Appendix D Dewatering Plan

TECHNICAL MEMORANDUM

Dewatering Plan

San Luis Obispo County
Los Osos Collection System

Final

March 2012

CDM Smith

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Central Coast Region Letter dated May 27, 2011, Use and Disposal Plan for Construction Dewatering, Los Osos Project

Acronyms

AFY	acre-feet per year
CDFG	California Department of Fish and Game
CDP	Coastal Development Permit
FM	forcemain
ft	feet
ft/d	feet per day
gpd	gallons per day
gpd/ft^2	gallons per day per square foot
lf	linear feet
LOVR	Los Osos Valley Road
ml/l	milliliter per liter
MPN	most probable number
PS	pump station
REW	recycled water
RWQCB	California Regional Water Quality Control Board Central Coast Region
sq ft	square feet
USACE	United States Army Corps of Engineers
WWTP	wastewater treatment plant

Los Osos Collection System Dewatering Plan

CDM Smith evaluated the construction dewatering requirements for the Los Osos collection system and estimates that the groundwater disposal requirement is approximately 620 – 1,300 gpm. CDM Smith considered twelve disposal alternatives including combinations of construction use, the new retention facility at the Mid-Town site, the new Broderson leachfield site, the existing public retention basins, the existing storm drains, and agricultural reuse.

Based on this analysis, CDM Smith recommends a four-stage approach. The first stage is to use construction use and treatment since no groundwater retention sites will be available when work starts. The second stage will involve construction use and use of the new Mid-Town retention site and the existing retention sites to the fullest extent possible. Naturally, the infrastructure to get water to Mid-Town groundwater retention basin will need to be installed before use. The third stage is to build the Broderson leachfield system and the recycled water pipeline to get flow there. The intent would be to use the Mid-Town retention site as the primary disposal site, using the Broderson site to offset the peak groundwater disposal. Construction use will be implemented throughout construction in combination with the other disposal alternatives. Disposal to the Mid-Town site augmented with the Broderson leachfield site appears to be a viable and cost-effective means to dispose of the entire range of the anticipated groundwater disposal (approximately 620 to 1,300 gpm for a single area or 2,500 to 4,900 gpm for up to 4 concurrent areas) throughout construction. Groundwater production in excess of 6,500 gpm would require a fourth approach involving agricultural reuse along Clark Valley Road. This would be necessary if the groundwater production exceeds what could be disposed of with the combined capacity of the construction use + Mid-Town retention site + Broderson leachfield site. Disposal to storm drains will always be an optional disposal method, but will likely require treatment for a range of constituents, primarily fecal coliform, ammonia, pH, and sediment.

1. Summary of Proposed Approach

The Contract Documents will specify the following conditions for the disposal of construction dewatering water:

1. The Contractor will be encouraged to utilize the collection system sewer mains, conveyance force main, and the recycled water force main for the conveyance of construction dewatering water to the new Mid-Town groundwater retention site. This will require coordination between the construction contracts for the different bid packages.

2. The Contractor will be encouraged to utilize the collection system sewer mains and force mains or recycled water lines for the conveyance of construction dewatering water to selected manholes or pump station wet wells and to the force mains and the recycled water force mains as needed.

3. The phasing (schedule) of construction/dewatering and construction of disposal sites must be managed to ensure proper disposal of dewatering effluent.

4. The selected manholes or pump station wet wells or recycled water force main may be used by the Contractor to install temporary drainage pumps to convey the construction dewatering water to disposal locations with temporary piping. (The wastewater pumps to be provided for the Project will not be allowed for use as drainage pumps.)

5. The construction dewatering water will be pretreated by desilting with an inline sediment settling tank when required before discharge to sewer mains, pump station wet wells, and recycled water pipeline.

6. At completion, the Contractors will be required to clean the newly constructed sewer mains, manholes, wet wells, and force mains if used for conveyance of construction dewatering.

2. Introduction

This dewatering plan was developed by CDM Smith for the proposed Los Osos Collection System. The collection system will be a conventional gravity collection system serving 15,000 residents with pump stations that collect wastewater from individual parcels within the service area and convey these flows to the Mid-Town site. The system will include approximately 195,000 linear feet of gravity sewer mains ranging in size from 8-inch to 18-inch in diameter, 790 manholes, 4,700 sewer laterals, six duplex and two triplex pump stations, twelve pocket pump stations, the Mid-Town Pump Station, and 28,000 linear feet of force main ranging in size from 2-inches to 12-inches in diameter.

As described in the March 2004 Geotechnical Report for the Los Osos Wastewater Project by Fugro West, groundwater conditions are notoriously shallow in many areas of the communities of Los Osos, Baywood, and Cuesta-by-the-Sea. On the basis of the groundwater conditions encountered at the site, dewatering will be a critical aspect of construction for the pipeline trenches in areas with shallow groundwater.

CDM Smith prepared this construction dewatering plan for the extraction, treatment, storage, and disposal of groundwater. The plan includes anticipated quantities, treatment methods, and storage and disposal locations and practices. The material provided is sufficient to partially satisfy pre-construction Coastal Development Permit (CDP) conditions 10 and 14.

The County is preparing an application for an NPDES Construction Activity Storm Water Permit. The application will define appropriate BMPs to be employed during project construction and the use of construction dewatering and the requirements for disposal of water from dewatering activities.

The Contractor will be required to submit a thorough dewatering plan prepared by a California licensed professional engineer. The Contractor's dewatering plan shall include descriptions of the dewatering water disposal approach with locations and methods of dewatering water collection, conveyance, and discharge for disposal.

The dewatering plan presented in this document is not intended to replace the Contractor's dewatering plan but is intended to think through the anticipated dewatering plan requirements to evaluate their impact on design and construction of the Los Osos Collection System.

3. Hydrogeologic Setting

3.1 Groundwater Levels and Subsurface Geology

Shallow groundwater is common over about 18 percent of the entire project area. In areas A and B, which are adjacent to Morro Bay, shallow groundwater is common to about 21 percent and 36 percent, respectively. The geotechnical report states that the depth to groundwater in the field explorations ranged from approximately 1 foot to greater than 80 feet below the ground surface over the site area. The geotechnical report also observed that there were numerous springs and areas of ponded water at the site.

Within the low lying areas of the site along the Morro Bay shore, and interdunal depressions such as along Paso Robles Avenue and Ramona Avenue, the geotechnical report stated that groundwater was encountered at shallow depths (less than 10 feet below ground surface), and that the dune sand was typically loose and readily caved into backhoe test pits and drill holes excavated within those areas.

Domestic water is supplied via deeper wells penetrating the deeper aquifer in the Paso Robles Formation. Groundwater dewatering will be in the shallower groundwater above the Paso Robles Formation. Hence, construction dewatering should not have a direct impact on the domestic water wells.

3.2 Bacteria

The potential presence of fecal coliform bacteria in the construction dewatering water due to contamination from the proximity of septic tank effluent is possible, but difficult to predict. The District excavated one test pit in July 2004 at the intersection of El Moro Avenue and 6th Street to reach groundwater that would be representative of construction dewatering water. Water was reached at a depth of 10 to 11 feet below grade and a sample obtained. (Note that the proposed sewer main at this location will be approximately 10 feet below grade.) The sample was analyzed for bacteria with the following results:

E. Coli	<1 MPN / 100 ml
Total Coliform	5500 MPN / 100 ml

The May 27, 2011 letter from the California Regional Water Quality Control Board Central Coast Region (RWQCB) requires that the Contractors monitor the dewatering discharge to surface waters for fecal coliform and that dewatering water not exceed 14 MPN/100 ml of fecal coliform bacteria with no more of than 10 percent of the samples exceeding 43 MPN/100 ml prior to discharge to receiving waters. This may require disinfection and, if chlorine is used, the discharge must be dechlorinated prior to discharge to receiving waters. Disinfection may also be required for disposal to agricultural reuse for certain crops such as edible food crops as described in the Effluent Reuse and Disposal Alternatives Memo by Carollo Engineers (Carollo Engineers 2008b). However, disinfection would not be required for temporary land disposal to retention basins and the new Broderson leachfield site.

3.3 Sediment

The Contractor will be required to insure that the construction dewatering water is not discharged to surface waters with sediments in excess of 3 ml/l settleable solids. Where the approach used to extract the groundwater are wells or well points, auxiliary processes for desilting are not expected to be needed except during initial start up of the well. Where construction dewatering water is extracted from open excavation sumps that may pick-up sediments and silts, the Contractor will be required to provide a means of desilting the water prior to discharge. The desilting operation would probably include detention and settlement in baffled Baker tanks. Desilting may be required for temporary land disposal to retention basins. Desilting will be required for disposal to the Broderson leachfield to prevent long term clogging.

3.4 Additional Treatment That May Be Required

The RWQCB may require additional levels of treatment for nitrate, ammonia removal, and pH adjustment if pH is higher than 7 for disposal to surface waters. This additional treatment is not anticipated at this time based on recent groundwater sampling.

The Shallow Groundwater Water Quality Sampling and Analysis report dated February 2, 2012 prepared by Fugro Consultants, Inc. indicates that there are no detectable levels of asbestos, pesticides, semi-volatile compounds, or dioxin. Detectable levels of arsenic, chromium, copper, lead, mercury, nickel, and chromium III were observed. However, detections at or above the method detection limit are not necessarily above the screening level required by the RWQCB. This groundwater analysis and comparison will be required as part of the Contractors construction dewatering program.

4. Anticipated Dewatering Areas

The general alignment of the sewer mains and the locations of the pump stations for the collection system are shown in Figure 1. The depth of the sewer mains ranges from 5 feet to over 20 feet below grade. Areas where the sewer will be located below the groundwater are also shown in Figure 1 as red lines. The approach used to estimate areas where the depth of the as-designed sewer was below the estimated groundwater depth involved a digitized surface of the water table from groundwater contour data for the 1999 — 2003 time period as described in Plate 8 of the 2004 Fugro Geotechnical Report. The depth of the groundwater was then compared to the proposed pipe invert elevation at each manhole. The result was that approximately 35,700 feet of gravity sewer pipe will be installed at or below the water table with an additional 7,600 feet of conveyance force main and recycled water main. Based on the water table elevation data used in this analysis, of the pipes that will be installed below the water table, approximately ¾ of pipe inverts are less than 5 feet below the water table. Recent groundwater sampling described in the Shallow Groundwater Water Quality Sampling and Analysis report dated February 2, 2012 prepared by Fugro Consultants, Inc. indicates that the water level monitored on December 7, 2011 are generally similar to those observed in the previous geotechnical investigation for the 2004 Fugro Geotechnical Report.

In areas of the collection system that are in high groundwater, more stringent construction inspection measures are warranted to ensure proper installation. The standard for construction oversight is for “observation” of the work, with close inspection provided on a random sample of

the work. Additional verification of quality is provided by testing requirements. CDM Smith will add a condition that in areas of high groundwater all joints and pipe sections must be visually inspected for proper installation and joint integrity. The areas where construction excavations may encounter groundwater are located within the highlighted areas depicted in Figure 1.

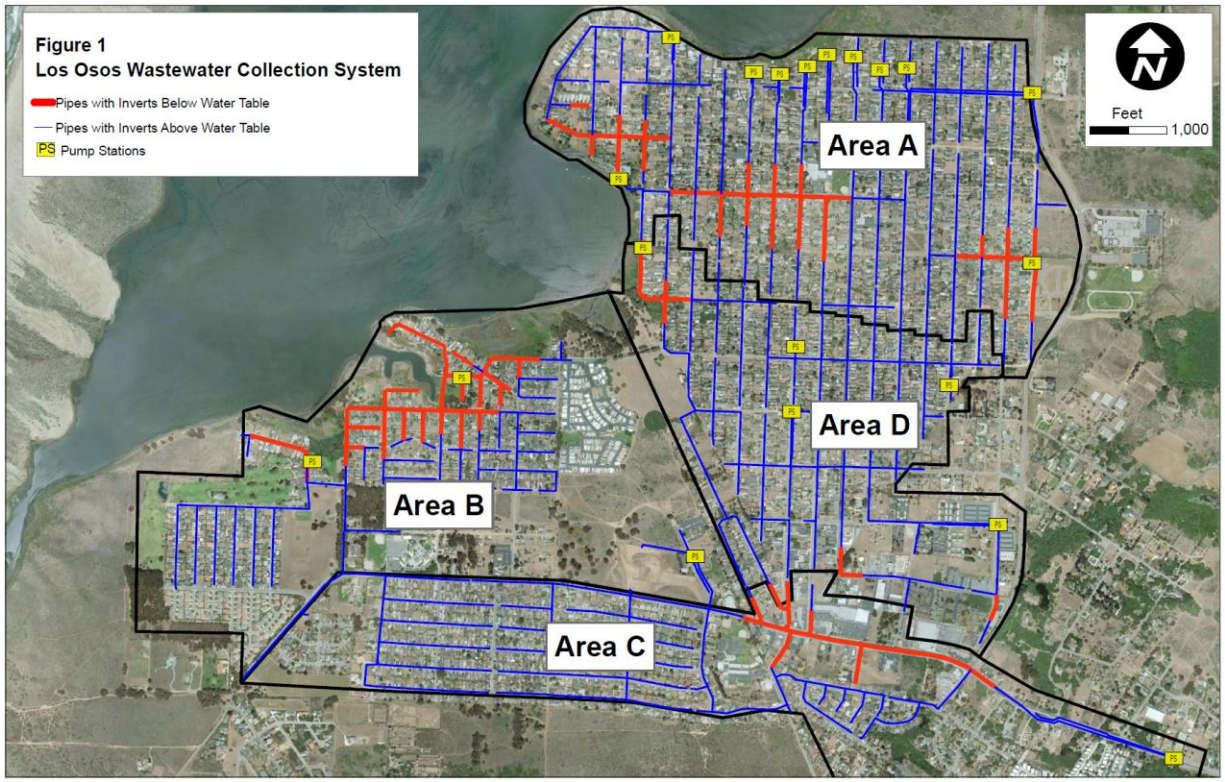

Figure 1. Los Osos Wastewater Collection System

The six areas of anticipated construction dewatering are located in the following general vicinities:

- Collection System Area B - The Solano Pump Station (PS) and Lupine Pump PS area (along Binscarth Road and western Ramona Avenue
- Collection System Area A west - The West Paso and Baywood PS area (along western Santa Maria Avenue and western El Moro Avenue)
- Collection System Area A east - The East Paso PS area (along eastern Paso Robles Avenue)
- Collection System Areas C and D - The Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way.
- Recycled Water Pipeline Area C - The Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and to Fairchild Way just beyond Oak Ridge Drive.

- Conveyance Force Main Area C - The Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way to just beyond Oak Ridge Drive.

Area A. Collection system area A is a coastal area known as Baywood Park and is the northern-most area of the project bounded by Morro Bay and Santa Paula Avenue on the north and west, South Bay Boulevard on the east, and a jagged saw-tooth line that runs diagonally southeasterly from Paso Robles Avenue and 3rd Street to Ramona Avenue and South Bay Blvd.

Area B. Collection system area B is a coastal area known as Cuesta-by-the-Sea and is the central western area of the project bounded by Morro Bay on the north and west, Ferrell Avenue on the east, and Los Osos Valley Road (LOVR) in the south.

Area C. Collection system area C is the southern-most area of the project bounded by LOVR in the north, Highland Drive and Green Oaks Drive in the south, and Sunny Oaks in the east.

Area D. Collection system area D is the central area of the project bounded by Area C on the south, Ferrell Avenue (Area B) on the west, and South Bay Boulevard on the east.

Area C. Recycled Water Pipeline in area C is the Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way to just beyond Oak Ridge Drive.

Area C. Conveyance Force Main in area C is the Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way to just beyond Oak Ridge Drive.

The total area where depth to groundwater is above the pipe invert for each of the project areas is summarized in Table 1.

Table 1. Depth to Groundwater Calculations for each Project Area

Project Area	Estimated total area where water table is above the pipe invert	Estimated total length of pipe where water table is above the pipe invert
Area A	3,500,000 sq ft	14,100 lf
Area B	4,800,000 sq ft	12,700 lf
Area C	1,800,000 sq ft	6,100 lf
Area D	1,300,000 sq ft	2,800 lf
Gravity Subtotal	11,400,000 sq ft	35,700 lf
Recycled Water Main	1,240,000 sq ft	4,200 lf
Conveyance Force Main	1,003,000 sq ft	3,400 lf
Pressure Main Subtotal	2,243,000 sq ft	7,600 lf

5. Dewatering Analysis

Assumptions:

- The soils in the study area are a mix of alluvium and sand dune deposits. The hydraulic conductivity range of 10 ft/d to 50 ft/d was used to test the sensitivity of the calculated dewatering to this parameter.
- In addition to the uncertainty of hydraulic conductivity, the thickness of the aquifer was tested over a range of 40 to 60 feet based on site geologic data to test the sensitivity of the calculated dewatering to this parameter.
- Drawdown targets will vary depending on the depth to groundwater in the excavation depth needed for construction. As a third sensitivity test, the drawdown targets were varied from 5 to 10 feet. As mentioned above, of the pipes that will be installed below the water table, approximately ¾ of pipe inverts are less than 5 feet below the water table.
- The total area in need of dewatering at any given time was assumed to be equivalent to a circle approximately 1,250 ft in diameter. This assumption was made based on the need to dewater a two block by three block area in Area A (approximately 1,250,000 sq ft). This assumes two crews constructing one heading per area.
- The approach used to estimate dewatering flow assumes one well and a circular drawdown cone. The dewatering estimate is a planning-level guidance which must be fine-tuned with updated analysis when specific dewatering layouts and well locations are available.
- A value of 1,250 ft, or approximately double the drawdown target radius, was used for the limit of the drawdown cone in the single well calculation. In reality, the effect of dewatering may extend beyond this limit.
- The analysis assumes equilibrium conditions. The dewatering rate will vary depending on dewatering progress. Higher pumping rates will be needed at the start of dewatering. When dewatering areas closer to the coast, higher pumping rates may be needed, as more groundwater is available in these locations through inflow of seawater.

Under equilibrium conditions, the volume of water that a dewatering system will have to pump from an unconfined aquifer to produce a certain drawdown is given by[1]:

Dewatering Flow (Q) = $K(H^2-h^2)/(1055*\log(R/r))$

where

Q = discharge in gpm

K = hydraulic conductivity, in gpd/ft^2

H = saturated thickness of the aquifer before pumping, in ft

[1] From Driscoll. Groundwater and Wells, 2nd Edition. 1986

h = depth of water in the well while pumping, in ft

R = radius of cone depression, in ft, and

r = radius of "well", in feet.

Table 2. Parameters Used in Dewatering Flow Calculation

Parameter	Parameter Description	Parameter Assumptions
K	Aquifer hydraulic conductivity	10 – 50 ft/d
H	Aquifer thickness	40 - 60 ft
h	Drawdown	5 - 10 ft
R	Radius of drawdown cone	1250 ft
r	Radius of dewatered area	625 ft

Using a range of soil hydraulic conductivity (10 ft/d - 50 ft/d), and aquifer thickness of 40 – 60, with a target drawdown of 5 feet, the resulting range of dewatering is 110 to 670 gpm (160,000 gpd to 970,000 gpd) for a dewatered area of approximately 1,250,000 sq ft (a circle with radius of 625 ft based on the example above). With a target drawdown of 10 feet, the range of dewatering is increased to 200 to 1,250 gpm (300,000 gpd to 1,800,000 gpd). In general, the calculated dewatering rate increases as aquifer thickness and hydraulic conductivity increase as both changes increase the flow of water to the dewatering well.

Based on this analysis, the dewatering areas have been broken down into subareas within each gravity sewer area. These are shown in Figure 2 entitled Los Osos Sewer Areas With Shallow Groundwater.

As shown in Figure 2, Area A has been broken into four subareas:

1. A1 is located on Santa Maria Avenue from Pasadena to 4th. Estimated dewatering production is 690 to 1340 gpm.
2. A2 is located on El Morro from 4th to 8th. Estimated dewatering production is 740 to 1420 gpm.
3. A3 is located on El Morro from 8th to 11th. Estimated dewatering production is 830 to 1600 gpm.
4. A4 is located on Paso Robles from 15th to 18th. Estimated dewatering production is 620 to 1200 gpm.

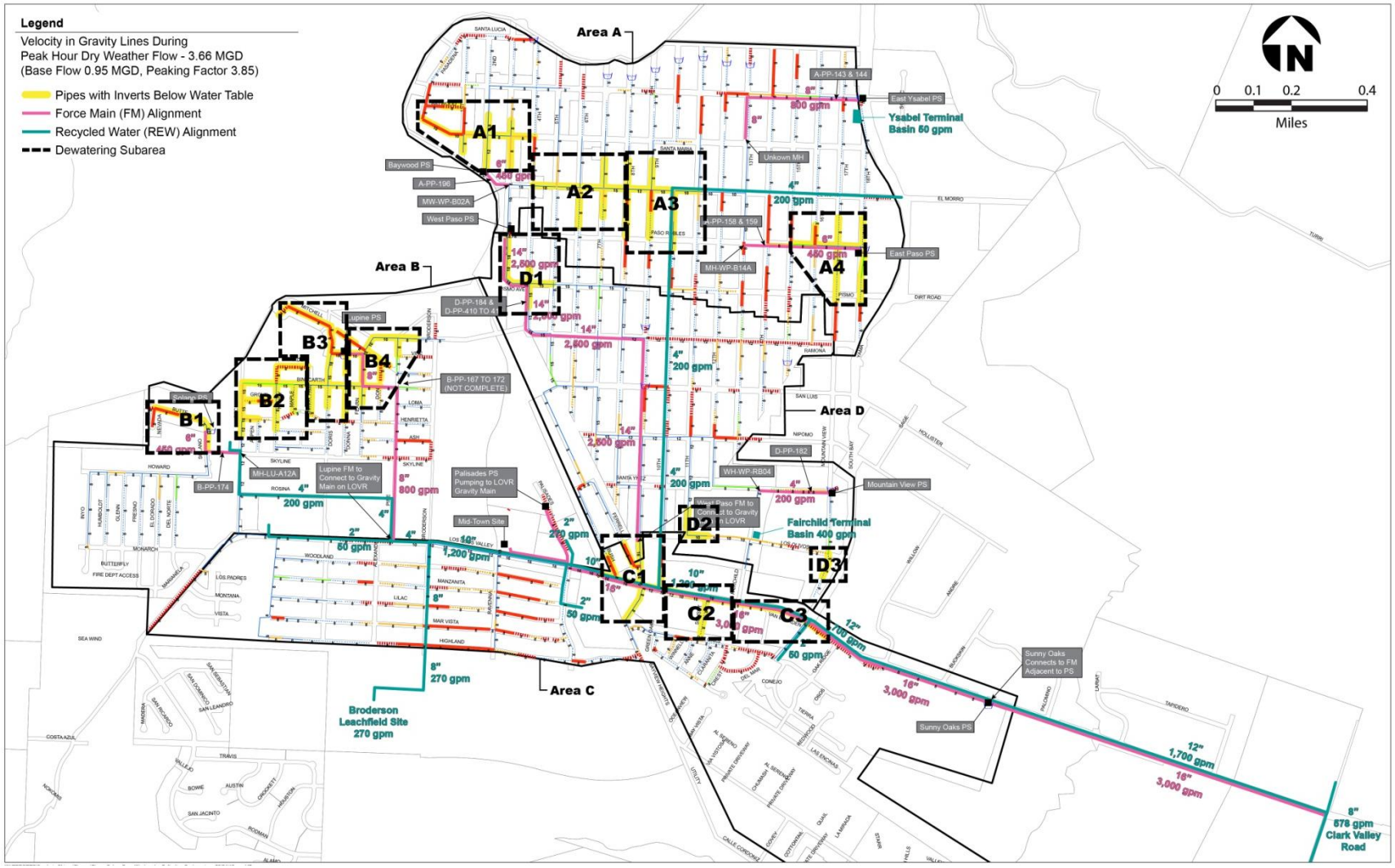

Figure 2. Los Osos Wastewater Collection System – Sewer Areas with Shallow Groundwater

Area B has been broken into four subareas:

1. B1 is located on Butte from Nevada to Solano. Estimated dewatering production is 390 to 750 gpm.
2. B2 is located on Binscarth from Pecho to Sunny Hill. Estimated dewatering production is 590 to 1140 gpm.
3. B3 is located on Mitchell to Lupine. Estimated dewatering production is 650 to 1250 gpm.
4. B4 is located on Lupine from Donna to Broderson. Estimated dewatering production is 480 to 930 gpm.

Area C has been broken into three subareas:

1. C1 is located on LOVR from Bush to 10th. Estimated dewatering production is 560 to 1100 gpm.
2. C2 is located on LOVR from 10th to Fairchild. Estimated dewatering production is 370 to 720 gpm.
3. C3 is located on LOVR from Fairchild to Oak Ridge. Estimated dewatering production is 410 to 790 gpm.

Area D has been broken into three subareas:

1. D1 is located on 3rd from Pismo and 3rd to 5th Street. Estimated dewatering production is 490 to 950 gpm.
2. D2 is located on Los Olivos from 11th to 12th. Estimated dewatering production is 140 to 270 gpm.
3. D3 is located on Mt View from Los Olivos to LOVR. Estimated dewatering production is 120 to 240 gpm.

The average dewatering production from a single area is approximately 620 to 1,300 gpm. If four separate areas which require dewatering are in construction at the same time, the resulting production for disposal could range from 2,500 gpm to 4,900 gpm.

5.1 Dewatering Analysis Conclusions

The drawdown needed to support excavation and construction will vary depending on the depth to groundwater in the excavation needed for construction in the area of interest. To obtain an estimate of dewatering pumping needed, a range of potential dewatering targets were evaluated, as well as sensitivity analysis on soil hydraulic conductivity and aquifer thickness. The approach used to estimate dewatering flow follows the “one large well” example and assumes one well sized to the extent of dewatering area and a circular drawdown cone. The dewatering estimate is a planning-level guidance which must be fine-tuned with updated analysis when specific dewatering layouts and well locations are available. Because the approach assumes an

equilibrium condition, higher pumping rates will be needed at the start of dewatering and will ultimately depend on how quickly the area needs to be fully dewatered.

5.2 Dewatering Analysis Limitations

Due to the wide range of unknowns in the calculation, the dewatering analysis estimates are very rough planning numbers. The following factors could impact the dewatering estimates:

- Soil conditions (hydraulic conductivity, aquifer thickness) much different then assumed values
- Initial flow rates during start of dewatering may be greater
- Boundary inflows along the coast
- Water table elevations that are significantly different from the 1999 – 2003 data used in this study, including possible impacts of land use changes, seasonal variability, etc. Data collected by Fugro in December 2011 suggests only slight differences in head compared to 2004 but the recent sampling was limited to 12 well locations.
- Construction phasing and extent of area dewatered at any one time.

The dewatering contractor will need to perform a field pumping test to confirm expected dewatering flows.

6. Pipeline Dewatering System

On the basis of the groundwater conditions encountered at the site, dewatering will be needed to construct the pipeline trenches in areas with shallow groundwater. The contractor should be responsible for selecting the method of dewatering, and for maintaining the dewatering system, as-needed, to allow for the pipeline construction. Dewatering should consist of lowering groundwater levels to at least 2 feet below the bottom of the trench prior to excavation. Dewatering should be performed such that water does not seep through side walls of the trench, and is significantly below the invert of the pipe to allow for stabilization of the subgrade and compaction of the pipe zone bedding material. Dewatering facilities, such as sump pits, wells, and well points should be designed with filters such that sand and fine-grained materials are not removed from the soil during dewatering operations. Dewatering facilities should be installed in advance of beginning excavation, and time should be allowed for lowering of the groundwater table before beginning excavation.

Construction dewatering and trench shoring are the likely means and methods defined and selected by the Contractor to provide a stable excavation for the construction of the proposed pipelines and pump stations. Dewatering will remove groundwater from trench and structure excavations where the bottom of the excavation is below the groundwater table. The construction dewatering methods selected by the Contractor may include dewatering pumps in sumps located in the bottom of the excavations and/or wells or well points along the perimeter of the excavations. Alternatives for disposal of construction dewatering are discussed below.

The dewatering system and shoring system work together to provide the following minimum project requirements:

1. Provide stable excavation walls and bottom.
2. Provide reasonably dry base of excavation.
3. Filter native soil and prevent loss of ground through dispersion and erosion.
4. Prevent piping (boiling) of the excavation bottom.
5. Preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation.
6. Where shoring is not designed to resist hydrostatic pressure, the dewatering system shall draw down the groundwater level below and beyond the excavation sidewalls.
7. Where shoring is not designed to resist hydrostatic pressure, the Contractor will provide monitoring wells located midway between dewatering points to demonstrate that groundwater level is lowered as required.
8. Speed shores and trench box shoring in flowing ground conditions will not be allowed. The 2004 Fugro Geotechnical Report recommends dewatering in advance of the excavation or continuous tight shoring in areas of shallow groundwater.

In addition, the shoring system will be designed by the Contractor to protect personnel that enter the excavations and protect adjacent existing utilities, pipelines, and structures. There are several different shoring systems that define the type of dewatering system required. The shoring systems are generally classed as an active shoring system which provides full support of trench wall during excavation since the shoring is predriven or a passive shoring system which is installed after the excavation is complete. At one extreme is an active shoring system using interlocked steel sheet piles that would require minimum external dewatering since the length of the shoring would provide sufficient depth of toe embedment to provide lateral stability at the bottom of the shoring system and prevent heave and boiling through the base of the excavation. At the other extreme, is a passive shoring system such as a trench box or speed shores that would require a very aggressive dewatering system to provide a stable excavation and enough stand-up time after the excavation is completed but prior to the installation of the shoring system. Interlocked sheet piling would be too expensive since installation is slow and the sheet piles would have to be burned off and abandoned in place to prevent vibration damage to the new pipe and adjacent structures. The stand-up time of the dune sands is so short that there would not be enough time to allow trench boxes or speed shores. The test pits dug by Fugro indicated that the dune sand was typically loose and readily caved into the excavation. We would anticipate that in areas of shallow groundwater an unshored excavation would collapse before the passive shoring could be installed.

The shoring system that will probably be proposed by the Contractor is a slide-rail system that is a compromise between an active shoring system and a passive shoring system since the shoring system elements are driven into the ground as the excavation is advanced. This will require a

reasonable dewatering system with wells drilled along the pipeline alignment. The wells discharge into a collector pipeline that discharges into a Baker tank for settlement of separation of any sediment and water quality monitoring if required. The overflow discharge from the Baker tank is pumped to the disposal site. If the disposal site is the storm drains, then disinfection may be required (chlorination with hypochlorite and dechlorination with sodium bisulfite). If the disposal site is land disposal such as retention basins or the Broderson site, we anticipate that no disinfection or monitoring would be required. As discussed below, the new gravity sewers, the new pump station wet wells with temporary pumps provided by the Contractor, and the new force mains that will be used as the temporary infrastructure necessary convey the dewatered groundwater to disposal sites.

The typical pipeline dewatering system: including the wells, discharge pipeline, and Baker tanks to settle discharge to the disposal pipeline are shown in Figure 3. The dewatering pumps will be electric motor driven and, for normal operation, served by the local electrical utility with a local power drop from the existing overhead power. The Contractor may provide portable engine-generator sets to maintain standby electrical power in the event of a power outage. To minimize construction noise in the residential neighborhoods, the engine-generator sets will not be allowed to operate when service from the electrical utility is available.

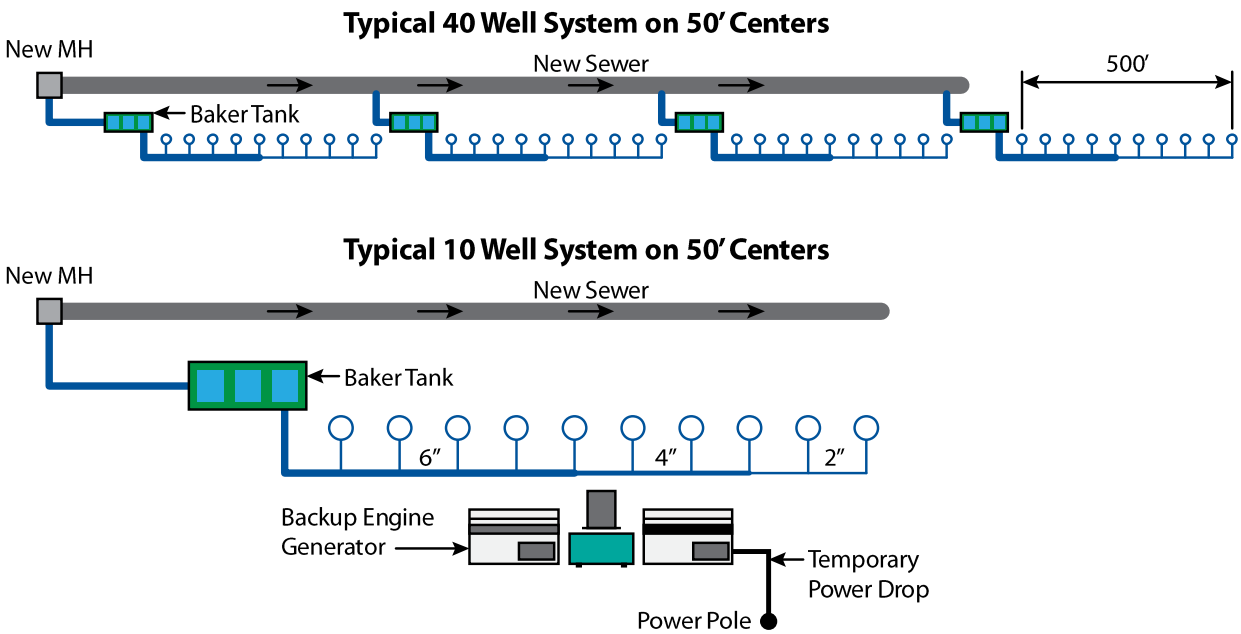

Figure 3. Typical Dewatering System

We have assumed that the Contractors will have at least two pipeline crews in construction at two parallel streets in each collection system area.

In Area A, for example, as the pipe laying progresses from East Ysabel Avenue south to El Morro Avenue, one dewatering crew would begin work on one of the parallel north-south streets such as Pasadena or 1st Street and proceed south from East Ysabel to El Morro while the second

dewatering crew would begin work on 3rd Street or 4th Street at East Ysabel and proceed south to El Morro, and then fill in the east-west portion on Santa Maria Avenue. Once the potholing and utility clearance has been approved, the drilling subcontractor will install and develop the dewatering wells. After the area from East Ysabel Avenue south to El Morro Avenue has been dewatered for several days and it has been confirmed that the groundwater has been pumped down to a depth at least two feet below the bottom of the trench excavation, the trench excavation will begin on Pasadena, 1st Street, 2nd Street, 3rd Street and 4th Street proceeding south from East Ysabel Avenue to El Morro Avenue and west on Santa Maria from 4th Street to Pasadena. After the pipelines have been installed, the trench backfilled and compacted, the pipe tested, and temporary pavement installed, groundwater pumping will continue for several days. In the meantime, the dewatering well installation will relocate to El Morro Avenue at 4th Street and start the entire dewatering, pipe installation, and temporary pavement restoration process again from Santa Maria south to Paso Robles on 5th, 6th, and 7th Streets. Once the second subarea is completed, the dewatering well installation will relocate to El Morro Avenue at 10th Street and start the process again from Santa Maria south to Paso Robles on 8th, 9th, and 10th Streets. Once that third subarea is completed, the dewatering well installation will relocate to Paso Robles Avenue at 18th Street and start the process again from El Morro south to Pismo Avenue. The geotechnical report indicates that the depth of the groundwater will be below the bottom of the trench in the other portions of Area A. We are assuming that dewatering with an occasional sump pump in the bottom of the trench would keep the excavation dry in these sections of Area A.

6.1 Drilling Methods and Well Development Techniques.

We anticipate that the following will occur prior to discharging into the new sewer pipe for temporary disposal.

The driller will drill a 24” diameter borehole, set an 8” diameter commercially slotted casing (depths vary); backfill the borehole around the casing with a clean, washed pea gravel sand mixture in the annular space and set a dewatering pump. The driller will then develop the well by pumping, overpumping, bailing and backwashing to obtain a clear, artifact-free water from the formation. The procedure involves pumping from well to well to complete the development process. The last well will be developed into the sand sediment tank (Baker tank).

Once the well has been developed, it is plumbed into the discharge line and run to a sand sediment tank, before it reaches the final discharge point. The well filter pack remains in an undisturbed state throughout the daily 24 hour per day dewatering process. During the developmental stage of the well, the fines are removed through the well filter pack and resulting discharge will be sediment free.

However, if a well is turned off for a period of time and then turned back on, there will be a small amount of color to the discharge water caused by the increased entrance velocity of the water stored around the well. Once the stored water has been removed and the well is only controlling the influx of water, the water will be clear, sediment and color free. Inspection of the discharge, after two hours, should result in a clear, sediment free discharge.

7. Groundwater Disposal Alternatives

Various construction dewatering disposal methods have been evaluated including: 1) surface disposal; 2) construction use to minimize discharge; 3) land disposal; 4) storm drain discharge; 5) Broderson leachfield site; 6) Mid-Town groundwater retention site; 7) sprayfields; 8) agricultural reuse; 9) a combination of disposal to the Broderson leachfield site and agricultural reuse; and 10) a combination of disposal to the Mid-Town retention site and the Broderson leachfield site. Each alternative was evaluated for: 1) level of effort; 2) relative cost to the project; and 3) estimated quantity of water that can be disposed of.

7.1 Surface Disposal

Surface disposal directly to Los Osos Creek tributaries, such as Willow Creek (South Bay Boulevard and Santa Ynez) or Walker Ditch (Paso Robles and 18th) or Morro Bay may not be feasible for several reasons. First, Morro Bay is a National Estuary that is being managed for the long-term protection of its fragile natural resources; discharging potentially contaminated groundwater to this estuary would conflict with this long-term environmental protection program. Similarly, Los Osos Creek discharges directly to Morro Bay and provides habitat for several special status species including Southern Steelhead. Los Osos Creek is managed as a SRA and as wetlands under the jurisdiction of the USACE, RWQCB and CDFG. The RWQCB discharge requirements for both water bodies include monitoring requirements and discharge limits for a range of constituents. Surface water disposal directly to Morro Bay or Los Osos Creek and its tributaries is an option for Contractors, however the risk of costly monitoring and treatment requires other options to be considered.

7.2 Construction Use Discharge Minimization

Where feasible, the water will be utilized by the Contractor for earthwork compaction and dust control. Such construction use will preserve potable water sources for domestic use and reduce the total discharge requirements. This would eliminate a portion of the construction dewatering but the bulk of the water would need to be disposed of in other locations. The estimated quantity of water that could be disposed of through auxiliary construction use is only about 5,000 gallons per day (gpd) per construction area since the water will have to be pumped to an elevated temporary storage tank and spread as needed by a water truck. The Contractor will be required to post signs to minimize direct human contact with the construction water since it is non-potable and has not been disinfected. The estimated quantity of construction water consumed at 5,000 gpd per construction area equates to 3.5 gallons per minute (gpm). Construction use will be required throughout construction. However, this is a very small volume compared to the total anticipated range of construction dewatering production.

7.3 Mid-Town Retention Site (Former Water Treatment Plant Site)

The Mid-Town site is being restored as a separate project and will include a retention basin with a capacity of 11,100 gpm (16 million gpd) with a safety factor of 2 and 5,600 gpm (8.1 million gpd) with a safety factor of 4 based on an estimated percolation rate of 180 gpd/sf per discussions with Jon Blanchard with Fugro West, Inc. Geotechnical Engineers. Dewatering discharges to this site are allowed under project permits and its use by Contractors is encouraged. Based on the geologic cross sections presented in the 2004 report, the groundwater in this area is approximately 25 to 40 feet below ground surface. The soils underlying the site are

made up of a 10- to 15-foot layer of dune sand located above the Paso Robles Formation, which is made up of medium to dense sands and silty sands. Approximately, four acres of the 11.6 acre site will be available for the stormwater retention facility.

7.4 Broderson Leachfield Site

According to the 2004 Fugro Geotechnical Report, approximately 8 acres of the 81-acre Broderson site is suitable for a leachfield. The report summarizes several prior analyses that evaluated the Broderson leachfield hydraulic capacity. The report states that the percolation capacity of the Broderson site is 810,000 gpd. Therefore, the estimated quantity of water that might be disposed of at the Broderson leachfield site is 560 gpm (810,000 gpd). The Area C contractor is responsible for installing the Broderson leachfield site and the REW force main from the Mid-Town PS to the Broderson site.

7.5 Retention Basins

There are publicly and privately owned stormwater retention basins within the project area. Where practical, the Contractor may utilize these facilities for the disposal of construction dewatering water without requirements for sediment removal and disinfection criteria. The Contractor will be encouraged to negotiate the use of private retention basins. The estimated quantity of water that might be disposed of through public retention basins is about 50 gpm (72,000 gpd) for the Ysabel Terminal Basin and about 400 gpm (576,000 gpd) for the Fairchild Terminal Basin.

7.6 Storm Drain Discharge

Disposal to storm drains and stormwater pumping stations leads directly to regulated surface waters and will likely require pretreatment to remove sediments and silts, disinfection (chlorinated with hypochlorite and dechlorinated with sodium bisulfate) and frequent water quality monitoring and reporting to the RWQCB. Specification Section 02140 defines several storm drain pipelines and channels that could be used for disposal. The estimated combined capacity of the Lupine Stormwater Pump Station wetwell, the 8th and El Morro Stormwater Pump Station wetwell, and the Walker Ditch is about 5,300 gpm (7,600,000 gpd).

7.7 Sprayfields

Sprayfield disposal is the practice of spraying the construction dewatering discharge on land to dispose of the water through evapotranspiration and percolation. It is assumed that disinfection would be required due to the potential for air-borne contact with potentially contaminated groundwater. For this reason, sprayfield disposal has been dropped from further consideration.

7.8 Agricultural Reuse

Agricultural reuse consists of using construction dewatering discharge to irrigate agricultural crops. According to the California Department of Public Health Title 22, California Code of Regulations Division 4, Chapter 3, Section 60304, certain crops such as fodder and fiber crops, sod, and ornamentals, can be irrigated with secondary effluent. This could be extended to non-disinfected groundwater for irrigating non-fodder crops and grasses. Several sites that were considered for agricultural reuse for the WWTP Effluent Disposal have been identified in the Carollo Effluent Disposal Alternative Evaluation.

Some advantages of agricultural reuse are that it increases available local water supplies on a short term basis and it allows farmers to reduce groundwater pumping from present levels. One disadvantage is that agricultural reuse is seasonal and would only be feasible during the dry season.

Agricultural reuse can be implemented only if existing farmers agree to use the construction dewatering for irrigation. Contractors are encouraged to negotiate use of private agricultural land for dewatering disposal. The estimated quantity of water that could be discharged to irrigation depends on the amount of land available for use. This may not be a realistic alternative for augmenting the Broderson leachfield site disposal.

7.9 Combining Broderson Site Disposal/Agricultural Reuse Alternatives

Combining disposal to the Broderson leachfield system augmented with agricultural irrigation is a cost effective method for disposing the construction dewatering and would provide additional flexibility. The resulting disposal capacity would be 560 gpm (810,000 gpd) which is below the minimum estimated groundwater disposal requirement of 620 gpm (893,000 gpd). A serious disadvantage of this alternative is that the pipeline and leachfield infrastructure must be in place and operational before either the Broderson site or the agricultural reuse can be implemented. And as discussed previously, the agricultural use agreement must be finalized before the agricultural reuse can be made available.

7.10 Combining Mid-Town Retention Site/Broderson Site Disposal Alternatives

Combining disposal to the Mid-Town retention site augmented with the Broderson leachfield system is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 6,000 gpm (8.6 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

7.11 Combining Mid-Town Retention Site/Public Retention Basin Site Disposal Alternatives

Combining disposal to the Mid-Town retention site augmented with the existing public retention basin sites is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 5,900 gpm (8.5 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

7.12 Combining Public Retention Basin Sites/Broderson Site Disposal Alternatives

Combining disposal to the Public retention basin sites augmented with the Broderson leachfield system is the most cost effective method for disposing of the construction dewatering water and

would provide additional flexibility. The resulting disposal capacity would be approximately 960 gpm (1.4 million gpd) which meets and exceeds the minimum estimated groundwater disposal requirement of 620 gpm (893,000 gpd) for a single dewatering area but is well below the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single area or the 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

7.13 Combining Mid-Town Retention Site/Public Retention Basin Sites/ and Broderson Site Disposal Alternatives

Combining disposal to the new Mid-Town retention site, the existing public and private retention basin sites augmented with the Broderson leachfield system is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 6,000 gpm (8.6 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

7.14 Combining Mid-Town Retention Site/Public Retention Basin Sites/Broderson Site/ and Ag Reuse Disposal Alternatives

Combining disposal to the Mid-Town retention site, the existing public retention basin sites, augmented with the Broderson leachfield system and agricultural reuse irrigation is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 6,000 gpm (8.6 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas. As discussed previously, the agricultural use agreement must be finalized before the agricultural reuse can be made available.

7.15 Dewatering Disposal Alternative Analysis

As developed in the dewatering analysis, the estimated disposal requirements vary depending on the type of soils encountered and the depth of the groundwater. Table 3 summarizes the dewatering disposal alternative analysis.

Table 3. Dewatering Disposal Alternative Analysis to Meet Maximum Demand (2,530 to 4,900 gpm)

	Alternative	Description	Relative Cost	Estimated Capacity GPM	Level of Effort	Benefits/Disadvantages
1	Construction use	Dust control, compaction. No disinfection	$	3.5	Minor	CDP Condition / Only uses small amount of GW.
2	Mid-Town retention site	No disinfection No settlement.	$$	5,500	Minor	Uses large volume of GW. / Inclement weather and rain runoff restricts use.
3	Broderson leachfield site	Settle first. No disinfection.	$	560	Reasonable	Not restricted by weather. Available for use year round/ Broderson leachfield and pipe must be built first.

Table 3. Dewatering Disposal Alternative Analysis to Meet Maximum Demand (2,530 to 4,900 gpm)

	Alternative	Description	Relative Cost	Estimated Capacity GPM	Level of Effort	Benefits/Disadvantages
4	Public retention basins	No disinfection and no settlement.	$$	450	Minor	Uses large volume of GW but rain runoff restricts use.
5	Storm drain	Settle first and Disinfect.	$$$$	5,300	High	Uses large volume of GW but inclement weather and rain runoff restricts use.
6	Agricultural reuse (irrigation)	Settle first. No disinfection.	$	Depends on area available	High	Broderson pipeline to WWTP must be built first/Ag reuse is seasonal.
7	Combining Broderson site and Agricultural reuse	Settle first. No disinfection.	$	>560	High	Broderson not restricted by weather. / Broderson leachfield site and pipeline must be built first./ Ag reuse is seasonal.
8	Combining Mid-Town retention site and Broderson site	No disinfection. Mid-Town – no settlement. Broderson - settlement.	$	6,000	Reasonable	Broderson not restricted by weather. Available for use year round/ Broderson leachfield site and pipeline must be built first. Mid-Town weather restricted.
9	Combining Mid-Town and Public retention sites	No settlement. No disinfection.	$	5,900	Reasonable	Minimal infrastructure to use. / Restricted by weather.
10	Combining Public retention sites and Broderson site	Settle first. No disinfection.	$	960	Reasonable	Not restricted by weather. Available for use year round/ Broderson leachfield site and pipeline must be built first.
11	Combining Mid-Town and Public retention sites and Broderson site	Settle first. No disinfection.	$	6,500	Reasonable	Broderson is not restricted by weather, available for use year round/ Broderson leachfield site and pipeline must be built first. / Retention sites are restricted by weather.
12	Combining Mid-Town and Public retention sites Broderson site and Ag Reuse	Settle first. No disinfection.	$	>6,500	High	Broderson is not restricted by weather, available for use year round/ Broderson leachfield site and pipeline must be built first/Ag reuse is seasonal.

7.16 Conveyance Infrastructure Required to Use Mid-Town Retention Site

It may be feasible to utilize the new gravity sewers, pump station wet wells, force mains, and recycled water pipelines as soon as these facilities are completed to convey the dewatering water to disposal at the Mid-Town retention site. This section summarizes by project area what new infrastructure would need to be in place to dispose of the dewatering water in the Mid-Town stormwater retention basin and the existing adjacent public and private basins.

Figure 4A through 4D shows the Los Osos Collection System and the routing of the conveyance force main (FM) to the WWTP and the recycled water (REW) pipeline from the WWTP just north

of Los Osos Valley Road at Clark Valley Road. The figure also shows the location of the Mid-Town Site, Ysabel Terminal Basin, the Fairchild Terminal Basin, the Broderson Leachfield Site, and the Clark Valley Road agricultural reuse area.

In Figure 4A through 4D, pipelines with inverts below the water table are highlighted in yellow in each of the four gravity sewer areas. The total area in need of dewatering at any given time was assumed to be equivalent to a circle approximately 1,250 ft in diameter. This assumption was made based on the need to dewater a two block by three block area in Area A (approximately 1,250,000 sq ft). The estimated groundwater disposal requirement is approximately 620 to 1,300 gpm (893,000 to 1.9 million gpd) within the two block by three block dewatered zone. The new infrastructure that would need to be in place to dispose of the dewatering water in the Mid-Town site is highlighted in purple in each of the four gravity sewer areas.

Area A

Figure 4A shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area A. Area A has very few retention basins available for groundwater disposal. As a result, the initial phases of construction will require stage 1 groundwater disposal relying on construction use and treatment and disposal to the storm drainage system until the Baywood PS and West Paso PS wet wells, the interconnection gravity sewers and the 6-inch Baywood force main, the 14-inch West Paso force main, the 16-inch gravity sewer on 9th Street, the 16-inch gravity sewer on LOVR, and the Mid-Town PS wet well are constructed and operational. The West Paso force main discharges to the 16-inch gravity sewer at Los Olivos and 9th Street. As a result, the 16-inch gravity sewer on 9th Street and the 16-inch gravity sewer on LOVR must also be constructed to convey groundwater to the Mid-Town PS wet well.

In subarea A1, the Contractor could use the new gravity sewer to convey water to the Baywood PS located on 2nd at El Morro Avenue. Baywood PS has a wet well capacity sufficient for the 380 gpm pump. The additional wetwell pumping capacity required to move the 690 to 1,340 gpm dewatered flow from area A1 would range from 310 to 960 gpm. However, the 6-inch Baywood PS FM discharges into the 18-inch gravity sewer at 3rd and El Morro Avenue which feeds to the West Paso PS wetwell in Area D. The West Paso PS discharges into a 14-inch FM which has a capacity of 2,500 gpm. The West Paso PS wetwell has a capacity of 1,500 gpm. Once constructed, the 14-inch FM runs south through Area D down 3rd, Pismo, 4th, Ramona, and 9th Street where it discharges into a gravity sewer manhole at Los Olivos. This 16-inch gravity sewer runs south on 9th Street to LOVR where it connects to the 16-inch gravity sewer flowing into Mid-Town Pump Station. To use the Fairchild Terminal Basin and the Mid-Town retention basin, both the Baywood PS and the West Paso PS wet wells and the entire length of the 14-inch force main from West Paso PS to Los Olivos Street would need to be installed by the Area D Contractor, and the 16-inch gravity sewer in LOVR from 9th Street west to the Mid-Town site, and the Mid-Town PS wet well would need to be installed by the Area C Contractor. Subareas A2, A3, and A4 would similarly require that the Area D force main from West Paso PS and the gravity sewer on 9th Street and the Area C gravity sewer on LOVR and the Mid-Town PS wet well would need to be installed to convey the dewatered flows to Fairchild Terminal Basin and the Mid-Town site.

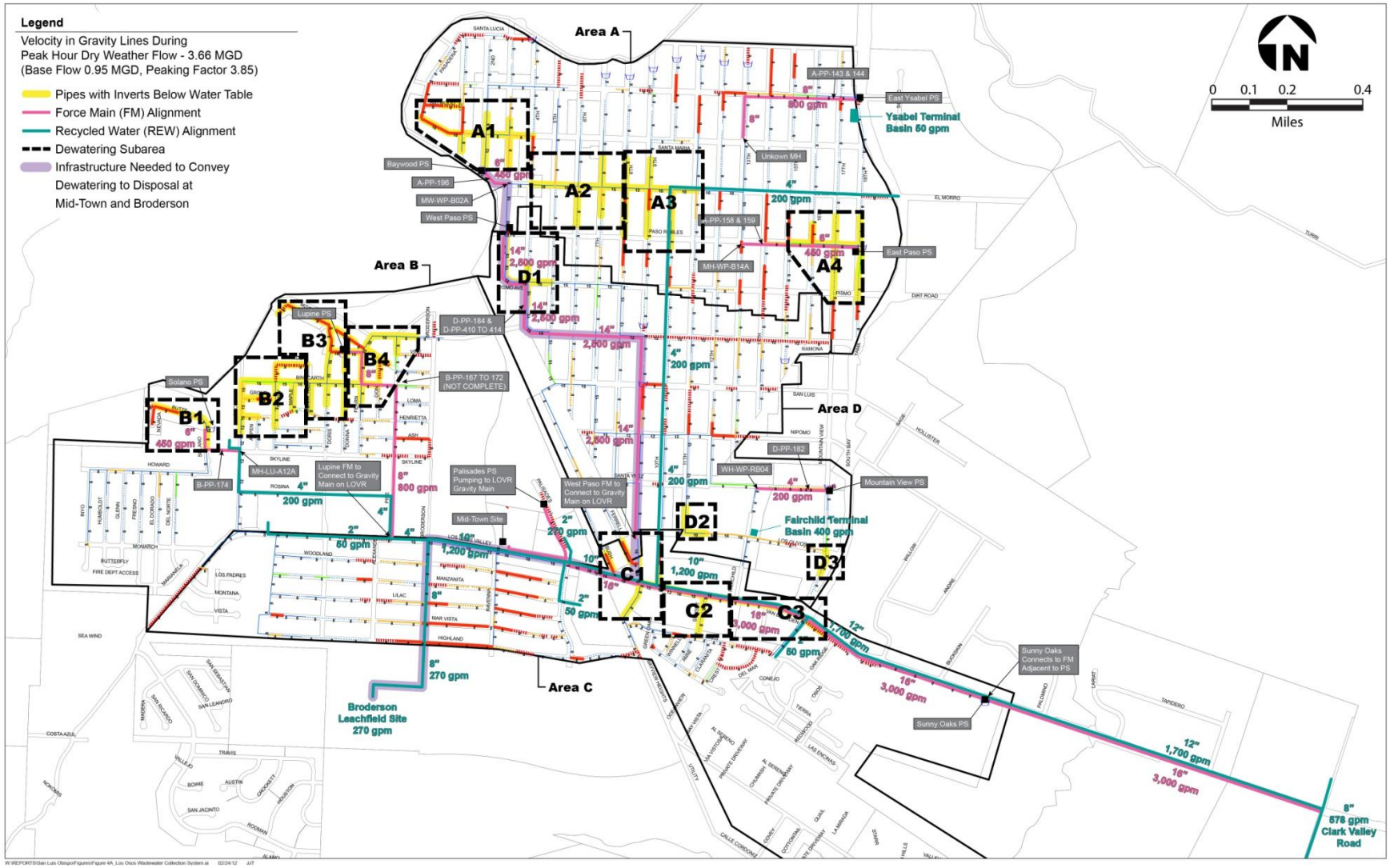

Figure 4A. Los Osos Wastewater Collection System – Area A Dewatering Disposal Conveyance Infrastructure

Area B

Figure 4B shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area B. As in Area A, Area B has very few retention basins available for groundwater disposal. Figure 3B shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area B. The initial phases of construction will require stage 1 groundwater disposal relying on construction use and treatment and disposal to the storm drainage system until the Solano PS and Lupine PS wet wells, the interconnecting gravity sewer, the 8-inch Lupine PS force main and the gravity sewer on LOVR are complete, allowing dewatering water to be conveyed to the Mid-Town retention site. The Area B contractor will start construction in Subareas B1, B2, B3, and B4 by building the wet wells at Solano PS and Lupine PS. Once the two wet wells are constructed the intent will be to use the new gravity sewers as they are constructed to convey the dewatering water to the two pump station wet wells.

In subarea B1, the Contractor could use the new gravity sewer to convey water to the Solano PS located on Butte at Solano Avenue. Solano PS has a wet well capacity sufficient for the 168 gpm pump. However, the 6-inch Solano PS FM discharges into the 12-inch gravity sewer at Pecho Road and Skyline Avenue which feeds to the Lupine PS. The additional wetwell pumping capacity required to move the 390 to 750 gpm dewatered flow from area B1 would range from 220 gpm to 580 gpm. To convey the dewatered flows from subarea B1 to the Lupine PS wetwell, the entire length of the gravity sewer on Pecho Road, Binscarth, and Doris would need to be installed by the Area B Contractor. Lupine PS has a wet well capacity sufficient for the 623 gpm pump. The 8-inch Lupine PS FM discharges into the 10-inch gravity sewer on LOVR which feeds to the Mid-Town PS wet well. To use the Fairchild Terminal Basin and the Mid-Town retention basin, the Solano Paso PS wetwell, the Lupine PS wetwell, and the entire length of the gravity sewer on Pecho Road, Binscarth, and Doris, and the 8-inch Lupine FM would need to be installed by the Area B Contractor, and the 16-inch gravity sewer in LOVR from 9th Street west to the Mid-Town site and the Mid-Town PS wet well would need to be installed by the Area C Contractor. Subareas B2, B3, and B4 would similarly require that the Area B force main from Lupine PS and the Area C gravity sewer on LOVR and the Mid-Town PS wet well would need to be installed to convey the dewatered flows to Fairchild Terminal Basin and the Mid-Town site. However, the capacity of the Lupine FM is only about 800 gpm, so additional dewatering flows would have to be pumped into a temporary pipeline to carry these additional flows to the LOVR gravity sewer at Pine Street and LOVR.

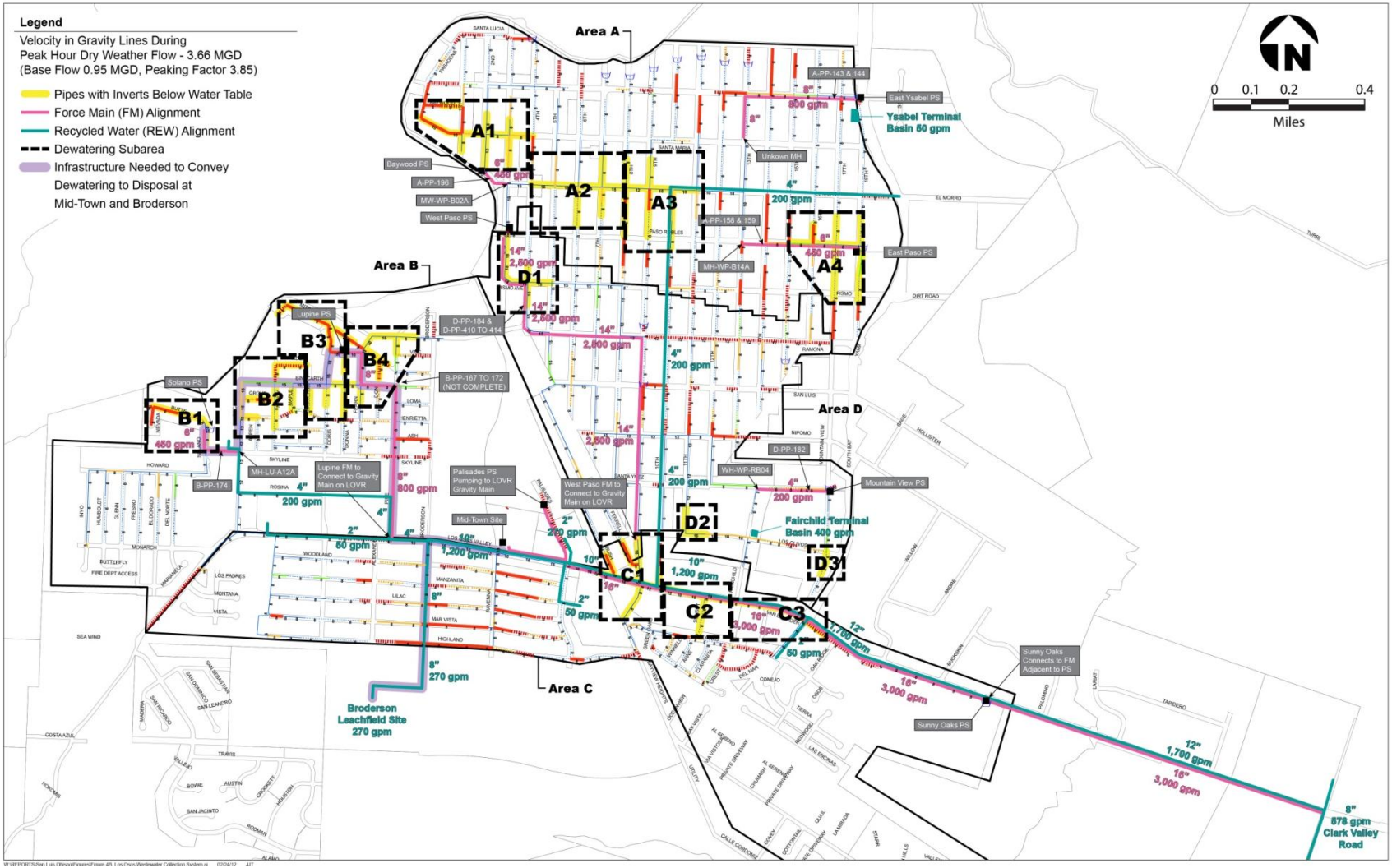

Figure 4B. Los Osos Wastewater Collection System – Area B Dewatering Disposal Conveyance Infrastructure

Area C

Figure 4C shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area C. Area C has the Mid-Town retention site and several private retention basins. In subarea C1, the Contractor could use the new gravity sewer to convey water to the Mid-Town site. To use the Mid-Town retention basin, the 16-inch gravity sewer in LOVR from 9th Street west to the Mid-Town site and the Mid-Town PS wet well would need to be installed by the Area C Contractor. To convey dewatered flows by gravity from subarea C2, the Contractor would need to install the 12- and 16-inch gravity sewers on LOVR to the Mid-Town PS wet well. To convey dewatered flows by gravity from subarea C3, the Contractor would need to install the 8-, 10-, 12-, and 16-inch gravity sewers on LOVR from 10th Street to the Mid-Town PS wet well. To utilize the Fairchild Terminal Basin, Subareas C1, C2 and C3 the Contractor would probably use a temporary pipeline to convey pumped dewatered flows the short distance from LOVR to the Fairchild Terminal Basin on Los Olivos Road.

Area D

Figure 4D shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area D. Area D has a large public retention basin called the Fairchild Terminal Basin with an estimated infiltration capacity of about 400 gpm available for groundwater disposal. Dewatering disposal flows in excess of 400 gpm will need to be conveyed to the Mid-Town retention site.

In subarea D1, the Contractor could use the new gravity sewer to convey water to the West Paso PS located on 3rd at Paso Robles Avenue. West Paso PS has a wet well capacity sufficient for the 1,550 gpm pumps. No additional wetwell pumping capacity required to move the 490 to 950 gpm dewatered flow from area D1. To convey dewatered flows to the Mid-Town retention basin, the West Paso PS wetwell and the entire length of the 14-inch force main from West Paso PS to Los Olivos Street would need to be installed by the Area D Contractor, and the 16-inch gravity sewer in LOVR from 9th Street west to the Mid-Town PS wet well and the Mid-Town site would need to be installed by the Area C Contractor. To move Subarea D1 flows to the Fairchild Terminal Basin the Contractor would probably use a temporary pipeline on Los Olivos to convey the dewatered flows the four blocks from 9th Street to the Fairchild Terminal Basin. Subareas D2 and D3 would probably use a temporary pipeline to convey the dewatered flows the short distance to the Fairchild Terminal Basin.

7.17 Conveyance Infrastructure Required to Use Broderson Leachfield Site

It may be feasible to utilize the new gravity sewers, pump station wet wells, force mains, and recycled water pipelines as soon as these facilities are completed to convey the dewatering water to disposal at the Broderson leachfield site. This section summarizes by project area what new infrastructure would need to be in place to dispose of the dewatering water in the Broderson leachfield site.

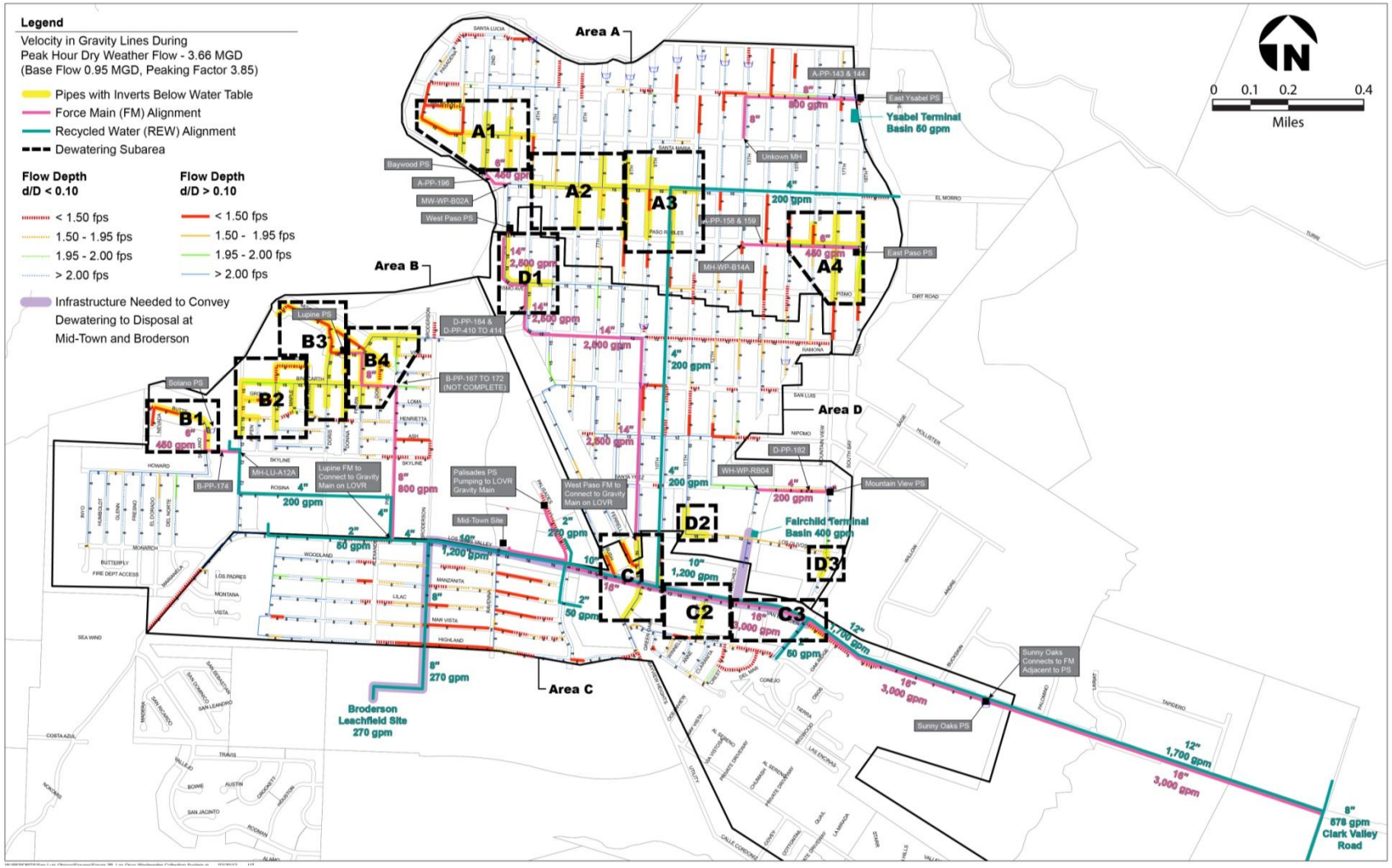

Figure 4C. Los Osos Wastewater Collection System – Area C Dewatering Disposal Conveyance Infrastructure

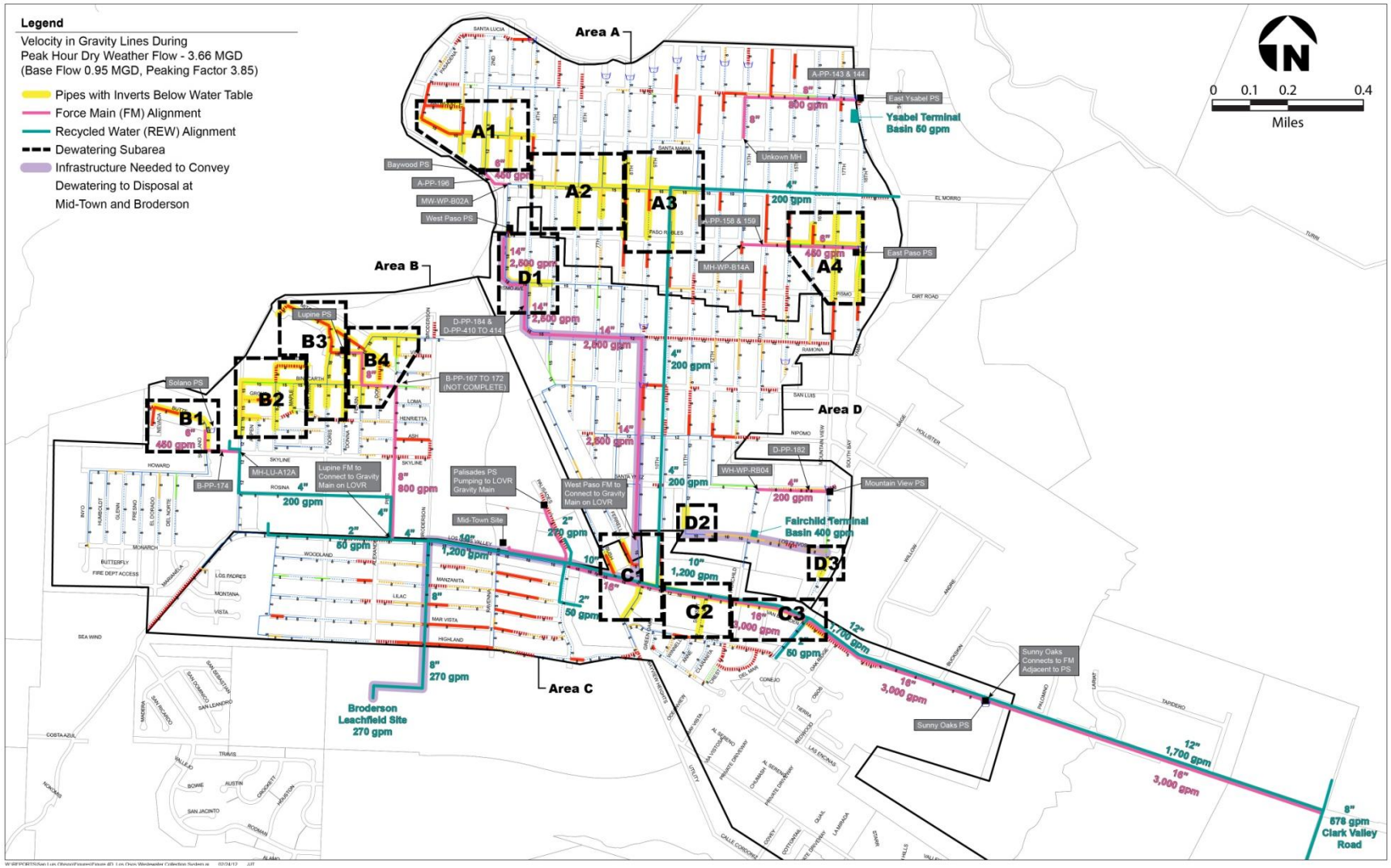

Figure 4D. Los Osos Wastewater Collection System – Area D Dewatering Disposal Conveyance Infrastructure

As described before, figure 4A through 4D show the Los Osos Collection System and the routing of the conveyance force main (FM) to the WWTP and the recycled water (REW) pipeline from the WWTP just north of Los Osos Valley Road at Clark Valley Road. The figures also show the location of the Mid-Town Site, Ysabel Terminal Basin, the Fairchild Terminal Basin, the Broderson Leachfield Site, and the Clark Valley Road agricultural reuse area.

The Contractor could use the new REW force main and the Mid-Town PS wet well to convey water to the Broderson leachfield site. To use the Borderson site, the Area C contractor must install the leachfield infiltration system, the perforated percolation piping, and the control valves and vaults. The 10-inch REW from the Mid-Town PS would need to be installed in LOVR from Ravenna Avenue to Borderson Avenue and the 8-inch REW would need to be installed from LOVR to the Broderson site. These facilities must be installed, tested and operational before Broderson can be put in temporary service for groundwater disposal. In addition, it may be necessary to install the five monitoring wells to monitor groundwater depth and performance of the leachfield.

Disinfection will not be required for groundwater disposal at the Broderson site. However, the Contractor must remove any sediment in the dewatering water to prevent clogging. If the pores beneath the leachfield become clogged over time, the leachfield would have to be excavated, the ground beneath it ripped or disked and the leachfield reconstructed.

8. Recommended Approach

CDM Smith's preliminary recommendation is to implement a four-stage approach. The first stage is to use construction use and treatment since no groundwater retention sites will be available when work starts. Stage two would utilize construction use and the new Mid-Town retention site and the existing retention basin sites for groundwater disposal while the Broderson leachfield system and the recycled water pipeline from the treatment plant to the Broderson Effluent Disposal site are being constructed. The current plan is to bid gravity sewer areas A and D together with the Area A and D pump station wet well construction as the first bid package. Gravity sewer areas B and C will be bid together with the Area B and C pump station wet well construction. The gravity sewer construction on LOVR will be defined as an early construction milestone. The pump station installation will be bid separately. During stage three, when the Broderson leachfield site and the recycled water pipeline have been constructed, both the Mid-Town retention site and the Broderson leachfield site will be operational and construction of the gravity collection system and pump stations and force mains can then proceed with the necessary dewatering. The intent would be to pump discharged groundwater to the Mid-Town and public retention basins for land disposal and Broderson for back-up. Disposal to Mid-Town and existing public retention sites augmented with the Broderson leachfield site appears to be a viable and cost-effective means to dispose of the anticipated groundwater disposal range (approximately 620 to 1,300 gpm for one dewatering area, and 2,500 to 4,900 gpm for four concurrent areas) throughout construction. Groundwater production in excess of 6,500 gpm would require a fourth stage involving agricultural reuse along Clark Valley Road. This would be necessary only if the groundwater production exceeds what could be disposed of with the combined capacity of the construction use + Mid-Town and existing retention sites + Broderson leachfield site. Treatment and disposal to the storm drains will always be an optional disposal method.

It is critical that the approach be revisited once construction dewatering begins. Because the amount of dewatering pumping needed will drive the need for additional disposal sites, the projected planning-level pumping rates presented in this document should be either confirmed or adjusted based on the field results. If construction conditions are such that water table levels are higher, soil conductivity is higher, or the area to be dewatered is larger than the assumptions in this analysis, dewatering rates could be higher and additional disposal may be necessary.

In addition, the infiltration rate of the Mid-Town disposal site should be measured from the start of construction including hourly readings (in terms of total gallons delivered) for the first three days and daily measurements thereafter to monitor any changes to the infiltration capacity of the site due to entrained sediment, piping in soil, etc. Once the Broderson disposal site comes online, infiltration monitoring should be started there as well. The specifications will require that the Contractor monitor and report the infiltration rate at each site during construction use. The infiltration rate is critical for the optimum performance of the disposal system at both sites.

It is recommended that the contract for the Area A and D bid package include the Mid-Town PS wet well construction and that the contract for the Area B and C bid package include the Broderson leachfield construction.

Appendix

Central Coast Region Letter dated May 27, 2011, Use and Disposal Plan for Construction Dewatering, Los Osos Project

California Regional Water Quality Control Board
Central Coast Region

Linda S. Adams
Acting Secretary for Environmental Protection

895 Aerovista Place, Suite 101, San Luis Obispo, California 93401-7906
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Edmund G. Brown Jr.
Governor

May 27, 2011

Mr. John Waddell
County of San Luis Obispo, Public Works Department
County Government Center, Room 207
San Luis Obispo, CA 93408

Dear Mr. Waddell:

USE AND DISPOSAL PLAN FOR CONSTRUCTION DEWATERING, LOS OSOS PROJECT

The purpose of this letter is to clarify issues related to the use and disposal of water generated by dewatering during the construction of San Luis Obispo County's Los Osos Water Recycling Facility Project (Project). As discussed previously, construction dewatering is authorized under the statewide *General Permit for Storm Water Discharges Associated with Construction Activities (General Permit)*, provided such discharges comply with the permit conditions and best management practices (BMPs) to protect water quality. To enroll under the General Permit, create an account in the Stormwater Multiple Application and Report Tracking System (SMARTS) at:

https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp

Once registered in SMARTS, the legally responsible person or his or her authorized signatory or data submitter must electronically submit permit registration documents prior to commencing construction activities. The County must develop a construction dewatering plan to address all items described in this letter related to Project dewatering activities. The County must include this plan in the project Storm Water Pollution Prevention Plan (SWPPP). The County shall adhere to all other requirements related to Project construction activities pursuant to the General Permit. The following information is intended as guidance in developing and implementing BMPs in your SWPPP and construction bid documents.

Central Coast Water Board staff has determined that water generated by Project dewatering activities is an authorized non-stormwater discharge under the General Permit provided that the following conditions are satisfied:

1. The discharge does not cause or contribute to a violation of any water quality standard;

2. The discharge does not violate any other provision of the General Permit;

3. The discharge is not prohibited by the Central Coast Water Board Basin Plan;

4. The County has included and implemented specific BMPs required by the General Permit to prevent or reduce the contact of groundwater from dewatering with construction materials or equipment.

5. The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants;

6. The discharge is monitored and meets the applicable Numeric Action Limits and Numeric Effluent Limits (General Permit, V. Effluent Standards); and

7. The County reports the sampling information in an annual report.

Considering analytical results of samples collected by the Los Osos Community Services District (CSD) and Central Coast Water Board staff, we anticipate that bacteria, sediment, nitrate, and ammonia are constituents of concern to water quality. However, we have also taken into consideration that dewatering activities will be short-term and necessary for construction of the Project. Each of the constituents of concern is described below, followed by applicable water quality objectives, the basis for specified requirements, and actions needed to protect against, minimize, and mitigate for potential water quality impacts associated with construction dewatering activities. Compliance with the applicable water quality objectives (below) constitutes compliance with the aforementioned conditions for authorized non-stormwater discharge pursuant to Section III of the General Permit.

Discharge Minimization – Use and disposal of water generated by construction dewatering to land (i.e., compaction, dust control, irrigation, percolation, etc.) is the primary BMP to ensure water quality protection. The County must dispose of construction dewatering to land whenever feasible. The alternative disposal options described below are applicable only after the Central Coast Water Board agrees that land disposal options are infeasible. Feasibility considerations include, but are not limited to, project delay, environmental impacts, technical, and cost considerations.

Bacteria – Due to the proximity of septic systems to dewatering intakes, bacteria may be present in the discharge in excess of water quality objectives. A wide variety of coliform bacteria are naturally prevalent in soil, so, because of the source, fecal coliform bacteria are the most appropriate indicator of human pathogens. Accordingly, dewatering discharges must not cause receiving waters to exceed water quality objectives for fecal coliform bacteria of 14 most probable number per 100 milliliters

(MPN/100ml) median and no more than ten percent of samples exceeding 43 MPN/100ml. These objectives are based upon protection of the shellfish harvesting beneficial uses of the receiving waters[1]. Basin Plan criteria for protection of body-contact recreation beneficial uses of receiving waters are also applicable, but are less stringent than the shellfish objectives above. Body-contact recreation criteria for fecal coliform bacteria include 200 MPN/100ml log mean and no more than ten percent of samples exceeding 400 MPN/100ml. If disinfection of the discharge is implemented using chlorine, residual chlorine must be removed prior to discharge into surface waters. Representative samples of construction dewatering discharges must be collected and analyzed for fecal coliform bacteria weekly while dewatering discharges continue.

Sediment – Our understanding of the proposed dewatering procedure is that shallow groundwater will be extracted from the soil rather than directly from the trench, although occasional pumping from trenches may be needed. Based upon this information, we do not anticipate excess sediment to be an issue of concern for water quality. However, discharges should be free of sediment concentrations that result in deposition or concentration of material that causes nuisance or adversely affects beneficial uses. Also, the discharge velocity should be diminished and conveyed to channels (rather than exposed mudflats) to minimize disturbance of bay sediments. This objective is based upon Basin Plan general objectives for all inland surface waters, enclosed bays and estuaries. Representative samples of construction dewatering discharges must be collected and analyzed for turbidity weekly while dewatering discharges continue. Compliance with the following effluent limitations[2] satisfies effluent standards in Section V.B. of the General Permit.

Table 1 – Turbidity Effluent Limitations

Parameter	Test Method	Discharge Type	Min. Detection Limit	Units	Numeric Action Level	Numeric Effluent Limitation
Turbidity	EPA 0180.1 and /or field test with calibrated portable instrument	Risk Level 2[1]	1.0	NTU	250 NTU	N/A
		Risk Level 3[1]			250 NTU	500 NTU

1 – Risk level will be determined by staff pursuant to Section VIII of the General Permit.
NTUs - Nephelometric Turbidity Units
N/A – not applicable
EPA –Environmental Protection Agency

[1] Morro Bay Pathogen TMDL, Resolution No. R3-2002-0117
[2] Table obtained from Section V.B., Table 1 of the Construction Stormwater General Permit Order No. 2009-0009-DWQ.

pH – According to October 2006 groundwater quality data for the Los Osos upper aquifer, pH ranges from 5.9 to 7.2[3]. In order to protect warm freshwater, cold freshwater, and ocean water habitats, pH shall not be depressed below 7.0 or raised above 8.5, and any change in normal ambient pH shall not exceed 0.5 in fresh waters[4]. pH can vary greatly in receiving waters (diurnal and annual fluctuations). Therefore, Section V.B. of the General Permit provides effluent limitations protective of surface water beneficial uses. Representative samples of construction dewatering discharges shall be collected and analyzed monthly for pH while dewatering occurs. Compliance with the following effluent limitations[5] satisfies Section V.B. of the General Permit..

Table 2 – ph Effluent Limitations

Parameter	Test Method	Discharge Type	Min. Detection Limit	Units	Numeric Action Level (NAL)	Numeric Effluent Limitation (NEL)
pH	Field test with calibrated portable instrument	Risk Level 2[1]	0.2	s.u.	Lower NAL= 6.5 Upper NAL= 8.5	N/A
		Risk Level 3[1]			Lower NAL= 6.5 Upper NAL= 8.5	Lower NEL= 6.0 Upper NEL= 9.0

s.u. – pH standard units

Nitrate – The Basin Plan does not have a water quality objective for nitrate specific to Morro Bay Estuary. However, as a biostimulatory substance, nitrate and other nitrogen-containing compounds may contribute to algal blooms resulting in water quality impairment. Algal blooms due to the discharge are prohibited. Therefore, dewatering discharges should be conveyed close to actively flowing channels in order to minimize accumulation of nutrients in shallow waters.

Ammonia – Due to septic system effluent discharges to shallow groundwater, water generated by construction dewatering may contain concentrations of ammonia that could be toxic to marine organisms. Construction dewatering discharges shall not cause receiving water concentrations of total ammonia to exceed 24 milligrams per liter as nitrogen (mg/L as N) in freshwater and 21 mg/L as N in Morro Bay. These criteria

[3] Table 3 - Los Osos Nitrate Monitoring Program, Los Osos Community Services District, Cleath and Associates, October 2006
[4] Pursuant to Section II.A.1 and Section II.A.2 of the Basin Plan
[5] Table obtained from Section V.B., Table 1 of the Construction Stormwater General Permit Order No. 2009-0009-DWQ.

are based upon USEPA ambient water quality criteria for waters with pH of 7[6]. If monitoring indicates a pH value above 7, then more stringent ammonia criteria may apply. In addition, according to Section II.A.2 of the Basin Plan, the discharge shall not cause concentrations of un-ionized ammonia (NH_3) to exceed 0.025 mg/L in the receiving water (i.e., inland surface waters, enclosed bays, and estuaries). If the ammonia concentrations exceeds 24 mg/L (freshwater) or 21 mg/L (Morro Bay) and the pH value is above 7 when dewatering, then follow-up receiving water sampling for temperature and salinity is required. Representative samples of construction dewatering discharges shall be collected and analyzed monthly for ammonia and pH while dewatering occurs.

Monitoring, Reporting, and Notifications - The water quality objectives described above are for receiving waters. This means that compliance with the specified objective is measured in the receiving water rather than the discharge. However, due to the variability of receiving water quality and conditions, compliance monitoring must be implemented by representative sampling of the discharge. If discharge samples reveal concentrations in excess of water quality objectives, then follow-up sampling of receiving water must be implemented to verify compliance with the appropriate receiving water objectives. Throughout Project construction, monthly monitoring reports must be submitted summarizing bacteria, turbidity, pH, and ammonia monitoring data; estimated volume of dewatering discharges; time, date and location of dewatering and location of discharge. If monitoring results indicate noncompliance with criteria described above, then Central Coast Water Board staff must be notified immediately (via email or telephone). Additionally, monthly reports must include a description of corrective actions and a corresponding schedule for implementation.

SUMMARY OF DISCHARGE & MONITORING REQUIREMENTS

Parameter	Water Quality Objective	Monitoring Frequency
Discharge Minimization	Alternatives Feasibility Evaluation	Advance Approval
Volume & Location	Recorded for each surface water discharge	Ongoing
Fecal Coliform Bacteria	14 MPN/100ml median	Weekly
	No more than 10% exceed 43 MPN/100ml	
Turbidity	250 NTU (NAL)	Weekly
	500 NTU (NEL)	
pH	6.5 to 8.5 (NAL)[1]	Monthly

[6] U.S. Environmental Protection Agency, Office of Water, National Recommended Water Quality Criteria 2002, EPA 822-R-02-047

	6.0 to 9.0 (NEL)[1]	
Ammonia	24 mg/l (as N)[1]	Monthly
Un-ionized Ammonia	0.025 mg/L (as N)	Calculated Monthly
Temperature	35 degrees C	Triggered if pH is above 7
Salinity	20 g/kg	Triggered if pH is above 7
Summary Reports	Discharge & Compliance Summary	Monthly

1 - If monitoring indicates a pH value above 7, then more stringent ammonia criteria may apply.
MPN/100ml – most probable number per 100 milliliters
NTUs - Nephelometric Turbidity Units
NAL – Numeric Action Level
NEL – Numeric Effluent Limitation
mg/L – milligrams per liter
g/kg – grams per kilogram

We look forward to completion of the Los Osos Water Recycling Facility Project as soon as possible to prevent further degradation of water quality due to septic system discharges and we are available to assist County staff if needed to facilitate project completion. If you have questions, please call **David LaCaro at (805) 549-3892 or by email dlacaro@waterboards.ca.gov.**

Sincerely,

Harvey Packard
for

Roger W. Briggs
Executive Officer

cc:

Paavo Ogren, SLO County Public Works Director (pogren@co.slo.ca.us)
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