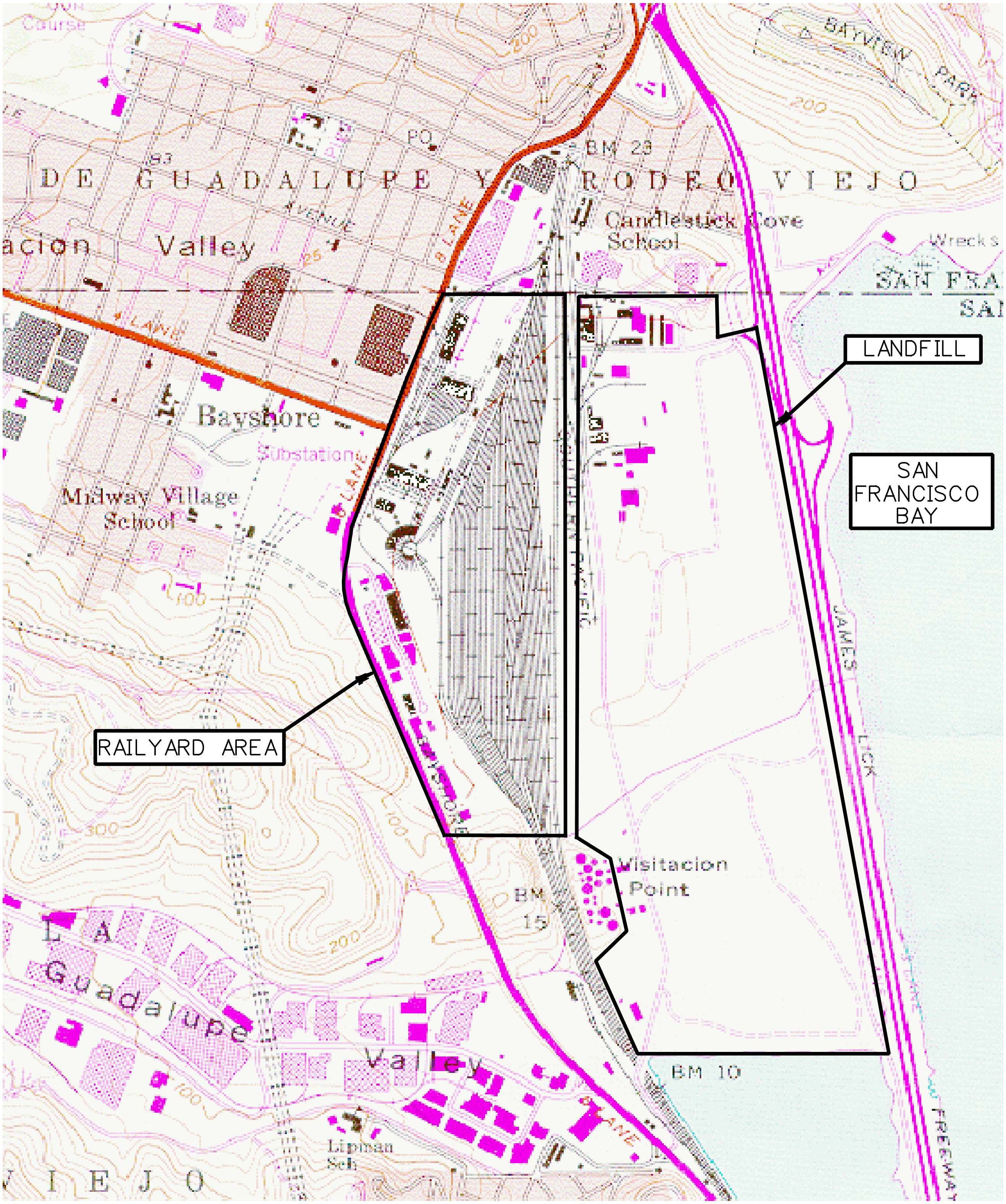
cc: Dave Silverstein, Burns & McDonnell
Jason Lin, Sunquest Properties, Inc.
Charles Ice, San Mateo County Division of Health Services

Below is a table summarizing the bedrock investigation near MP 6.18. Locations are referenced to the four sets of tracks that bisect the investigation. All three borings were drilled using a hollow stem auger to a depth of 4 to 4.5 feet. Below 4.5 feet all three borings were geoprobed to their total depths.

Boring I D	**Location**	**Depth of fill (BGS)**	**Depth of Bay Mud (BGS)**	**Depth of Bedrock (BGS)**	**Depth wet conditions encountered (BGS)**	**Total Depth (BGS)**
TR – 1	Between MT4 and MT2	Surface to 14.5 feet	14.5 to 31.5 feet	31.5 to 33 feet	8.5 feet	33 feet
TR – 2	Between MT1 and MT3	Surface to 21 feet	21 to 44.5 feet	44.5 to 46 feet	6.6 feet	46 feet
TR – 3	Between MT4 and Visitacion Lead	Surface to 19 feet*	19 to 28.5 feet*	28.5 to 31 feet	8.5 feet	31 feet

* Contact between fill and Bay Mud may occur at a shallower depth. Contact referenced by soft gray clay. Exact depth of fill and Bay Mud contact is unknown, due to no recovery between the depth of 14 and 19 feet.

FIG1TWOSITES.DGN/11-19-2003 1:18/FBK:\SUNQUEST\USTN.MISC



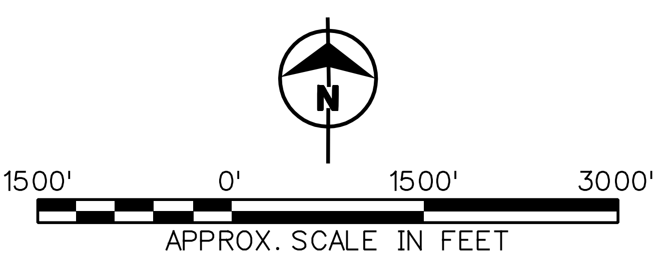


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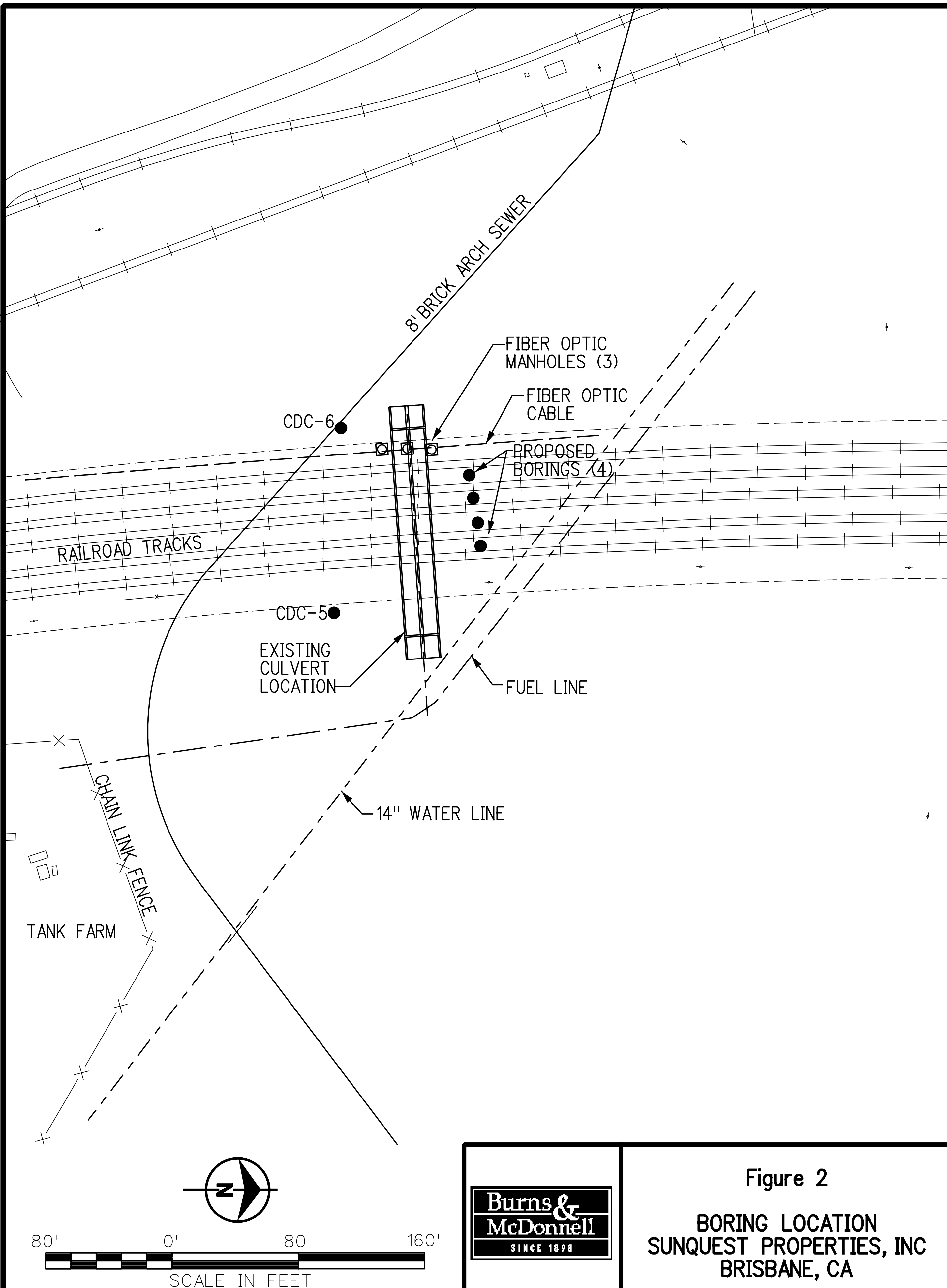
Figure 1

SITE LOCATION MAP
SUNQUEST PROPERTIES, INC.
BRISBANE, CA



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SINCE 1898

Figure 2

BORING LOCATION
SUNQUEST PROPERTIES, INC
BRISBANE, CA

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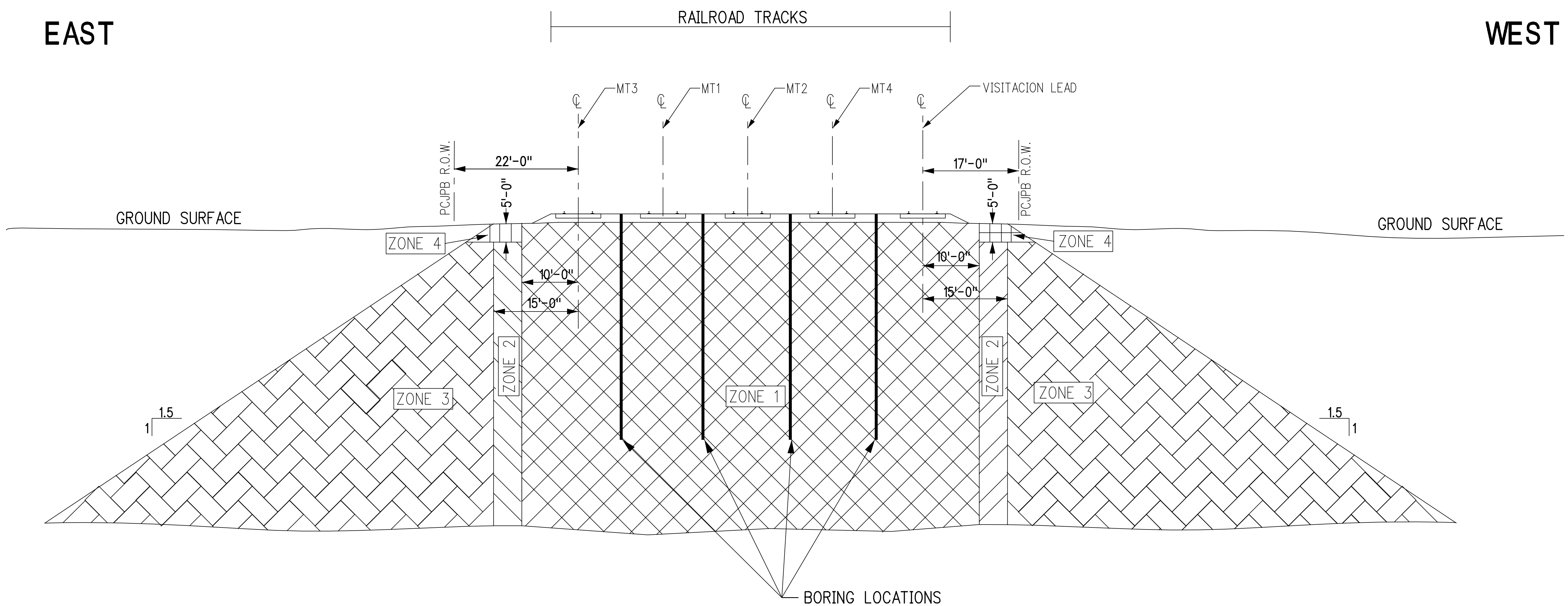

NOTES

1. BORINGS WILL BE DRILLED APPROXIMATELY ONE HUNDRED AND FIFTY FEET NORTH OF THE TIMBER BOX CULVERT (MP 6.18).
2. BORINGS WILL BE DRILLED TO THE TOP OF THE BEDROCK, ESTIMATED TO BE FORTY FEET BELOW GROUND SURFACE.
3. ZONE DESIGNS ARE BASED ON PCJPB GUIDELINE FOR EXCAVATION SUPPORT SYSTEMS-RAILROAD ZONE OF INFLUENCE (FIGURE 2.1).
4. TRACK ALIGNMENT IS BASED ON PCJPB RAILSURVEY (DWG. NO. C2206) - TYPICAL SECTION AT ARCH CULVERT MP 6.18 (STATION 282+46).

20' 0' 20' 40'
SCALE IN FEET

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SINCE 1898

Figure 3

PROPOSED BORING LOCATIONS
SUNQUEST PROPERTIES, INC.
BRISBANE, CA

<u>APPENDIX C</u>

Central Drainage Channel Mitigation Design Storm Water Report

July 15, 2004

Central Drainage Channel Mitigation Design Stormwater Report

Prepared For

Sunquest Properties Inc.

July 15, 2004

Burns & McDonnell Engineering Company
33107

CENTRAL DRAINAGE CHANNEL MIGATION DESIGN

STORMWATER REPORT

FOR

SUNQUEST PROPERTIES INC.

INDEX

Certification

CENTRAL DRAINAGE CHANNEL MITIGATION DESIGN
STORMWATER REPORT

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PAGE NO.

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INTRODUCTION

Sunquest Properties Inc. (Sunquest) is under order (# 01-041) of the Regional Water Quality Control Board to implement remedial measures to prevent leachate from discharging to waters of the State or of the United States via an open channel traversing the former Brisbane Landfill. The existing channel is commonly referred to as the Central Drainage Channel (CDC) and it conveys runoff from a significant upstream watershed including portions of the City of Brisbane, Daly City, and the former Southern Pacific Railroad Yard (railyard) owned by Sunquest. The proposed Central Drainage Channel Remediation project must not only address the Regional Board's order; it must also address the stormwater management requirements of any future development of Sunquest property and the offsite portions of the watershed. Sunquest is currently seeking approval for site development within both the railyard and the landfill portions of the watershed. Therefore, this report describes the hydrologic and hydraulic design of the proposed CDC improvements and its ability to convey "future" stormwater flows.

This report is intended to be a supplement to previous reports produced by Burns and McDonnell and others. Information contained in these reports will be referred to in this report, it will not be repeated in detail. Sunquest has submitted each of the reports to the City of Brisbane (City). The referenced reports are:

- *Eastern Bayshore Storm Drainage Outfall Study* by Brian Kangas Foulk (BKF) Consulting Engineers (1995)
- *Brisbane Baylands Stormwater System Report* by Burns & McDonnell (2001)
- *Interim Grading Plan Stormwater Report* by Burns & McDonnell (2004)

EXISTING CONDITIONS

The *Interim Grading Plan Stormwater Report* contains a detailed description of existing (2004) conditions within the watershed. The report describes the existing drainage system network including the CDC. Hydrologic and hydraulic modeling of the watershed was performed for the 100 year storm event (combined with a high tide) utilizing the storm water management model XP – SWMM and the following results were obtained:

- The brick arch sewer extending from Bayshore Blvd. to the CDC does not have adequate capacity to convey stormwater flows.

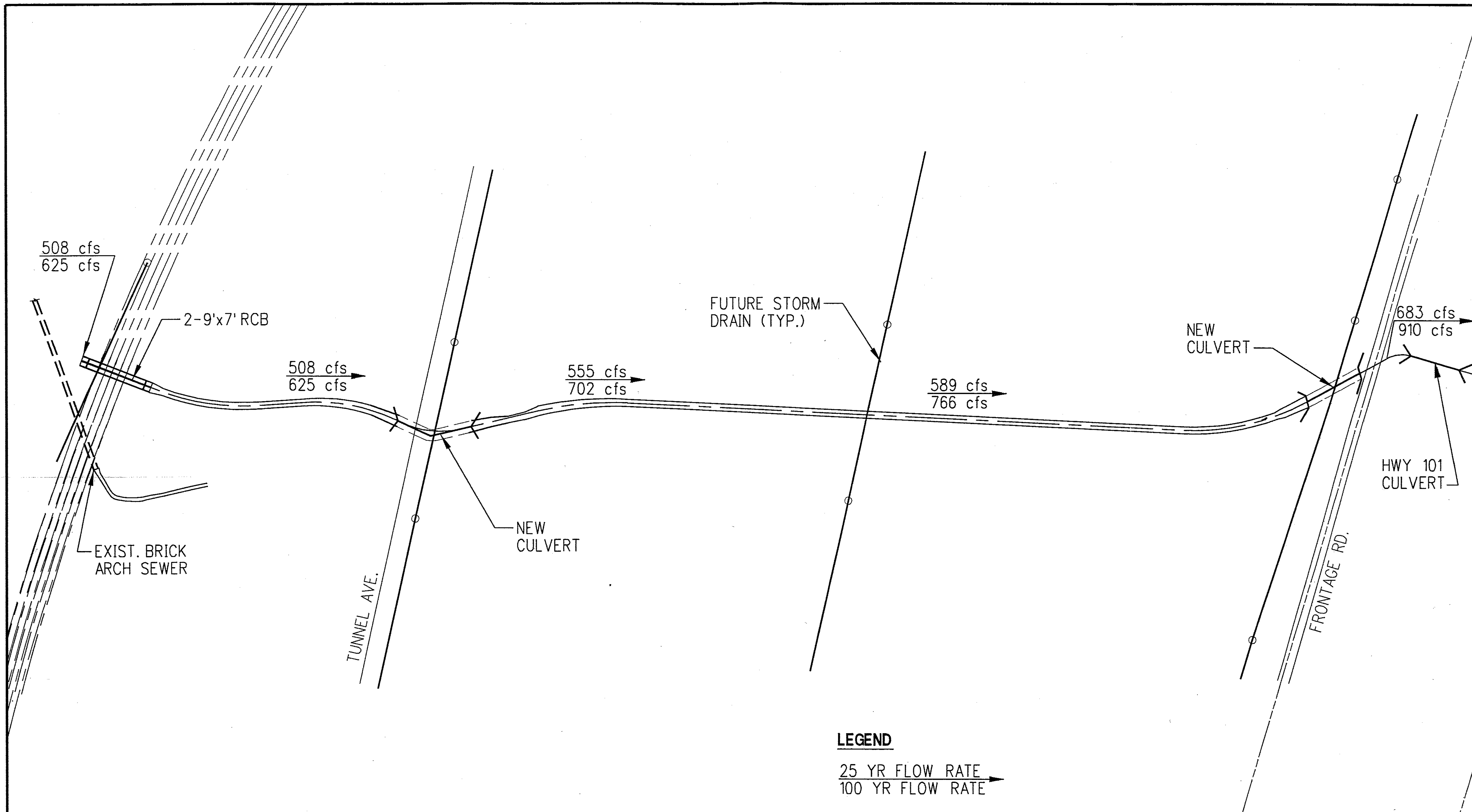
- Flooding on Bayshore Blvd occurs as predicted in the 1995 BKF report and as observed by City staff. The model predicts that flooding during the 100 year event will reach an elevation of 8.4' (approx. 0.4' above grade) and the duration of flooding is approx.5 to 6 hours. A copy of the stage versus time graph at Bayshore from the 2004 report is included in Appendix A of this report.

FUTURE CONDITIONS

Future conditions within the portion of the watershed west of Bayshore Blvd. are not expected to change markedly from existing conditions, because much of the watershed is fully developed. However, conditions within the railyard and landfill are expected to change significantly due to development of the areas by Sunquest. Sunquest has submitted a preliminary plan or "bubble plan" to the City showing that the site will be developed for commercial proposes with varying degrees of development density. The bubble plan also shows that numerous park features will be incorporated into the proposed development including a "river park" in the railyard and a park feature encompassing the CDC.

The proposed development plan for the railyard and landfill are in the initial planning stages only and the breakdown of land use between developed areas and park lands will likely undergo changes as the plans progress. Given this uncertainty, Sunquest directed Burns & McDonnell to proceed with a conservative or worst case design approach and assume that the majority of the site is fully developed, and that the proposed river park provides little or no storage for stormwater. By taking this approach, the CDC will be designed to convey the highest possible stormwater flow rates. If the actual development plan does incorporate on-site storage and less dense land uses, the channel will be over-designed and will convey flows more efficiently.

The 2001 *Brisbane Baylands Stormwater System Report* was developed based on full development of the railyard and landfill with no provisions for a river park. Therefore, the stormwater flows presented in that report for the 25 and 100 year events (with fixed high tide) can be considered worst case. The predicted flow rates in the CDC, from just upstream of the Caltrain tracks to Highway 101, were used as the basis of design for the current CDC improvements. The flows taken from the report and utilized for the current design are shown in Table 1 and in Figure 1.



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SINCE 1898

date JULY, 2004

CENTRAL DRAINAGE CHANNEL

FIGURE 1
STORM WATER FLOWS FOR
25 AND 100 YR. STORMS

project 33107

contract

dwg. no.

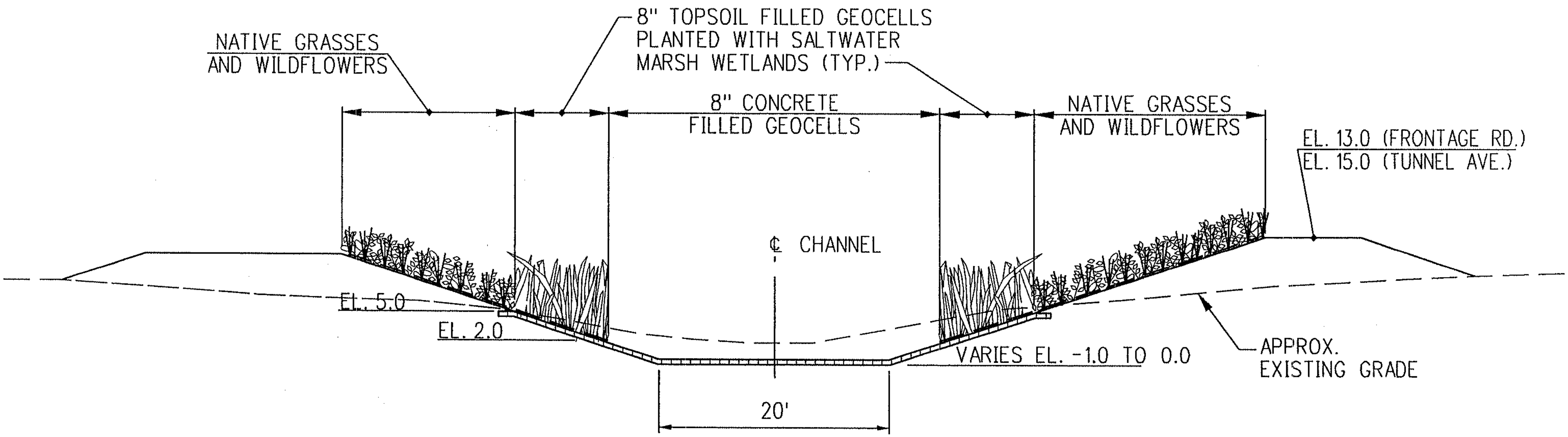
Table 1 – CDC Design Flow Rates

Location	25-yr Flow (cfs)	100-yr Flow (cfs)
Upstream of Caltrain ROW to Downstream of Tunnel Ave Culvert	508.72	624.88
Downstream of Tunnel Ave Culvert to Channel Midpoint	554.57	702.25
Channel Midpoint to Downstream End Frontage Road Culvert	588.58	766.14
Downstream of Frontage Road Culvert to Downstream of 101 Culvert	682.89	910.35

PROPOSED CHANNEL CONFIGURATION

The CDC was designed for the purposes of stormwater conveyance and to achieve mitigation of wetlands on the existing channel side slopes that will be destroyed during construction. The channel will be a typical trapezoidal configuration with 3:1 side slopes. The channel invert wills closely approximate the existing channel inverts of –1.0' National Geodetic Vertical Datum (NGVD) at the eastern end of the landfill (future Frontage Road), and 0.0' NGVD at both Tunnel Avenue and the Caltrain tracks. The channel invert and the sides slopes up to elevation 2.0' NGVD will be lined with concrete filled geocells for protection of the underlying liner and cover material. From elevation 2.0' to 5.0' NGVD, the geocells will be planted with different varieties of saltwater wetland plants. The remainder of the channel side slopes will be planted with native grasses and wildflowers. A graphical representation of the proposed channel cross section is shown in Figure 2.

Culvert crossings of the CDC are required at the Caltrain tracks, Tunnel Ave., and at Frontage Road (see Figure 1). The Caltrain culvert will consist of two 9' x 7' precast reinforced concrete boxes (RCBs) that are intended to pass flows from the Brick Arch Sewer and the future railyard development under the railroad right-of-way (ROW). The culvert was made large enough to pass flows form the Brick Arch Sewer because it was assumed that the portion of the Brick Arch Sewer lying within the ROW might be abandoned in the future. The culvert crossings at Tunnel Ave. and Frontage Road will consist of CON/SPAN culvert systems (arch culverts). The CONSPAN culverts were selected because their appearance is more aesthetically pleasing than typical concrete box culverts and they will fit in well with the proposed park setting envisioned for the CDC. The structure sizes were determined by hydraulic



TYPICAL CHANNEL SECTION BETWEEN RAILROAD R.O.W. AND FRONTAGE RD.

NOT TO SCALE

Burns & McDonnell SINCE 1898 date JULY, 2004	**CENTRAL DRAINAGE CHANNEL** FIGURE 2 TYPICAL SECTION	project 33107 contract dwg. no. rev.

modeling as described in subsequent sections. It should be noted that the Tunnel Ave. culvert will consist of a double span structure due to foundation requirements determined by future fill heights. The actual or proposed future ROW widths and fill slope lengths at each location determined the culvert lengths.

The channel invert a short distance upstream of the Frontage Road culvert will be raised to elevation 2.0' NGVD, in order to permit 2 to 3 feet of water to be held in the channel at all times. The water is being held in the channel to help provide additional weight to offset bouyant forces acting on the liner that will be buried 5' below the channel invert. The water will also serve to soften the look of the concrete portion of the channel. Elevation 2.0' was selected to ensure that the daily tide cycle would be allowed to enter the channel and maintain the current hydrologic cycle (Mean daily high tide level is 3.1' NGVD).

MODELING AND RESULTS

The Corps of Engineers HEC-RAS computer model was used to determined the required channel width and the culvert sizes. Modeling scenarios were developed using the 25 and 100 year flow rates, the proposed channel configuration, and culvert locations. For the channel, Manning's Roughness Coefficient "N" was determined for each of the different surface treatments. The concrete filled geocells were assigned an "N" of 0.18 per the manufacturer's recommendations, the wetlands were assigned an "N" of 0.35 and the grassed slopes were assigned an "N" of 0.30. Boundary conditions consisted of a high tide elevation of 3.7' NGVD as described in both the 2001 and 2004 Burns & McDonnell reports and water surface elevations predicted in the 2001 report just upstream of the railroad culvert (@ Node 143 on the Node/Link Network Map presented in Appendix A of the 2001 report). The predicted water surface elevations are 6.4 feet for the 25 year event and 7.2 feet for the 100 year event. The 2001 report indicates that minimal flooding occurs at Bayshore Blvd. given these elevations.

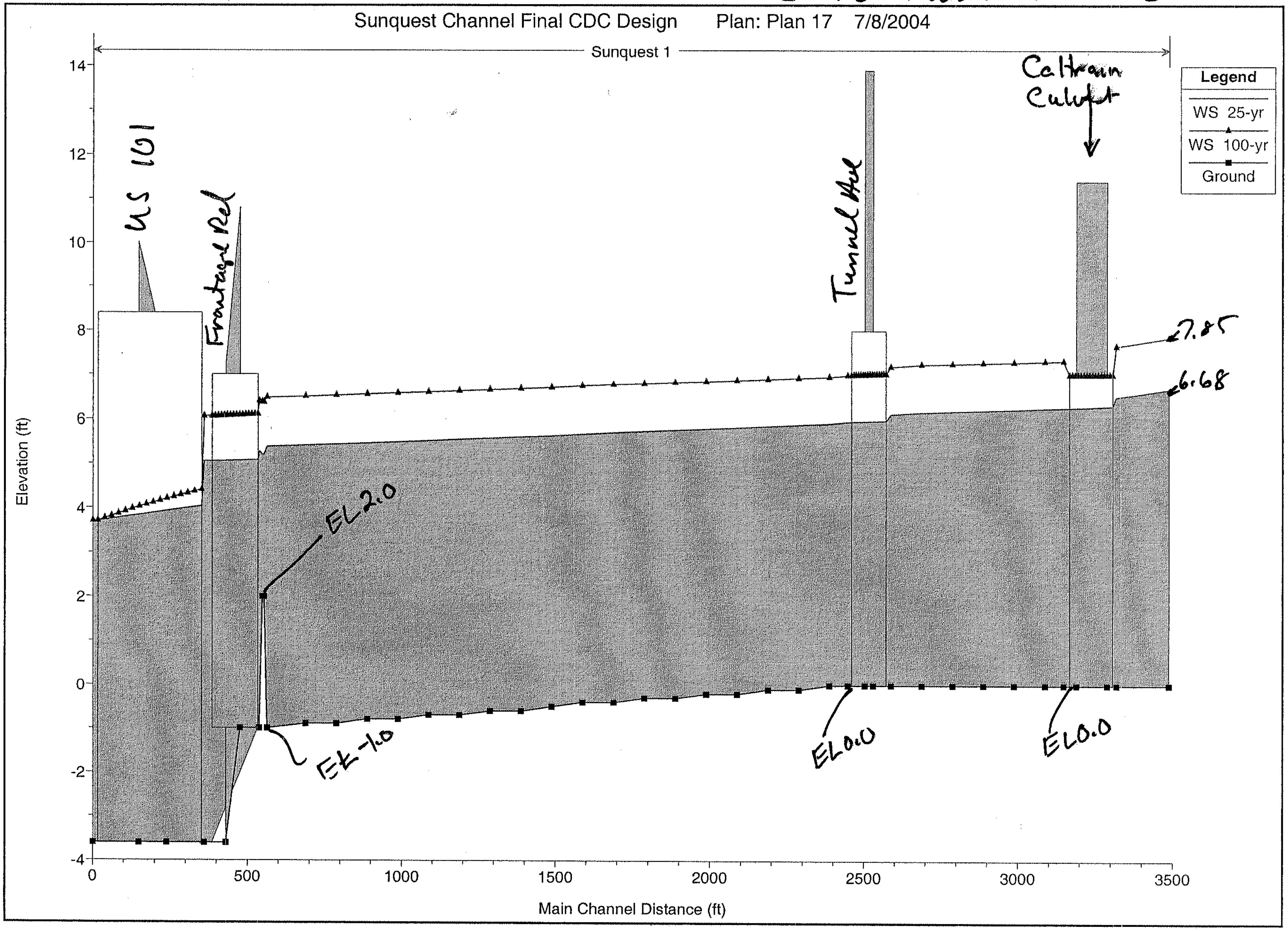
Multiple model runs were made varying the channel bottom width and the required culvert sizes. The final trial resulted in a channel with a bottom width of 20', a 24' x 8' CONSPAN culvert at Frontage Road, and 2-12' x 8' CONSPAN culverts at Tunnel Ave. The channel width was limited to a maximum of 20 feet in order to minimize the amount of refuse excavated during widening of the existing channel. The culvert under the railroad ROW was not revised and the double 9' x 7' RCBs will be used at this location because this is the maximum size that the railroad operator, the Peninsula Corridor Joint Powers Board (JPB or Caltrain), will consider for this location given the anticipated method of construction.

The final channel and culvert configuration resulted in water levels upstream of the railroad ROW of elevation 6.68' NGVD and 7.85' NGVD. The calculated levels exceeded the target levels at the upstream end of the railroad culvert; therefore additional modeling was required to determine if these stages affected flooding on Bayshore Blvd. The XP-SWMM model presented in the 2001 report was modified by reducing the size of the railroad culvert until the predicted upstream water levels approximated those obtained by the HEC-RAS modeling. The results of the revised model indicate that flooding on Bayshore does not occur during the 25 year event and flooding during the 100 year event occurs for a period of 1.5 hours with a corresponding elevation of 8.4' NGVD. This elevation is virtually identical to the level predicted for existing conditions and the duration of flooding is reduced by 4 to 5 hours.

The model results demonstrate that the proposed design for the channel and culverts in conjunction with full development of the railyard and landfill will not adversely affect flooding on Bayshore Blvd. In fact, the duration of flooding is actually reduced. If the final development plan for the site includes any type of detention or if significant park areas are provided, the runoff rates will be lower than those predicted in the 2001 report and the resulting stages in the CDC and at Bayshore Blvd. will be lower as well.

Appendix A
Modeling Results

HECRAS Model Results



HEC-RAS Model Results

WS @ upstream and railroad culvert.

HEC-RAS Plan: 20hnhf(24x8) River: Sunquest Reach: 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	34	25-yr	508.72	0.00	$\boxed{6.68}$		6.73	0.000168	1.90	267.26	60.06	0.16
1	34	100-yr	624.88	0.00	$\boxed{7.85}$		7.90	0.000133	1.83	341.68	67.08	0.14
1	33	25-yr	508.72	0.00	6.50	2.46	6.67	0.000161	3.29	154.76	59.02	0.23
1	33	100-yr	624.88	0.00	7.65	2.82	7.84	0.000140	3.43	182.38	65.93	0.22
1	32.5		Culvert									
1	32	25-yr	508.72	0.00	6.26		6.33	0.000215	2.09	242.91	57.58	0.18
1	32	100-yr	624.88	0.00	7.32		7.38	0.000176	2.04	306.84	63.89	0.16
1	31	25-yr	508.72	0.00	6.25		6.32	0.000217	2.10	242.14	57.49	0.18
1	31	100-yr	624.88	0.00	7.30		7.37	0.000177	2.04	306.14	63.83	0.16
1	30	25-yr	508.72	0.00	6.23		6.30	0.000220	2.11	240.84	57.36	0.18
1	30	100-yr	624.88	0.00	7.29		7.35	0.000179	2.05	304.97	63.72	0.17
1	29	25-yr	508.72	0.00	6.20	2.39	6.27	0.000223	2.12	239.52	57.22	0.18
1	29	100-yr	624.88	0.00	7.27	2.70	7.33	0.000181	2.06	303.79	63.60	0.17
1	28	25-yr	508.72	0.00	6.18	2.39	6.25	0.000226	2.14	238.18	57.08	0.18
1	28	100-yr	624.88	0.00	7.25	2.70	7.31	0.000183	2.07	302.60	63.49	0.17
1	27	25-yr	508.72	0.00	6.16		6.23	0.000230	2.15	236.84	56.94	0.19
1	27	100-yr	624.88	0.00	7.23		7.30	0.000185	2.07	301.40	63.38	0.17
1	26	25-yr	508.72	0.00	6.11	2.39	6.21	0.000171	2.48	205.21	56.67	0.19
1	26	100-yr	624.88	0.00	7.18	2.70	7.28	0.000141	2.54	245.72	63.06	0.18
1	25		Culvert	Tunnel ave								
1	24.5	25-yr	508.72	0.00	5.95	2.39	6.03	0.000263	2.26	225.11	55.69	0.20
1	24.5	100-yr	624.88	0.00	6.99	2.70	7.06	0.000211	2.18	286.32	61.93	0.18
1	24	25-yr	554.57	0.00	5.91		6.01	0.000320	2.49	222.94	55.46	0.22
1	24	100-yr	702.25	0.00	6.95		7.04	0.000273	2.47	283.75	61.68	0.20
1	23	25-yr	554.57	-0.10	5.88		5.97	0.000305	2.44	226.90	55.88	0.21

HEC-RAS Plan: 20hnhf(24x8) River: Sunquest Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	23	100-yr	702.25	-0.10	6.92		7.01	0.000261	2.43	288.42	62.14	0.20
1	22	25-yr	554.57	-0.10	5.85		5.94	0.000311	2.46	225.10	55.69	0.22
1	22	100-yr	702.25	-0.10	6.90		6.99	0.000265	2.45	286.71	61.97	0.20
1	21	25-yr	554.57	-0.20	5.82		5.91	0.000297	2.42	229.12	56.12	0.21
1	21	100-yr	702.25	-0.20	6.87		6.96	0.000254	2.41	291.45	62.43	0.20
1	20	25-yr	554.57	-0.20	5.79		5.88	0.000303	2.44	227.36	55.93	0.21
1	20	100-yr	702.25	-0.20	6.84		6.94	0.000257	2.42	289.79	62.27	0.20
1	19	25-yr	554.57	-0.30	5.76		5.85	0.000288	2.40	231.44	56.37	0.21
1	19	100-yr	702.25	-0.30	6.82		6.91	0.000246	2.38	294.60	62.73	0.19
1	18	25-yr	554.57	-0.30	5.73		5.82	0.000294	2.41	229.72	56.18	0.21
1	18	100-yr	702.25	-0.30	6.80		6.89	0.000250	2.40	292.98	62.58	0.20
1	17	25-yr	554.57	-0.40	5.70		5.79	0.000280	2.37	233.87	56.63	0.21
1	17	100-yr	702.25	-0.40	6.77		6.86	0.000239	2.36	297.86	63.04	0.19
1	16	25-yr	554.57	-0.40	5.67		5.76	0.000285	2.39	232.20	56.45	0.21
1	16	100-yr	702.25	-0.40	6.75		6.84	0.000242	2.37	296.28	62.89	0.19
1	15	25-yr	588.58	-0.50	5.64		5.73	0.000308	2.50	235.67	56.82	0.22
1	15	100-yr	766.14	-0.50	6.71		6.81	0.000278	2.55	299.97	63.24	0.21
1	14	25-yr	588.58	-0.60	5.61		5.70	0.000294	2.45	239.79	57.25	0.21
1	14	100-yr	766.14	-0.60	6.68		6.78	0.000266	2.51	304.73	63.69	0.20
1	13	25-yr	588.58	-0.60	5.58		5.67	0.000299	2.47	238.01	57.06	0.21
1	13	100-yr	766.14	-0.60	6.65		6.75	0.000270	2.53	302.95	63.52	0.20
1	12	25-yr	588.58	-0.70	5.55		5.64	0.000285	2.43	242.19	57.50	0.21
1	12	100-yr	766.14	-0.70	6.63		6.73	0.000259	2.49	307.77	63.98	0.20
1	11	25-yr	588.58	-0.70	5.52		5.61	0.000291	2.45	240.46	57.32	0.21
1	11	100-yr	766.14	-0.70	6.60		6.70	0.000263	2.50	306.03	63.82	0.20

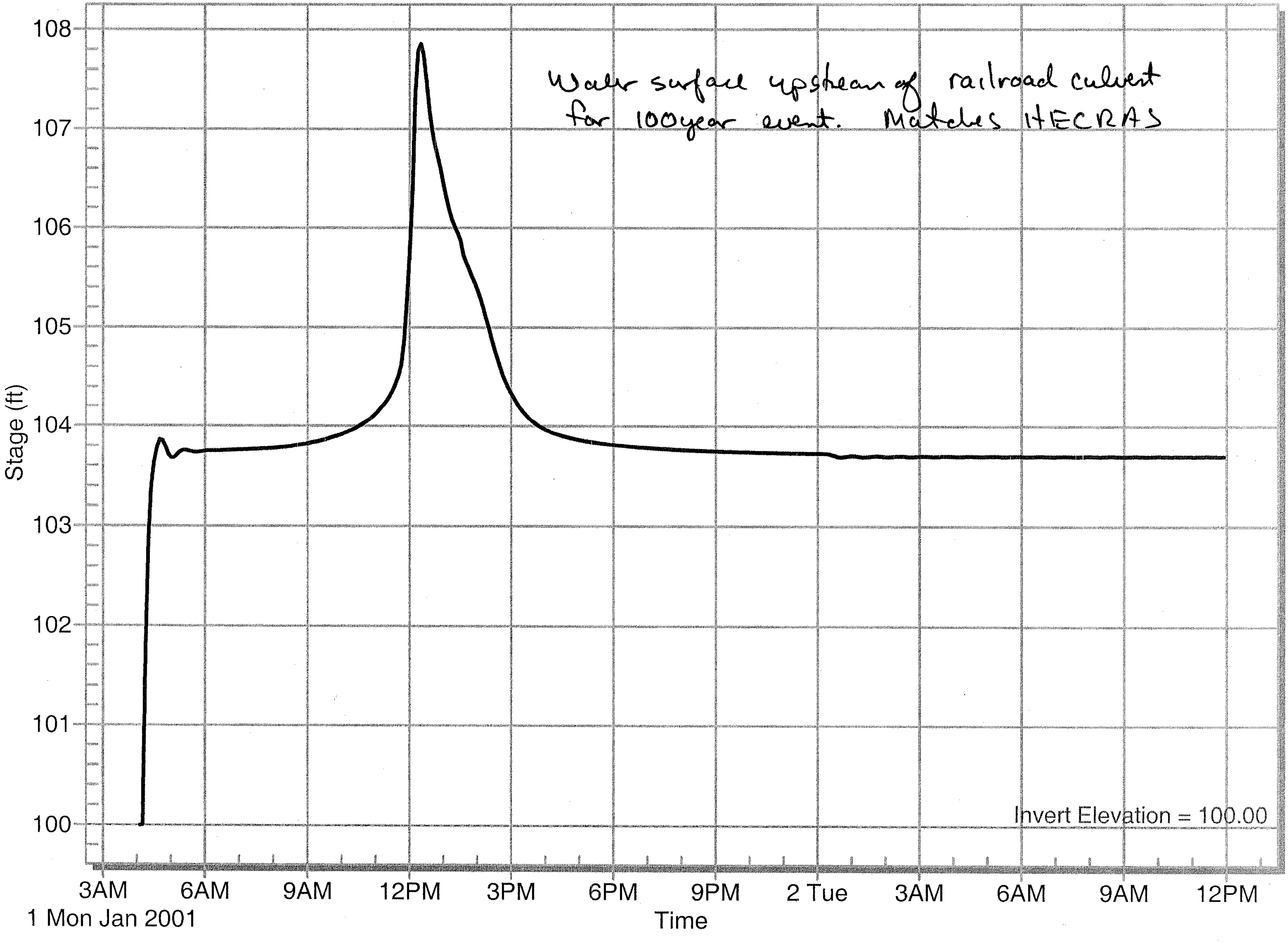
HEC-RAS Plan: 20hnhf(24x8) River: Sunquest Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	10	25-yr	588.58	-0.80	5.49		5.58	0.000277	2.41	244.71	57.76	0.21
1	10	100-yr	766.14	-0.80	6.58		6.67	0.000252	2.46	310.92	64.27	0.20
1	9	25-yr	588.58	-0.80	5.46		5.56	0.000282	2.42	243.02	57.59	0.21
1	9	100-yr	766.14	-0.80	6.55		6.65	0.000255	2.48	309.23	64.11	0.20
1	8	25-yr	588.58	-0.90	5.44		5.53	0.000269	2.38	247.33	58.03	0.20
1	8	100-yr	766.14	-0.90	6.53		6.62	0.000244	2.44	314.19	64.58	0.19
1	7	25-yr	588.58	-0.90	5.41		5.50	0.000274	2.40	245.69	57.86	0.20
1	7	100-yr	766.14	-0.90	6.50		6.60	0.000248	2.45	312.53	64.42	0.20
1	6.6	25-yr	588.58	-1.00	5.38		5.47	0.000262	2.36	249.67	58.28	0.20
1	6.6	100-yr	766.14	-1.00	6.48		6.57	0.000238	2.42	317.16	64.85	0.19
1	6.4	25-yr	588.58	2.00	5.22		5.45	0.001101	3.84	153.34	57.31	0.41
1	6.4	100-yr	766.14	2.00	6.37		6.55	0.000656	3.43	223.38	64.22	0.32
1	6.2	25-yr	588.58	2.00	5.21		5.44	0.001107	3.85	153.00	57.27	0.41
1	6.2	100-yr	766.14	2.00	6.37		6.55	0.000658	3.43	223.16	64.20	0.32
1	6	25-yr	588.58	-1.00	5.28	1.61	5.40	0.000189	2.78	211.82	57.71	0.21
1	6	100-yr	766.14	-1.00	6.39	2.04	6.53	0.000175	3.02	253.94	64.36	0.21
1	4.5		Culvert		Frontage Rd							
1	3	25-yr	682.89	-3.60	5.06	-2.10	5.07	0.000064	1.02	669.68	99.69	0.07
1	3	100-yr	910.35	-3.60	6.06	-1.78	6.08	0.000078	1.18	773.54	108.95	0.08
1	2.1		Culvert	101	Culvert							
1	1	25-yr	682.89	-3.60	3.70	-0.43	3.79	0.000594	2.46	277.73	59.70	0.20
1	1	100-yr	910.35	-3.60	3.70	0.12	3.87	0.001056	3.28	277.73	59.70	0.27

7-4

Nod - 143

[Max Stage = 107.854]



Nod · 143

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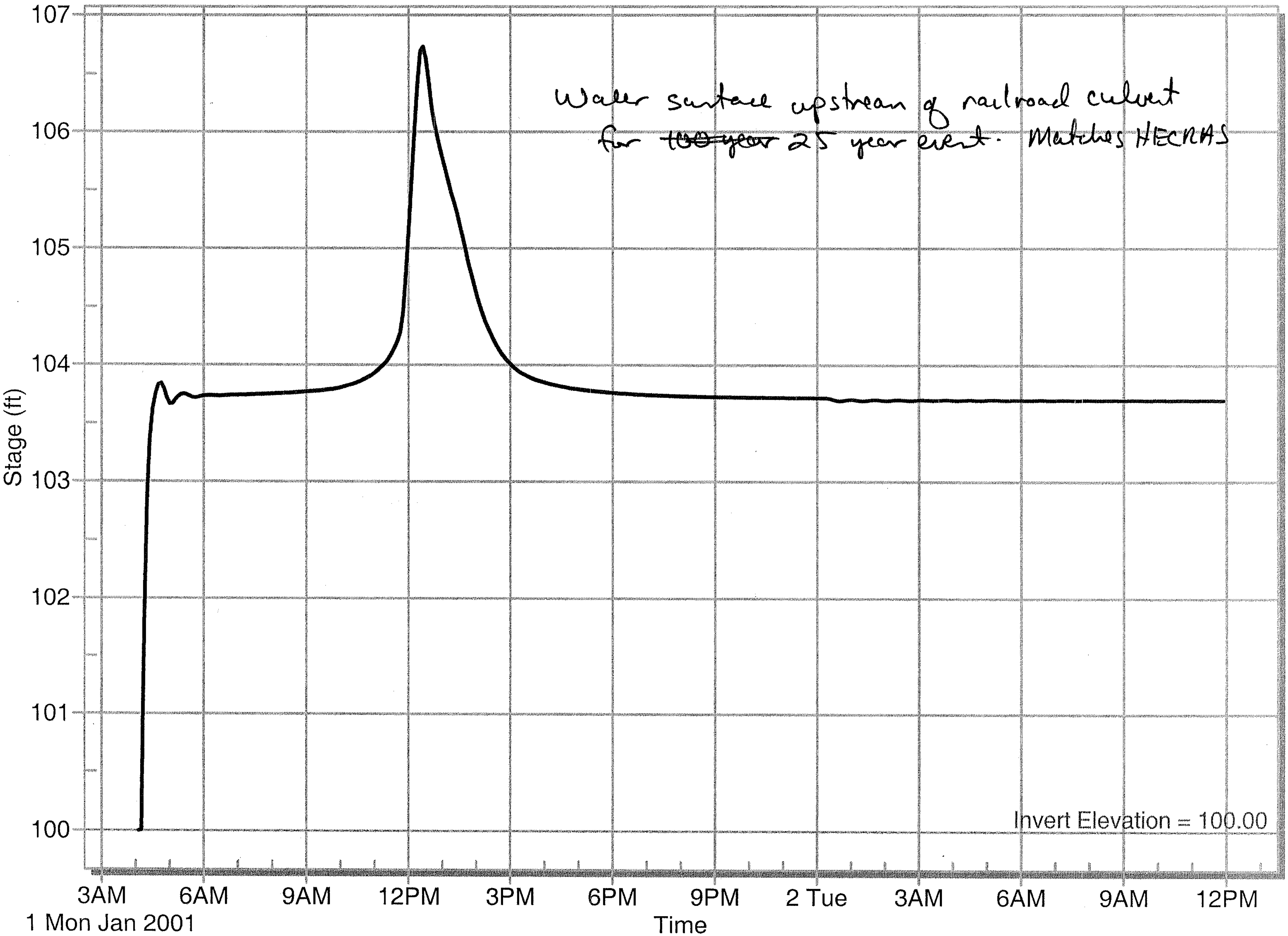

Nod · 277

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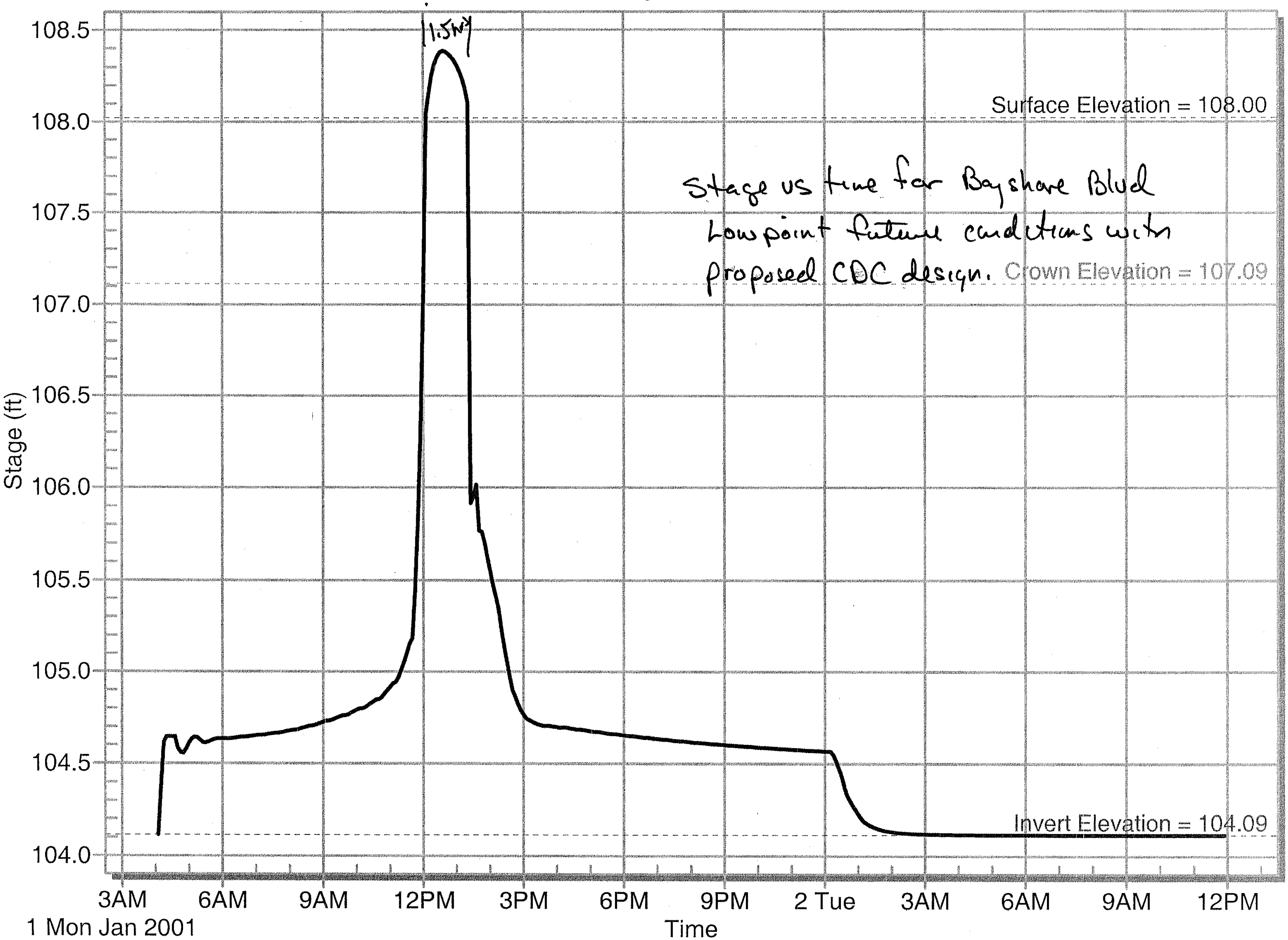

Nod · 277

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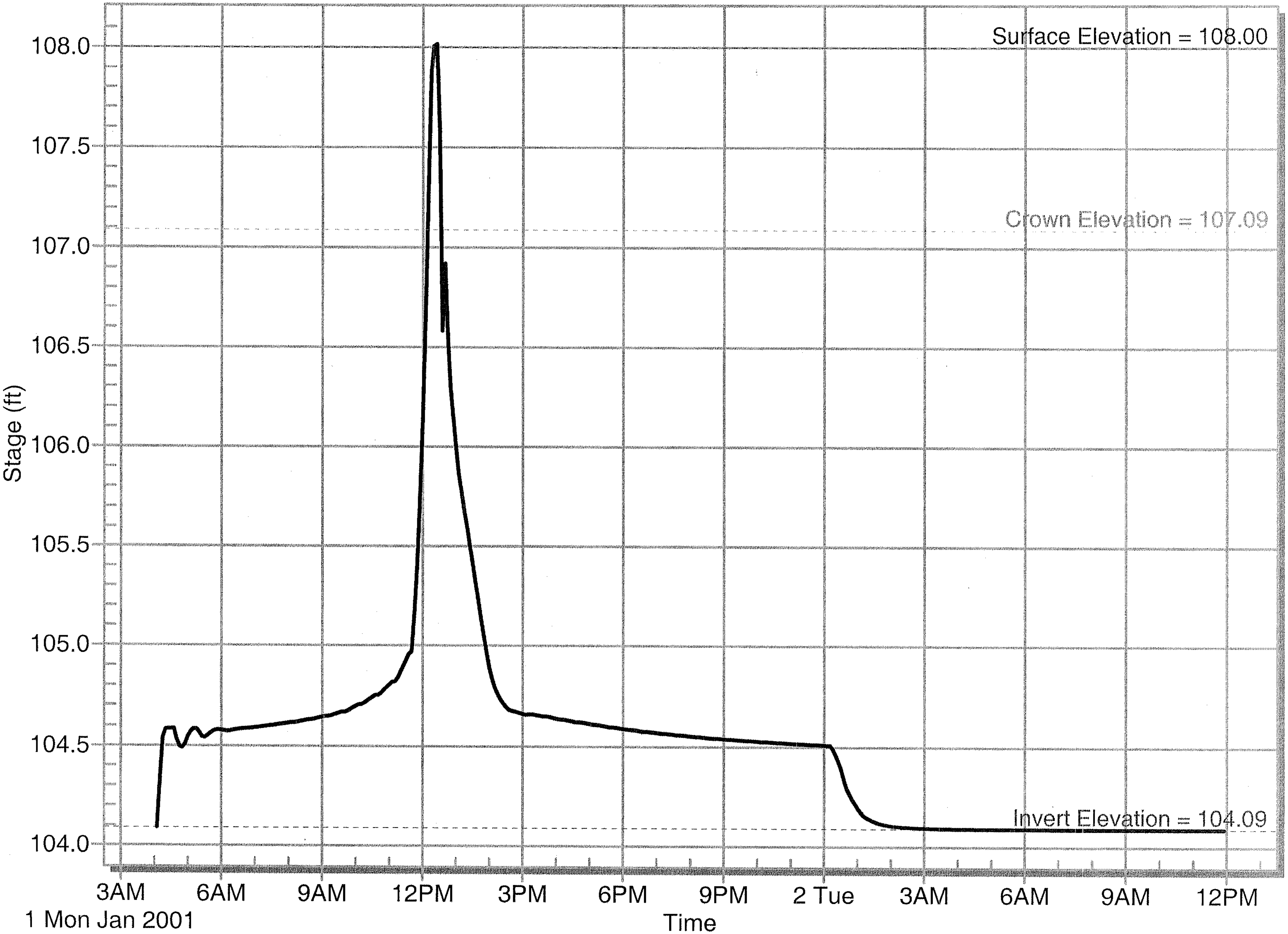
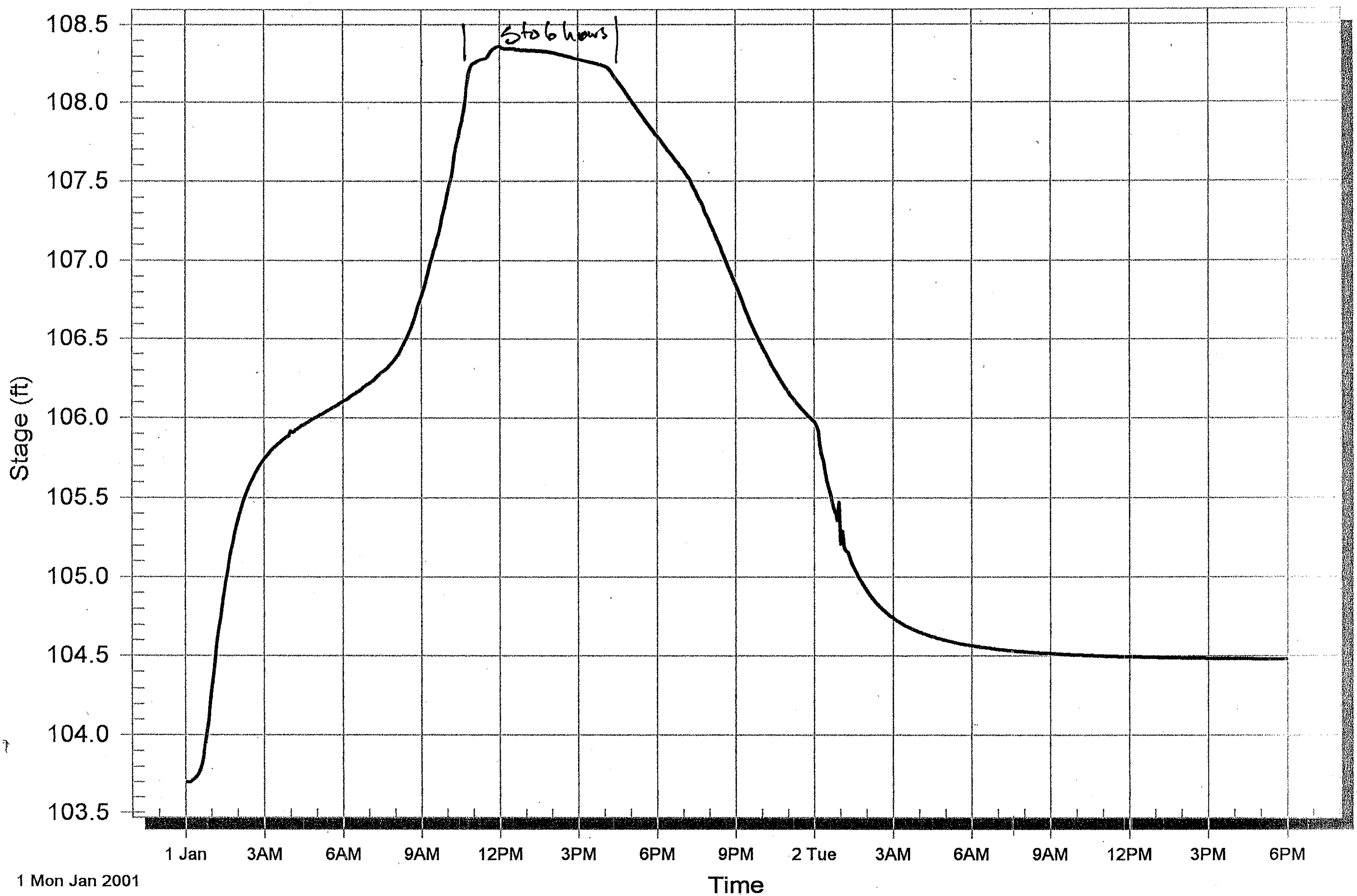


Stage vs time graph K –
Bayshore Blvd
from 2004 report.

Node - 753 Existing Conditions Bayshore Blvd

[Max Stage = 108.362] (Low Point)



<u>APPENDIX D</u>
Test Pit Report
September 2003

TEST PIT EXCAVATION
Former Bayshore Railyard- OU-2
Brisbane, CA

Prepared for:

Sunquest Properties, Inc.
150 Executive Park Boulevard, Suite 4200
San Francisco, California 94134-3309

September 2003

Prepared by:

Burns & McDonnell Engineering Company, Inc.
393 E. Grand Ave., Ste. J
South San Francisco, California

Burns & McDonnell
SINCE 1898

1.0 INTRODUCTION

Sunquest Properties, Inc. (Sunquest) retained Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) to conduct test pit investigations in the area surrounding the timber box culvert (TBC) at the Brisbane Landfill, Brisbane, California.

The test pits were excavated on the east and west sides of the Peninsula Corridor Joint Powers Board (PCJPB) railroad tracks, just north of the TBC, and at least 10 feet outside the railroad easement (Figure A-1). The primary objective of these excavations was to visually examine the fill material to see if the underlying bedrock could be mechanically removed, and to evaluate de-watering requirements during construction. These activities were completed in preparation for the installation of a new culvert across the PCJPB railroad tracks.

2.0 SCOPE OF WORK

Burns & McDonnell conducted the test pit investigations on September 4, 2003. The excavations were completed using a Komatsu 300 LC excavator, under the supervision of a C-57 licensed operator. Soil removed from the excavations was temporarily stockpiled and used for immediate backfilling activities. Due to the historic land use and visual presence of impacted soil, samples were collected from both excavations and sent for laboratory analysis.

2.1 West Side Excavation

The west side excavation was completed first to a depth of 14-feet below ground surface. Boring logs were not completed, but the excavation is photo-documented in Appendix A-1.

A solid mass was encountered about 2 feet below ground surface. It is possible that this mass was the north side of the brick arch sewer. The excavation was moved north to avoid this, but the brick and concrete structure is visible in the photos. The structure came in at an angle from the west, and was observed to leave the excavation perpendicular to the nearby JPB railroad tracks.

In general, the soil was mainly large boulders and fill, typical of earthquake fill material as reported. Groundwater was encountered at 8-feet below ground surface and was observed to enter the excavation at a rapid rate. The sidewalls were very unstable due to flowing groundwater and loosely packed fill. The excavator experienced difficulty in keeping the test pit open and preventing collapse. No sheen, prevalent odors, or visible evidence of contamination was observed on the groundwater or in the soil. There was also no presence of trash. The excavation was moved to about 10 feet below ground surface to take a groundwater sample.

Bedrock was encountered around 10-feet below ground surface, as expected from the nearby geotechnical borings. The operator was able to move earth down to about 14-feet below ground surface with little to no difficulty. The concrete and brick structure went all the way down to the bottom of the excavation.

2.2 East Side Excavation

The east side excavation was completed second to a depth of 12-feet below ground surface. Boring logs were not completed, but the excavation is photo-documented in Appendix A-1.

After just scraping the surface, a blue green layer of soil was present. In the next scoop, about 2-feet below ground surface, trash was being excavated. The excavated material had a slight odor, and was mainly wood, glass, and plastic bottles that were partially degraded. The trash appeared to be loosely compacted, and was easily excavated. From 4 to 6-feet below ground surface, water was not encountered, but the soil appeared wet, black, and viscous. This observation confirmed what the nearby geotechnical boring reported at the same depths.

Groundwater was encountered around 6-feet below ground surface. The flow rate into the excavation was approximately one-quarter of the rate observed in the west side excavation. There was a visible sheen on the water and a noticeable hydrocarbon odor. The excavation was advanced to about 10-feet below ground surface to take a groundwater sample. In addition, a composite sidewall soil sample was taken from the most visually impacted area, approximately 7 feet below ground surface. The soil taken also had a noticeable hydrocarbon odor.

The excavation was moved further down to see if the bottom of the trash layer could be found. Around 12-feet below ground surface, the excavator was pulling out large boulders and fill, similar to what was encountered on the west side.

3.0 ANALYTICAL RESULTS

Grab groundwater samples were collected from both excavations. A soil sample was collected from the east side only, as there was no visual impact to the soil observed on the west side. Samples were placed into appropriate containers, labeled and sent under chain-of-custody protocol to a state certified analytical laboratory.

Groundwater samples were analyzed for volatile organic compounds (VOCs) using EPA Method 8260B, polynuclear aromatic hydrocarbons (PAHs/semi-VOCs) using EPA Method 8310, total petroleum hydrocarbons (TPH) as gasoline, diesel, motor oil, and Bunker C oil using EPA Method 8015M, and total dissolved metals using EPA Method 6010. Groundwater samples were also analyzed for water quality parameters including, total dissolved solids using EPA Method 160.1, total nitrate and sulfates using EPA Method 300.0, and ammonia using EPA Method 350.3.

The soil sample was analyzed for PAHs/semi-VOCs using EPA Method 8270, total petroleum hydrocarbons (TPH) as gasoline, diesel, motor oil, and bunker C oil using EPA Method 8015M, and total dissolved metals using EPA Method 6010. In addition, any metals considered to have high concentrations were analyzed by TCLP Leachate using EPA Method 6010.

Analytical results from both excavations are presented in Table A-1.

3.1 Groundwater Results

The west side results showed significant concentrations of fuel-related compounds, including diesel, motor oil, and Bunker C, ranging from 4,000 ug/L to 36,000 ug/L. In addition trace amounts of semi-volatile compounds and metals were encountered. Methyl-tert-butyl-ether (MTBE) was discovered at a concentration of 14 ug/L.

The east side results showed significant concentrations of fuel-related compounds, including diesel, motor oil, and Bunker C, ranging from 27,000 ug/L to 180,000 ug/L. In addition, volatile compounds, semi-volatile compounds and metals were encountered. MTBE was discovered at a concentration of 100 ug/L.

MTBE was an unexpected discovery in both excavations due to its historical industrial use. Although these compounds were detected at concentrations higher than expected, analysis shows that none of the results exceeded site Remedial Action Objectives (RAOs).

3.2 Soil Results

The east side results showed significant concentrations of fuel-related compounds, including diesel, motor oil, and Bunker C, ranging from 250 mg/kg to 1,300 mg/kg. In addition trace amounts of semi-volatile compounds and metals were encountered.

Chromium was detected at a concentration of 110 mg/kg, which qualified for TCLP Leachate analysis. Results from the additional analysis yielded a TCLP concentration of 91ug/L. This was the only metal compound encountered with a significant concentration.

Although these compounds were detected at concentrations higher than expected, analysis shows that none of the results exceeded site Remedial Action Objectives (RAOs).

4.0 CONCLUSIONS

The conclusions of this investigations are summarized as follows:

- Excavation activities on the west side will be able to use conventional earth moving equipment to easily move the bedrock, and blasting devices are not necessary to install the channel on the west side.

- Waste materials were present in the east side excavation at depths from 2 to 12-feet below ground surface.

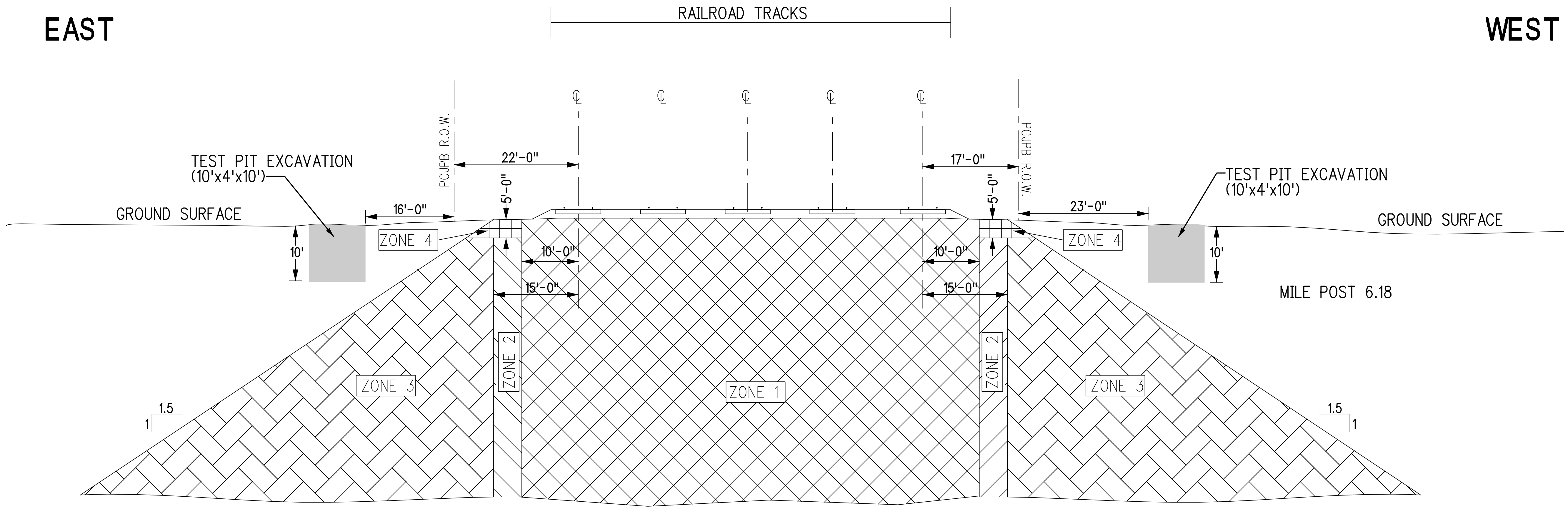
- Any activities conducted on the east side will encounter a waste trash layer for approximately 10-feet below ground surface.

- Any work conducted in and along the drainage channel may proceed with appropriate safety measures, including personal protective equipment and necessary training.

- Special considerations may have to be included in any design or construction work if work areas are discovered to exceed RAO levels.

- In the future, design and construction estimates should continue to examine the effects and impacts of the waste on the east side of the railroad tracks on the overall project goals and objectives.

Figure A-1
Test Pit Escavation Location



NOTES

1. TEST PITS WILL BE EXCAVATED 1) OUTSIDE PCJPB R.O.W., AND 2) OUTSIDE ZONE OF INFLUENCE.
2. NO ACCESS AGREEMENT/APPLICATIONS OR SITE-SPECIFIC WORKPLAN WILL BE REQUIRED.
3. ZONE DESIGNS ARE BASED ON PCJPB GUIDELINE FOR EXCAVATION SUPPORT SYSTEMS-RAILROAD ZONE OF INFLUENCE (FIGURE 2.1).
4. TRACK ALIGNMENT IS BASED ON PCJPB RAILSURVEY (DWG. NO. C2206) - TYPICAL SECTION AT ARCH CULVERT MP 6.18 (STATION 282+46).

20' 0' 20' 40'
SCALE IN FEET

Burns & McDonnell SINCE 1898

Figure

TEST PIT EXCAVATION LOCATIONS
SUNQUEST PROPERTIES, INC.
BRISBANE, CA

K:\SUNQUEST\USTN\LANDFILL\

SQ TESTPIT1.DGN/ 8-27-2003 13:54/FB

Appendix A-1
Photo Summary

WEST SIDE


Photo 1: Excavation at 2-feet below ground surface, looking southward


Photo 2: Excavation at 3-feet below ground surface, looking southward


Photo 3: Excavation at 8-feet below ground surface, looking southward


Photo 4: Groundwater flowing in the excavation at 9-feet below ground surface, looking northward

Photo 5: Groundwater at 10-feet below ground surface and excavation collapsing, looking northward

Photo 6: Concrete and brick structure to the south of the excavation, looking southwesterly

Photo 7: Compaction of the excavation with heavy groundwater flow, looking northward

Photo 8: Compaction of the excavation, looking northward


Photo 9: Compaction of the excavation, looking northward


Photo 10: Compaction of the excavation, looking westward

EAST SIDE


Photo 1: Excavation at 1-foot below ground surface, looking eastward


Photo 2: Excavation at 2-feet below ground surface, looking southward


Photo 3: Excavation at 4-feet below ground surface, looking southward


Photo 4: Excavation at 5-feet below ground surface, looking northward


Photo 5: Groundwater flowing in the excavation at 6-feet below ground surface, looking southward


Photo 6: Excavated material, looking eastward


Photo 7: Soil excavated from approximately 10-feet below ground surfac


Photo 8: Excavation at 7-feet below ground surface, looking eastward

Photo 9: Groundwater with sheen flowing into excavation, looking northward

Photo 10: Compaction of the excavation, looking eastward

Table A-1
Summary of Analytical Results

Table A-1

Groundwater and Soil Results from Test Pit Excavations
September 4, 2003
Former Bayshore Railyard
Brisbane, California

		Fuel Related Compounds											Volatile Organics		Natural Attenuation Parameters			
Groundwater	Sample ID (ug/L)	TPH-g	TPH-d	TPH-d (SGC)	TPH-c	TPH-c (SGC)	TPH-m	TPH-m (SGC)	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Carbon Disulfide	Nitrate	Sulfate	Ammonia	Total Dissolved Solids
	TP-W	<50	5,900 H Y	4,000 H Y	56,000 Y	36,000 Y	24,000	14,000	0.6	<0.050	<0.050	<0.050	14	<5.0	3,400	97,000	280	7,200,000
	TP-E	130 H Y	32,000 H L Y	27,000 H L Y	210,000 Y	180,000 Y	77,000 L	69,000 L	<0.50	<0.50	<0.50	1.75	100	9.5	270	1,600	10,000	1,030,000
Soil	Sample ID (mg/kg)	TPH-g	TPH-d	TPH-d (SGC)	TPH-c	TPH-c (SGC)	TPH-m	TPH-m (SGC)	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Carbon Disulfide	Nitrate	Sulfate	Ammonia	Total Dissolved Solids
	TP-E-SS	1.4 H Y	260 H Y	250 H Y	1,400 Y	1,300 Y	430 L	410 L	<.052	<.052	<.052	<.052	NA	NA	NA	NA	NA	NA

		Polynuclear Aromatic Hydrocarbons by HPLC (EPA Method 8270C)															
Groundwater	Sample ID (ug/L)	Napthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo (a) anthracene	Chrysene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Indeno (1,2,3-cd) pyrene	Dibenz (a,h) anthracene	Benzo (g,h,i) perylene
	TP-W	<8.3	<17	<8.3	5.7	41	3.9	32	54	20	30	18	7.1	22	16	16	15
	TP-E	<2.5	<5.0	34	<0.50	15	1.3	9.3	9.1	3.4	5.5	4.8	2	4	5.4	3	2.4
Soil	Sample ID (mg/kg)	Napthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo (a) anthracene	Chrysene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Indeno (1,2,3-cd) pyrene	Dibenz (a,h) anthracene	Benzo (g,h,i) perylene
	TP-E-SS	0.89	1.2	0.63	0.74	6.7	1	7.2	9.5	2.2	2.5	2.1	2.3	3	1.8	<0.25	2.7

		California Title 26 Metals (EPA Method 6010B)																
Groundwater	Sample ID (ug/L)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
	TP-W	<60	94	160	<2.0	<5.0	<10	<20	<10	<3.0	<0.20	<20	<20	<5.0	<5.0	<5.0	<10	<20
	TP-E	<60	23	420	<2.0	<5.0	<10	<20	<10	<3.0	<0.20	<20	<20	<5.0	<5.0	<5.0	<10	<20
Soil	Sample ID (mg/kg)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
	TP-E-SS	4.2	20	50	0.38	1.3	110	13	39	61	0.24	2.1	42	0.79	<0.24	6.7	33	170

Notes:

1. TPH - Total Petroleum Hydrocarbons
2. TPHg - TPH as gasoline
3. TPHd - TPH as diesel
4. TPHm - TPH as motor oil
5. TPHc - TPH as Bunker C oil
6. VOCs - Volatile Organic Compounds
7. BTEX - Benzene, Ethylbenzene, Toluene, Xylene Compounds
8. NA - Not Analyzed
9. H - Heavier hydrocarbons contributed to the quantation
10. L - Lighter hydrocarbons contributed to the quantation
11. Y - Sample exhibits fuel pattern which does not resemble standard
12. Samples were analyzed for TPH by EPA Method 8015M
13. Samples were analyzed for BTEX by EPA Method 8021B
14. Samples were analyzed for VOCs by EPA Method 8260B
15. Samples were analyzed for Natural Attenuation by EPA Methods 300.0, 350.3, and 160.1

Table A-1

Groundwater and Soil Results from Test Pit Excavations
Former Bayshore Railyard
Brisbane, California

	Sample ID	TP-W	TP-E	TP-E-SS
	Units	ug/L	ug/L	mg/kg
	Date Sampled	9/4/2003	9/4/2003	9/4/2003
Fuel Related Compounds	**TPH-g**	<50	130 H Y	1.4 H Y
	TPH-d	5,900 H Y	32,000 H L Y	260 H Y
	TPH-d (SGC)	4,000 H Y	27,000 H L Y	250 H Y
	TPH-c	56,000 Y	210,000 Y	1,400 Y
	TPH-c (SGC)	36,000 Y	180,000 Y	1,300 Y
	TPH-m	24,000	77,000 L	430 L
	TPH-m (SGC)	14,000	69,000 L	410 L
	Benzene	0.6	<0.50	<.052
	Toluene	<0.050	<0.50	<.052
	Ethylbenzene	<0.050	<0.50	<.052
	Xylenes	<0.050	1.75	<.052
VOCs	**MTBE**	14	100	NA
	Carbon Disulfide	<5.0	9.5	NA
Natural Attenuation Parameters	**Nitrate**	3,400	270	NA
	Sulfate	97,000	1,600	NA
	Ammonia	280	10,000	NA
	Total Dissolved Solids	7,200,000	1,030,000	NA
Polynuclear Aromatic Hydrocarbons	**Napthalene**	<8.3	<2.5	0.89
	Acenaphthylene	<17	<5.0	1.2
	Acenapthene	<8.3	34	0.63
	Fluorene	5.7	<0.50	0.74
	Phenanthrene	41	15	6.7
	Anthracene	3.9	[illegible]	1
	Fluoranthene	32	9.3	7.2
	Pyrene	54	9.1	9.5
	Benzo (a) anthracene	20	3.4	2.2
	Chrysene	30	5.5	2.5
	Benzo (b) fluoranthene	18	4.8	2.1
	Benzo (k) fluoranthene	7.1	2	2.3
	Benzo (a) pyrene	22	4	3
	Indeno (1,2,3-cd) pyrene	16	5.4	1.8
	Dibenz (a,h) anthracene	16	3	<0.25
	Benzo (g,h,i) perylene	15	2.4	2.7
California Title 26 Metals	**Antimony**	<60	<60	4.2
	Arsenic	94	23	20
	Barium	160	420	50
	Beryllium	<2.0	<2.0	0.38
	Cadmium	<5.0	<5.0	1.3
	Chromium	<10	<10	110
	Cobalt	<20	<20	13
	Copper	<10	<10	39
	Lead	<3.0	<3.0	61
	Mercury	<0.20	<0.20	0.24
	Molybdenum	<20	<20	2.1
	Nickel	<20	<20	42
	Selenium	<5.0	<5.0	0.79
	Silver	<5.0	<5.0	<0.24
	Thallium	<5.0	<5.0	6.7
	Vanadium	<10	<10	33
	Zinc	<20	<20	170

Notes:
1. TPH - Total Petroleum Hydrocarbons
2. TPHg - TPH as gasoline
3. TPHd - TPH as diesel
4. TPHm - TPH as motor oil
5. TPHc - TPH as Bunker C oil
6. SGC - Silica-gel cleanup
7. VOCs - Volatile Organic Compounds
8. BTEX - Benzene, Ethylbenzene, Toluene, Xylene Compounds
9. NA - Not Analyzed
10. H - Heavier hydrocarbons contributed to the quantation
11. L - Lighter hydrocarbons contributed to the quantation
12. Y - Sample exhibits fuel pattern which does not resemble standard
13. Samples were analyzed for TPH by EPA Method 8015M
14. Samples were analyzed for BTEX by EPA Method 8021B
15. Samples were analyzed for VOCs by EPA Method 8260B
16. Samples were analyzed for Natural Attenuation by EPA Methods 300.0, 350.3, and 160.1