# APPENDIX D

# DRAINAGE, EROSION, AND SEDIMENT CONTROL PLAN

# COLUSA GENERATING STATION PROJECT

# DRAINAGE EROSION AND SEDIMENT CONTROL PLAN

**Document No. 25196-002-30G-K03G-00001**

**DRAFT**

**BECHTEL CORPORATION**
**GEOTECHNICAL & HYDRAULIC ENGINEERING SERVICES**
**FREDERICK, MARYLAND**

**March 2007**

Revision A

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## 1.0 Overview

E&L Westcoast LLC (E&LW) and Pacific Gas & Electric (PG&E) propose to build and operate a 660 MW-capacity combined cycle electric power generating facility in Colusa County, California, approximately 14 miles north of the town of Williams and 4 miles west of I-5, as shown in the Vicinity Map, provided as Attachment No. 1. The plant, scheduled to be on line by late spring, 2010, will supply power to the PG&E electrical transmission grid by connecting the plant switchyard with PG&E's existing 230 kV north-south transmission lines located approximately 1,800 feet east of the project site.

The plant will be fueled by natural gas delivered to the site via a new 1,500-foot pipeline owned and operated by PG&E.

Process water will be delivered to the site by a new 2,500-foot pipeline from the Tehama-Colusa canal. No process water will be discharged off site.

The project will include construction of a new power generating facility, switchyard, and associated linear facilities occupying approximately 31 acres within the 100-acre fenced in site. Approximately 89 acres will be disturbed during construction, including 53 acres for temporary offices, construction parking, and a lay down area to be graded on the north side of the site. After construction these areas will be returned to pre-construction conditions by regrading and seeding as necessary.

Offsite work will include the installation of the gas and water supply pipelines, the construction of a new free-span bridge across the Glenn-Colusa canal, a new bridge across Teresa Creek, and improvements to the intersection of Delevan Road and McDermott Road.

The purpose of this report is to describe the Drainage Erosion and Sediment Control Plan to be implemented during the construction of the Colusa Generating Station Project, and provide relevant data, as requested by the California Energy Commission.

The report includes narrative text outlining site management activities during the phases of site mobilization, clearing and grading, construction, and post-construction activities

(including the installation of the permanent storm water management facilities to be constructed and maintained for the developed site) with a level of detail consistent with preliminary design. Engineering drawings developed during the process of preliminary design are provided as Figures 1 through 10. A copy of the calculations carried out for the design of the erosion control and storm water management facilities described in this plan are provided as Attachment No. 5.

**2.0 Description of Existing Site**

The proposed site is located on rolling hills in an unincorporated section of Colusa County which is currently used as open range for cattle grazing, as shown in the aerial photograph provided in Attachment No. 2.

The proposed facilities will be situated on an approximately 100-acre site secured by a perimeter fence and located just east of the existing PG&E compressor station, which will continue in operation during and after construction of the new facility.

Existing conditions drainage patterns are shown on the topographic map provided as Figure No. 1. Ground surface elevations at the site vary from about 200 feet down to 150 feet above mean sea level. Drainage patterns are dominated by the ridge line running roughly north and south through the site. Approximately 78 acres of the site drain off the ridge line to the east and north, towards the Glenn-Colusa Canal, and 19 acres drain to the west and south in the direction of the Tehama-Colusa Canal. There is no permanently flowing water course adjacent to the site

The site is located within the Hunters Creek watershed. Hunters Creek drains east to the Colusa Drain/Trough and south to canals eventually discharging into the Sacramento River. Based on Flood Insurance Rate Maps for Colusa County, California and Unincorporated Areas, the site is determined to be outside the limits of the 0.2 percent annual change floodplain (see Attachment No. 3).

The U.S. Department of Agriculture Soil Survey for Colusa County, California (Reference 3) indicates that surface soils at the site consist chiefly of clays, silty clays, and clayey loams, almost entirely classified as hydrologic group D soils series, which are

described by the USDA as "soils having a very slow infiltration rate (high runoff potential) when thoroughly wet", consisting chiefly of clays or soils with a clay layer and or near the surface.

## 3.0 Proposed Site Description

This section of the plan provides an overall description of the project and its location with respect to all nearby water courses, followed by the delineation of all areas of the site subject to soil disturbance, broken out by the key project elements.

### 3.1 Overall site drainage

The site is located approximately half way between the Tehama-Colusa and Glenn-Colusa canals, as shown in the project location map provided as Attachment No. 4. Drainage is generally from west to east, perpendicular to the alignment of the canals. The plant will be located on cut and fill in local high ground between the canals. Runoff collecting as shallow concentrated flow coming towards the site from the west will be intercepted by diversion ditches and directed around the site during construction and for post development conditions. For the final developed condition, runoff collected on built up areas of the site will be detained in storm water management ponds with discharge maintained equal to or less than predevelopment peak levels as calculated with standard hydrologic methods.

The discharge from all storm water management ponds will outfall onto rip rap aprons, or level spreaders, designed to avoid erosion and reduce the velocity of the flow before reaching existing swales.

From the point of view of managing erosion during construction, the key elements of the site include the power block and switch yard, the temporary offices and construction parking, the laydown area, and off-site linear facilities associated with the project - the plant access road and new bridges, the electric power transmission line interconnection, natural gas pipeline, and water supply pipeline.

Existing drainage patterns will be modified by construction of the facility. During construction and after final development, runoff will flow to five outlets, as shown in post-development drainage area plan provided as Figure No. 2, where the subbasins are numbered to correspond with the numbering system for the existing drainage basins.

During construction, sediment and erosion control measures will be implemented to minimize the impact on construction on adjacent ground and receiving water bodies, as described in Section 5.0 of this plan. A sediment basin will be installed to control runoff from four of the drainage outlets from the site, as shown in Figure No. 2. After the completion of construction and the stabilization of the interior areas, the basin outlets will be modified for storm water management requirements as appropriate, as described in Section 7.0 of this plan.

The drainage facilities associated with each of these elements are discussed in the following subsections.

3.2 Power Block and switch yard area drainage

When completed, the power plant and switchyard will occupy approximately 36 acres within the 100-acre site, with an average finished grade elevation of approximately 183 feet MSL. The power block will be located on an 18.3 acre lot, with buildings occupying approximately 12 percent and roads occupying 20 percent of the area. The remaining 68 percent of the power block will be covered with loose hard gravel.

The switch yard will occupy an additional 7.6 acres and will be entirely covered with gravel. Runoff will be collected in ditches and conveyed to catch basins connected to storm drain pipes in the power block area.

The power block is entirely contained within Subbasin No. 3. During construction all runoff from the power block construction area will be directed to the Basin #3 as shown in Figure 3.

After construction the power block area will be drained by a storm drain and perimeter ditch system. The drainage ditches will be designed to convey the 10 year, 24 hour

rainfall runoff and will be protected by erosion control fabric, rip rap, concrete paving, or soil-cement to minimize erosion. Drainage details are shown in Figures 6, 7 and 8.

All storm drains will discharge to the sediment basin, which will be converted to a storm water management pond designed to reduce peak discharge from the upstream area back to predevelopment conditions, and will be maintained for the life of the project. Process-related areas of the power block will be curbed to prevent runoff of hazardous materials.

### 3.3 Temporary offices and construction parking areas

The temporary offices and construction parking lot will be located on the east side of the power block area, adjacent to the temporary construction access road on the eastern boundary of the 100-acre site. Runoff from these areas will be directed in ditches to sediment control basins 2 and 4 during construction, as shown in Figure 3.

After construction is complete, the gravel will be removed, and the upstream area will be regraded and seeded. The basins will be dredged and graded, and the risers will be removed, leaving the outflow pipes to serve as culverts (which are sized for post construction drainage discharges) in place. The depression remaining after regrading the basins will serve to reduce peak runoff to predevelopment levels.

### 3.4 Laydown area

A temporary lay down area will be located on the north side of the site within Subbasin No. 1, as shown in Figure 4. The area will be stripped and regraded for construction as follows:

- Drainage channels will be established for the control of sheet flow, with average slopes of 2 percent. To avoid scour and erosion, check dams will be placed in the channel at intervals of between 100 and 200 feet.
- An approximately 20-acre pad will be graded with a 2 percent slope, covered in gravel, and used as a lay down area for construction.

- An approximately 8-acre pad will be graded to the north of the lay down area and used as an area for stockpiling top soil.

A sediment control basin will be provided at the downstream end of the catchment to intercept all runoff, as described in Section 5 of this plan.

After construction is completed, the area will be regraded, topsoil from the stockpile will be applied, and vegetation will be reestablished. The sediment basin will be dredged and graded, and the riser will be removed, leaving the culvert (which is sized for post construction drainage discharges) in place. The depression remaining after regrading the basin will serve to reduce peak runoff to predevelopment levels.

3.5 Offsite linear construction and bridges

The plant access road, new transmission interconnection, and access road to the water supply intake on the Tehama-Colusa Canal (see Attachment No. 4) will require an additional 2.6 acres.

## 4.0 Clearing and Grading

For all areas where earthwork will be executed, materials suitable for compaction will be stockpiled in designated locations on site. Materials not suitable for compaction will be stored in separate stockpiles and reused on the site, as appropriate. Any contaminated materials encountered during excavation will be disposed of in accordance with applicable laws, ordinances, regulations, and standards.

The following subsections provide a discussion of clearing and grading associated with each of the major construction elements of the project.

4.1 Power Block and Switch Yard Areas

Grading for the power block and switch yard areas is shown in Figure 3. Earthwork in the power block area will consist of removal of topsoil, vegetation, and debris; excavation and compaction of earth to create the plant grade; and excavation for foundations and

underground systems. Approximately 118,000 CY of cut and 150,000 CY of fill will be required to provide a level pad for the power block and switchyard.

The switch yard area will be graded as a level pad sloped to drain to the east and west. Perimeter drainage ditches will direct all runoff south towards the power block. Developing this surface will require adding fill material on the east side of the yard, and cutting into existing ground on the west side to accommodate the proposes switch yard foot print, with additional cut back into the existing slope at a minimum angle of 3:1 to provide space for diversion ditches.

All runoff from the power block and switchyard will be discharged to Sediment Basin No. 3 on the southwest corner of the site, which will be formed by excavation and embankment construction as necessary to provide a sufficient volume for the control of sedimentation from the disturbed area, as discussed in Section 5. This basin will be converted to a storm water management pond at the end of the construction period.

4.2 Temporary offices and Construction Parking

A 6.2-acre area on the east side of the site will be graded and covered in gravel for construction parking, as shown in Figure 3. Approximately 2,000 CY of cut and 24,000 CY of fill will be required to grade this area of the site. Runoff from this area will be directed to Sediment Basin No. 2. After construction the riser will be removed from this basin and the outfall pipe will be retained as a culvert for local drainage. Because a large part of the area currently draining to this outlet will be redirected to the south after development, no storm water management will be required for this basin.

An additional 2 acres just south of the parking lot will be graded as a pad for the construction of temporary offices. Approximately 10,000 CY of cut will be required to grade this area of the site. Temporary and permanent roads and associated drainage ditches will be installed as shown in Figures 2 and 3.

Runoff from this area will be directed to Sediment Basin No. 4 during construction, which is sized in accordance with BMP standards published by the State of California.

After construction is complete, the basin will be converted to a Stormwater Management Pond to attenuate peak discharges to predevelopment levels as required.

4.3 Lay down Area

The construction lay down area is located on the north side of the project site, as shown in Figure 4. Approximately 80,000 CY of cut and 30,000 CY of fill will be required to make this area ready for construction. Activities include clearing, grubbing, cut and fill operations, and the placement of gravel surface stabilization. The existing natural swale will be improved as a temporary drainage channel between the two pads with smaller drainage ditches along their outboard edges.

An embankment across the outlet of the subbasin will be constructed to form the downstream side of a sediment basin, and grading will be provided to divert all runoff from the upstream area into the sediment basin. Excavation will be carried out upstream of the embankment as necessary to provide the storage volume required for sediment control, as discussed in Section 5.

The upper 12 inches of top soil will be stockpiled and seeded on the north side of the site, as shown in Figure 4. The stockpile will be surrounded by a perimeter silt fence. The vegetation placed on the stockpile shall be inspected regularly to ensure that adequate moisture is applied to maintain the vegetative cover reducing erosion and dust. Additionally, care shall be used to not apply too much water and cause erosion of the stock pile from runoff.

Before placement of the gravel pad for the lay down area, topsoil will be stripped and geotextile fabric will be placed over the existing soil surface. During construction activities, monitoring and maintenance of the laydown areas will be performed as described in Section 6.0. Once construction is complete, the gravel and geotextile will be removed. Sediment removed from the storm water management basin will be spread over the laydown area and then the topsoil replaced and seeded to restore the area to pre-development conditions.

Rainfall over the lay down area will run off the pad as shallow concentrated flow to be diverted to Sediment Basin No. 1. After construction is complete, the gravel in the lay down areas will be removed and the site will be graded to a more natural cross section, although not back to existing contours. The area will be seeded and after vegetation is established, the sediment basin will be removed and the area graded to fare into the existing swale.

### 4.4 Offsite clearing and grading

Offsite clearing and grading includes earthwork associated with permanent access roads for entering the facility and temporary access for the construction of the gas and water pipelines, as shown in Attachment No. 4.

Earth work associated with the roads includes excavation for the preparation of the subbase and side ditches and the placement and compaction of suitable drainage layers and fill, to be determined by the project civil engineer at a later date. Volumes of cut and fill associated with this work are expected to be minimal.

Standard installation techniques will be employed for the gas and water pipelines associated with the project. Excavations will be of the minimum width compatible with proper installation and safety requirements. The trenches will be as soon after the placement of the pipeline as is technically feasible, with every effort made to minimize the time in which excavations remain open.

Earth work associated with the bridges is expected to be minimal. All care shall be taken to prevent runoff from rain and wash water from entering the canals. Sediment control measures will be employed during the construction of these linear facilities as described in Section 5.

### 4.5 Tabulation of earthwork quantities

Based on preliminary feasibility studies, it was estimated that approximately 89 acres of the 100-acre fenced lot would be disturbed as some time during construction. A large percentage of the disturbed area will be regraded and returned to a vegetated state after

construction. A table providing estimated quantities of temporary and permanent cut and fill volumes for all project elements is provided in the margin of the rough grading plans reproduced as Figures 3 and 4 of this report. These figures will be revised during final design but are not expected to change by a significant amount.

## 5.0 Best Management Plan

Upon mobilization, best management practices (BMPs), including sediment basins, silt fences, straw bales, covered stockpiles, etc., will be implemented to minimize the impacts of erosion and sedimentation on adjacent ground and receiving water bodies. These measures will remain in place until construction activities are complete.

A construction storm water pollution prevention plan (SWPPP) that includes temporary BMPs to be implemented during construction will be prepared in accordance with the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharge Associated with Construction Activities.

After construction is complete and the interior areas have been stabilized and seeded, erosion control basins will be converted to storm water management facilities or removed as appropriate. The scheduling of erosion mitigation measures with respect to the major phases of project construction are summarized in the following section.

### 5. 1 Construction Schedule

The major activities associated with sediment and erosion control during mobilization, execution and demobilization for the project include:

- Installation of perimeter silt fences and entrance protection
- Excavation of sediment basins and installation of outlet works including riser and dewatering orifice, outfall pipe, rip-rap outfall aprons, etc.
- Clearing and grubbing and stockpiling of top soil
- Cut and fill operations associated with the lay down area, construction parking and temporary office buildings
- Grading for temporary drainage and stabilization of ditches
- Placement of gravel pads in areas indicated and implementation of dust control measures as appropriate
- Extension of BMP facilities and continued dust control operations as necessary to keep up with advancing fronts of excavation, soil placement and compaction.

- Routine and post-storm maintenance of erosion control facilities, basins, ditches and outfalls, as required.
- Installation of permanent storm drain systems and temporary protection of catch basin inlets
- Final grading operations and landscaping operations for areas of site outside of the built-up area.
- Removal or conversion of sediment basins to storm water management functioning as required to control the first half-inch of runoff from developed areas and maintain peak discharges off site at predevelopment levels

A tentative schedule for the installation of BMP facilities is presented in the following table, based on a date for mobilization on site at the beginning of March, 2008, with the installation of all mechanical equipment completed at the end of November, 2009, as indicated in the Project Construction Schedule (Figure 3.6-1 of Reference 1).

**Approximate Schedule for Installation of BMP Facilities**

| **Site Mobilization** | |
|---|---|
| Install perimeter erosion control measures including silt fences and construction entrances | Complete March 2008, maintain as required |
| Install interior grade control structures and check dams as required | Complete March 2008, maintain as required |
| Excavate and construct 5 sedimentation basins with permanent outfall pipes and temporary riser structures and outfall weirs | Complete March 2008, maintain as required |
| Install temporary parking and lay down areas (strip and stockpile topsoil, install geotextile and stone) | Complete April 2008 |
| **Plant Construction** | |
| Power block major foundation excavations | Complete May 2008 |
| Install underground piping within plant | Complete July 2008 |
| Install storm drain piping | Complete July 2008 |
| Install Combustion Turbine Generator | Complete November 2009 |
| Install Heat Recovery Steam Generator | Complete August 2009 |
| Install Steam Turbine Generator | Complete November 2009 |
| Install Air Cooled Condenser | Complete August 2009 |
| Final site grading | Complete December 2009 |
| Restoration of temporary parking and lay down facilities and installation of permanent vegetation. Modification of sediment control structures for permanent storm water management functions as required. | Complete January 2010 |
| **Off-site Construction** | |
| Excavate and install gas pipeline from compressor station | As arranged before January 2010 |
| Excavate and install water line from Tehama-Colusa Canal | As arranged before January 2010 |
| Replacement of Teresa Creek Bridge | As arranged before May 2008 |
| Replacement of Glenn-Colusa Canal Bridge | As arranged before May 2008 |

Details concerning the best management practices utilized for the project are presented in the following subsections.

## 5. 2 Measures for entire site

Best management practices pertaining to the entire site include silt fences and straw wattle dikes, access road protection, and the establishment of vegetation.

### 5.2.1 Perimeter Silt Fence and Straw Wattle Dikes

A silt fence is to be installed around the perimeter of the entire project site and within other construction areas as indicated in Figures 3 and 4, including the construction lay down areas and on either side of all linear excavations advance on and off site.

In addition to the perimeter silt fence, straw wattle dikes shall also be installed around the construction lay down and parking areas and within drainage channels with a slope greater than 1 percent. Where possible the silt fence and straw bale dikes are to be installed parallel to the ground contours to avoid concentration of flow at low points. Details of the silt fence and straw wattle dike installation are shown in Figure 5.

### 5.2.2 Inlet Protection

Once the storm drains and catch basins are installed, each catch basin shall be provided with inlet protection to reduce sediment accumulation in the storm drain system. Details of the inlet protection are shown in Figure 5.

### 5.2.3 Access Road Tire Wash

A tire wash station will be installed along the main access road to remove sediment from construction vehicles before leaving the site and entering public access roads. Details of the tire wash station are shown in Figure 5.

### 5. 2.4 Vegetative Stabilization

Disturbed areas will be provided with permanent vegetative cover. Seeding operations will take place after slopes and other areas have received final grading. Vegetative

stabilization shall occur as soon as possible after disturbance has permanently or temporarily ceased, but in no case more than 14 days after the construction activity in an area has ceased. An exception to this requirement is for when construction activity will resume on that portion of the site within 21 days.

A range of seedbed preparation methods shall be used. The seedbed preparation method used for any individual site shall depend on various factors including size of the area, slope, potential for erosion, and landowner requirements. The seedbed shall be prepared to a depth of 3 to 4 inches, where possible, by harrowing, disking, or mechanical raking. Seed shall be dispersed by dry broadcasting where slopes are less than 2:1. Manually operated cyclone type spreaders will be employed to uniformly broadcast the seed. After broadcasting, the seed shall be manually raked, on contour, into the top 3/8 inch of soil.

5.2.4.1 Vegetative stabilization for bridge replacements and water intake

Vegetation disturbed during the bridge replacements will be replanted with appropriate native species, such as California bulrush (Scirpus californicus), cattail (Typha spp.), and water primrose (Ludwigia peploides) in the emergent wetland area. Native erosion control seed mix including creeping wild-rye (Leymus triticoides), meadow barley (Hordeum brachyantherum), tomcat clover (Trifolium willdenovii) annual fescue (Vulpia spp.), blue wildrye (Elymus glaucus), mugwort (Artemisia vulgaris) and California brome (Bromus carinatus) would be applied to upland areas and areas adjacent to streams.

The extent of construction activities for the erection of the bridges will be limited to the minimum extent along the banks as possible. An erosion control mat will be laid down if stabilization of the bank is needed.

The banks will be restored to their original condition as far as possible once bridge construction activities have been completed. New plantings will be monitored for one year until the banks are adequately revegetated to prevent erosion and sedimentation of these areas and the banks have similar total vegetation cover equal to or greater than

adjacent areas. Additional plantings will be implemented if adequate vegetation cover is not attained after one year.

Vegetation disturbed during and after construction of the intake and associated pipeline at the Tehama-Colusa Canal will be replanted with native erosion control seed mix including creeping wild-rye (Leymus triticoides), meadow barley (Hordeum brachyantherum), tomcat clover ( Trifolium willdenovii) annual fescue (Vulpia spp.), blue wildrye (Elymus glaucus), mugwort (Artemisia vulgaris) and California brome (Bromus carinatus). This seed mix would be applied to upland areas and areas adjacent to streams. Silt fences and erosion control blankets will be installed on all disturbed slopes greater than 2:1.

Progress in reestablishing vegetation along the impacted reaches of the Tehama-Colusa Canal, Glenn-Colusa Canal, and Teresa Creek will be monitored and reported to the USFWS one year after restoration is implemented.

5.2.4.2 Vegetative stabilization for upland areas

Permanent erosion control for the construction laydown area and temporary access roads will consist of revegetation with a native erosion control seed mix equivalent to the following:

- blando brome (Bromus hordeacous) at 30 pounds of pure live seed per acre,
- zorro fescue (Vulpia myuros) at 6 pounds of pure live seed per acre, and
- hykon rose clover (Trifolium hirtum) at 12 pounds of pure live seed per acre.

Performance Criteria for Upland Erosion Control Revegetation

A qualified biologist or erosion control specialist will evaluate the upland revegetation using the following performance criteria:

- Year 1: 70 percent of vegetation cover measured at undisturbed reference sites adjacent to project site;
- Year 2: 80 percent of vegetation cover measured at undisturbed reference sites adjacent to project site;
- Year 3: 95 percent of vegetation cover measured at undisturbed reference sites adjacent to project area.

Erosion control will be considered successful if the following erosion thresholds are not exceeded:

- Flow Pattern Development – More than 25 percent of the area shows evidence of recent translocation and deposition of soil and litter.
- Rills – Usually greater than 3 inches deep and found at 10-foot intervals

- Gullies – More frequent than 200-foot intervals and appear to be unstable

If performance criteria for revegetation or erosion control are not met, remedial measures will be implemented. Areas that do not meet revegetation criteria will be reseeded. If necessary, the erosion control seed mix may be modified to substitute other native species to improve success; and temporary erosion control measures including silt fences, erosion control blankets, bio-logs, or straw bales will be installed as necessary to prevent ongoing erosion or sedimentation until remedial seeding measures can be fully implemented.

All erosion control measures will be monitored monthly during the wet season (approximately December 1 to April 1). Revegetation will be monitored each May for the first three years following project completion.

Monitoring will be conducted by a USFWS-approved biologist.

5.3 Sediment Basins

A sediment basin will be provided at the outlet of each of the four post-development drainage areas, for sediment control during construction as shown in Figures 3 and 4.

Each basin will be formed by the construction of an engineered earth embankment, with additional volume provided by excavation, as necessary. The basins will be designed in accordance with Best Management Practices published by State of California Basins are sized in accordance with Option No. 2, which includes the following design guidelines (Reference 4):

- Provide a minimum total volume of 3,600 cubic feet in the pond for each acre drained
- Provide a sediment storage volume of 67 cubic yards of for each acre drained
- Provide a settling zone storage volume sufficient to capture all runoff from the 2-year storm
- Provide a minimum sediment storage zone depth of 1 foot
- Provide a minimum settling zone depth of 2 feet
- Provide a minimum total pond depth of 3 feet and a maximum depth of 5 feet
- Provide a basin length (from the inlet to the outlet) greater than twice the width
- Insure that the length to settling depth ratio (L/SD) is less than 200

The volume requirements for the sediment control basins to be installed for the construction of the Colusa Generating Station project are as follows (calculations are provided in Attachment No. 5):

| Subbasin | Catchment Area | | Minumum Volume below spillway, $ft^3$ (1) | Required sediment storage, $ft^3$ (2) | Required Settling Volume, $ft^3$ (3) | Total volume required below spillway, $ft^3$ (4) |
|---|---|---|---|---|---|---|
| | sq. mi. | acres | | | | |
| Interim 1 | 0.0586 | 37.5 | 135,000 | 67,838 | 155,509 | 223,347 |
| Interim 2 | 0.0097 | 6.2 | 22,320 | 11,216 | 35,284 | 46,499 |
| Interim 3 | 0.0464 | 29.7 | 106,920 | 53,727 | 173,804 | 227,532 |
| Interim 4 | 0.0228 | 14.6 | 52,560 | 26,411 | 75,794 | 102,206 |

2) Providing 67 CY of sediment storage for each acre & upstream sediment/erosion control
3) capture runoff from 2-year storm, modeled in HEC-HMS
4) Total volume = sum of sediment storage and settling volumes

Outlet works for the sediment control basins will include a vertical riser with a single orifice, attached to a horizontal outfall pipe placed under the embankment. The outfall pipe will convey inflow from the dewatering orifice to the outlet, which will be protected with rip rap, or other similar materials, to prevent erosion. For those basins to remain in service, the outfall pipe will be sized for final development flows, for use in storm water management, or drainage, as discussed in Section 7.

A 20-foot wide emergency spillway structure will be excavated into existing ground for each basin, as shown in Figures 3 and 4, to convey flow in excess of the basin storage and outlet works capacity.

Following BMP requirements, settling volume sufficient to hold the two-year runoff event will be contained between the bottom of the orifice and the emergency spillway. The orifices will be sized to dewater pond in about 40 hours to eliminate the potential for mosquito breeding.

The basins will be constructed with the vertical riser, outfall pipes and spillway structure to the specified elevations early in the construction process as indicated in Section 5.1.

A rip rap apron will be placed at the outlet from each sediment basin to protect the outfall channel from erosive velocities and permit spreading of the discharge from the pipe which will further slow the velocity of the discharge to non-erosive velocities.

Details for the sediment basin and SWM pond outlet structures are shown in Figure 9.

The key design parameters of the outlet works for each sediment basin are as follows:

| Basin No. | Orifice Dia., inches | Basin Bottom Elevation | Orifice Center-line Elev. | Top of Riser Elev. | Spillway Crest Elevation |
|---|---|---|---|---|---|
| 1 | 6.0 | 148.00 | 149.75 | 152.50 | 152.50 |
| 2 | 3.0 | 155.36 | 156.84 | 159.50 | 159.86 |
| 3 | 6.5 | 170.00 | 171.47 | 173.75 | 174.50 |
| 4 | 4.0 | 164.50 | 165.98 | 169.00 | 169.00 |

Upon completion of construction activities, the accumulated sediment in the basin will be removed along with the gravel berm and temporary sump structure. The sediment cleaned from the basin will be placed in the construction lay down area.

## 6.0 Inspection and Maintenance during Construction

### 6.1 Inspection Requirements

During installation, erosion and sediment control measures. starting with clearing and grubbing activities, shall be inspected on a daily basis to ensure that requirements are being met. Once in place, the Construction Environmental Coordinator shall inspect all erosion and sediment control measures at least once every 7 calendar days and within 24 hours of the end of any rainfall event producing 0.5 inches of precipitation or more.

Vegetation shall be inspected two times each week to insure that the vegetation is sustained with proper moisture and fertilization. Inspections are to be performed on all areas which have not been permanently stabilized, stockpiles, structural control measures, and construction entrances and exits to and from the site.

On areas with permanent stabilization, inspections are to be performed monthly. The construction laydown and parking areas shall be inspected weekly for leaks or spills from vehicular traffic. The inspection schedule will continue until all areas are permanently stabilized.

An Erosion Control/Storm Inspection Log will be maintained by the Construction Environmental Coordinator which documents field inspections and any maintenance and/or repair work performed. Where significant erosion has occurred, information on intensity and type of erosion shall be recorded and the area repaired as soon as possible. The log shall also note areas that cannot be immediately repaired due to the saturated soils or inaccessibility of equipment, and an estimate of when repairs will be initiated and completed.

6.2 Maintenance Requirements

The following maintenance procedures are to be performed as noted:

- Built up sediment shall be removed from silt fences when it has reached one-third the height of the fence or 6 inches, whichever is less.
- Silt fences will be inspected for depth of sediment, tears in the fabric, and fabric attachment to posts. Post shall also be inspected to ensure that they are firmly set in the ground.
- Temporary and permanent seeding shall be inspected weekly during its period of establishment for bare spots and areas of insufficient germination or growth. Remedial action shall be taken to establish a stabilized surface in these areas once identified.
- Rip rap shall be inspected for evidence of movement or washout. Rip rap experiencing movement or washout shall be removed and replaced individually in response to the observed runoff flow patterns. Larger stones shall be incorporated into the structure for anchoring and support where needed.

- Stone or sand filter traps used for storm inlet protection or filtering dikes shall be inspected and replaced when sediment impedes the effective functioning of the device. Stone shall be replaced or augmented to construction entrance tire mud removal devices when stones become inundated with mud.

- Erosion channels formed on slopes, in swales, or around structures shall be repaired and stabilized as soon as practicable after they are discovered.

- Deteriorated silt fences shall be replaced as soon as the condition is discovered.

- Inlet structures shall be cleaned and maintained to accept inflow at the design rate.

- Contaminated soils caused by spills or vehicle leaks shall be removed and treated or disposed of in an approved disposal facility.

- Fertilizer shall be applied strictly in accordance with manufacture's instructions.

- Storm water detention/retention structures, and settling basins shall be maintained in working order throughout the period of construction activity. Significant amounts of settled sediment and foreign debris shall be removed and properly disposed of. Detention basin outlet structures shall be periodically inspected for proper operation and absence of foreign debris.

- Diversion ditches/swales shall be maintained at the required depth. Sidewall cave-ins and settled sediment material shall be removed.

- At the completion of construction activities, the storm drain system shall be inspected for the presence of deposited sediment and be cleaned as necessary.

**7.0 Storm Water Management Measures**

Storm water management measures are incorporated at the Colusa Generating Station Project site to collect the runoff from the developed areas to capture and recycle the runoff. The storm water management measures incorporated for this site are listed and described below:

## 7.1 Storm Water Management Basins

Uncontrolled peak runoff rates would exceed predevelopment levels for all basins due to the construction. This is especially true of the power block and switch yard areas, but even in the subbasins that will be regraded and seeded, there will be some increase in runoff due to improved drainage.

For Subbasins 1, 2, and, 4, the dewatering riser will be removed to permit the use of the outfall pipe as a culvert. The depressed area at the upstream end of each culvert that will remain after dredging out all sediment accumulated during construction and regrading the excavation will provide sufficient volume to attenuate peak discharges from these subbasins back to predevelopment levels.

Uncontrolled peak runoff from subbasin No. 3 (containing the entire power block area) would exceed predevelopment peaks by a significant amount due to the construction of roads and impermeable surfaces and also due to the redirection of runoff from parts of adjacent predevelopment subbasins towards the new outlet.

Therefore, Sediment Basin No. 3 will be converted to function as a Storm Water Management Pond with a concrete riser controlling inflow to the outfall pipe, as shown in Figure 9.

## 7.2 Oil/Water Separator

Oil/water separators will be placed in the storm drain piping system in the parking lot areas and within the power block where small amounts of oil contamination may occur. Commercial oil/water separators will be used. Manufacturer's details will be provided at a later date.

## 7.3 Permanent Vegetation

All disturbed cut and fill slopes and laydown areas which are not occupied by plant facilities or stabilized surfaces will be stabilized with permanent vegetation to reduce runoff and provide water quality control for the runoff produced. Where possible, the permanent vegetation will reflect pre-development conditions. Prior to seedbed

preparation, the soil should be tested to determine existing nutrient conditions. Chemical fertilizer (where permissible), humus, manure, or other appropriate organic soil supplement shall be applied if test show that the existing fertility of the topsoil was lost as a result of construction activities. The vegetation stabilization shall be carried out in accordance with specifications shown in Section 5.2.4.

7.4 Maintenance of Storm Water Management System

The accumulated sediment will be removed from the storm water management basin when it reaches an average depth of 1 foot. Additionally, periodic inspections will be conducted on the storm drains to check for accumulated sediment and trash build up. Cleaning and removal of sediment or debris will be performed at least monthly during the summer months and at least every two weeks during periods of rainfall greater than 1 inch per week or as needed to maintain the operability of the drainage system.

## 8.0 References

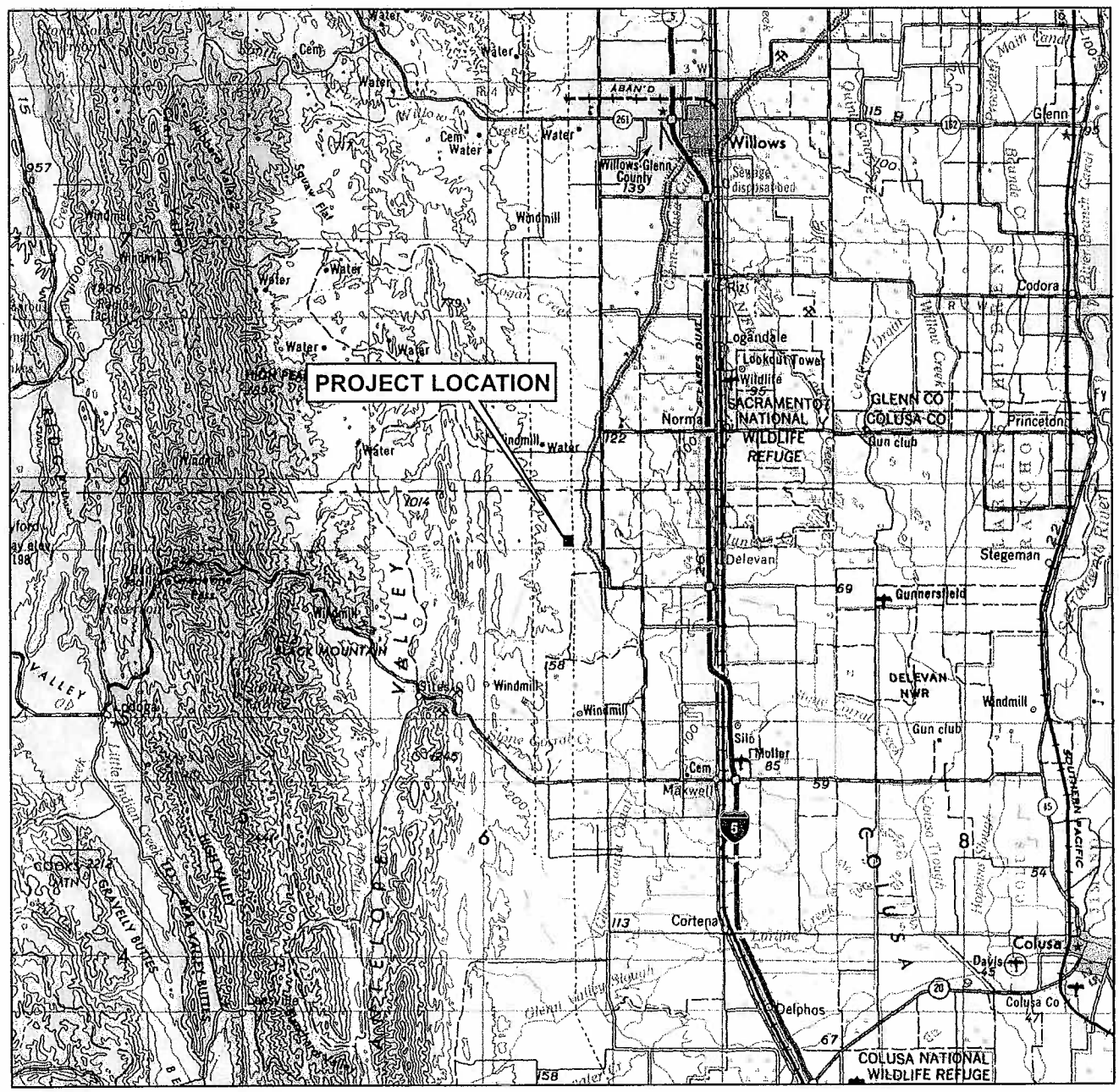

1. Application for Certification for Colusa Generating Station, Colusa County, California Volume 1. Prepared for E&L Westcoast , LLC by URS November 2006

2. Precipitation Frequency Atlas of the Western United States Volume XI, California, U.S. Department of Commerce NOAA National Weather Service 1973

3. Soil Survey of Colusa County, California, US Department of Agriculture, Natural Resources Conservation Service, Issued 2006.

4. California Stormwater BMP Handbook, California Stormwater Quality Association, 2003

5. Bechtel Power Corporation, Colusa Generating Station SWM Calculations, Calculation No. 25196-002-KDC-0000-00001, March 2007




Source:
USGS Topographic-Bathymetric Series
Ukiah, California, 1979

Draft DESCP Attachment No. 1
25196-002-30G-K03G-00001

N

0 5 10

Scale in Miles
1:250,000

**SITE VICINITY MAP**

Colusa Generating Station
E&L Westcoast, LLC
Colusa County, California

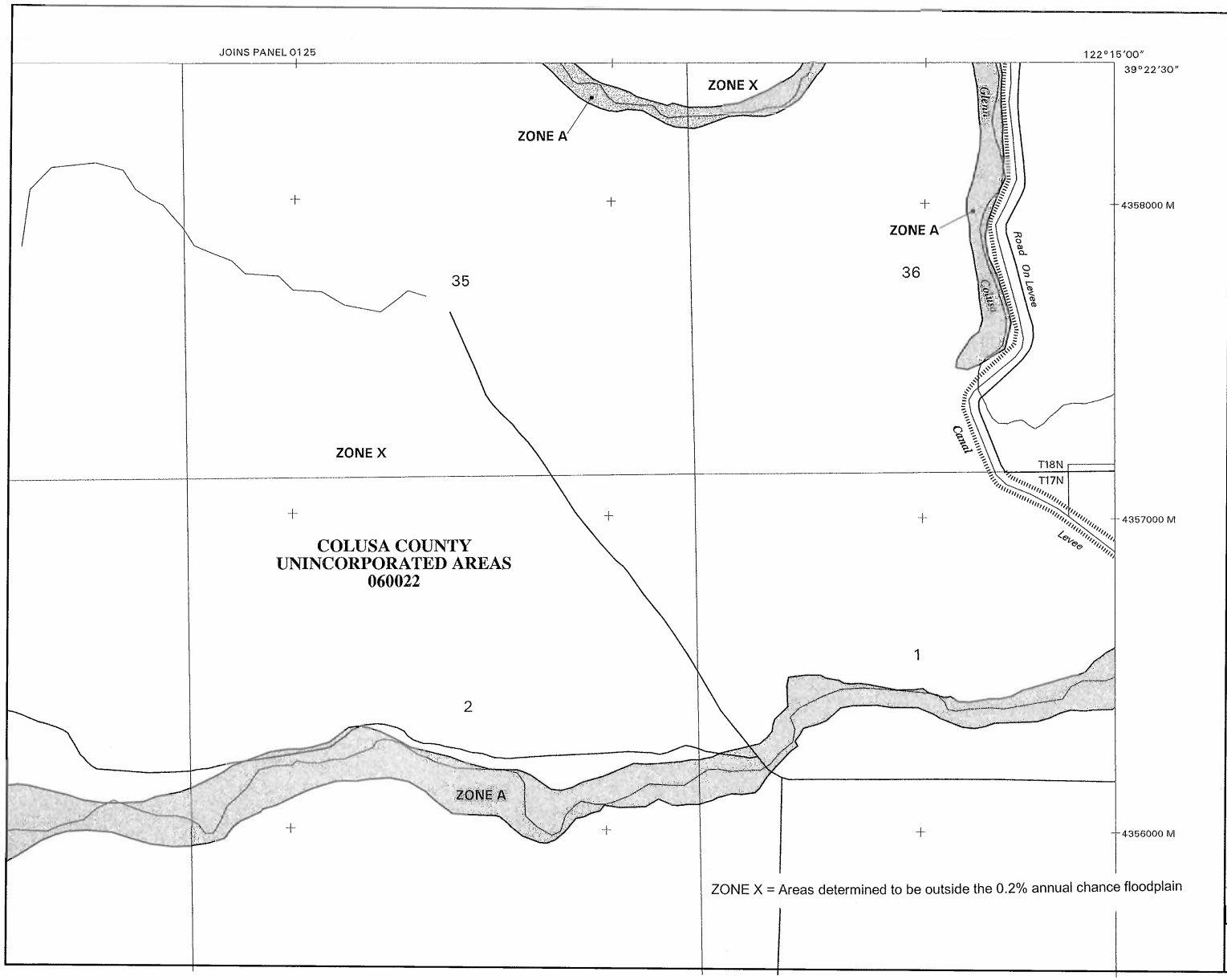
28067004
November 2006

URS

**FIGURE 1.1-1**

10/17/06 vsa ..\28067004 CPV Colusa\1.0 Introduction\1.1-1_svm.cdr

Noel Evan Rd
Dirks Rd
Delevan Rd
© 2007 Navteq
Pointer 39°21'46.98" N 122°15'19.92" W
Streaming 100%
Eye alt 6773 ft
Google




SCALE 1" = 1000'

1000 2000 FEET

METERS

PANEL 0310 F

# FIRM

## FLOOD INSURANCE RATE MAP

COLUSA COUNTY, CALIFORNIA AND INCORPORATED AREAS

## PANEL 310 OF 875

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COLUSA COUNTY, UNINCORPORATED AREAS | 060022 | 0310 | F |

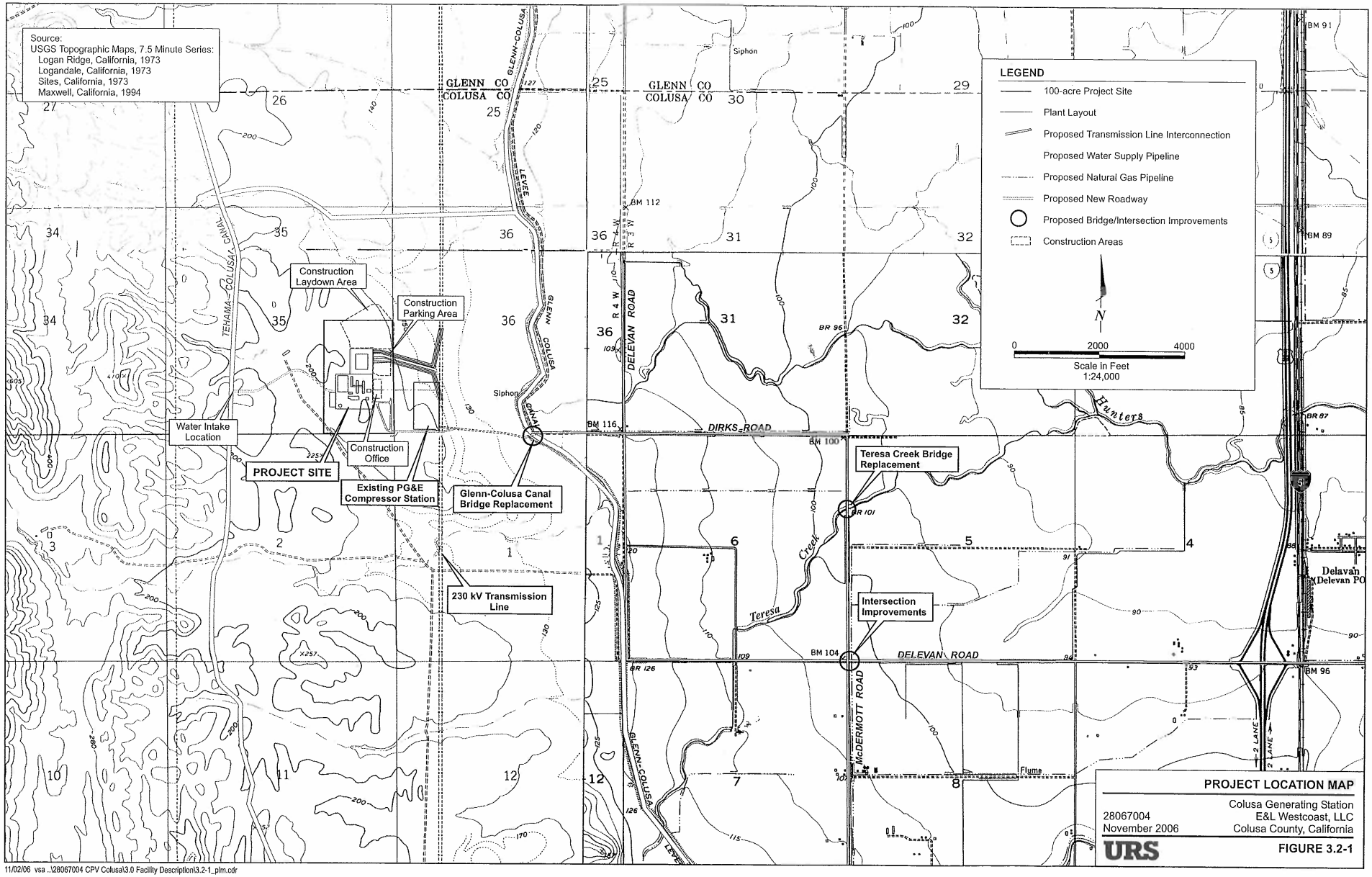
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**06011C0310 F**

**EFFECTIVE DATE:**
**MAY 15, 2003**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov




**PROJECT LOCATION MAP**

Colusa Generating Station
E&L Westcoast, LLC
Colusa County, California

28067004
November 2006

URS

**FIGURE 3.2-1**

11/02/06 vsa ..\28067004 CPV Colusa\3.0 Facility Description\3.2-1_plm.cdr

Draft DESCP Attachment No. 4
25196-002-30G-K03G-00001

# CALCULATION COVER SHEET

| PROJECT | JOB NO. | CALC NO. | SHEET |
|---|---|---|---|
| Colusa Generating Station Project Hydrology | 25196-002 | 25196-002-KDC-0000-00001 | 1 |

| SUBJECT | DISCIPLINE |
|---|---|
| Sediment & Erosion control & Storm Water Management Calculations | G&HES |

| CALCULATION STATUS DESIGNATION | PRELIMINARY | CONFIRMED | SUPERSEDED | VOIDED |
|---|---|---|---|---|
| | X | | | |

| Confirmed Calculation Issued with Preliminary Information | YES ☐ NO ☐ |
|---|---|

| PRELIMINARY INFORMATION FINAL REVIEW STATUS | REVIEWED/REVISION REQUIRED | REVIEWED/REVISION NOT REQUIRED | APPROVED/ACCEPTED |
|---|---|---|---|
| | | ☐ | |

| COMPUTER PROGRAM/TYPE | SCP | PROGRAM NO. | VERSION/RELEASE NO. |
|---|---|---|---|
| HEC-HMS | ☐ | | |

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VIII. Summary ..... Page 21
IX. References ..... Page 22
X. Reference Drawings ..... Page 22

Attachment No. 1 – Project Location Map (1 SHEET)
Attachment No. 2 – NOAA Atlas excerpts (5 SHEETS)
Attachment No. 3 – USDA soil map for site (4 SHEETS)
Attachment No. 4 – Pre-development Drainage Areas (1 SHEET)
Attachment No. 5 - Post-development Drainage Areas (1 SHEET)
Attachment No. 6 – Sediment Basin (SE-2), California Stormwater BMP Handbook (12 SHEETS)
Attachment No. 7 – Electronic copy of ColusaGS HEC-HMS project (1 CD)


| NO. | REASON FOR REVISION | TOTAL NO. OF SHEETS | LAST SHEET NO. | BY | CHECKED | APPROVED/ ACCEPTED | DATE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 00A | issue for Permitting | 46 | 22 | THJ | CMF | YZ | 3/16/07 |

**RECORD OF REVISIONS**

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## I. Objective

E&L Westcoast LLC (E&LW) and Pacific Gas & Electric (PG&E) are planning to build the Colusa Electric Generating Station with a 660 MW capacity, to be fueled by natural gas supplied to the site by an existing pipeline. The proposed site is located in a rural agricultural tract in Colusa County, California, off Dirks Road, about 4 miles west of Highway I-5, as shown in the Project Location Map from the Application for Certification prepared by URS in November 2006 (Reference 1), reproduced for this calculation as Attachment No. 1.

The objective of this calculation is to develop pre-, interim-, and post-development hydrographs for the approximately 100-acre Colusa facility for the design of sediment and erosion control structures during construction, and permanent post-construction SWM ponds for the power block and other areas as necessary.

## II. Approach

Drainage pathways were identified and four subbasins were delineated for existing conditions using topographic mapping of the site with one-foot contours, reproduced as Attachment No. 4.

A discharge hydrograph was developed in HEC-HMS for each of the four existing outfalls from the area impacted by the proposed development for the 2-, 10-, 50-, and 100-year design rainfall events, as defined in the Precipitation Frequency Atlas of the Western United States (Reference 2).

Altered drainage paths were identified and five subbasins were delineated for the final proposed development accounting for storm drains and detention pond facilities, as shown in Attachment No. 5. Post-development hydrographs were calculated for each of the outfalls in HEC-HMS for the 2-, 10-, 50-, and 100-year design storm events, separately accounting for changed runoff characteristics within the limits of development and unchanged runoff conditions outside the limits of development.

Sediment control basins, shown in Attachment No. 6, were sized for the outlet from each of the five subbasins identified for the project based on the drainage areas and volumes of runoff for a 2-year 24-hour design rainfall event, following BMP guidelines published by the State of California (Reference 7).

Modifications were identified for the conversion of the interim sediment control basins to permanent storm water management facilities in the post-construction period, as necessary to ensure that post development peak discharges remain less than predevelopment values for all rainfall events up to and including the 100-year return period. The SWM pond receiving runoff from the power block and switchyard was sized to hold the entire runoff volume from the 10-year 24-hour design rainfall event below the elevation of the outfall riser, providing the required detention to for pollutant removal by the appropriate sizing of dewatering orifices at the base of the riser box.

## III. Basic Data and Assumptions for HEC-HMS Model Development

All runoff hydrographs for pre-, interim- and post-development conditions were developed in HEC-HMS, version 3.0.1. The parameters used for modeling are described in the following subsections.

### a. Hyetograph development

Total rainfall depths for the 2-, 10-, 50-, and 100-year 24-hour design events were obtained from Figures 26, 28, 30, and 31 of the NOAA Atlas (Reference 2) for Colusa County, CA, as shown in Attachment No. 2 and summarized in Table 1. The hyetographs for each of these events, used as input to HEC-HMS, were developed from the SCS Type 1 Storm pattern, typical for "Pacific maritime climate with wet winters and dry summers" (Reference 4).

**Table 1 - Design rainfall depths for Colusa County, California (Reference 2)**

| Return Period, years | Depth, inches | Map Figure Number |
|---|---|---|
| 2 | 2.25 | 26 |
| 10 | 3.00 | 28 |
| 50 | 3.50 | 30 |
| 100 | 4.00 | 31 |

### b. HEC-HMS Basin Model Input Parameters

Elements within the HEC-HMS basin model include subbasins, reaches, and junctions. Runoff hydrographs are developed for subbasins and are routed through the channel system along reaches connected by junctions (Reference 5).

This calculation utilized the SCS Hydrograph Methodology, which requires the following parameters for each subbasin:

- Drainage Area, in square miles
- Runoff Curve Number and Initial Abstractions
- Lag Time, in minutes

Drainage Area

Drainage areas were delineated and measured in MicroStation for each subbasin for pre- and post-development conditions as shown in Attachment No. 4 and Attachment No. 5, respectively.

Runoff Curve Number

Runoff curve numbers are a function of land use and soil type, as indicated by the SCS hydrologic group rating.

Based on soil mapping for the site obtained on the USDA website, provided in Attachment No. 3, essentially all soil on site is classified as hydrologic group D soils series (Reference 3), which are described by the USDA as "soils having a very slow infiltration rate (high runoff potential) when thoroughly wet" (Reference 4), consisting chiefly of clays or soils with a clay layer and or near the surface.

Runoff curve numbers for land use conditions applicable to the site are provided in Table 2.

**Table 2 – Runoff Curve Numbers for land use patterns applicable to this site (Reference 6)**

| Land use | CN * | Storage ** |
|---|---|---|
| Roof tops & Pavement | 98 | 0.20 |
| paved road with open ditches | 93 | 0.75 |
| Gravel *** | 85 | 1.80 |
| Mowed grass | 80 | 2.50 |
| Range, grazed in good condition | 80 | 2.50 |
| Newly graded areas, no vegetation | 94 | 0.64 |

* CN values for D-type Soil per Reference 6

** Storage = (1000 - 10 CN)/CN

*** 6-inch gravel pack with porosity of 25 percent has storage depth of 1.80 inches. CN = 1000/(10+S)

Lag Time

For the implementation of the SCS method in HEC-HMS, the lag time is taken to be 60 percent of the time of concentration, calculated for each subbasin as the total time for overland, shallow concentrated, and channel flow times along the path through the contributing area resulting in the longest total item to guarantee that the entire subbasin is contributing to flow (Reference 6).

The SCS method gives the sheet-flow travel time as:

$$t_{sheet} = \frac{0.007(NL)^{0.8}}{(P_2)^{0.5} S^{0.4}}$$

in which $N$ = an overland-flow roughness coefficient; $L$ = flow length; $P_2$ = 2-year, 24-hour rainfall depth, in inches (estimated as 2.25 inches for this site per Reference 2); and $S$ = slope of hydraulic

grade line, which may be approximated by the land slope. *N* is taken as 0.011 for paved and gravel areas for proposed conditions and as 0.240 for grass-covered areas.

For this calculation, sheet flow is assumed to become shallow concentrated flow after 100 feet. The average velocity for shallow concentrated flow is estimated as $16.1345*S^{0.5}$ for unpaved areas and $20.3282*S^{0.5}$ for paved areas. Channel flow times are estimated from Manning's Equation for typical flow depths.

## IV. Results of Runoff Modeling for Storm Water Management

The results of pre-, interim-, and post-development runoff modeling are discussed in the following sections.

Predevelopment Hydrology

The predevelopment drainage patterns are shown in Attachment No. 4. A screen capture from HEC-HMS of the drainage network used to simulate predevelopment hydrology for the site is shown in Figure 1.

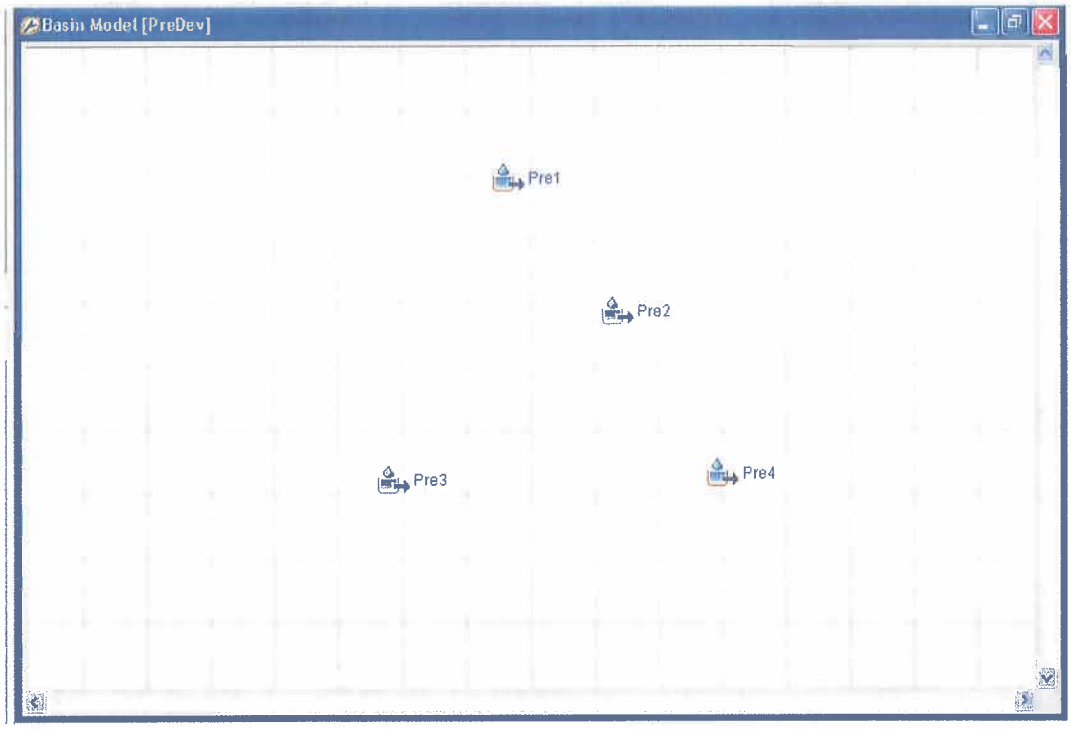



**Figure 1 – HEC-HMS drainage Basin Schematic for predevelopment drainage system**

The four drainage outlets for existing conditions, shown in Attachment No. 4, are represented in the model as catchments Pre1, Pre2, and Pre4, which drain to the northeast, and Pre3, which drains to the south-west.

The calculations for the hydrologic parameters for the pre-development subbasins shown in Figure 1 are summarized in Tables 2 and 3.

**Table 2 – SCS Hydrologic parameters for predevelopment conditions**

| Subbasin | Catchment Area | | CN | Tc, min. * | Lag, minutes ** |
|---|---|---|---|---|---|
| | acres | sq. mi. | | | |
| Pre 1 | 36.8 | 0.0575 | 80 | 26.5 | 15.9 |
| Pre 2 | 26.4 | 0.0413 | 80 | 26.0 | 15.6 |
| Pre 3 | 18.8 | 0.0294 | 80 | 21.2 | 12.7 |
| Pre 4 | 13.1 | 0.0205 | 80 | 25.9 | 15.5 |
| total | 95.1 | 0.1486 | | | |

* Time of concentraion - see Table 3 for calculation
** lag = Tc x 0.6

**Table 3 – Predevelopment time of concentration calculations**

| Sheet Flow | | | | Shallow Concentrated Flow | | | | | Time of Conc. (min.) |
|---|---|---|---|---|---|---|---|---|---|
| Length, L (ft) | Manning's n value | Slope, S | T1 (hours) * | Paved =0; Unpaved =1 | Length, L (ft) | Slope, S | Velocity, fps ** | T2 (hours) | |
| **Pre1** | | | | | | | | | |
| 100 | 0.24 | 0.03 | 0.24 | 1 | 450 | 0.0378 | 3.1 | 0.04 | |
| | | | | 1 | 1440 | 0.0236 | 2.5 | 0.16 | 26.54 |
| **Pre 2** | | | | | | | | | |
| 100 | 0.24 | 0.02 | 0.28 | 1 | 720 | 0.0292 | 2.8 | 0.07 | |
| | | | | 1 | 640 | 0.0203 | 2.3 | 0.08 | 26.01 |
| **Pre 3** | | | | | | | | | |
| 100 | 0.24 | 0.04 | 0.21 | 1 | 480 | 0.0563 | 3.8 | 0.03 | |
| | | | | 1 | 780 | 0.0167 | 2.1 | 0.10 | 21.23 |
| **Pre 4** | | | | | | | | | |
| 100 | 0.24 | 0.01 | 0.37 | 1 | 200 | 0.0400 | 3.2 | 0.02 | |
| | | | | 1 | 440 | 0.0364 | 3.1 | 0.04 | 25.87 |

* T = 0.007*(nL)^0.8/(P2^0.5 * S^0.4), with p_2 = 2.25
** V = K*S^0.5; T = L/3600V; K = 16.1345 unpaved & K = 20.3282 paved. see text for definition of variables

Peak discharges for the four subbasins of the pre-development model for the 2-, 10-, 50-, and 100-year rainfall events modeled in HEC-HMS are shown in Table 4.

**Table 4 – Results of HEC-HMS modeling of predevelopment conditions**

| sub-basin | Area, sq. mi. | 2-year Event | | | 10-year Event | | | 50-year Event | | | 100-year Event | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Q peak, cfs | Runoff | | Q peak, cfs | Runoff Volume | | Q peak, cfs | Runoff Volume | | Q peak, cfs | Runoff Volume | |
| | | | inches | ac-ft | | inches | ac-ft | | inches | ac-ft | | inches | ac-ft |
| Pre1 | 0.0575 | 11.06 | 0.72 | 2.21 | 21.50 | 1.25 | 3.83 | 29.22 | 1.64 | 5.02 | 37.34 | 2.04 | 6.26 |
| Pre2 | 0.0413 | 8.03 | 0.72 | 1.59 | 15.61 | 1.25 | 2.75 | 21.20 | 1.64 | 3.60 | 27.08 | 2.04 | 4.50 |
| Pre3 | 0.0294 | 6.35 | 0.72 | 1.13 | 12.30 | 1.25 | 1.96 | 16.69 | 1.64 | 2.57 | 21.31 | 2.04 | 3.20 |
| Pre4 | 0.0205 | 4.00 | 0.72 | 0.79 | 7.77 | 1.25 | 1.37 | 10.56 | 1.64 | 1.79 | 13.48 | 2.04 | 2.23 |

The values of peak runoff at the four outlets for pre-development conditions are not to be exceeded for the developed site for the 10-year runoff event. The hydrographs calculated in HEC-HMS for these outfalls are shown in Figure 2; output is provided in Attachment No. 7.

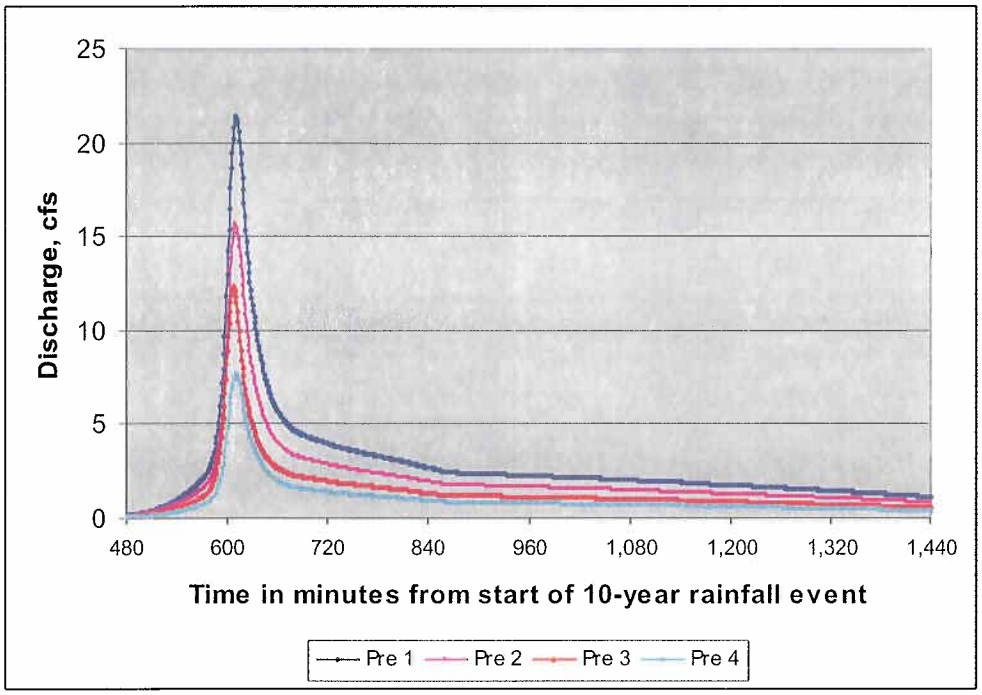



**Figure 2 – 10-year return period outfall hydrographs for pre-development conditions**

## V. Runoff Modeling for Interim Conditions Hydrology

The proposed interim and post-development drainage patterns are shown in Attachment No. 5. Approximately 17.9 acres that currently drain to the east will be diverted the southwest as the result of site grading for the power block and switch yard.

The drainage network used to simulate interim hydrologic conditions for the site (i.e. during construction) in HEC-HMS is shown in Figure 3. The Interim1, Interim2 and Interim4 subbasins correspond to the similar numbered predevelopment basins, although areas are not the same; the Pre3 subbasin was divided into Interim3, containing the power block, and Interim5, outside the power block, to account for the drainage from the unimproved area within Pre3 that will be diverted around sediment basin 3.

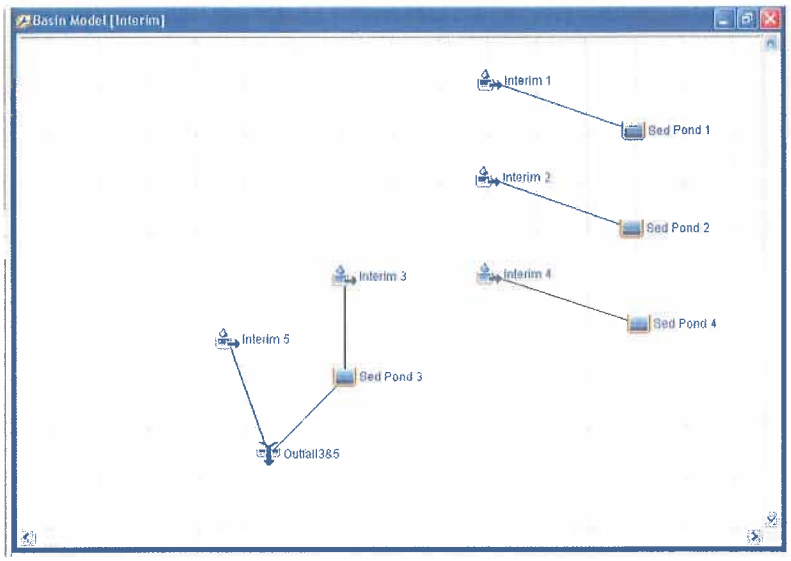



**Figure 3 – HEC-HMS drainage Basin Schematic for interim conditions**

During the interim construction period a great deal of additional land within the 100-acre site will be cleared and graded as lay down areas and temporary access roads. The sediment ponds at the outlet of each basin are sized in accordance with best management requirements as described below.

The runoff curve numbers for estimating runoff volumes during construction are increased to account for the increased runoff associated with the maximum extent of grubbing and grading, as shown in Table 7 (i.e. the gravel to be applied in the construction parking is not counted – that area is assumed to be recently graded for purposes of conservative assessment of runoff).

Runoff curve numbers for the post construction period have been selected to account for final land cover, including areas that will be permanently covered in gravel and areas to be revegetated.

Area-weighted curve numbers, CN, are calculated for the interim and postdevelopment land use conditions for each subbasin based on the standard formula:

$$CN = \sum_i CN_i * Area_i / \sum_i Area_i$$

Times of concentration are calculated with the same methodology as was used for predevelopment conditions.

The calculations of the hydrologic parameters for the interim conditions subbasins shown in Figure 3 are summarized in Tables 5 and 6. Calculations for post development hydrology are presented in a later section, after the calculations for the dimensioning of the sedimentation basins.

### Table 5 – SCS Hydrologic parameters for interim conditions

INTERIM CONDITIONS - WORST POINT DURING CONSTRUCTION

| Subbasin | Catchment Area | | | Land Use | | | | Weighted CN * | Tc, min. ** | Lag, minutes ** |
|---|---|---|---|---|---|---|---|---|---|---|
| | acres | sq. ft. | sq. mi. | Disturbed | Impervious | Gravel | Range/grass | | | |
| Interim 1 | 37.5 | 1,633,500 | 0.0586 | 805,000 | 60,000 | 0 | 768,500 | 87.6 | 22.9 | 13.8 |
| Interim 2 | 6.2 | 270,072 | 0.0097 | 222,512 | 25,488 | 0 | 22,072 | 93.2 | 3.7 | 2.2 |
| Interim 3 | 29.7 | 1,293,732 | 0.0464 | 1,173,744 | 80,388 | 0 | 39,600 | 93.8 | 11.3 | 6.8 |
| Interim 4 | 14.6 | 635,976 | 0.0228 | 470,688 | 45,288 | 0 | 120,000 | 91.6 | 19.0 | 11.4 |
| Interim 5 | 5.1 | 222,156 | 0.0080 | 0 | 0 | 0 | 222,156 | 80.0 | 16.4 | 9.8 |
| | 93.1 | | | 94 | 98 | 85 | 80 | | | |

* see text for calculation of weighted CN.

** See time of concentration calculation in following table.

### Table 6 – Interim conditions time of concentration calculations

| Sheet Flow | | | | Shallow Concentrated Flow | | | | | | Ditch Flow | | | | Time of Conc. (min.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length, L (ft) | Manning's n value | Slope, S | T1 (hours) * | Paved =0; Unpaved =1 | Length, L (ft) | Slope, S | Velocity, fps ** | T2 (hours) | Link Type | Slope, S | Length, L (ft) | Estimated Vel (fps) | T3 (hours) | |
| **Interim 1** | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.03 | 0.24117 | 1 | 600 | 0.035 | 3.01848856 | 0.05522 | geotextile-lined swale | 0.02 | 1550 | 5.00 | 0.0861 | 22.9 |
| **Interim 2** | | | | | | | | | | | | | | |
| 100 | 0.011 | 0.03333 | 0.02 | 0 | 410 | 0.0176 | 2.7 | 0.04 | no ditch | 0.0025 | 0 | 4.50 | 0.00 | 3.7 |
| **Interim 3** | | | | | | | | | | | | | | |
| 100 | 0.011 | 0.01 | 0.03 | 0 | 200 | 0.0100 | 2.0 | 0.03 | ditch & SD | 0.0025 | 1400 | 3.00 | 0.13 | 11.3 |
| **Interim 4** | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.04 | 0.21 | 1 | 150 | 0.0533 | 3.7 | 0.01 | grass ditch | 0.0165 | 970 | 3.00 | 0.09 | 19.0 |
| **Interim 5** | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.04 | 0.21 | 1 | 330 | 0.0576 | 3.9 | 0.02 | grass ditch | 0.0300 | 500 | 4.00 | 0.03 | 16.4 |

* T = 0.007*(nL)^0.8/(P2^0.5 * S^0.4), with p_2 = 2.25

** V = K*S^0.5; T = L/3600V; K = 16.1345 unpaved & K = 20.3282 paved. see text for definition of variables

The acreage of the contributing area for each sediment basin was measured in Microstation for each of the areas delineated in rough grading plan (see Attachment No. 6).

The volume of runoff for the 2-year 24-hour storm was determined in HEC-HMS, as summarized in Table 7, which is extracted from the Global Summary Results for Run "Interim_2yr".

**Table 7 – Runoff for 2-year storm on interim conditions subbasins (to be provided for settling storage volume)**

| Subbasin | Area, $mi^2$ | Peak Discharge, cfs | Runoff Volume, Ac-ft | Runoff Volume, cubic feet |
|---|---|---|---|---|
| Interim 1 | 0.0586 | 22.86 | 3.57 | 155,509 |
| Interim 2 | 0.0097 | 8.34 | 0.81 | 35,284 |
| Interim 3 | 0.0464 | 34.71 | 3.99 | 173,804 |
| Interim 4 | 0.0228 | 12.62 | 1.74 | 75,794 |
| Interim 5 | 0.008 | 1.94 | 0.31 | 13,504 |

## VI. Sediment Pond Sizing

The sizes of the sediment ponds required during the construction of the generating station are based on requirements laid out in the California Stormwater BMP Handbook, Section SE-2 (Reference 7). A copy of the SE-2 section of the manual is provided as Attachment No. 9. The calculations required for sizing the basins are summarized in this section. Upstream erosion and sediment controls are to be used in conjunction with the sediment ponds, as described in the Sediment and Erosion Control Plan.

The ponds are sized in accordance with Option 2 of the manual. Referring to Figure 4, the volume requirements for each pond according to this option include:

- Provide a minimum total volume of 3,600 cubic feet in the pond for each acre drained
- Provide a sediment storage volume of 67 cubic yards of for each acre drained
- Provide a settling zone storage volume sufficient to capture all runoff from the 2-year storm

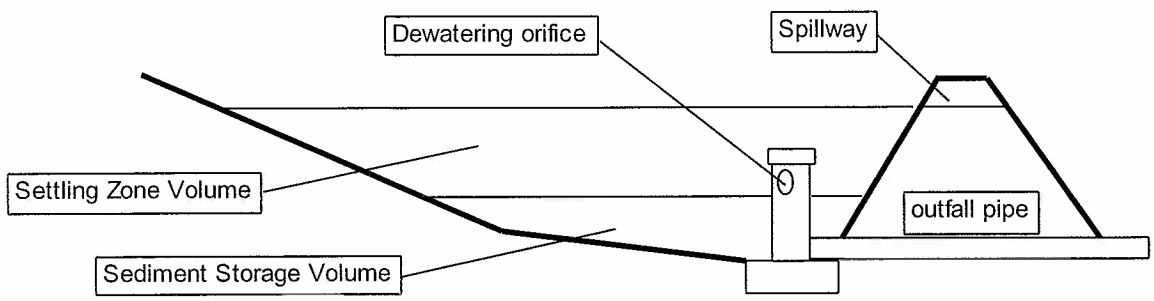



**Figure 4 – Schematic drawing of sediment ponds for Colusa Project construction site**

No sediment basin is required for Basin 5, in which no construction activities are planned. The volume requirements for the other four subbasins are summarized in Table 8. The volume requirement based on sediment storage and settling volume is greater than the minimum volume requirement based on acreage alone for all basins.

**Table 8 Sediment Basin Volume Requirements per California BMP Practices (Reference 7)**

| Subbasin | Catchment Area | | Minumum Volume below spillway, $ft^3$ (1) | Required sediment storage, $ft^3$ (2) | Required Settling Volume, $ft^3$ (3) | Total volume required below spillway, $ft^3$ (4) |
|---|---|---|---|---|---|---|
| | sq. mi. | acres | | | | |
| Interim 1 | 0.0586 | 37.5 | 135,000 | 67,838 | 155,509 | 223,347 |
| Interim 2 | 0.0097 | 6.2 | 22,320 | 11,216 | 35,284 | 46,499 |
| Interim 3 | 0.0464 | 29.7 | 106,920 | 53,727 | 173,804 | 227,532 |
| Interim 4 | 0.0228 | 14.6 | 52,560 | 26,411 | 75,794 | 102,206 |

1) Providing 3,600 CF storage per acre drained
2) Providing 67 CY of sediment storage for each acre & upstream sediment/erosion control
3) capture runoff from 2-year storm, modeled in HEC-HMS
4) Total volume = sum of sediment storage and settling volumes

Additional geometric design parameters for sediment basins include (Reference 7):

- Provide a minimum sediment storage zone depth of 1 foot
- Provide a minimum settling zone depth of 2 feet
- Provide a minimum total pond depth of 3 feet and a maximum depth of 5 feet
- Provide a basin length (from the inlet to the outlet) greater than twice the width
- Insure that the length to settling depth ratio (L/SD) is less than 200

Based on the geometric design parameters and required storage volumes for the sediment storage and settling zones, preliminary minimum dimensions of the five basins have been determined, as follows:

- The depth from the bottom of the basin to the spillway was set to 4.5 feet for all basins
- A rectangular base footprint is assumed with a width to length ratio of 1:3, exceeding the minimum required ratio of 1:2.
- Based on a trial width, w, a bottom area is calculated as $A_1 = 3w^2$
- Using a 3 horizontal to 1 horizontal pond side slope (1:Z = 1:3) to increase the width and length each by twice the product of Z times the depth, h, the basin surface area at the spillway elevation is calculated as $A_2 = (w + 6h)*(3w + 6h)$
- The bottom side width, w, was calculated iteratively to give a total basin volume $V = h*(A_1 + A_2 + \sqrt{A_1 * A_2})/3$ equal to the required volume given in the last column of Table 9.
- The requirement that L/SD < 200 is checked

Geometric calculations for are summarized in Table 9.

**Table 9 - Minimum sediment basin dimensions**

| Bottom dimensions of pond W x L | Depth to spillway, Hs, ft | Pond dimensions at spillway (1) | L:W ratio at spillway elevation | Bottom area of pond (2) | Area of pond at spillway (2) | Check volume below spillway, $ft^3$ (3) | Depth to top of pond, ft | Top of Pond rough dimensions | Top of pond area, sf (4) |
|---|---|---|---|---|---|---|---|---|---|
| 120 x 360 | 4.50 | 147 x 387 | 2.63 | 43,200 | 56,889 | 224,495 | 6.50 | 162 x 399 | 64,738 |
| 50 x 150 | 4.50 | 77 x 177 | 2.30 | 7,500 | 13,629 | 46,859 | 6.50 | 92 x 189 | 17,435 |
| 135 x 330 | 4.50 | 162 x 357 | 2.20 | 44,550 | 57,834 | 229,715 | 6.50 | 177 x 369 | 65,405 |
| 80 x 240 | 4.50 | 107 x 267 | 2.50 | 19,200 | 28,569 | 106,784 | 6.50 | 122 x 279 | 34,108 |

1) Pond dimensions at height H = W x L = (W + 6H) x (3W + 6H)
2) Area = W x L
3) Volume = Hs*(A1 + A2 + [A1*A2]0.5)/3, with A1 = bottom area, A2 = area at spillway
4) Volume = $H_{TOP}$*(A1 + A2 + [A1*A2]0.5)/3, with A1 = bottom area, A2 = area at top of pond

Calculations to confirm that the basins as dimensioned comply with BMP requirements published by the State of California are presented in Table 10. As required, the sediment storage depth is greater than one foot and the settling zone depth is greater than 2 feet for all basins.

## Table 10 – Check that basins meet BMP requirements as dimensioned

| Required sediment storage, in cubic feet (1) | Sediment storage depth (1 ft min.) | Sediment storage provided (2) | Settling depth provided (3) | Settling volume provided, $ft^3$ (4) | Settling volume required, $ft^3$ (5) | Length to Settling depth Ratio (6) |
|---|---|---|---|---|---|---|
| 67,838 | 1.50 | 68,074 | 3.00 | 156,421 | 155,509 | 137.99 |
| 11,216 | 1.35 | 11,216 | 3.15 | 35,643 | 35,284 | 61.22 |
| 53,727 | 1.20 | 55,487 | 3.30 | 174,228 | 173,804 | 118.80 |
| 26,411 | 1.31 | 26,894 | 3.19 | 79,890 | 75,794 | 90.26 |

1) From BMP requirements (see Table 8)
2) Storage volume = hs*(A1 + A2 + [A1*A2]2)/3
3) Settling depth = Height to spillway - sediment depth
4) Settling volume provide = Total volume below spillway - sediment storage volume
5) per requirement to hold the 2-year runoff volume
6) pond diagonol length at spillway height /sediment depth provided

Actual sediment basin dimensions vary from the calculated values as the result of fitting the basins to the site topography. Table 11 presents the stage-area data for the ponds as laid out on the rough grading plans (see Attachment No. 6) and shows that the calculated volumes are greater than the minimum required volumes presented above in Table 8.

## Table 11 Stage-area take-off data for sediment basins laid out for construction

| | Location of cutting plane | Elev * | Area, sf * | acres | Volume Provided, acft | | Required Volume ** | |
|---|---|---|---|---|---|---|---|---|
| | | | | | wedge | cumulative | Cubic Feet | Acre-feet |
| Basin No. 1 | Bottom | 148.00 | 43,138.0 | 0.990 | | | | |
| | Spillway | 152.50 | 56,842.0 | 1.305 | 5.148 | 5.148 | 223,346.7 | 5.127 |
| | Top of basin | 154.50 | 63,224.0 | 1.451 | 2.755 | 7.903 | | |
| Basin No. 2 | Location of cutting plane | Elev * | Area, sf * | acres | Volume, acft | | | |
| | | | | | wedge | cumulative | | |
| | Bottom | 155.36 | 7,500.0 | 0.172 | | | | |
| | Spillway | 159.86 | 13,525.0 | 0.310 | 1.071 | 1.071 | 46,499.4 | 1.067 |
| | Top of basin | 161.86 | 16,559.0 | 0.380 | 0.689 | 1.760 | | |
| Basin No. 3 | Location of cutting plane | Elev * | Area, sf * | acres | Volume, acft | | | |
| | | | | | wedge | cumulative | | |
| | Bottom | 170.00 | 44,526.0 | 1.022 | | | | |
| | Spillway | 174.50 | 57,786.0 | 1.327 | 5.270 | 5.270 | 227,531.7 | 5.223 |
| | Top of basin | 176.50 | 64,056.0 | 1.471 | 2.796 | 8.066 | | |
| Basin No. 4 | Location of cutting plane | Elev * | Area, sf * | acres | Volume, acft | | | |
| | | | | | wedge | cumulative | | |
| | Bottom | 164.50 | 19,200.0 | 0.441 | | | | |
| | Spillway | 169.00 | 28,497.0 | 0.654 | 2.448 | 2.448 | 102,205.8 | 2.346 |
| | Top of basin | 171.00 | 32,961.0 | 0.757 | 1.410 | 3.858 | | |

* values provided by project
** see total volume required below spillway, Table 8

The outlet for each basin consists of a vertical stand pipe rising from the pond bottom to an elevation six inches below the spillway crest. An orifice is cut into the side of the stand pipe with its bottom invert located at the sediment storage depth given in Column 2 of Table 11. This ensures that the full calculated sediment storage is provided.

The orifice diameter is sized with a standard diameter to provide dewatering of the entire basin's settling volume in approximately 40 hours, following BMP guidelines published by the State of California. The time in hours for dewatering the settling volume is estimated as (Reference 7):

$T = \frac{7x10^{-5} A(H - H_0)^{0.5}}{C * a}$ where A is the area in $ft^2$ at the midpoint elevation, H and $H_0$ are the height above the pond bottom of the spillway crest and orifice invert, respectively, C is the discharge coefficient for the orifice, set at 0.8 for thick-walled risers, and a is the orifice area. These calculations are presented for each basin in Table 12.

**Table 12 Sediment Basin dewatering orifice calculations**

| Subbasin | Middepth | Mid-depth surface area, sf | Dewatering depth ($H - H_0$) | Single orifice dia, in inches | Orifice area, sf (1) | Dewatering time, hrs (2) |
|---|---|---|---|---|---|---|
| Interim 1 | 3.00 | 52,164.00 | 3.00 | 6.0 | 0.1963 | 40.3 |
| Interim 2 | 2.92 | 11,315.88 | 3.15 | 3.0 | 0.0491 | 35.8 |
| Interim 3 | 2.85 | 52,793.91 | 3.30 | 6.5 | 0.2304 | 36.4 |
| Interim 4 | 2.91 | 25,084.93 | 3.19 | 4.0 | 0.0873 | 44.9 |

1) Area = $\pi$(Dia[inches]/12)$^2$/4

2) T = $7x10^{-5}*A(H-H_0)^{0.5}/(C*a)$; see text for explaination of variables

Each sediment pond is provided with a 20-foot wide emergency spillway cut into natural ground, following BMP guidelines (Reference 7).

The performance of the sediment basins for the 10-year rainfall event is checked in an interim conditions HEC-HMS model, assuming that the sediment storage for each basin is full (i.e. the starting water surface is set to the sediment storage depth shown in Table 10. Stage-area data for each basin is presented in Table 11, above; stage-discharge relations were calculated for the outlet works for each basin and input into HEC-HMS as summarized in Table 13.

Results for the 10-year rainfall event are shown in Table 14. Based on the results it is concluded that the sediment pond design is adequate for controlling sediment from the site during the construction period.

# CALCULATION SHEET

PROJECT: Colusa Generating Station
JOB NUMBER: 25196-002
CALC NO. 25196-002-KDC-0000-00001
SHEET NO. 15
SHEET REV. A

SUBJECT: Colusa Generating Station Project Hydrology

BY: Thomas H. Jackson

DATE: March 2007

## Table 13 Stage-discharge calculations for each sediment basin

| Sediment Basin #1 | | | | | | Sediment Basin #2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Weir Length | 20 | ft | Orifice Dia. | 6 | in | Weir Length | 20 | ft | Orifice Dia. | 3.0 | in |
| Cw | 2.8 | | $C_D$ | 0.8 | | Cw | 2.8 | | $C_D$ | 0.8 | |
| Crest Elev | 152.50 | ft | Inv Elev | 149.50 | ft | Crest Elev | 159.86 | ft | Inv Elev | 156.71 | ft |
| Bottom | 148.00 | ft | C.L. Elev | 149.75 | ft | Bottom | 155.36 | ft | C.L. Elev | 156.84 | ft |
| Elev. ft | Weir | | Orifice | | Q cfs (3) | Elev. ft | Weir | | Orifice | | Q cfs (3) |
| | H | Q (1) | H | Q (2) | | | H | Q (1) | H | Q (2) | |
| 148.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 155.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 149.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 156.71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 151.00 | 0.00 | 0.00 | 1.25 | 1.41 | 1.41 | 158.29 | 0.00 | 0.00 | 1.45 | 0.38 | 0.38 |
| 152.50 | 0.00 | 0.00 | 2.75 | 2.09 | 2.09 | 159.86 | 0.00 | 0.00 | 3.03 | 0.55 | 0.55 |
| 153.00 | 0.50 | 19.80 | 3.25 | 2.27 | 22.07 | 160.36 | 0.50 | 19.80 | 3.53 | 0.59 | 20.39 |
| 153.50 | 1.00 | 56.00 | 3.75 | 2.44 | 58.44 | 160.86 | 1.00 | 56.00 | 4.03 | 0.63 | 56.63 |
| 154.00 | 1.50 | 102.88 | 4.25 | 2.60 | 105.48 | 161.36 | 1.50 | 102.88 | 4.53 | 0.67 | 103.55 |
| 154.50 | 2.00 | 158.39 | 4.75 | 2.75 | 161.14 | 161.86 | 2.00 | 158.39 | 5.03 | 0.71 | 159.10 |

| Sediment Basin #3 | | | | | | Sediment Basin #4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Weir Length | 20 | ft | Orifice Dia. | 6.5 | in | Weir Length | 20 | ft | Orifice Dia. | 4 | in |
| Cw | 2.8 | | $C_D$ | 0.8 | | Cw | 2.8 | | $C_D$ | 0.8 | |
| Crest Elev | 174.50 | ft | Inv Elev | 171.20 | ft | Crest Elev | 169.00 | ft | Inv Elev | 165.81 | ft |
| Bottom | 170.00 | ft | C.L. Elev | 171.47 | ft | Bottom | 164.50 | ft | C.L. Elev | 165.98 | ft |
| Elev. ft | Weir | | Orifice | | Q cfs (3) | Elev. ft | Weir | | Orifice | | Q cfs (3) |
| | H | Q (1) | H | Q (2) | | | H | Q (1) | H | Q (2) | |
| 170.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 164.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 171.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 165.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 172.85 | 0.00 | 0.00 | 1.38 | 1.74 | 1.74 | 167.41 | 0.00 | 0.00 | 1.43 | 0.67 | 0.67 |
| 174.50 | 0.00 | 0.00 | 3.03 | 2.57 | 2.57 | 169.00 | 0.00 | 0.00 | 3.02 | 0.97 | 0.97 |
| 175.00 | 0.50 | 19.80 | 3.53 | 2.78 | 22.58 | 169.50 | 0.50 | 19.80 | 3.52 | 1.05 | 20.85 |
| 175.50 | 1.00 | 56.00 | 4.03 | 2.97 | 58.97 | 170.00 | 1.00 | 56.00 | 4.02 | 1.12 | 57.12 |
| 176.00 | 1.50 | 102.88 | 4.53 | 3.15 | 106.03 | 170.50 | 1.50 | 102.88 | 4.52 | 1.19 | 104.07 |
| 176.50 | 2.00 | 158.39 | 5.03 | 3.32 | 161.71 | 171.00 | 2.00 | 158.39 | 5.02 | 1.26 | 159.65 |

1) $Q = L*C_w*H^{1.5}$
2) $Q = C_D*A*(2gH)^{0.5}$
3) Q = Qweir + Qorifice

## Table 14 Sediment Basin Performance for 10-year Storm Event

| Basin No. | Depth to orifice invert | Basin Bottom Elevation | Starting WSL for HEC-HMS | Spillway Crest Elevation | Top of Basin Elevation | Maximum Water Surface Elevation | Peak Q in, cfs | Peak Q out, cfs |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.50 | 148.00 | 149.50 | 152.50 | 154.50 | 152.33 | 36.86 | 2.01 |
| 2 | 1.35 | 155.36 | 156.71 | 159.86 | 161.86 | 159.29 | 12.09 | 0.49 |
| 3 | 1.20 | 170.00 | 171.20 | 174.50 | 176.50 | 173.96 | 49.88 | 2.30 |
| 4 | 1.31 | 164.50 | 165.81 | 169.00 | 171.00 | 168.59 | 18.88 | 0.89 |

## VII. Runoff Modeling for Postdevelopment Conditions SWM Hydrology

The HEC-HMS network schematic for the post development site hydrology modeling is shown in Figure 5. Drainage areas are the same as for interim conditions; runoff curve numbers and times of concentration are adjusted for final conditions on site (removing gravel, regrading, and seeding in the lay down and temporary construction office and parking areas, and placing gravel in the power block and switch yard areas), as summarized in Tables 15 and 16.

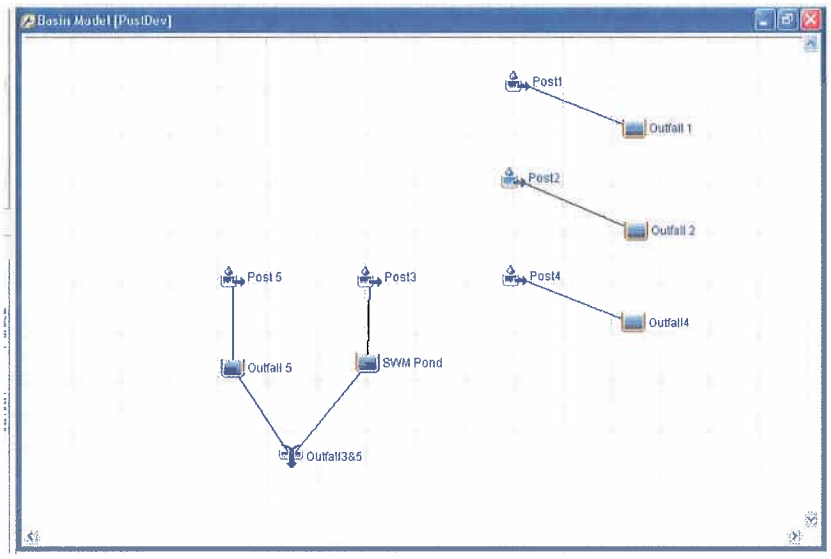



**Figure 5 – HEC-HMS schematic for Postdevelopment Conditions modeling**

**Table 15 - SCS Runoff Curve Numbers for final development conditions**

| Subbasin | Catchment Area | | | Land Use | | | | Weighted CN * | Tc, min. ** | Lag, minutes ** |
|---|---|---|---|---|---|---|---|---|---|---|
| | acres | sq. ft. | sq. mi. | Road | Impervious | Gravel | Range/grass | | | |
| Post 1 | 37.5 | 1,633,500 | 0.0586 | 0 | 0 | 0 | 1,633,500 | 80.0 | 26.0 | 15.6 |
| Post 2 | 6.2 | 270,072 | 0.0097 | 37,007 | 0 | 0 | 233,065 | 81.8 | 17.1 | 10.2 |
| Post 3 | 29.7 | 1,293,732 | 0.0464 | 162,852 | 102,234 | 1,028,646 | 0 | 87.0 | 11.3 | 6.8 |
| Post 4 | 14.6 | 635,976 | 0.0228 | 65,714 | 0 | 0 | 570,262 | 81.3 | 19.0 | 11.4 |
| Post 5 | 5.1 | 222,156 | 0.0080 | 0 | 0 | 0 | 222,156 | 80.0 | 16.4 | 9.8 |
| | | | CN = | 93 | 98 | 85 | 80 | | | |

* see text for calculation of weighted CN.
** See time of concentration calculation in following table.

## Table 16 – Post-development time of concentration calculations

| Sheet Flow | | | | Shallow Concentrated Flow | | | | | | Ditch Flow | | | | Time of Conc. (min.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length, L (ft) | Manning's n value | Slope, S | T1 (hours) * | Paved =0; Unpaved =1 | Length, L (ft) | Slope, S | Velocity, fps ** | T2 (hours) | Link Type | Slope, S | Length, L (ft) | Estimated Vel (fps) | T3 (hours) | |
| Post 1 | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.02 | 0.28364 | 1 | 1150 | 0.02 | 2.28176287 | 0.14 | grass ditch | 0.02 | 100 | 3.00 | 0.0093 | 26.0 |
| Post 2 | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.03333 | 0.23 | 1 | 410 | 0.0176 | 2.1 | 0.05 | no ditch | 0.0025 | 0 | 4.50 | 0.00 | 17.1 |
| Post 3 | | | | | | | | | | | | | | |
| 100 | 0.011 | 0.01 | 0.03 | 0 | 200 | 0.0100 | 2.0 | 0.03 | ditch & SD | 0.0025 | 1400 | 3.00 | 0.13 | 11.3 |
| Post 4 | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.04 | 0.21 | 1 | 150 | 0.0533 | 3.7 | 0.01 | grass ditch | 0.0165 | 970 | 3.00 | 0.09 | 19.0 |
| Post 5 | | | | | | | | | | | | | | |
| 100 | 0.24 | 0.04 | 0.21 | 1 | 330 | 0.0576 | 3.9 | 0.02 | grass ditch | 0.0300 | 500 | 4.00 | 0.03 | 16.4 |

* T = 0.007*(nL)^0.8/(P2^0.5 * S^0.4), with p_2 = 2.25

** V = K*S^0.5; T = L/3600V; K = 16.1345 unpaved & K = 20.3282 paved. see text for definition of variables

## Comparison of pre- and post-development runoff

Four subbasins were delineated for existing, or predevelopment conditions; five subbasins were delineated for post development runoff to the same four outlets, based on final drainage and land use patterns.

Uncontrolled runoff from each of the predevelopment subbasins is compared with the appropriate post development subbasin or basins in Table 17.

## Table 17 – comparison of pre- and post-development drainage basins

| sub-basin | Area, sq. mi. | 2-year Event | | | 10-year Event | | | 50-year Event | | | 100-year Event | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Q peak, cfs | Runoff | | Q peak, cfs | Runoff Volume | | Q peak, cfs | Runoff Volume | | Q peak, cfs | Runoff Volume | |
| | | | inches | ac-ft | | inches | ac-ft | | inches | ac-ft | | inches | ac-ft |
| Pre1 | 0.0575 | 11.06 | 0.72 | 2.21 | 21.50 | 1.25 | 3.83 | 29.22 | 1.64 | 5.02 | 37.34 | 2.04 | 6.26 |
| Pre2 | 0.0413 | 8.03 | 0.72 | 1.59 | 15.61 | 1.25 | 2.75 | 21.20 | 1.64 | 3.60 | 27.08 | 2.04 | 4.50 |
| Pre3 | 0.0294 | 6.35 | 0.72 | 1.13 | 12.30 | 1.25 | 1.96 | 16.69 | 1.64 | 2.57 | 21.31 | 2.04 | 3.20 |
| Pre4 | 0.0205 | 4.00 | 0.72 | 0.79 | 7.77 | 1.25 | 1.37 | 10.56 | 1.64 | 1.79 | 13.48 | 2.04 | 2.23 |
| Post 1 | 0.0586 | 11.39 | 0.72 | 2.25 | 22.14 | 1.25 | 3.91 | 30.08 | 1.64 | 5.11 | 38.42 | 2.04 | 6.38 |
| Post 2 | 0.0097 | 2.74 | 0.81 | 0.42 | 5.01 | 1.37 | 0.71 | 6.66 | 1.77 | 0.91 | 8.37 | 2.19 | 1.13 |
| Post 3 | 0.0464 | 22.63 | 1.10 | 2.73 | 36.79 | 1.74 | 4.30 | 46.6 | 2.18 | 5.40 | 56.57 | 2.64 | 6.52 |
| Post 5 | 0.0080 | 1.94 | 0.72 | 0.31 | 3.74 | 1.25 | 0.53 | 5.07 | 1.64 | 0.7 | 6.47 | 2.04 | 0.87 |
| Post 3 & 5 | 0.0544 | 24.57 | 1.04 | 3.04 | 40.53 | 1.67 | 4.83 | 51.67 | 2.10 | 6.1 | 63.04 | 2.55 | 7.39 |
| Post 4 | 0.0228 | 5.86 | 0.78 | 0.95 | 10.91 | 1.33 | 1.62 | 14.58 | 1.73 | 2.1 | 18.41 | 2.15 | 2.61 |
| Increase in post development peak runoff compared to predevelopment values | | | | | | | | | | | | | |
| Post 1 | | 3% | | | 3% | | | 3% | | | 3% | | |
| Post 2 | | -66% | | | -68% | | | -69% | | | -69% | | |
| Post 3 & 5 | | 287% | | | 230% | | | 210% | | | 196% | | |
| Post 4 | | 47% | | | 40% | | | 38% | | | 37% | | |

Based on the results summarized in Table 17, it was determined that permanent storm water management measures would be required for Outlets 1, 3, and 4.

After construction is completed and the upstream area contributing to each sediment basin has been stabilized, the interim-conditions outlet structures will be modified as follows:

- For basins 1 & 4: the dewatering riser will be removed and the outfall pipe will be retained as a culvert
- For basin 3: the dewatering riser will be replaced by a storm water management riser with the outfall pipe remaining in place.

A further requirement for the Basin 3 SWM pond is that it must have sufficient storage below the riser to store the volume of runoff from power block and switch yard for the 10-year runoff event, which was calculated in HEC-HMS as 4.3 acre-feet, or 187,308 cubic feet.

Solving for the height to provide the required storage volume for a pond with a 135 x 330-foot base and 3:1 side slopes results in the following equation for the required riser crest height:

$$187{,}308 = \frac{H}{3} * \left(135x330 + (135+6H)(330+6H) + \sqrt{(135x330)*(135+6H)(330+6H)}\right)$$

The solution of this equation results in a riser crest height of 3.75 feet above the base:

Storm Water Management Pond hydraulics

The performance of the storm water management ponds for the 2-, 10-, 50-, and 100-year rainfall events is checked in a post-development conditions HEC-HMS model. Stage-area data for each SWM pond is unchanged from the interim conditions model, as presented in Table 11, above with the exception that there is no accumulated sediment; stage-discharge relations were calculated for the outlet works for each basin and input into HEC-HMS as summarized in Table 18.

Results for the post-development model are shown in Table 19. Based on the results it is concluded that the storm water management ponds and outfall structures are sized adequately to maintain peak discharges from the site at or below predevelopment levels.

The outlet riser of the SWM Pond for the power block and switch yard (No. 3) is provided with two orifices sized to dewater the pond. Figure 6 shows the HEC-HMS output for SWM Pond #4 for the 10-year design storm. Inspection of the figure shows that the runoff showing it dewaters within 48 hours as required.

## Table 18 Stage-discharge calculations for SWM Ponds

**Power Block & Switch Yard (Outlet #3) Storm Water Management Pond**

| | | | | | |
|---|---|---|---|---|---|
| Bottom of pond elevatic | 170.00 | Pipe n = | 0.013 | | |
| Riser side length (ft) | 4 | Riser Crest EL.(ft) | 173.75 | Riser Crest Length (ft) | 16.00 |
| Pipe Diameter (ft) | 1.5 | Outlet Inv. EL.(ft) | 170.00 | Pipe Length (ft) | 60 |
| Orifice Diameter (ft) | 0.5 | Orifice Inv. El.(ft) | 170.50 | Orifice Centerline EL (ft) | 170.75 |
| Orifice Area (sq ft) | 0.196 | Pipe Area (sq ft) | 1.767 | Number of Orifices | 2 |
| Em Spillway Crest EL ( | 174.5 | Em Spillway Width (ft) | 25.0 | Hc, riser crest height above ground = | 3.75 |

| Elevation | Orifice Flow | | Riser Weir Flow | | Pipe Flow | | flow from pipe * | Spillway Flow | | Total Basin |
|---|---|---|---|---|---|---|---|---|---|---|
| | h | Q | H | Q | h | Q | | H | Q | Flow |
| (ft) | (ft) | (cfs) | (ft) | (cfs) | (ft) | (cfs) | Q (cfs) | (ft) | (cfs) | (cfs) |
| 170.00 | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 170.50 | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 171.00 | 0.250 | 0.95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 |
| 172.00 | 1.250 | 2.11 | 0.00 | 0.00 | 0.50 | 6.23 | 0.00 | 0.00 | 0.00 | 2.11 |
| 173.75 | 3.000 | 3.28 | 0.00 | 0.00 | 2.25 | 13.22 | 0.00 | 0.00 | 0.00 | 3.28 |
| 173.83 | 3.080 | 3.32 | 0.08 | 1.16 | 2.33 | 13.46 | 1.16 | 0.00 | 0.00 | 4.48 |
| 174.00 | 3.250 | 3.41 | 0.25 | 6.55 | 2.50 | 13.94 | 6.55 | 0.00 | 0.00 | 9.96 |
| 174.50 | 3.750 | 3.66 | 0.75 | 34.74 | 3.00 | 15.27 | 15.27 | 0.00 | 0.00 | 18.93 |
| 175.00 | 4.250 | 3.90 | 1.25 | 76.01 | 3.50 | 16.49 | 16.49 | 0.50 | 24.75 | 45.14 |
| 175.50 | 4.750 | 4.12 | 1.75 | 127.92 | 4.00 | 17.63 | 17.63 | 1.00 | 70.00 | 91.75 |
| 176.00 | 5.250 | 4.33 | 2.25 | 189.40 | 4.50 | 18.70 | 18.70 | 1.50 | 128.60 | 151.63 |
| 176.50 | 5.750 | 4.53 | 2.75 | 259.84 | 5.00 | 19.71 | 19.71 | 2.00 | 197.99 | 222.24 |

* flow from pipe calculated as minimum of weir and pipe flow capacities for each head value

**SWM Pond for Basin #1**

| | |
|---|---|
| Bottom elevation: | 148.00 |
| Pipe Diameter (ft) | 1.50 |
| Pipe Area (sf) | 1.77 |
| Outlet Inv. EL.(ft) | 172.00 |
| Pipe Length (ft) | 60 |
| Pipe n | 0.013 |

| Elevation (ft) | h (ft) | Q * (cfs) |
|---|---|---|
| 148.00 | 0.00 | 0.00 |
| 149.50 | 1.50 | 10.80 |
| 150.00 | 2.00 | 12.47 |
| 150.50 | 2.50 | 13.94 |
| 151.00 | 3.00 | 15.27 |
| 152.00 | 4.00 | 17.63 |
| 153.00 | 5.00 | 19.71 |
| 154.00 | 6.00 | 21.60 |
| 154.50 | 6.50 | 22.48 |

**SWM Pond for Basin #4**

| | |
|---|---|
| Bottom elevation: | 164.50 |
| Pipe Diameter (ft) | 1.50 |
| Pipe Area (sf) | 1.77 |
| Outlet Inv. EL.(ft) | 172.00 |
| Pipe Length (ft) | 60 |
| Pipe n | 0.013 |

| Elevation (ft) | h (ft) | Q * (cfs) |
|---|---|---|
| 164.50 | 0.00 | 0.00 |
| 166.00 | 1.50 | 10.80 |
| 166.50 | 2.00 | 12.47 |
| 167.00 | 2.50 | 13.94 |
| 167.50 | 3.00 | 15.27 |
| 168.50 | 4.00 | 17.63 |
| 169.50 | 5.00 | 19.71 |
| 170.50 | 6.00 | 21.60 |
| 171.00 | 6.50 | 22.48 |

* $$Q = \frac{h^{1/2} A}{\left(0.0233 + \frac{0.45 n^2 L}{R^{4/3}}\right)^{1/2}}$$

## Table 19 Results of Post-development Modeling

| 2-year Event | | | | |
|---|---|---|---|---|
| | Predevelopment subbasin peak discharge | Postdevelopment | | |
| | | Peak inflow to SWM pond | Peak discharge from SWM Pond | Peak discharge from subbasin |
| Outlet 1 | 11.06 | 11.39 | 3.12 | 3.12 |
| Outlet 2 | 8.03 | n/a | n/a | 2.74 |
| Outlet 3 * | 6.35 | 22.63 | 1.72 | 3.09 |
| Outlet 4 | 4.00 | 5.86 | 2.23 | 2.23 |
| 10-year Event | | | | |
| | Predevelopment subbasin peak discharge | Postdevelopment | | |
| | | Peak inflow to SWM pond | Peak discharge from SWM Pond | Peak discharge from subbasin |
| Outlet 1 | 21.50 | 22.14 | 6.14 | 6.14 |
| Outlet 2 | 15.61 | n/a | n/a | 5.01 |
| Outlet 3 * | 12.30 | 36.79 | 2.37 | 5.38 |
| Outlet 4 | 7.77 | 10.91 | 4.26 | 4.26 |
| 50-year Event | | | | |
| | Predevelopment subbasin peak discharge | Postdevelopment | | |
| | | Peak inflow to SWM pond | Peak discharge from SWM Pond | Peak discharge from subbasin |
| Outlet 1 | 29.22 | 30.08 | 8.44 | 8.44 |
| Outlet 2 | 21.20 | n/a | n/a | 6.66 |
| Outlet 3 * | 16.69 | 46.6 | 2.73 | 7.08 |
| Outlet 4 | 10.56 | 14.58 | 5.75 | 5.75 |
| 100-year Event | | | | |
| | Predevelopment subbasin peak discharge | Postdevelopment | | |
| | | Peak inflow to SWM pond | Peak discharge from SWM Pond | Peak discharge from subbasin |
| Outlet 1 | 37.34 | 38.42 | 10.84 | 10.84 |
| Outlet 2 | 27.08 | n/a | n/a | 8.37 |
| Outlet 3 * | 21.31 | 56.57 | 3.11 | 8.71 |
| Outlet 4 | 13.48 | 18.41 | 7.33 | 7.33 |

* Outlet 3 for predevelopment is divided into Post3 and Post5 subbasins for post-development modeling. Post5 is an undeveloped area, diverted around the subbasin 3 SWM pond. Postdevelopment discharge for Outlet 3 includes the unattenuated outflow from Post5 and the outflow from SWM Pond 3.

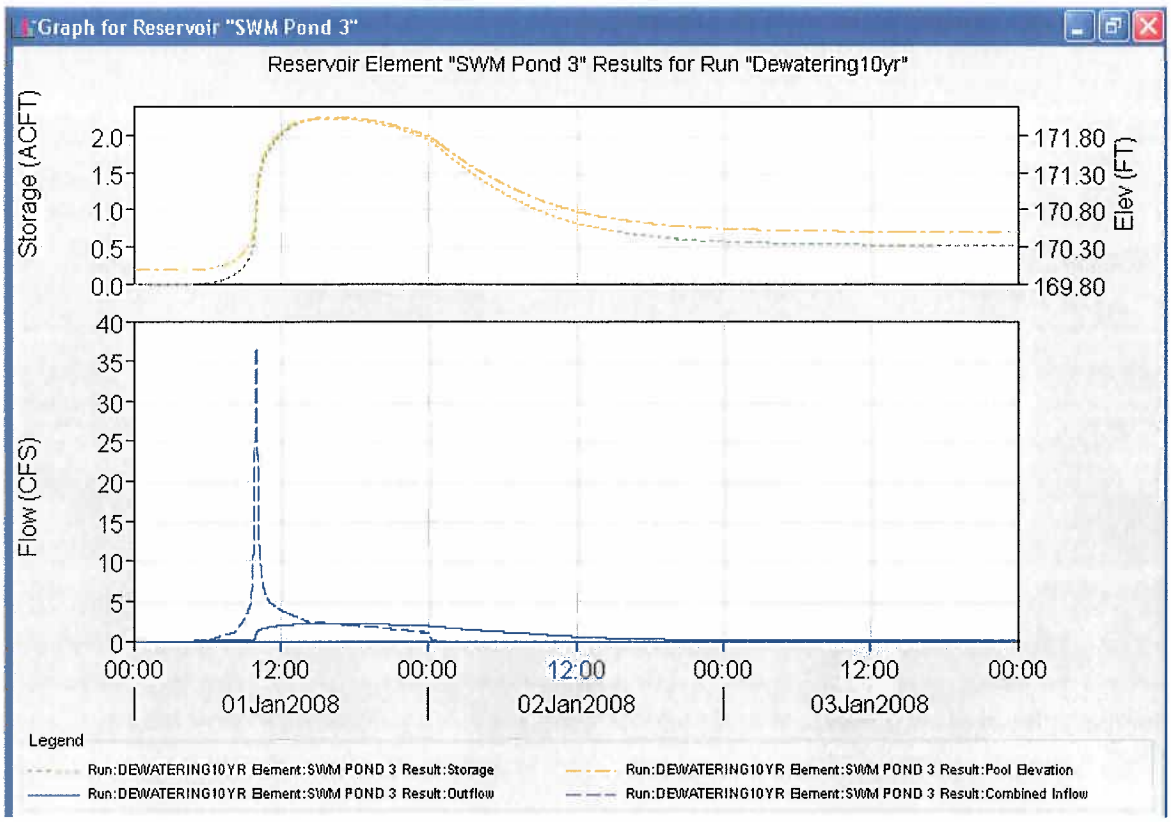



**Figure 6 – Performance of SWM Pond #3 for 10-year design rainfall event**

## VIII. Summary

Predevelopment, interim, and postdevelopment hydrologic conditions have been modeled in HEC-HMS for the 100-acre site proposed for the construction of the Colusa Generating Station Project.

Sediment control basins are proposed for the outlets of four drainage subbasins which will experience disturbance of upland areas during construction of the project. These basins will be sized according to BMP guidelines published by the State of California. Each basin will have an outlet riser perforated by a single orifice located to provide sediment storage of 67 cubic yards per acre drained and a settling volume sufficient to capture all runoff from the 2-year rainfall event acting over the upland area during the critical point in construction.

After construction is complete and the upland areas are stabilized, the sediment control basin serving the power block and switch yard (Basin #3) will be converted to a Storm Water Management Pond by reconfiguring the outfall riser for permanent service. The risers for Basin No. 1 and No. 4 will be removed and the outfall pipes will be retained as drainage culverts, with upstream storage sufficient to attenuate runoff peaks to less than predevelopment values.

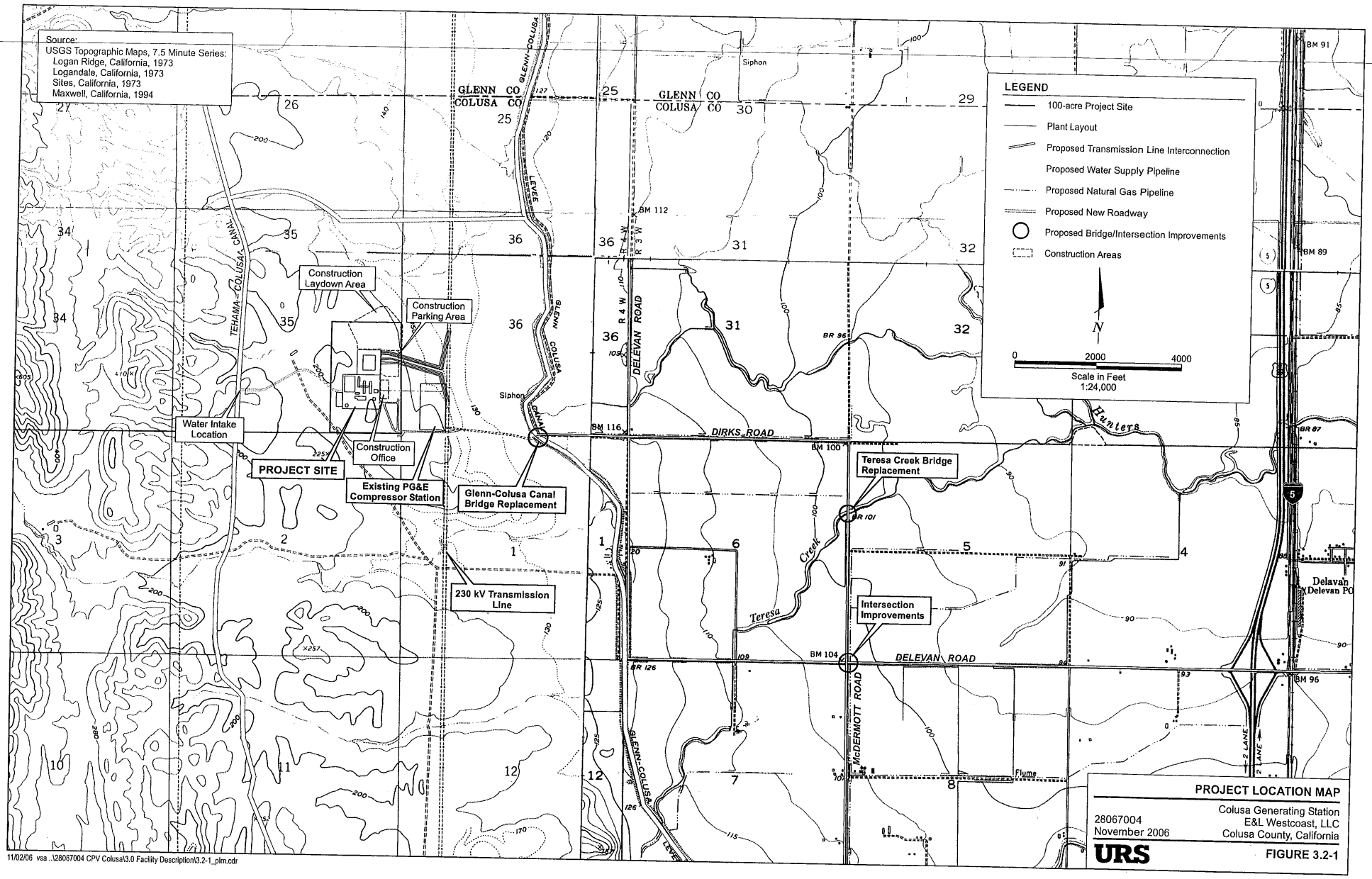
## IX. References

1. Application for Certification for Colusa Generating Station, Colusa County, California Volume 1. Prepared for E&L Westcoast , LLC by URS November 2006
2. Precipitation Frequency Atlas of the Western United States Volume XI, California, U.S. Department of Commerce NOAA National Weather Service 1973
3. USDA Natural Resources Conservation Service Hydrologic Group Rating for Colusa County, California downloaded from http://websoilsurvey.nrcs.usda.gov/app/ on 2/15/2007
4. Applied Hydrology, Chow, Maidment & Mays, McGraw-Hill 1988
5. HEC-HMS Hydrologic Modeling System, Version 3.0.1 User's Manual, U.S. Army Corps of Engineers, April 2006
6. HEC-HMS Hydrologic Modeling System Technical Reference Manual, March 2000
7. California Stormwater BMP Handbook, California Stormwater Quality Association, 2003
8. Open Channel Hydraulics, Venn T. Chow, McGraw-Hill,1959

## X. Reference Drawings

Figures submitted with the Colusa Generating Station Project Drainage Erosion and Sediment Control Plan (Colusa GSP DESCP):

1. Colusa GSP DESCP Figure 1. Project Predevelopment Drainage Areas
2. Colusa GSP DESCP Figure 2. Colusa G.S. Project Post development Drainage Areas
3. Colusa GSP DESCP Figure 3. Colusa G.S. Rough Grading Plan Sheet No. 1
4. Colusa GSP DESCP Figure 4. Colusa G.S. Rough Grading Plan Sheet No. 2
5. Colusa GSP DESCP Figure 5. Colusa G.S. Erosion Control Details
6. Colusa GSP DESCP Figure 6. Colusa G.S. Drainage Details
7. Colusa GSP DESCP Figure 7. Colusa G.S. Catch Basin & Manhole Details
8. Colusa GSP DESCP Figure 8. Colusa G.S. Headwall Details
9. Colusa GSP DESCP Figure 9. Colusa G.S. Storm Water/Sediment Basin Details
10. Colusa GSP DESCP Figure 10. Colusa G.S. Road Details




11/02/06 vsa ..\28067004 CPV Colusa\3.0 Facility Description\3.2-1_plm.cdr

**PROJECT LOCATION MAP**

28067004
November 2006

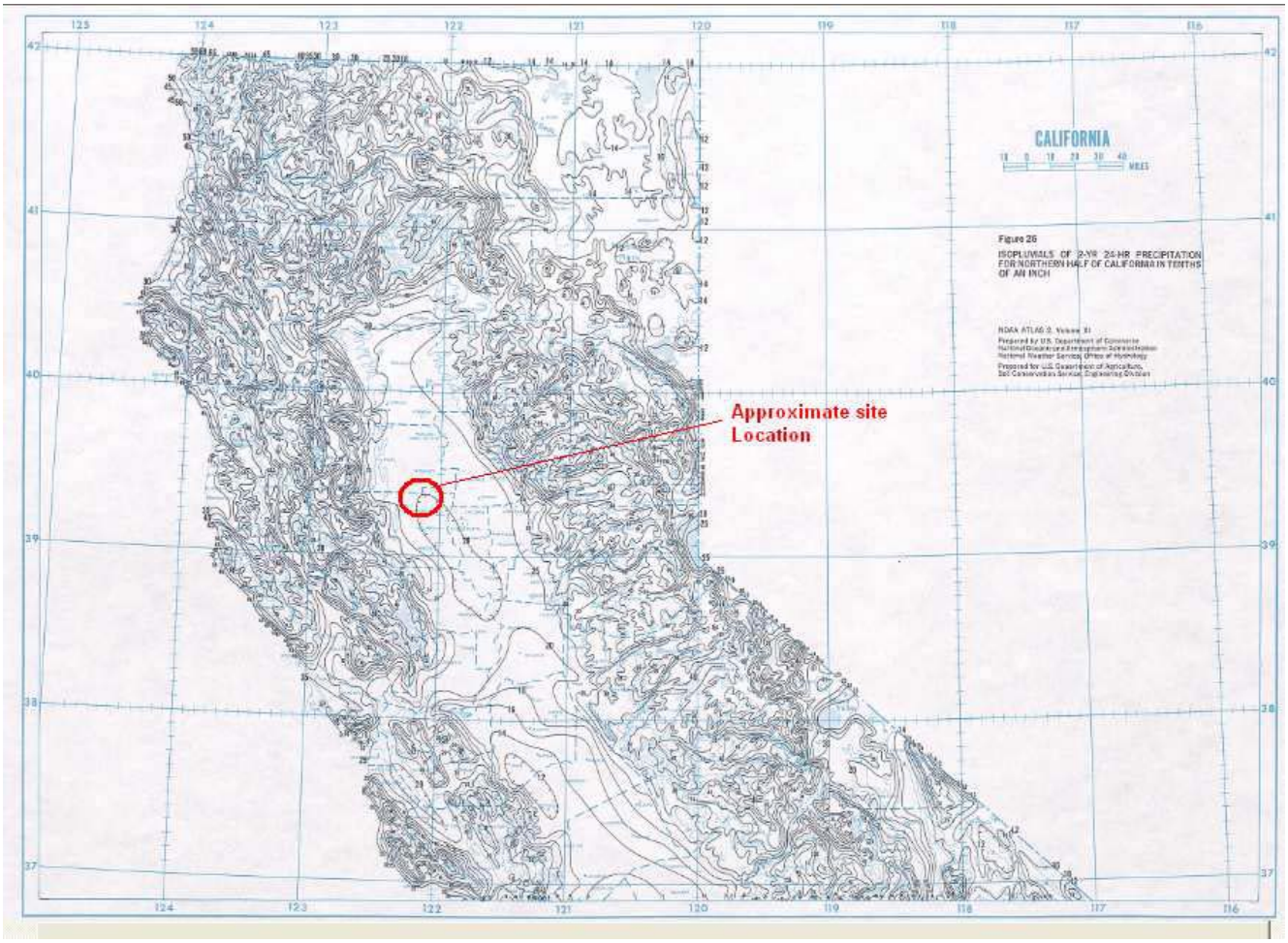
Colusa Generating Station
E&L Westcoast, LLC
Colusa County, California

URS

**FIGURE 3.2-1**

Calculation 25196-002-KDC-0000-00001
Attachment No. 1 SHEET 1 of 1

## 2-year 24-hour Rainfall Depths for Northern California



# ATTACHMENT NO. 2

PROJECT Colusa Generating Station

JOB NUMBER 25196

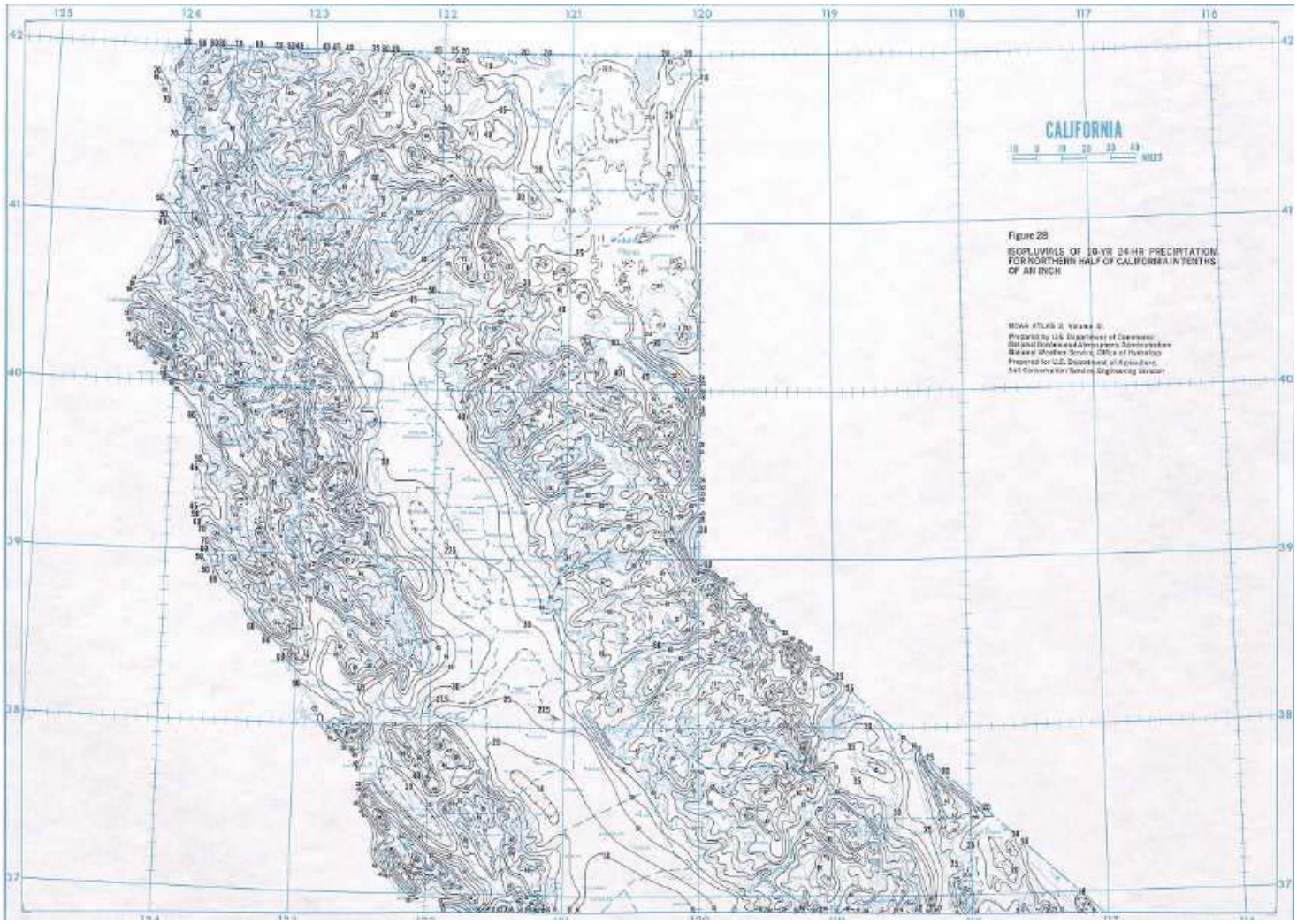
SUBJECT NOAA precipitation depth maps (Reference 2)

CALC NO 25196-002-KDC-0000-00001

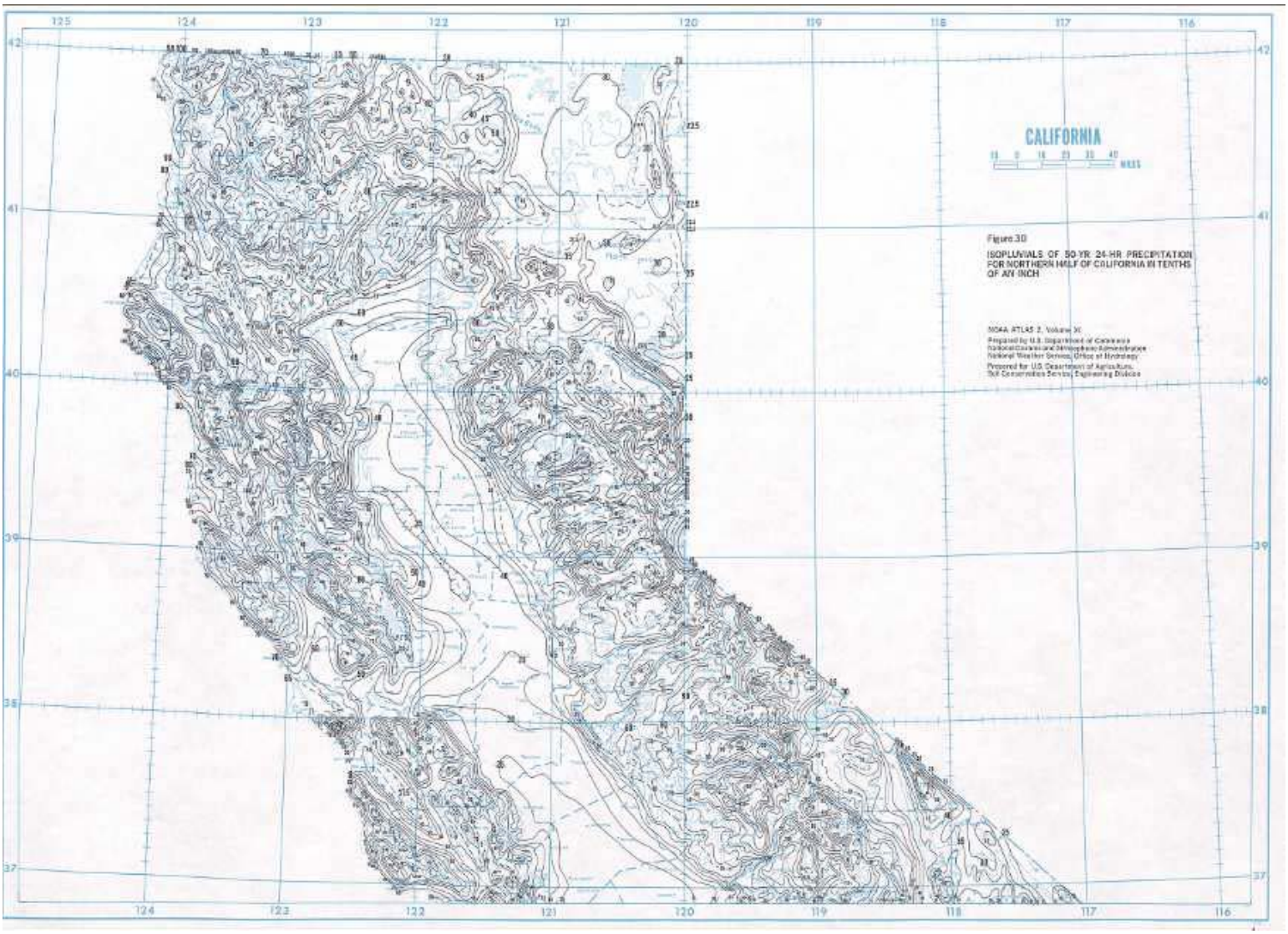
SHEET NO 2 OF 5

REV. NO. A

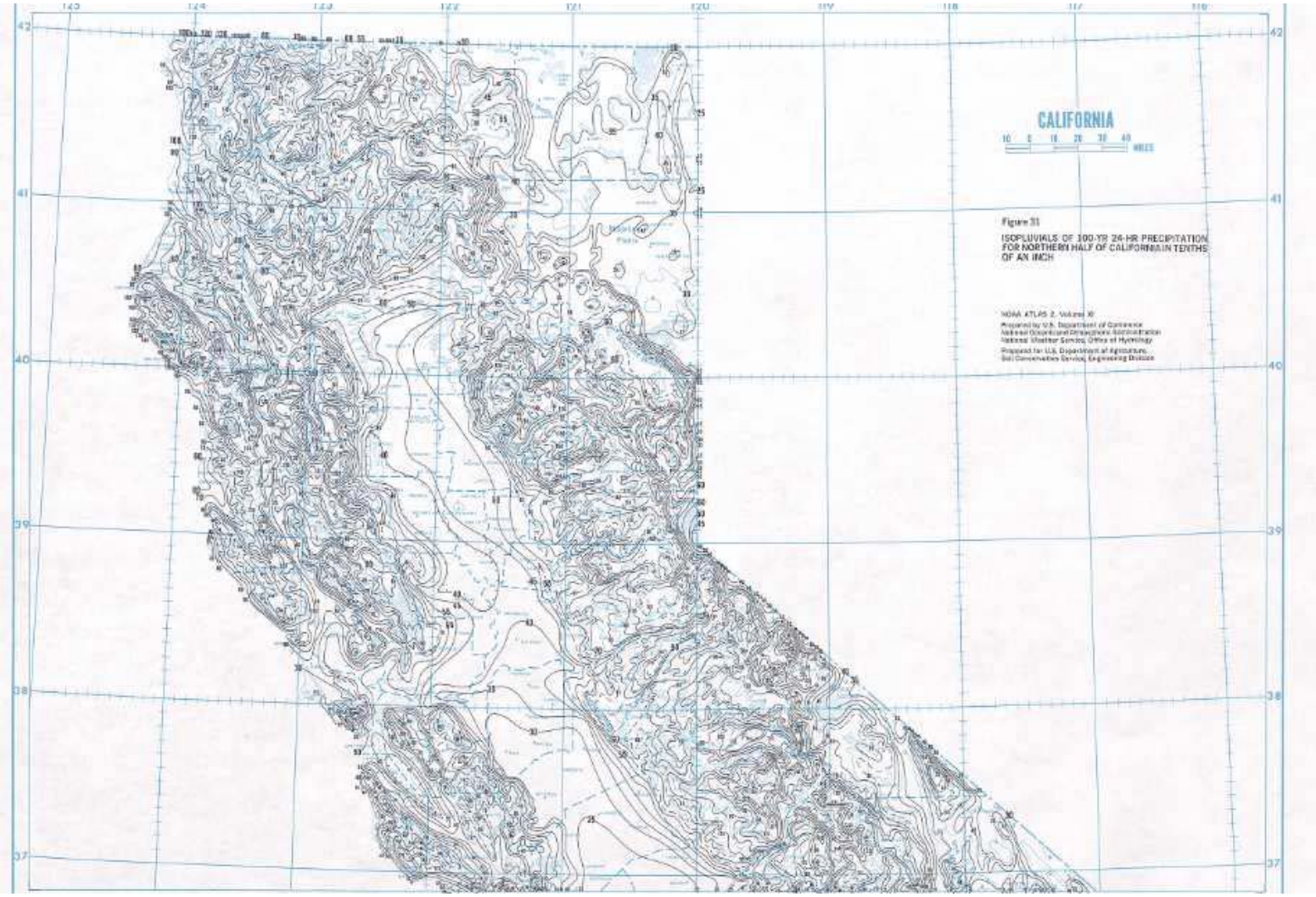
## 10-year 24-hour Rainfall Depths for Northern California



## 50-year 24-hour Rainfall Depths for Northern California



## 100-year 24-hour Rainfall Depths for Northern California



**ATTACHMENT NO. 2**

PROJECT Colusa Generating Station

JOB NUMBER 25196

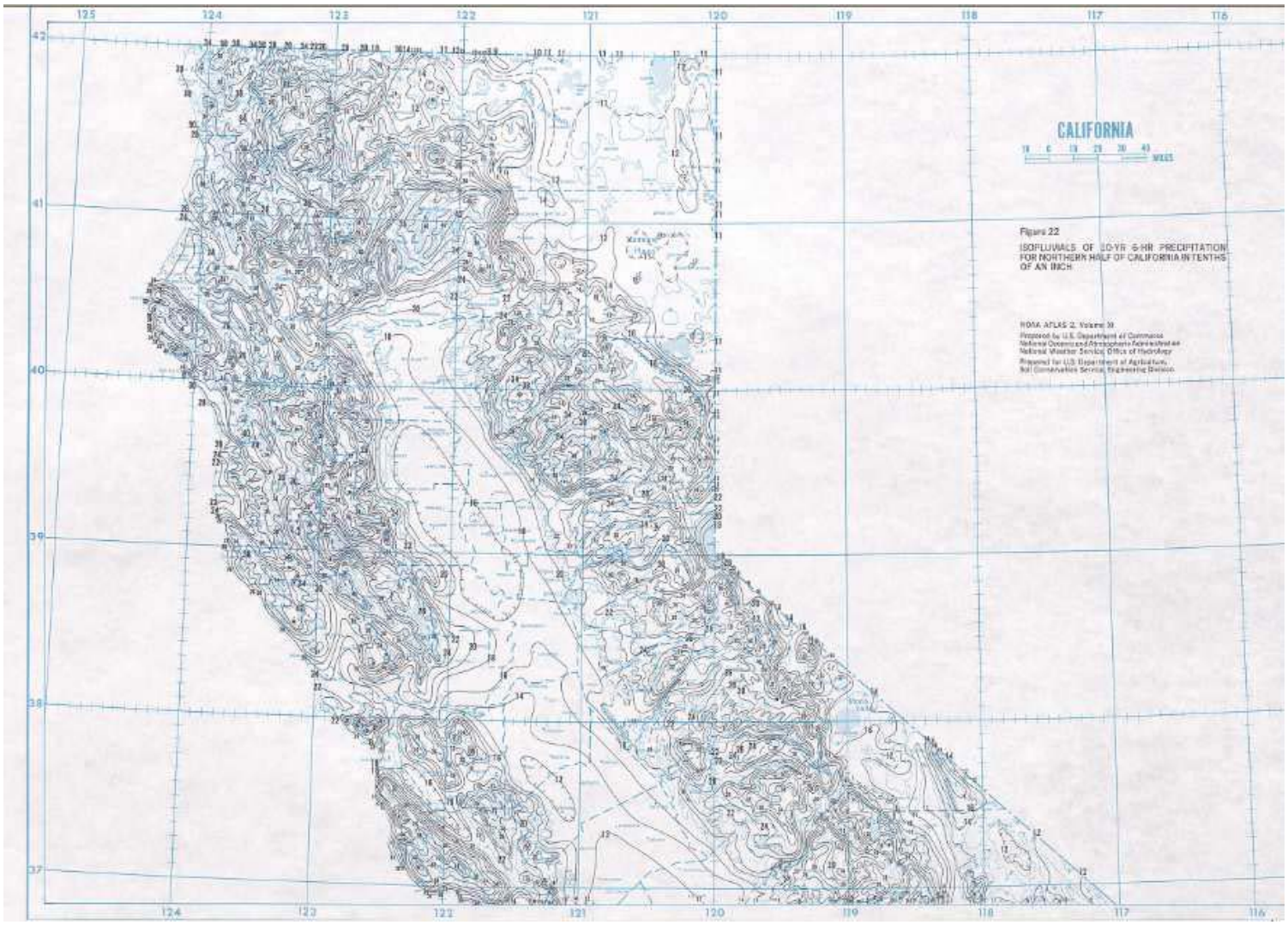
SUBJECT NOAA precipitation depth maps (Reference 2)

CALC NO 25196-002-KDC-0000-00001

SHEET NO 5 OF 5

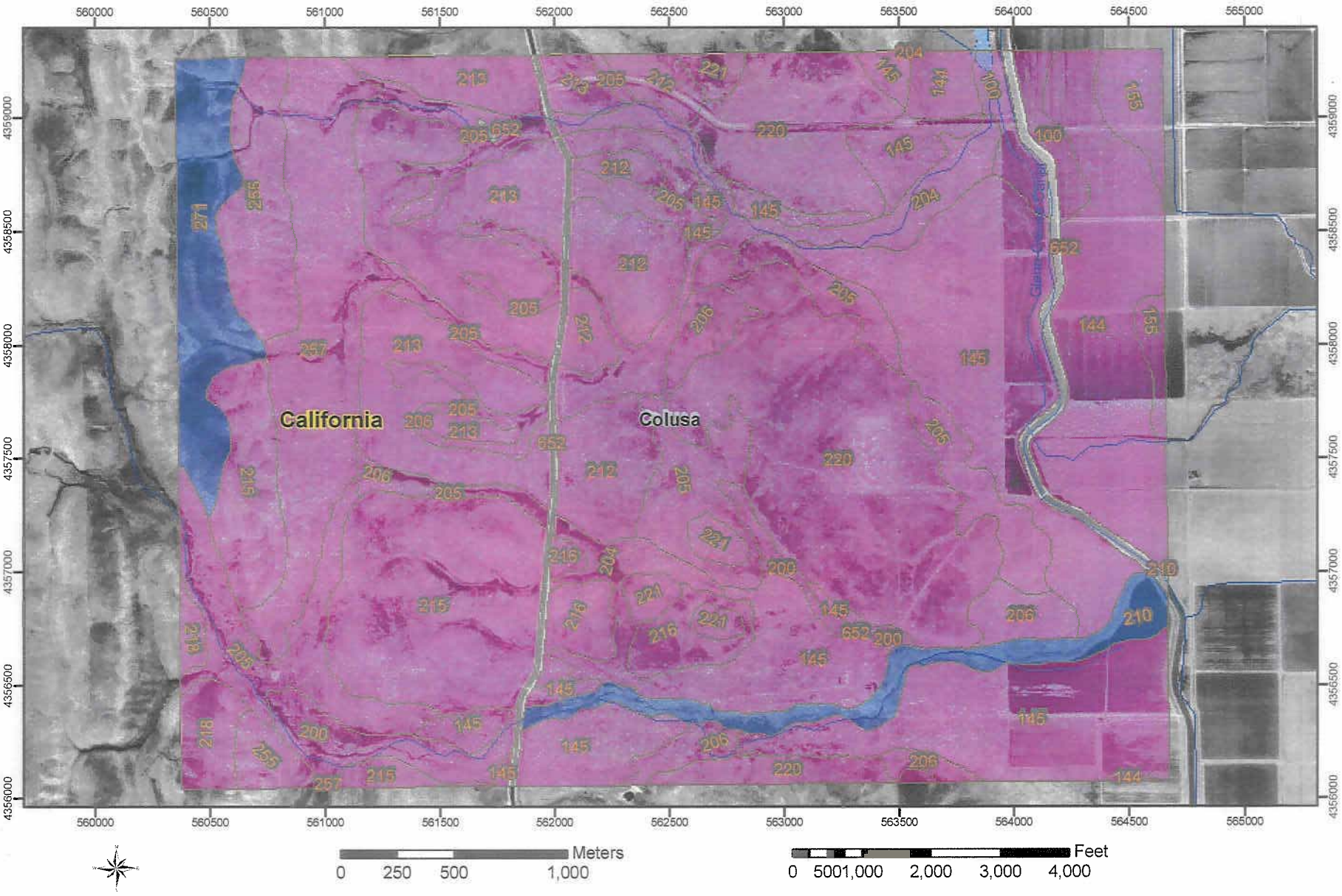
REV. NO. A

## 10-year 6-hour Rainfall Depths for Northern California



# HYDROLOGIC GROUP RATING FOR COLUSA COUNTY, CALIFORNIA

SCS soil types



# HYDROLOGIC GROUP RATING FOR COLUSA COUNTY, CALIFORNIA

SCS soil types

## MAP LEGEND

**Hydrologic Group**

**{Dominant Condition, <}**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available
- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Rails
- Water
- Hydrography
- Oceans

## MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 10

Soil Survey Area: Colusa County, California
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

Map comprised of aerial images photographed on these dates:
8/25/1998; 9/13/1998; 7/29/1999

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Calculation 25196-002-KDC-0000-00001
Attachment No. 3 SHEET 2 of 4

# Tables - Hydrologic Group

Summary by Map Unit - Colusa County, California

| Soil Survey Area Map Unit Symbol | Map Unit Name | Rating | Total Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 100 | Capay clay loam, 0 to 1 percent slopes, occasionally flooded | D | 47.5 | 1.4 |
| 144 | Hillgate clay loam, 0 to 2 percent slopes | D | 225.9 | 6.5 |
| 145 | Hillgate loam, 0 to 2 percent slopes | D | 608.9 | 17.5 |
| 155 | Alcapay clay, 0 to 1 percent slopes | D | 45.3 | 1.3 |
| 200 | Clear Lake clay, 0 to 2 percent slopes, occasionally flooded | D | 64.9 | 1.9 |
| 204 | Capay clay, 0 to 3 percent slopes, occasionally flooded | D | 143.5 | 4.1 |
| 205 | Capay clay, 0 to 3 percent slopes | D | 363.3 | 10.5 |
| 206 | Capay clay, 5 to 9 percent slopes | D | 87.1 | 2.5 |
| 210 | Corval loam, 0 to 3 percent slopes | B | 75.2 | 2.2 |
| 212 | Ayar clay, 5 to 15 percent slopes | D | 159.3 | 4.6 |
| 213 | Ayar clay, 15 to 30 percent slopes | D | 316.8 | 9.1 |
| 215 | Altamont-Sehorn complex, 15 to 30 percent slopes | D | 277.5 | 8.0 |
| 216 | Altamont-Sehorn complex, 9 to 15 percent slopes | D | 61.9 | 1.8 |
| 218 | Sehorn-Altamont complex, 30 to 50 percent slopes | D | 37.5 | 1.1 |
| 220 | Altamont silty clay, 5 to 9 percent slopes | D | 456.8 | 13.2 |
| 221 | Altamont silty clay, 9 to 15 percent slopes | D | 38.4 | 1.1 |
| 255 | Millsholm-Rock outcrop complex, 9 to 30 percent slopes | D | 97.4 | 2.8 |
| 257 | Millsholm-Capay complex, 3 to 9 percent slopes | D | 198.7 | 5.7 |
| 271 | Balcom-Ayar complex, 30 to 50 percent slopes | B | 113.3 | 3.3 |
| 652 | Water | Null | 53.1 | 1.5 |

Summary by Map Unit - Colusa County, California

| Soil Survey Area Map Unit Symbol | Map Unit Name | Rating | Total Acres in AOI | Percent of AOI |
|---|---|---|---|---|

# Description - Hydrologic Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are placed into four groups A, B, C, and D, and three dual classes, A/D, B/D, and C/D. Definitions of the classes are as follows:

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only soils that are rated D in their natural condition are assigned to dual classes.

# Parameter Summary - Hydrologic Group

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Lower

Calculation 25196-002-KDC-0000-00001
Attachment No. 3 SHEET 4 of 4

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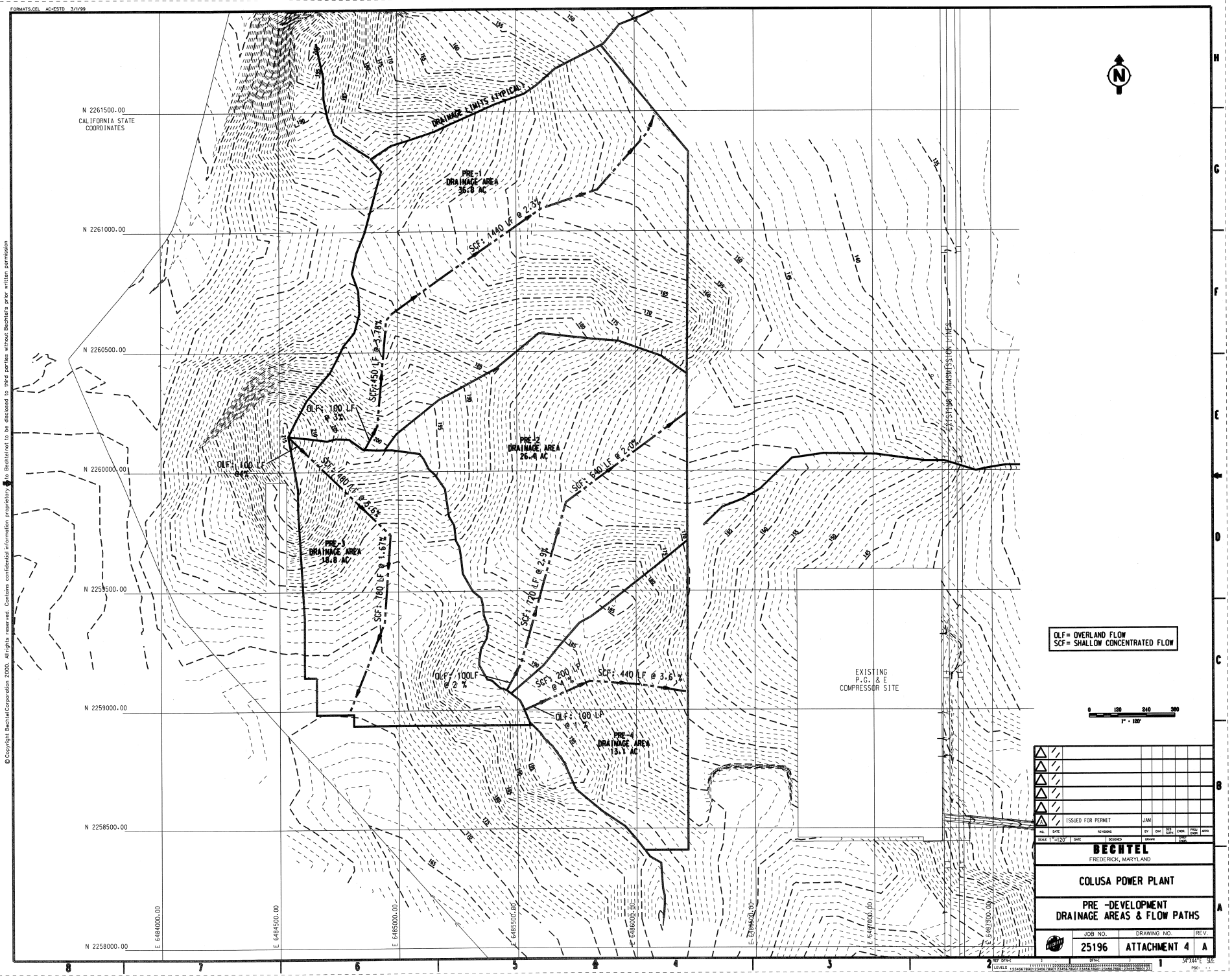


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|---|---|---|---|---|---|---|---|---|
| 1 | | ISSUED FOR PERMIT | JAM | | | | | |

SCALE 1"=120' DATE DESIGNED DRAWN CHKD ENGR

**BECHTEL**
FREDERICK, MARYLAND

**COLUSA POWER PLANT**

**PRE -DEVELOPMENT DRAINAGE AREAS & FLOW PATHS**

| JOB NO. | DRAWING NO. | REV. |
|---|---|---|
| 25196 | ATTACHMENT 4 | A |

REF DFWG LEVELS

34°44'4"E SOE

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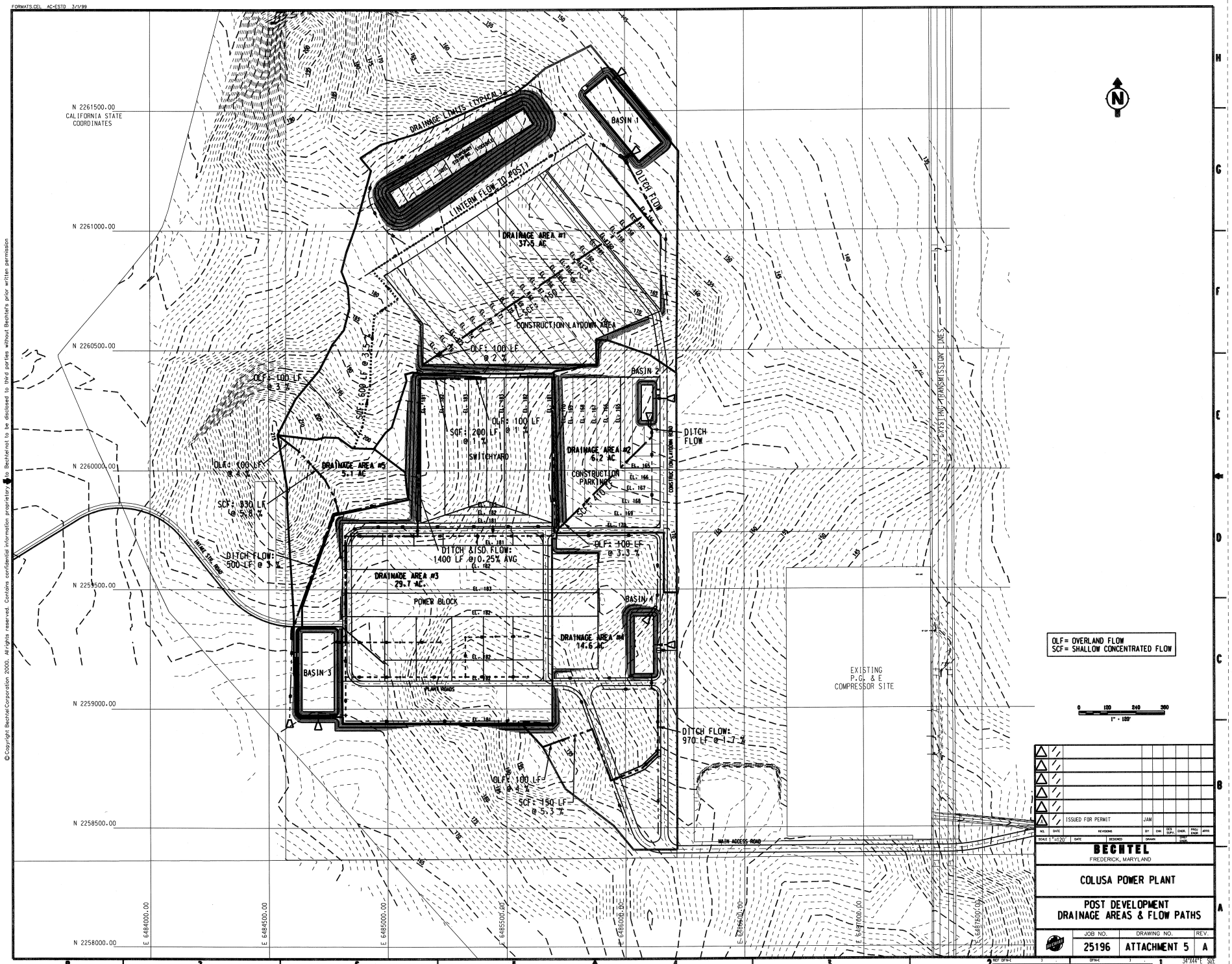


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| | | ISSUED FOR PERMIT | JAM | | | | | |

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**BECHTEL**
FREDERICK, MARYLAND

**COLUSA POWER PLANT**

**POST DEVELOPMENT DRAINAGE AREAS & FLOW PATHS**

| JOB NO. | DRAWING NO. | REV. |
|---|---|---|
| 25196 | ATTACHMENT 5 | A |

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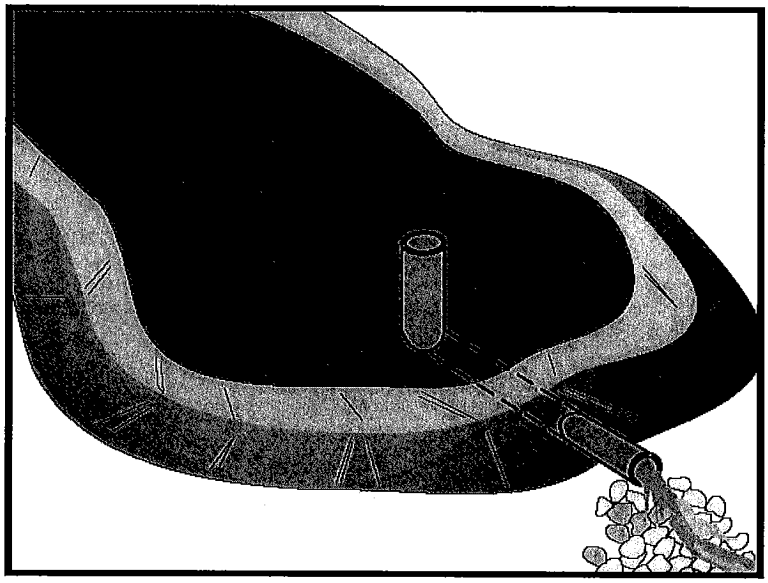
# Sediment Basin

# SE-2



| Objectives | | |
|---|---|---|
| EC | Erosion Control | |
| SE | Sediment Control | ☑ |
| TR | Tracking Control | |
| WE | Wind Erosion Control | |
| NS | Non-Stormwater Management Control | |
| WM | Waste Management and Materials Pollution Control | |

Legend:

☑ Primary Objective

☒ Secondary Objective

| Targeted Constituents | |
|---|---|
| Sediment | ☑ |
| Nutrients | |
| Trash | ☑ |
| Metals | |
| Bacteria | |
| Oil and Grease | |
| Organics | |

**Potential Alternatives**

SE-3 Sediment Trap (for smaller areas)

## Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

## Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres
- At the outlet of large disturbed watersheds, as necessary
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

## Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- Generally, sediment basins are limited to drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this handbook are only practically effective in removing sediment down to about the medium silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical treatment is used in addition to the sediment basin.
- Sites with very fine sediments (fine silt and clay) may require longer detention times for effective sediment removal.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from Division of Safety of Dams.
- Standing water may cause mosquitoes or other pests to breed.
- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

## Implementation

### *General*

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure with a design life of 12 to 28 months in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to divert runoff to the basin inlet.

Many development projects in California will be required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins trap 70-80 % of the sediment that flows into them if designed according to this handbook. Therefore, they should be used in conjunction with erosion control practices such as

temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

### *Planning*

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. The best locations are generally low areas. Drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). The basin must not be located in a stream but it should be located to trap sediment-laden runoff before it enters the stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

- Construct before clearing and grading work begins when feasible.
- Do not locate in a stream.
- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Large basins are subject to state and local dam safety requirements.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

### *Design*

Sediment basins must be designed in accordance with Section A of the State of California NPDES General Permit for Stormwater Discharges Associated with Construction Activities (General Permit) where sediment basins are the only control measure proposed for the site. If there is insufficient area to construct a sediment basin in accordance with the General Permit requirements, then the alternate design standards specified herein may be used.

Sediment basins designed per the General Permit shall be designed as follows:

*Option 1:*

Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

*Option 2:*

Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet (133 $yd^3$) of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The

length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency.

OR

*Option 3:*
Sediment basin(s) shall be designed using the standard equation:

$$As=1.2Q/Vs \qquad \text{(Eq. 1)}$$

Where:

As = Minimum surface area for trapping soil particles of a certain size

Vs = Settling velocity of the design particle size chosen

Q = C I A

Where

Q = Discharge rate measured in cubic feet per second

C = Runoff coefficient

I = Precipitation intensity for the 10-year, 6-hour rain event

A = Area draining into the sediment basin in acres

The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the *Vs* used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the 2 ft of capacity.

OR

*Option 4:*
The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

Other design considerations are:

- The volume of the settling zone should be sized to capture runoff from a 2-year storm or other appropriate design storms specified by the local agency. A detention time of 24 to 40 hours should allow 70 to 80 % of sediment to settle.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.
- The length to settling depth ratio (L/SD) should be less than 200.
- Sediment basins are best used in conjunction with erosion controls. Sediment basins that will be used as the only means of treatment, without upstream erosion and sediment controls, must be designed according to the four options required by the General Permit (see Options 1-4 above). Sediment basins that are used in conjunction with upstream erosion and sediment controls should be designed to have a capacity equivalent to 67 $yd^3$ of sediment storage per acre of contributory area.
- The length of the basin should be more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet.
- The depth must be no less than 3 ft.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 $ft^3$, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- Basins should be designed to drain within 72 hours following storm events. If a basin fails to drain within 72 hours, it must be pumped dry.
- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.
  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.
- Rock or vegetation should be used to protect the basin inlet and slopes against erosion.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.

- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- Basin inlets should be located to maximize travel distance to the basin outlet.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen; although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.
- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 72 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.
- The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. Design guidance for single orifice and perforated riser outlets follow:
  - *Flow Control Using a Single Orifice At The Bottom Of The Basin (Figure 1)*: The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H - Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H - Ho)^{0.5}}{CT} \qquad \text{(Eq. 2)}$$

where:

a = area of orifice ($ft^2$)

A = surface area of the basin at mid elevation ($ft^2$)

C = orifice coefficient

T = drawdown time of full basin (hrs)

g = gravity (32.2 ft/s²)

H = elevation when the basin is full (ft)

Ho = final elevation when basin is empty (ft)

With a drawdown time of 40 hours, the equation becomes:

$$a = \frac{(1.75x10^{-6})A(H - Ho)^{0.5}}{C} \qquad \text{(Eq. 3)}$$

- *Flow Control Using Multiple Orifices (see Figure2):*

$$a_t = \frac{2A(h_{max})}{3600CT(2g[h_{max} - h_{centroid\ of\ orifices}])^{0.5}} \qquad \text{(Eq. 4)}$$

With terms as described above except:

$a_t$ = total area of orifices

$h_{max}$ = maximum height from lowest orifice to the maximum water surface (ft)

$h_{centroid\ of\ orifices}$ = height from the lowest orifice to the centroid of the orifice configuration (ft)

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally (refer to Figure 2).

Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Care must be taken in the selection of "C"; 0.60 is most often recommended and used. However, based on actual tests, GKY (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

### *Installation*

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.
- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

### Costs

Average annual costs for installation and maintenance (2 year useful life) are:

- Basin less than 50,000 $ft^3$: Range, \$0.24 - \$1.58/$ft^3$. Average, \$0.73 per $ft^3$. \$400 - \$2,400, \$1,200 average per drainage acre.
- Basin size greater than 50,000 $ft^3$: Range, \$0.12 – \$0.48/$ft^3$. Average, \$0.36 per $ft^3$. \$200 - \$800, \$600 average per drainage acre.

### Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at appropriate locations.
- Remove standing water from basin within 72 hours after accumulation.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

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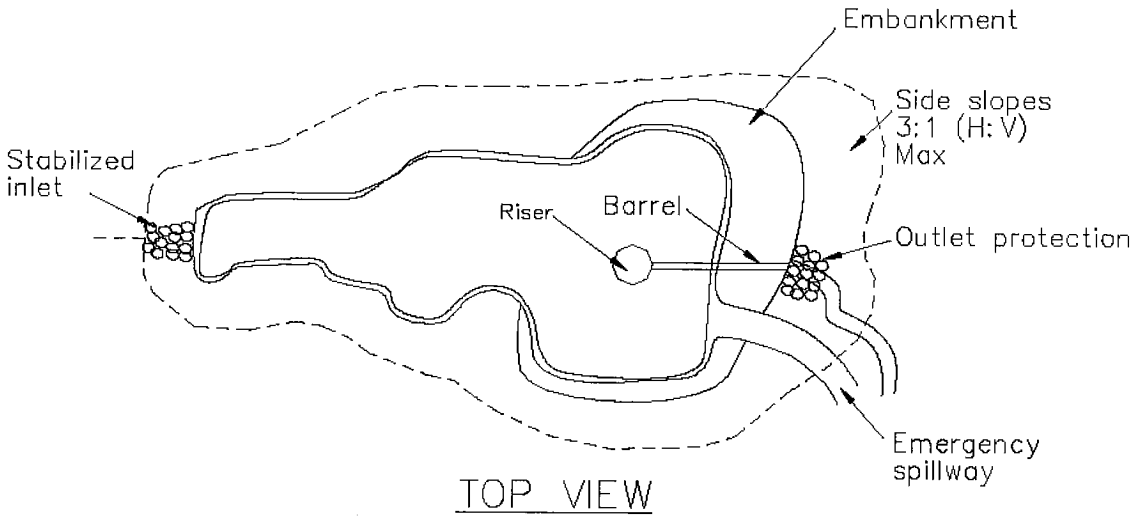


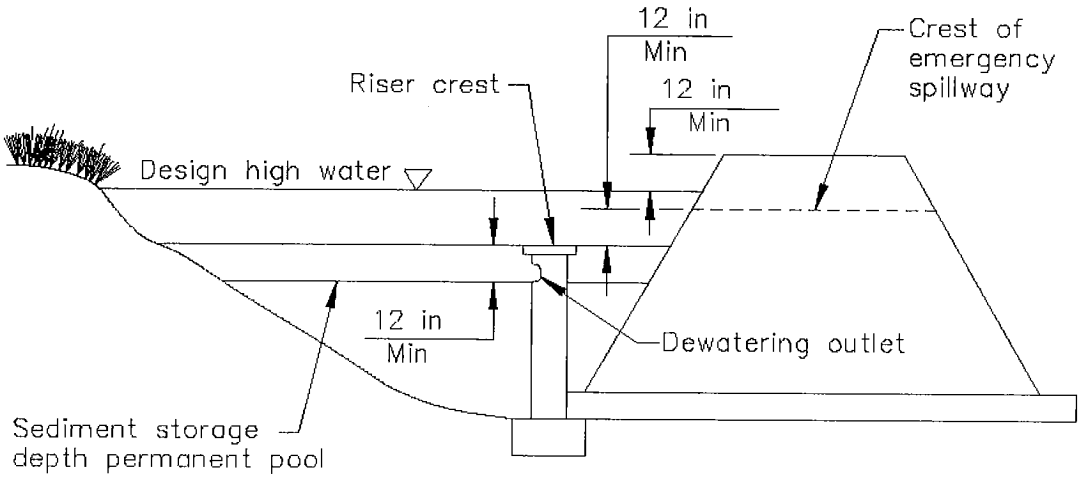


NOTE:
This outlet provides no drainage for permanent pool.

FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
SINGLE ORIFICE DESIGN
NOT TO SCALE

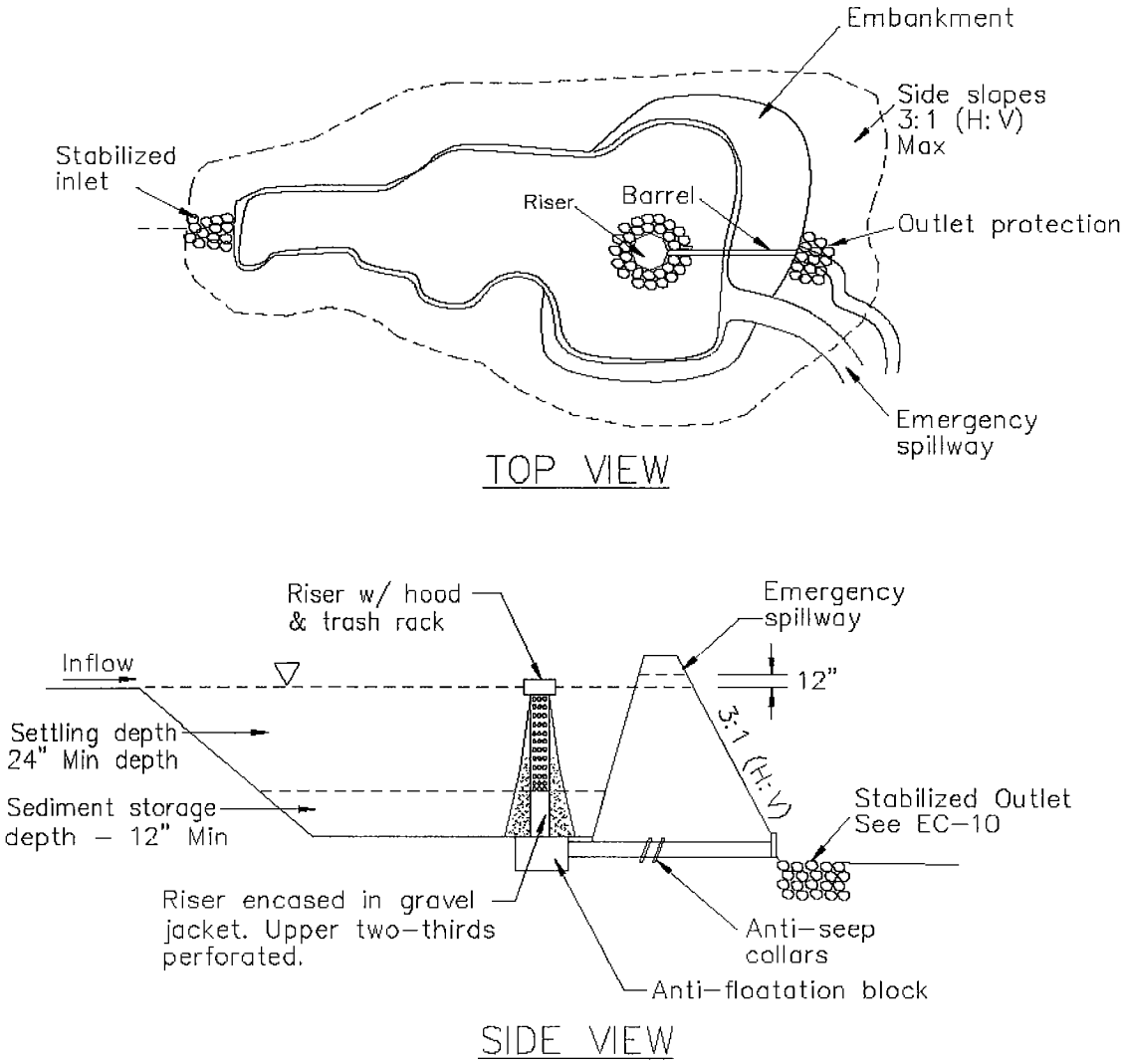


FIGURE 2: TYPICAL TEMPORARY SEDIMENT BASIN

MULTIPLE ORIFICE DESIGN

NOT TO SCALE

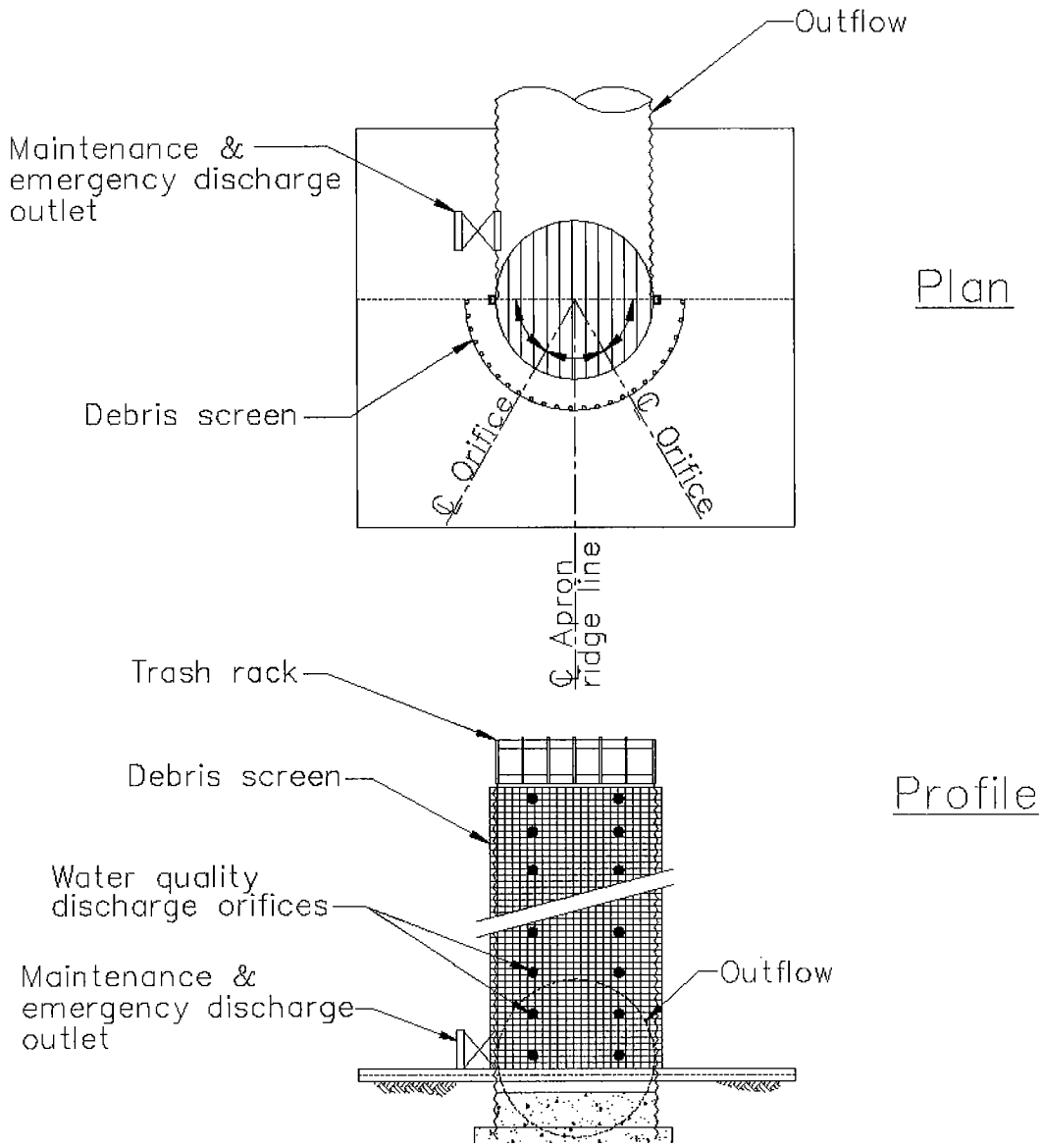


FIGURE 3: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

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| 0 | 5/1/01 | ISSUED FOR PERMIT | JAM | DLV | VGA | THS | | |

SCALE 1"=120' | DATE | DESIGNED | DRAWN | ENG CHGR

**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

PRE -DEVELOPMENT
DRAINAGE AREAS

| JOB NO. | DRAWING NO. | REV. |
|---|---|---|
| 25196 | FIGURE 1 | A |

34"X44"E SIZE

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**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

POST DEVELOPMENT DRAINAGE AREAS

| JOB NO. | DRAWING NO. | REV. |
|---|---|---|
| 25196 | FIGURE 2 | A |

REF DFWG: DFWG: LEVELS 34"X44"E SIZE

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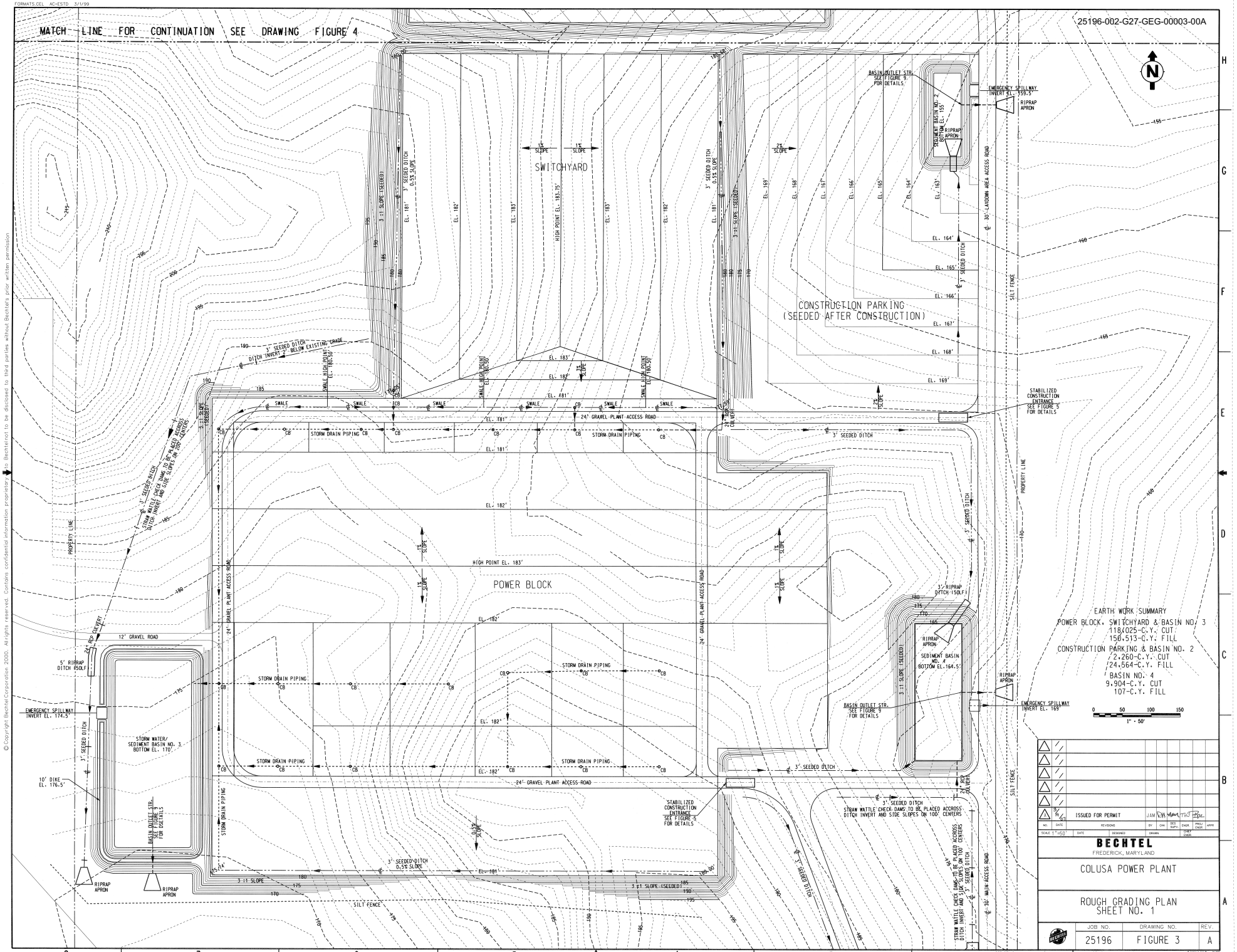
MATCH LINE FOR CONTINUATION SEE DRAWING FIGURE 4

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SCALE 1" = 50' | DATE | DESIGNED | DRAWN | FIELD ENGR

**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

ROUGH GRADING PLAN
SHEET NO. 1

| JOB NO. | DRAWING NO. | REV. |
|---|---|---|
| 25196 | FIGURE 3 | A |

34"X44" E SIZE

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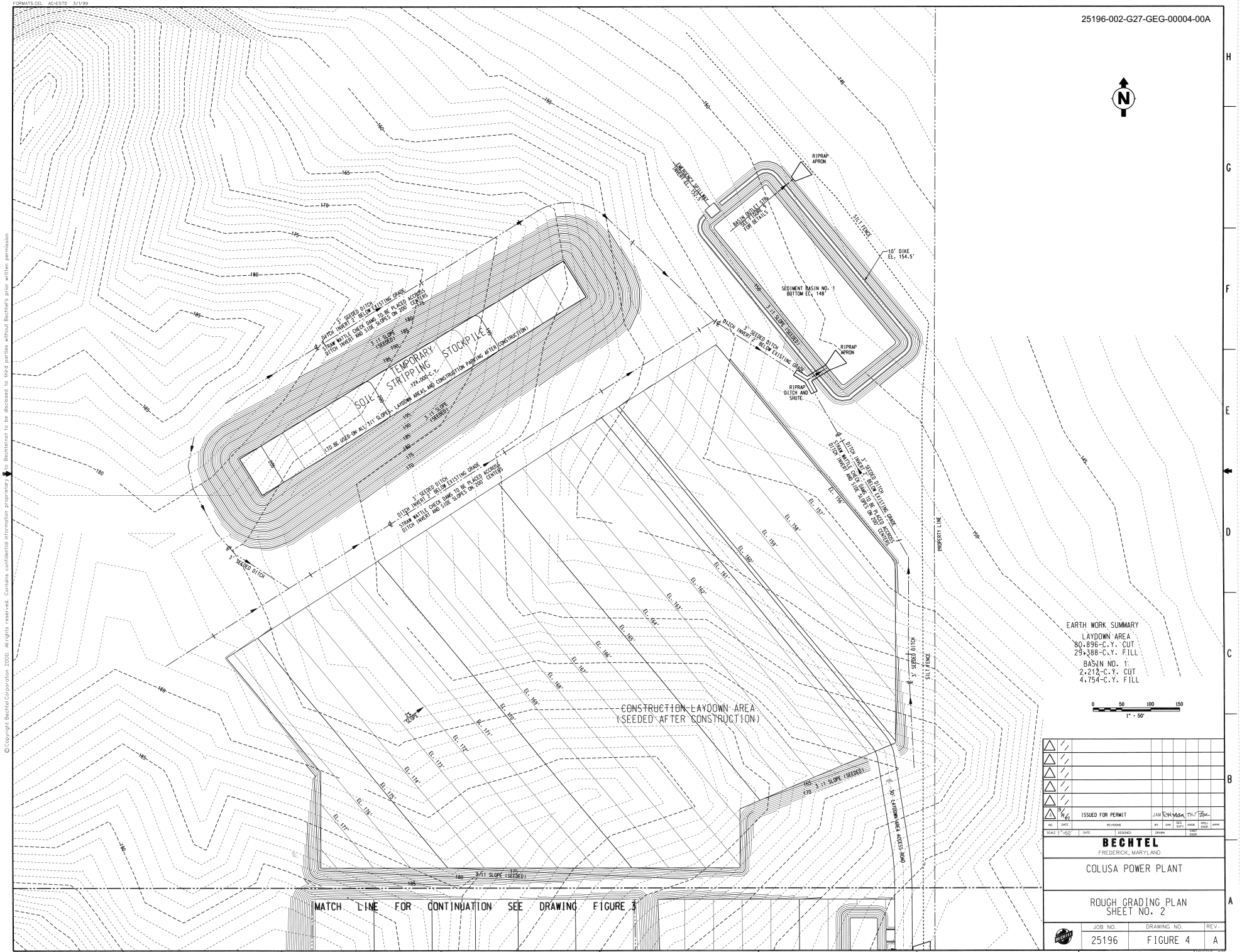


EARTH WORK SUMMARY

LAYDOWN AREA
80,896-C.Y. CUT
29,388-C.Y. FILL

BASIN NO. 1
2,212-C.Y. CUT
4,754-C.Y. FILL

0 50 100 150
1" = 50'

| NO. | DATE | REVISIONS | BY | CHK | DES SUPV. | ENGR | PROJ ENGR | APPR |
|---|---|---|---|---|---|---|---|---|
| 3 | 8/6/01 | ISSUED FOR PERMIT | JAM | CWM | MGA | THJ | BHE | |

SCALE 1"=50' DATE DESIGNED DRAWN CHK ENGR

**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

ROUGH GRADING PLAN
SHEET NO. 2

| JOB NO. | DRAWING NO. | REV. |
|---|---|---|
| 25196 | FIGURE 4 | A |

34"X44" E SIZE

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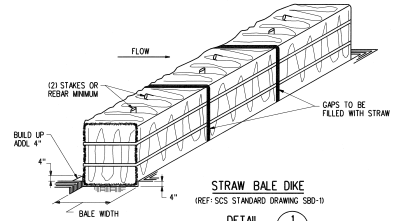
25196-002-G27-GEG-00005-00A

## GENERAL NOTES

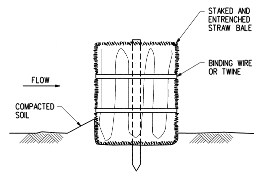
1. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER CONSTRUCTION, STABILIZATION, AND MAINTENANCE OF ALL EROSION AND SEDIMENTATION CONTROLS AND RELATED ITEMS INCLUDED WITHIN THIS PLAN.
2. ALL RUNOFF FROM THIS PARCEL MUST BE TREATED UNTIL THE PARCEL IS UNIFORMLY STABILIZED (70% VEGETATIVE COVER).
3. SHOULD ANY MEASURES CONTAINED WITHIN THIS PLAN PROVE INCAPABLE OF ADEQUATELY REMOVING SEDIMENT FROM ON-SITE FLOWS PRIOR TO DISCHARGE OR PRIOR TO SURFACE STABILIZATION, ADDITIONAL MEASURES MUST BE TAKEN IMMEDIATELY BY THE SUBCONTRACTOR TO ELIMINATE ANY SUCH PROBLEMS.
4. THE LOCATIONS OF THE PROPOSED LOT IMPROVEMENTS ARE APPROXIMATED, SUBJECT TO THE FINAL PLACEMENT AT THE TIME OF CONSTRUCTION.
5. ALL CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT SUCH THAT SOIL EROSION AND AIR/WATER POLLUTION IS MINIMIZED. STATE AND LOCAL LAWS CONCERNING POLLUTION ABATEMENT SHALL BE FOLLOWED.
6. SHOULD UNFORESEEN EROSIVE CONDITIONS DEVELOP DURING CONSTRUCTION, THE SUBCONTRACTOR SHALL TAKE ACTION TO REMEDY SUCH CONDITIONS AND TO PREVENT DAMAGE TO ADJACENT PROPERTIES AS A RESULT OF INCREASED RUNOFF AND/OR SEDIMENT DISPLACEMENT. SPECIAL ATTENTION SHOULD BE GIVEN TO FROZEN SLOPES. STOCKPILES OF WOOD CHIPS, CRUSHED STONE AND OTHER MULCHES SHALL BE IN READINESS TO DEAL IMMEDIATELY WITH THE EMERGENCY EROSION PROBLEM.

## STRAW BALE FENCE NOTES

1. STRAW BALE FENCES SHALL BE INSTALLED PRIOR TO DISTURBING THE UP SLOPE AREA.
2. STRAW BALE FENCES SHALL BE REMOVED ONCE THE DISTURBED AREA IS STABILIZED BY PERMANENT BEST MANAGEMENT PRACTICES.
3. STRAW BALE FENCES SHALL BE PLACED ON THE CONTOUR SIDE TO THE EXTENT PRACTICAL. STRAW BALE FENCES MAY NOT BE PLACED PERPENDICULAR TO THE CONTOUR ON SLOPES OF GREATER THAN 2%. THE ENDS OF THE STRAW BALE FENCE SHOULD BE TURNED UP SLOPE ONE TO TWO FEET IN ELEVATION TO PREVENT FLANKING.
4. THE STRAW BALE FENCE SHALL BE ENTRENCHED AT LEAST FOUR INCHES. THE UP SLOPE SIDE OF THE BALE SHALL BE BUILT UP AN ADDITIONAL FOUR INCHES.
5. STRAW BALE FENCES SHALL BE CONSTRUCTED BY TIGHTLY ABUTTING ENDS OF ADJACENT BALES. GAPS BETWEEN BALES SHALL BE FILLED WITH STRAW. SEE DETAIL 1.
6. ALL BALES SHALL BE EITHER WIRE-BOUND OR STRING-TIED. STRAW BALES SHALL BE INSTALLED SO THAT BINDINGS ARE ORIENTED AROUND THE SIDES RATHER THAN ALONG THE TOPS AND BOTTOMS OF THE BALES TO PREVENT DEGRADATION OF THE BINDINGS. SEE DETAIL 2.
7. EACH STRAW BALE SHALL BE SECURELY ANCHORED BY AT LEAST TWO STAKES OR REBARS DRIVEN THROUGH THE BALE AND AT LEAST EIGHT INCHES INTO THE GROUND. THE FIRST STAKE SHALL BE DRIVEN TOWARDS THE PREVIOUSLY ANCHORED BALE TO HELP CREATE A TIGHT FIT.
8. STRAW BALE FENCES SHALL BE INSPECTED WITHIN 24 HOURS AFTER EACH RAINFALL. REPAIR OR REPLACEMENT SHALL BE MADE IMMEDIATELY.
9. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT. SEDIMENT DEPOSITS SHALL BE REMOVED WHEN DEPOSITS REACH ½ OF THE HEIGHT OF THE FENCE.
10. STAW BALE FENCE SHALL BE CONSTRUCTED WITH THE MATERIALS AND INSTALLED IN ACCORDANCE WITH THE CALIFORNIA "EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL".



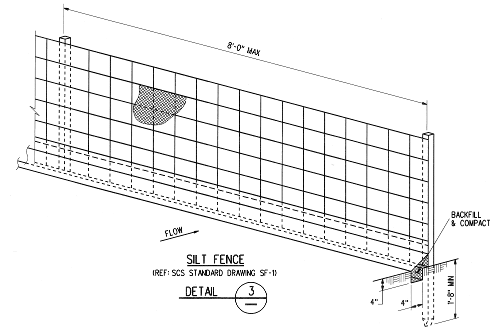

STRAW BALE DIKE
(REF: SCS STANDARD DRAWING SBD-1)
DETAIL 1




DETAIL 2

## CONSTRUCTION SEQUENCE NOTES

1. INSTALL PERIMETER EROSION CONTROL MEASURES.
2. EXCAVATE AND CONSTRUCT SEDIMENT BASINS BEFORE UPSTREAM EARTHWORK OPERATIONS IN THE PROPER SEQUENCE TO ENSURE THE SEDIMENT BASINS WILL PERFORM THE INTENDED FUNCTION.
3. EXCAVATE THE AREA TO ESTABLISH THE SITE GRADE, SEQUENTIALLY PERFORM SITE GRADING FOR ALL OTHER AREAS AND ESTABLISH AND STABILIZE SPOIL PILES OF EXCAVATED MATERIALS.
4. INSTALL STORM DRAIN PIPING
5. INSTALL TEMPORARY PARKING AND LAYDOWN AREAS
6. INSTALL UNDERGROUND PIPING
7. STRUCTURAL AND MAJOR FOUNDATION EXCAVATIONS
8. ERECTION OF PLANT FACILITIES
9. FINAL SITE GRADING
10. RESTORE TEMPORARY PARKING/LAYDOWN AREAS & INSTALLATION OF PERMANENT VEGETATION.




SILT FENCE
(REF: SCS STANDARD DRAWING SF-1)
DETAIL 3

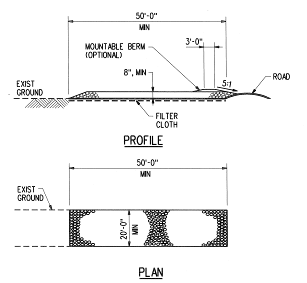
## EROSION & SEDIMENTATION CONTROL NOTES

1. ONLY LIMITED DISTURBANCE WILL BE PERMITTED TO PROVIDE ACCESS TO SEDIMENT TRAPS AND DIVERSION SWALES FOR GRADING AND ACQUIRING BORROW TO CONSTRUCT THOSE CONTROLS.
2. EROSION AND SEDIMENTATION CONTROLS MUST BE CONSTRUCTED, STABILIZED AND FUNCTIONAL BEFORE SITE DISTURBANCE WITHIN THE TRIBUTARY AREAS OF THOSE CONTROLS.
3. AFTER FINAL STABILIZATION IS ACHIEVED, TEMPORARY EROSION AND SEDIMENTATION CONTROLS MUST BE REMOVED. AREAS DISTURBED DURING REMOVAL OF THE CONTROLS MUST BE STABILIZED IMMEDIATELY.
4. SEDIMENT BASINS MUST BE PROTECTED FROM UNAUTHORIZED ACTS OF THIRD PARTIES.
5. FABRIC FILTER (SILT) FENCE MUST BE INSTALLED AT GRADE LEVEL. BOTH ENDS OF EACH FENCE SECTION MUST EXTEND AT LEAST 10 FEET UP SLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.
6. SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH ½ OF THE ABOVE GROUND HEIGHT OF THE SILT FENCE.
7. ANY FENCE SECTION THAT HAS BEEN UNDERMINED OR TOPPED MUST BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET.
8. ANY DISTURBED AREA WHERE ACTIVITY HAS CEASED MUST BE STABILIZED WITHIN 7 DAYS. DURING NON-GERMINATING PERIODS, MULCH MUST BE APPLIED AT THE RECOMMENDED RATES. DISTURBED AREAS THAT ARE NOT AT FINISHED GRADE AND WILL BE REDISTRIBUTED WITHIN ONE YEAR MAY BE STABILIZED IN ACCORDANCE WITH TEMPORARY SEEDING SPECIFICATIONS. DISTURBED AREAS THAT ARE EITHER AT FINISHED GRADE OR WILL NOT BE REDISTRIBUTED WITHIN ONE YEAR MUST BE STABILIZED IN ACCORDANCE WITH PERMANENT SEEDING SPECIFICATIONS.
9. DIVERSIONS, CHANNELS, SEDIMENTATION BASINS, SEDIMENT TRAPS AND STOCKPILES MUST BE STABILIZED IMMEDIATELY.
10. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENTATION MUST BE MAINTAINED PROPERLY. MAINTENANCE MUST INCLUDE INSPECTIONS OF ALL EROSION AND SEDIMENTATION CONTROLS AFTER EACH RUNOFF EVENT. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING AND RENETTING MUST BE PERFORMED IMMEDIATELY.
11. ALL WORK SHALL BE CONDUCTED IN A MANNER TO PRESERVE ALL EXISTING VEGETATION THAT IS NOT REQUIRED TO BE MOVED.
12. WORK SHALL BE SCHEDULED AND EXECUTED IN A MANNER SO THAT GROUND COVER IS REMOVED AND EARTHWORK IS EXPOSED TO EROSION FOR THE MINIMAL TIME PRACTICAL.
13. ALL ON-SITE EROSION AND SEDIMENTATION DAMAGE SHALL BE THE RESPONSIBILITY OF THE SUBCONTRACTOR AND SHALL BE CORRECTED IMMEDIATELY.
14. EARTHWORK THAT HAS BEEN COMPLETED OR TEMPORARILY SUSPENDED AND IS NOT SUBJECT TO CONSTRUCTION TRAFFIC, SHALL BE STABILIZED IMMEDIATELY WITH UNROTTED SMALL GRAIN STRAW OR SALT HAY AT A RATE OF THREE TONS PER ACRE. THE MULCH SHALL BE ANCHORED WITH EMULSION.
15. ALL TOPSOIL AND EARTH STOCKPILES SHALL BE PLACED IN DESIGNATED AREAS SHOWN ON THE PLAN AND THEY SHALL BE GRADED TO MINIMIZE EROSION. WINDWARD SLOPES OF STOCKPILES SHALL BE GRADED TO A 2:1 SLOPE AND SHALL BE IMMEDIATELY STABILIZED AS NOTED ABOVE. AFTER CONSTRUCTION IS COMPLETE, ANY REMAINING STOCKPILE MATERIAL SHALL BE GRADED ONTO THE SITE AND STABILIZED OR HAULED OFF-SITE.
16. THE SUBCONTRACTOR SHALL INSPECT, CLEAN AND/OR REPAIR ALL EROSION CONTROL FACILITIES WEEKLY OR AFTER EACH RAIN. THE SUBCONTRACTOR SHALL REMOVE ALL ACCUMULATED SEDIMENT AS REQUIRED AND PLACE ON SITE IN NON-ERODIBLE AREAS AND PERMANENTLY STABILIZE THESE AREAS BY SEEDING IN ACCORDANCE WITH THE PERMANENT SEEDING SPECIFICATIONS.
17. THE SUBCONTRACTOR SHALL MAINTAIN ALL AREAS WHERE EROSION IS APPARENT FOR ONE YEAR FROM THE DATE OF COMPLETION.
18. WHEN CONDITIONS WARRANT, THE SUBCONTRACTOR SHALL CONTROL EXCESSIVE DUST GENERATED BY CONSTRUCTION ACTIVITIES ON THE SITE IN ACCORDANCE WITH THE SWPPP.
19. ALL EROSION CONTROL WORK SHALL BE DONE IN ACCORDANCE WITH THE CALIFORNIA "EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL".
20. SILT FENCE SHOWN ON THE PLAN SHALL BE REPAIRED, CLEANED OR REPLACED IF NECESSARY.
21. TEMPORARY AND PERMANENT SEEDING TO BE USED TO ESTABLISH VEGETATIVE STABILZATION ON EXPOSED SOIL AS PER THE CALIFORNIA "EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL". STRAW MULCH OR WOOD CELLULOSE FIBER MULCH SHALL BE APPLIED TO ALL SEEDED AREAS IMMEDIATELY AFTER SEEDING. ALL SEED MUST MEET THE REQUIREMENT OF THE CALIFORNIA DEPARTMENT OF AGRICULTURE "SEED LAW".
22. EROSION CONTROL MATTING SHALL BE USED TO TEMPORARILY STABILIZE SEEDED DITCHES AND 3:1 CUT AND FILL SLOPES UNTIL VEGETATION IS ESTABLISHED. THE EROSION CONTROL MATTING THAT IS USED MUST WITH STAND VELOCITIES OF 6 FEET PER SECOND.
23. SEDIMENT CONTROL DEVICES MUST REMAIN IN PLACE DURING GRADING, SEEDBED PREPARATION, SEEDING, MULCHING AND VEGETATIVE ESTABLISHMENT TO PREVENT LARGE QUANTITIES OF SEDIMENT AND ASSOCIATED CHEMICALS AND NUTRIENTS FROM WASHING INTO SURFACE WATERS.

## SILT FENCE NOTES

1. SILT FENCES SHALL BE INSTALLED PRIOR TO DISTURBING THE UP SLOPE AREA.
2. SILT FENCES MAY BE REMOVED ONCE THE DISTURBED AREA IS STABILIZED BY PERMANENT BEST MANAGEMENT PRACTICES.
3. SILT FENCES SHALL BE PLACED ON THE CONTOUR TO THE EXTENT PRACTICAL. SILT FENCES MAY NOT BE PLACED PERPENDICULAR TO THE CONTOUR ON SLOPES OF GREATER THAN 2%. PARALLEL FENCES MAY BE USED.
4. THE ENDS OF SILT FENCES SHALL BE TURNED UP SLOPE TO PREVENT WATER FROM RUNNING AROUND THE ENDS OF THE FENCE. SEE DETAIL 3. FOR FENCES USING 24 IN SILT FENCE FABRIC, THE ENDS SHALL BE UPTURNED AT LEAST 16 INCHES IN ELEVATION. FOR SILT FENCES USING 36 INCH FABRIC THE ENDS SHALL BE UPTURNED AT LEAST 28 INCHES IN ELEVATION.
5. INSTALLED SILT FENCES SHALL BE A MINIMUM OF 14 INCHES HIGH AND SHALL NOT EXCEED 28 INCHES IN HEIGHT. THE HEIGHT REQUIREMENT IS MEASURED FROM THE GROUND SURFACE TO THE TOP OF THE FENCE; THIS DOES NOT INCLUDE THE ANCHOR MATERIAL. THESE HEIGHT REQUIREMENTS ARE DESIGNED TO ACCOMMODATE 24 AND 36 INCH SILT FENCE FABRIC.
6. THE FULL HEIGHT OF THE SILT FENCE SHALL BE SUPPORTED BY 1⅛" X 1⅛" AIR OR KILN DRIED POSTS OF HICKORY, OAK OR EQUIVALENT. THE POSTS SHALL BE 3 FEET LONG FOR 24 INCH SILT FENCE FABRIC AND 4 FEET LONG FOR 36 INCH SILT FENCE FABRIC. AT LEAST 20 INCHES OF THE POST SHALL EXTEND INTO THE GROUND AFTER FENCE INSTALLATION. THE SILT FENCE FABRIC SHALL BE STAPLED USING AT LEAST ½ INCH STAPLES TO THE UP SLOPE SIDE OF THE POSTS. THE MAXIMUM SPACING OF POSTS FOR NON-WOVEN SILT FENCE SHALL BE 3 FEET. NO SUPPORT CORD IS REQUIRED FOR 3 FOOT SPACING. THE MAXIMUM POST SPACING FOR NON-WOVEN FABRIC WITH SUPPORT NET AND TOP SUPPORT CORD, AS SPECIFIED BELOW, OR FOR WOVEN FABRIC WITH SUPPORT CORD SHALL BE 8 FEET.
7. THE SILT FENCE FABRIC SHALL BE ANCHORED BY SPREADING AT LEAST 8 INCHES OF FABRIC IN A 4 INCH X 4 INCH TRENCH OR A 4 INCH DEEP V-TRENCH ON THE UP SLOPE SIDE OF THE FENCE. SEE DETAIL 3. THE TRENCH SHALL BE BACK FILLED AND COMPACTED.
8. SILT FENCE FABRIC SHALL MEET THE FOLLOWING SPECIFICATIONS: NON WOVEN SILT FENCE
   a) GRAB STRENGTH: 100 POUND MINIMUM IN ANY PRINCIPAL DIRECTION (ASTM D-4632)
   b) MULLEN BURST: MINIMUM 200 PSI (ASTM D-3786)
   c) EQUIVALENT OPENING SIZE: BETWEEN 70 AND 140 FOR SOILS WITH MORE THAN 15% BY WEIGHT PASSING A NO. 200 SIEVE

      BETWEEN 20 AND 70 FOR SOILS WITH LESS THAN 15% BY WEIGHT PASSING A NO. 200 SIEVE.
   d) WATER FLOW RATE OF 10 GALLON PER MINUTE PER SQUARE FOOT AT 50mm CONSTANT HEAD AS DETERMINED BY MULTIPLYING PERMITIVITY IN 1 / SEC AS DETERMINED BY ASTM D-4491 BY A CONVERSION FACTOR OF 74.
   e) ULTRA VIOLET RADIATION STABILITY OF 90% USING TEST METHOD ASTM D-4355.
   f) FABRIC WITH SUPPORT NETTING SHALL BE REINFORCED WITH A INDUSTRIAL POLYPROPYLENE NETTING WITH A ¾ INCH SPACING OR EQUIVALENT. A HEAVY DUTY NYLON TOP SUPPORT CORD OR EQUIVALENT IS REQUIRED. WHERE POST SPACING IS 3 FEET OR LESS, SUPPORT CORD IS NOT REQUIRED.
9. SILT FENCES SHALL BE INSPECTED WITHIN 24 HOURS AFTER EACH RAINFALL. REPAIR OR REPLACEMENT SHALL BE DONE IMMEDIATELY IF FENCING IS TORN, SAGGING, OVERTOPPED, BLOWN OVER (LAYING DOWN), SHOWS A LACK OF MATERIAL INTEGRITY, OR IN ANY WAY IS NOT FUNCTIONING AS DESIGNED.
10. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT. SEDIMENT DEPOSITS SHALL BE REMOVED WHEN DEPOSITS REACH ½ OF THE HEIGHT OF THE FENCE.
11. SILT FENCE SHALL BE CONSTRUCTED WITH THE MATERIALS AND INSTALLED IN ACCORDANCE WITH THE CALIFORNIA "EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL".




STABILIZED CONSTRUCTION ENTRANCE DETAILS
(REF: SCS STANDARD DRAWING SCE-1)
DETAIL 6

## WHEEL WASH AND CONSTRUCTION ENTRANCE NOTES

1. STONE SIZE - USE TWO INCH STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - AS REQUIRED, BUT NOT LESS THAN 50 FEET.
3. THICKNESS - NOT LESS THAN EIGHT INCHES.
4. WIDTH - TWENTY FEET MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. FILTER CLOTH - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCE SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPE WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WASHING - WHEELS SHALL BE CLEANED AS REQUIRED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.
10. WHEEL WASH SHALL BE CONSTRUCTED WITH THE MATERIALS AND INSTALLED IN ACCORDANCE WITH THE CALIFORNIA "EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL"

## NOTES

1. FOR NOTES AND REFERENCE DRAWINGS SEE DWG XX-XXXX-XXXXX.

| NO. | DATE | REVISIONS | BY | CHK | DES SUPV. | ENGR. | PROJ ENGR | APPR |
|---|---|---|---|---|---|---|---|---|
| A | 3/19/07 | ISSUED FOR PERMIT | JAM | [signature] | | THJ | [signature] | |

SCALE | DATE | DESIGNED | DRAWN | CHIEF ENGR.

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FREDERICK, MARYLAND

COLUSA POWER PLANT

EROSION CONTROL DETAIL

| JOB NO. | UNITS | DRAWING NO. | REV. |
|---|---|---|---|
| 25316 | 000 | FIGURE 5 | A |

REF FILE: FILE NAME: 34"X44"E SIZE PSC-

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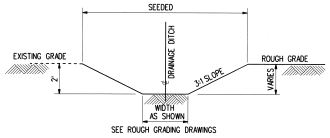
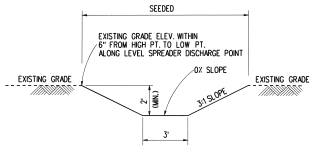
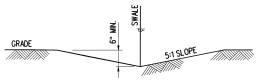


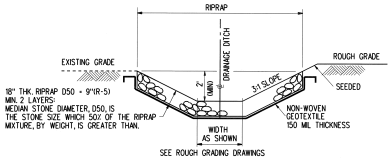

SEEDED DITCH DETAIL




LEVEL SPREADER DETAIL

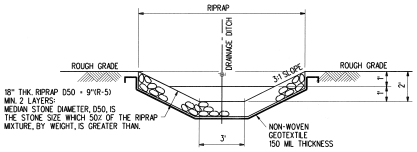



TYPICAL SWALE DETAIL

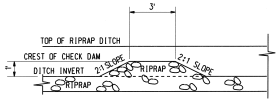



RIPRAP DITCH DETAIL

DRAINAGE DITCH DETAILS

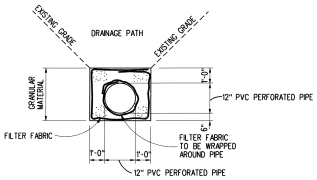



RIPRAP CHECK DAM DETAIL

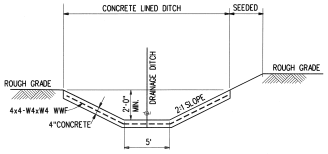



SECTION A

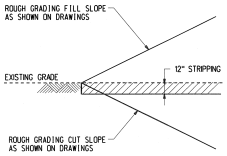
RIPRAP CHECK DAM DETAIL



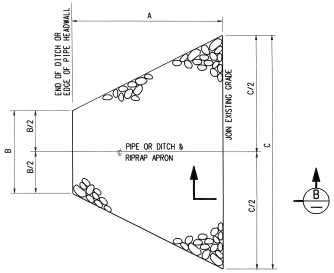

SUB-DRAIN PERFORATED DRAINAGE PIPE
INSTALLATION DETAIL
SCALE: 1"=3'



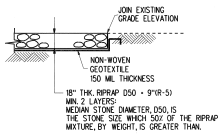

CONCRETE DITCH DETAIL
SCALE: 1"=3'




STRIPPING DETAIL
NTS




RIPRAP APRON DETAIL
NTS




SECTION B
NTS

## NOTES

1. FOR GENERAL NOTES & EROSION & SEDIMENTATION CONTROL NOTES, SEE DWG XXX-XXXX-XXXXX.
2. RIPRAP SHALL CONFORM TO THE FOLLOWING:
   DENSITY GREATER THAN 150 POUNDS PER CUBIC FOOT; STONE THAT IS HARD, DURABLE AND ANGULAR IN SHAPE, RESISTANT TO WEATHERING & TO WATER ACTION & FREE FROM OVERBURDEN, SPOIL, SHALE & ORGANIC MATERIAL.
3. FOR NOTES AND REFERENCE DRAWINGS SEE DWG XXX-XXXX-XXXXX.

| NO. | DATE | REVISIONS | BY | CHK | DES. SUPV. | ENGR | PROJ. ENGR | APPR |
|---|---|---|---|---|---|---|---|---|
| A | 5/1/01 | ISSUED FOR PERMIT | JAM | | | | | |

SCALE | DATE | DESIGNED | DRAWN | CHKD. ENGR.

**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

DRAINAGE DETAILS

| JOB NO. | UNITS | DRAWING NO. | REV. |
|---|---|---|---|
| 25316 | 000 | FIGURE 6 | A |

FILE NAME: | REF FILE: | 34"X44"E SIZE

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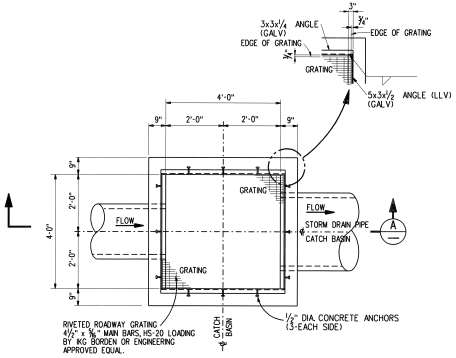
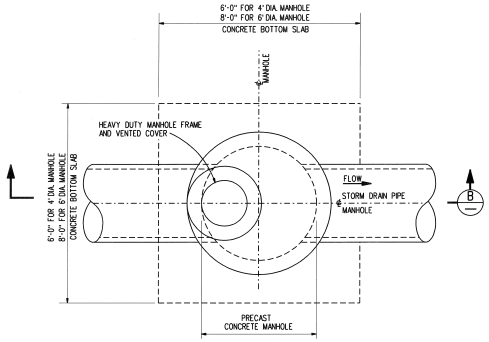


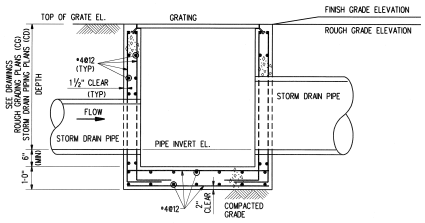

CATCH BASIN DETAIL

SCALE ½" = 1'-0"



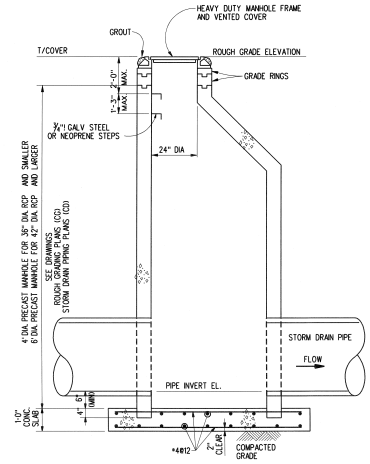

MANHOLE DETAIL

SCALE ½" = 1'-0"




SECTION A

SCALE ½" = 1'-0"

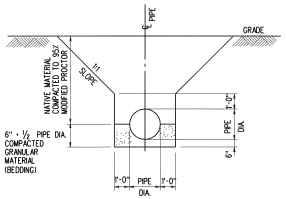



SECTION B

SCALE ½" = 1'-0"

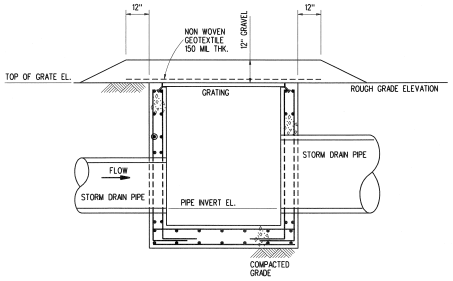
NOTES:

1. CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 4000 PSI (MIN) AT 28 DAYS.
2. MIXING, PLACING, FINISHING AND CURING OF CONCRETE SHALL BE IN ACCORDANCE WITH ACI 301.
3. FOR NOTES AND REFERENCE DRAWINGS SEE DWG.XX-XXXX-XXXXX.




TYPICAL CULVERT & STORM DRAIN INSTALLATION DETAIL

NTS




CATCH BASIN INLET PROTECTION DETAIL DURING CONSTRUCTION

SCALE ½" = 1'-0"

| NO. | DATE | REVISIONS | BY | CHK | DES SUPV | ENGR | PROJ ENGR | APPR |
|---|---|---|---|---|---|---|---|---|
| 0 | 5/6/01 | ISSUED FOR PERMIT | JAM | CNM | AGA | THJ | | |

SCALE | DATE | DESIGNED | DRAWN | CHIEF ENGR

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CATCH BASIN AND MANHOLE DETAILS

| JOB NO. | UNITS | DRAWING NO. | REV. |
|---|---|---|---|
| 25316 | 000 | FIGURE 7 | A |

FILE NAME: 1 34"X44"E SIZE

REF FILE:

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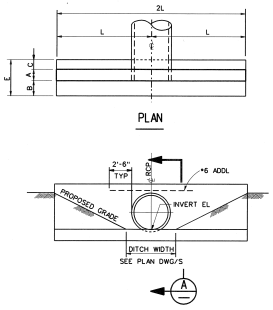
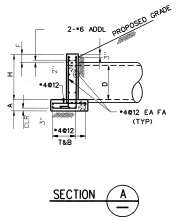
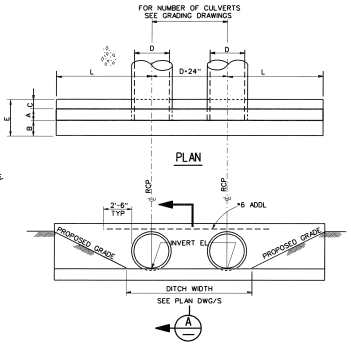
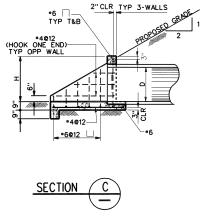


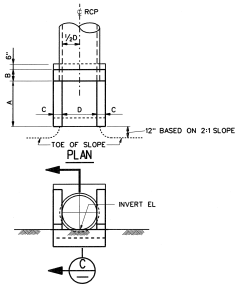

HEADWALL TYPE A-1




HEADWALL TYPE A-2




HEADWALL TYPE C-1

HEADWALL TYPES A-1 & A-2

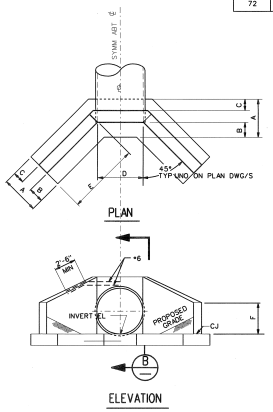
| PIPE DIA D INCHES | DIMENSIONS A | B | C | E | F | H | L |
|---|---|---|---|---|---|---|---|
| 12 | 9" | 6" | 6" | 1'-9" | 9" | 1'-9" | 3'-3" |
| 15 | 9" | 6" | 6" | 1'-9" | 9" | 2'-0" | 3'-10½" |
| 18 | 9" | 6" | 6" | 1'-9" | 9" | 2'-3" | 4'-6" |
| 21 | 9" | 6" | 6" | 1'-9" | 9" | 2'-6" | 5'-1½" |
| 24 | 9" | 14" | 6" | 2'-5" | 9" | 2'-9" | 5'-9" |
| 27 | 9" | 14" | 6" | 2'-5" | 9" | 3'-0" | 6'-5" |
| 30 | 9" | 14" | 6" | 2'-5" | 12" | 3'-6" | 7'-1" |
| 33 | 9" | 14" | 6" | 2'-5" | 12" | 3'-9" | 7'-8½" |
| 36 | 12" | 16" | 10" | 3'-2" | 12" | 4'-0" | 8'-4" |
| 42 | 12" | 16" | 10" | 3'-2" | 12" | 4'-6" | 9'-7" |
| 48 | 12" | 16" | 10" | 3'-2" | 12" | 5'-0" | 10'-10" |
| 54 | 12" | 20" | 12" | 3'-8" | 12" | 5'-6" | 12'-1" |
| 60 | 12" | 20" | 12" | 3'-8" | 12" | 6'-0" | 13'-4" |
| 72 | 12" | 20" | 12" | 3'-8" | 12" | 7'-0" | 15'-10" |

HEADWALL TYPE C-1

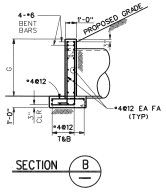
| PIPE DIA D INCHES | DIMENSIONS A | B | C | H |
|---|---|---|---|---|
| 12 | 1'-4" | 9" | 6" | 1'-9" |
| 15 | 1'-11" | 9" | 6" | 2'-0" |
| 18 | 2'-5" | 9" | 6" | 2'-3" |
| 21 | 3'-0" | 9" | 6" | 2'-6" |
| 24 | 3'-8" | 12" | 9" | 2'-9" |
| 27 | 4'-2" | 12" | 9" | 3'-0" |
| 30 | 4'-9" | 12" | 9" | 3'-6" |
| 33 | 5'-3" | 12" | 9" | 3'-9" |
| 36 | 5'-10" | 12" | 9" | 4'-0" |
| 42 | 6'-11" | 12" | 12" | 4'-6" |
| 48 | 8'-0" | 12" | 12" | 5'-0" |
| 54 | 9'-2" | 12" | 12" | 5'-6" |
| 60 | 10'-2" | 12" | 12" | 6'-0" |

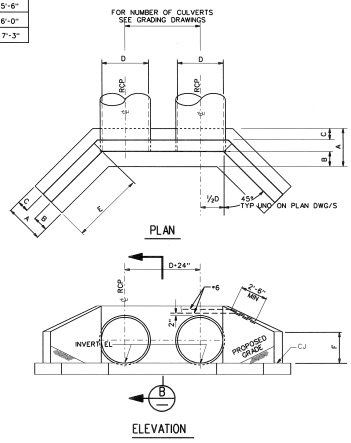
HEADWALL TYPES B-1 & B-2

| PIPE DIA D INCHES | DIMENSIONS A | B | C | E | F | G |
|---|---|---|---|---|---|---|
| 48 | 3'-2" | 1'-4" | 10" | 6'-3½" | 2'-9" | 5'-0" |
| 54 | 3'-8" | 1'-8" | 1'-0" | 6'-10½" | 3'-0" | 5'-6" |
| 60 | 3'-8" | 1'-8" | 1'-0" | 7'-7¼" | 3'-3" | 6'-0" |
| 72 | 4'-9" | 2'-6" | 1'-3" | 11'-1¾" | 3'-3" | 7'-3" |




HEADWALL TYPE B-1




HEADWALL TYPE B-2

NOTES:-

1. CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS.
2. MIXING, PLACING, FINISHING AND CURING OF CONCRETE SHALL BE IN ACCORDANCE WITH ACI 301.
3. FOR NOTES AND REFERENCE DRAWINGS SEE DWG XX-XXXX-XXXXX.

| NO. | DATE | REVISIONS | BY | CHK | DES SUPV | ENGR | PROJ ENGR | APPR |
|---|---|---|---|---|---|---|---|---|
| 0 | 11/6/07 | ISSUED FOR PERMIT | JMM | RCV | MMM | TMJ | TMJ | |

SCALE | DATE | DESIGNED | DRAWN | DSRD ENGR

**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

HEADWALL DETAILS

| JOB NO. | UNITS | DRAWING NO. | REV. |
|---|---|---|---|
| 25316 | 000 | FIGURE 8 | A |

REF FILE: | FILE NAME: | 34"X44"E SIZE PSC-

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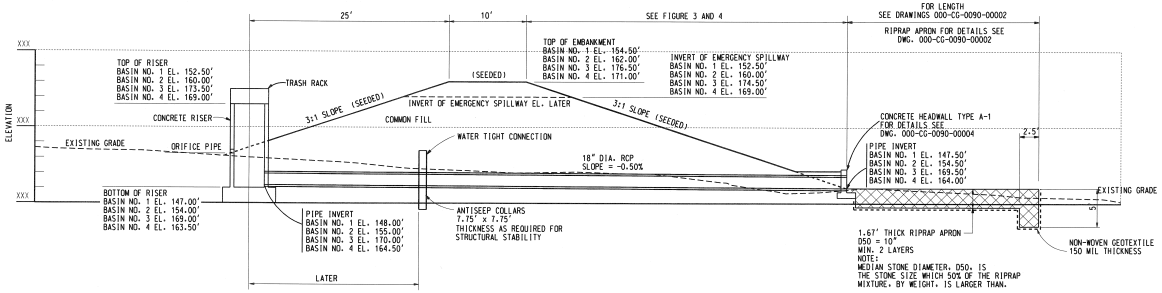
25196-002-G27-GEG-00009-00A

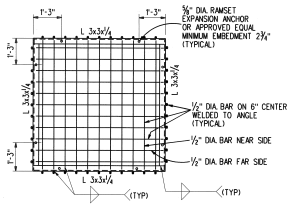
NOTES

1. FOR NOTES AND REFERENCE DRAWINGS SEE DWG LATER.

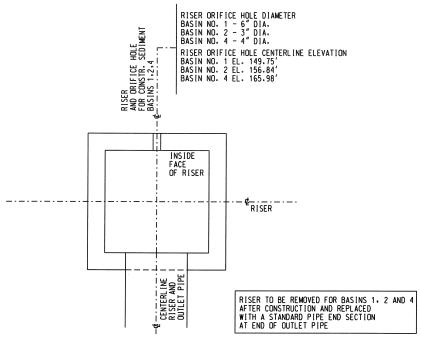



CONSTRUCTION SEDIMENT CONTROL BASIN
STORM WATER BASIN PROFILE

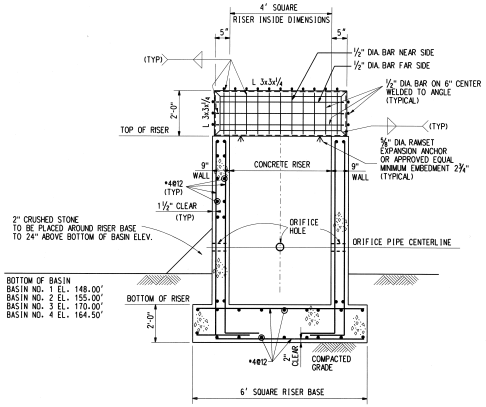
BASIN NO. 1 (LAYDOWN AREA)
BASIN NO. 2 (CONSTRUCTION PARKING)
BASIN NO. 3 (POWERBLOCK AND SWITCHYARD)
BASIN NO. 4 (CONSTRUCTION OFFICE)



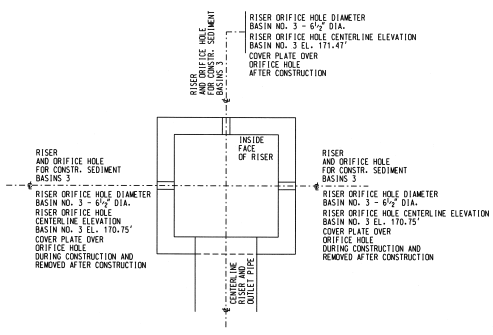

PLAN
RISER TRASH RACK
SCALE ½" = 1'-0"




PLAN
RISER ORIFICE HOLE LOCATIONS
FOR CONSTRUCTION SEDIMENT BASINS NO. 1, 2 AND 4
AND STORM WATER BASIN NO. 1, 2 AND 4
SCALE ½" = 1'-0"




ELEVATION
RISER AND TRASH RACK
SCALE ½" = 1'-0"




PLAN
RISER ORIFICE HOLE LOCATIONS
FOR CONSTRUCTION SEDIMENT BASINS NO. 3
AND STORM WATER BASIN NO. 3
SCALE ½" = 1'-0"

| NO. | DATE | REVISIONS | BY | CHK | DES SUPV. | CHIEF ENGR | APPR |
|---|---|---|---|---|---|---|---|
| 3 | 8/6/07 | ISSUED FOR PERMIT | JAM | CNV | VGM | TAJ | JDZ |

SCALE | DATE | DESIGNED | DRAWN | CHIEF ENGR

BECHTEL
FREDERICK, MARYLAND

COLUSA POWER PLANT

STORM WATER BASIN
OUTLET DETAILS

| JOB NO. | UNITS | DRAWING NO. | REV. |
|---|---|---|---|
| 25316 | 000 | FIGURE 9 | A |

FILE NAME: REF FILE: 34"X44"E SIZE PSC-

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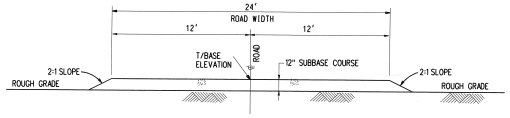
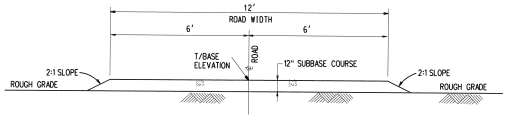
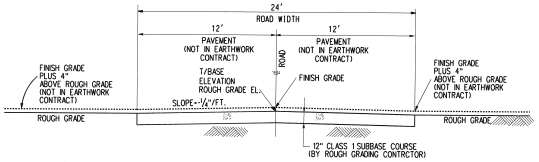
FORMATS.CEL AC-ESTD 3/1/99



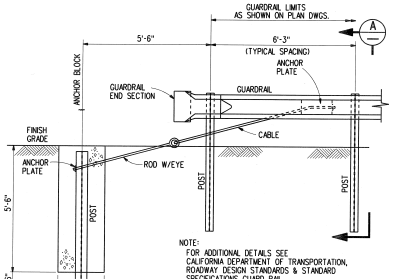

CONSTRUCTION GRAVEL ROAD CROSS SECTION
NTS



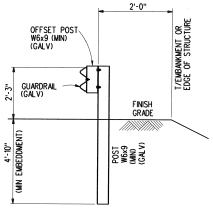

INTAKE STR. GRAVEL ROAD CROSS SECTION
NTS



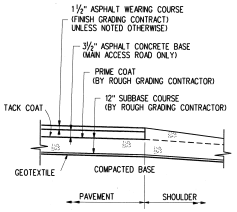

PLANT ACCESS ROAD CROSS SECTION
NTS



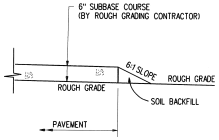

TYPICAL GUARDRAIL (GR) DETAIL
SCALE: 1"=2'



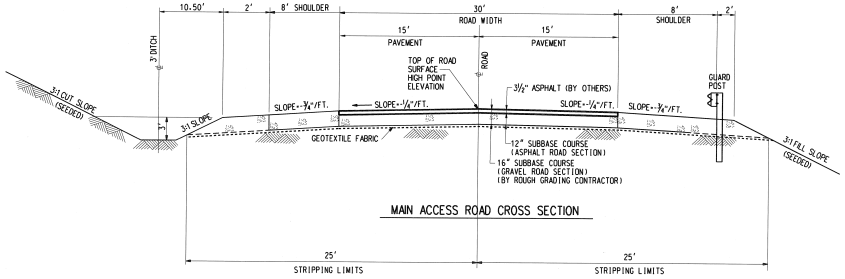

SECTION A
SCALE: 1"=2'



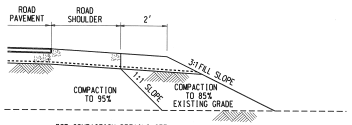

MAIN ACCESS ROAD PAVING DETAIL




CONSTRUCTION PARKING LOT DETAIL




MAIN ACCESS ROAD CROSS SECTION




ROAD COMPACTION DETAIL IN FILL

NOTES

1. FOR NOTES AND REFERENCE DRAWINGS SEE DWG XX-XXXX-XXXXX.

| NO. | DATE | REVISIONS | BY | CHK | DES SUPV | ENGR | PROJ ENGR | APPR |
|---|---|---|---|---|---|---|---|---|
| A | 3/8/01 | ISSUED FOR PERMIT | JAM | | | | | |

SCALE | DATE | DESIGNED | DRAWN | CHIEF ENGR

**BECHTEL**
FREDERICK, MARYLAND

COLUSA POWER PLANT

ROAD DETAILS

| JOB NO. | UNITS | DRAWING NO. | REV. |
|---|---|---|---|
| 25316 | 000 | FIGURE 10 | A |

FILE NAME: 34"X44"E SIZE

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