APPENDIX H

HYDROLOGY/WATER QUALITY DATA

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MEMORANDUM

TO:	Shannon Lucas Christopher A. Joseph & Associates	DATE:	September 17, 2007
FROM:	Charles D. Anderson, P.E.	JOB #:	CAJA.04.06
SUBJECT:	Review of Wetland Hydrology Indicators for Big Wave Jurisdictional Delineation Including Site Visit Commentary		

This memorandum, which discusses wetland hydrology indicators at the Big Wave site in Half Moon Bay, has been revised to reflect observations made during a site visit with staff from Christopher A. Joseph & Associates, San Mateo County, and representatives of the Applicant.

Issue

The Applicant is concerned that the wetland boundary resulting from the Christopher A. Joseph & Associates (CAJA) study encompasses a larger area than it should, primarily due to the presence of "furrows" created by agricultural tilling at the site. One of the indicators used in the CAJA delineation is wetland hydrology. This memorandum discusses the possible implications of agricultural tilling on that indicator.

Wetland Hydrology Indicators

CAJA has delineated jurisdictional wetlands using indicators for hydrophytic vegetation, hydric soils and wetland hydrology. This evaluation is limited to the potential impact of agricultural tilling on wetland hydrology.

Wetland hydrology indictors include periodic inundation (flooding or ponding), standing water, high water tables and saturated soils. Many of these indicators were observed on-site during observations made in December 2006, January 2007 and February 2007. In particular, the observations of January 10 and 11, 2007 were made roughly a week after the cessation of precipitation, and the delineation relies most heavily on the data collected during the January site visit.

A suggestion was made by the Applicant to perform a hydrologic evaluation based on topography with the site in a dry condition. While this memo has been revised to incorporate additional topographic information, it is difficult to evaluate parameters such as soil saturation during the dry season. Consequently any additional delineation should be made during the upcoming wet season with the site disturbed as little as possible.

Agricultural Practices at Big Wave Site

At the time of observation for wetland delineation described previously, the site was tilled so that furrows generally ran perpendicular to topographic contours; that is, the furrows were parallel to natural drainage. (Reference: Christopher A. Joseph & Associates, *Wetland Delineation Study: Big Wave Office Park and Wellness Center — Southern Parcel; San Mateo County, California; July 26, 2007*, Figure 2a, Appendix B, and personal communication with Shannon Lucas.)

A photograph from the wetland delineation report (Figure 1) shows site conditions at Sample Point 5 on January 10, 2007. The photograph shows standing water near the downhill extent of the cleared field along the western boundary of the site, one week after rain. It is not inherently clear how deep the furrows at the site are relative to the original unplowed ground. Estimates from various sources range from 8 inches to 18 inches, measured from the furrow to ridge as defined in Figure 2. According to the person farming the site, deeper furrows and a berm were created to help manage sediment runoff during the winter.

Fig. 1: Ponding at Sample Point 5 on 1/10/07 one week after rain.

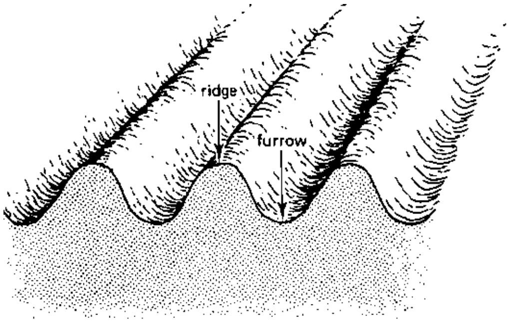

Fig. 2: Furrow and ridge definition.

Potential Impacts to Wetland Hydrology Indicators

The question is: Would wetland hydrology indicators have been different had these furrows not been made? Evaluating what observed wetland hydrology would have been absent the furrows is speculative at best, so generalized comments are offered for consideration; with more specific comment to the January 10, 2007 observations at Sample Point 5.

The drainage of furrowed soil should generally be no worse than that for non-furrowed soil, all else equal, since improving drainage is a primary reason to till soil, particularly for winter cover crops. Furrows will, however, allow for a greater extent of standing water than would be present otherwise since the water will seek its level within the furrows, and the excavated furrows are lower than the original undisturbed grade.

Standing water was observed at several locations including Sample Point 5 (Figure 1). During the recent site visit, the Applicant's representatives indicated that runoff generated on-site and storm water flowing through the culvert beneath Airport Street ponds at the southwest corner of the site before finding a natural release toward the Pillar Point Marsh at an approximate elevation of 9 feet, which matches previously flown topography. This ponding is the result of a topographic bowl near this location and a relatively thick layer of low permeability clay soil that underlies the shallow tilled and amended soil used for planting. During the winter, nearly all of the runoff generated on- or off-site will find its way to this ponding area. Some hydraulic gradient is required to move the water across the heavily vegetated release point, so one might expect the maximum normal limit of ponded water on site to follow the 9.5-foot or at most the 10-foot contour. The actual release elevation with winter furrows and berming is not directly documented, but the extent of observed standing water due to furrowing can be inferred from CAJA data as described below.

Sample Point 5 is on the ten-foot contour, and 2 inches of standing water was observed in the furrow on February 22, 2007 after flowing runoff had ceased. If the furrows were made at grade (a 1.6 percent slope according to available one foot contours), the "daylight" location of standing water would be about 10 feet "upslope" from Sample Point 5.

The extent of standing water also affects ***soil saturation*** due to the associated capillary fringe. Wetland delineators from Christopher A. Joseph & Associates observed a demarcation between saturated soil and unsaturated soil, based on data taken at Sample Points 6b and 6c, about 100 feet upslope from Sample Point 5. I find it unlikely that daylighted standing water in the furrow 10 feet upslope from Sample Point 5 would affect soil saturation 100 feet upslope, which corresponds to a change in elevation of 2.5 feet. It appears most likely that despite the drainage benefit of furrowing, site soils remained saturated for more than a week after the cessation of rainfall due to the inability of surface water to percolate through the thick clay "hardpan" that underlies the site. While this clay layer prevents groundwater saturation from below, it probably tends to promote surface saturation wherever natural drainage is relatively poor.

This assertion is supported by Figure 3, which shows adjacent non-furrowed site soil on January 10, 2007. It may also be noted that soils even farther upslope (e.g. Sample Point 10) were not saturated that day, lending credence to the theory that the practice of furrowing does not cause soil saturation by itself.

Fig. 3: Saturation of Site Soils One Week after Rain.

Opinion of Potential Impacts Agricultural Practice has on Jurisdictional Delineation
It is not clear that the absence of agricultural tillage on the property would have resulted in substantially different wetland delineation from the perspective of wetland hydrology indicators. Figure 2a, Table 1 and Table 2 of the CAJA report indicate that with respect to wetland hydrology, the margins of the Big Wave jurisdictional boundaries are delineated primarily on the basis of saturated soil observed after the cessation of rainfall. So the question of furrow impact to wetland hydrology is largely whether the furrowing encouraged a broader extent of saturated soil at the surface due to capillary action from adjacent standing water.

There is no question that the furrowing encouraged a broader extent of standing water, and an associated capillary fringe, than would have been present without furrowing. However, the observed upslope extent of observed saturated soil far exceeds the potential for standing water to spread upslope in furrowed ditches. Surface soil saturation rather than furrowing appears to be the key determinant with respect to jurisdictional wetland delineation at Big Wave Office Park and Wellness Center.

I would recommend additional wetland delineation during the upcoming rainy season, with the site left in as undisturbed a condition as practical. There should be no significant grading and furrowing should be minimized. If erosion control is needed, perhaps alfalfa could be planted.

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TECHNICAL MEMORANDUM #1 (TM#1)

TO: Jennie Anderson, Project Manager,
Christopher A. Joseph & Associates

DATE: May 15, 2009

FROM: Charles Hardy, PE

JOB #: CAJA.04.07

SUBJECT: Hydrologic Analysis of Big Wave Project

REGISTERED PROFESSIONAL ENGINEER
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INTRODUCTION

The Big Wave Project is planned for two parcels near Half Moon Bay in unincorporated San Mateo County. Schaaf & Wheeler has been tasked as part of the Environment Impact Review ("EIR") team with lead consultant Christopher A. Joseph & Associates to assess potential Hydrology and Water Quality impacts of the project. The assessment requires a relatively detailed hydrologic analysis. This memo details our analysis, including an estimate of project effects on groundwater recharge and stormwater runoff. Summaries of the various parts of the analysis will be in the Hydrology and Water Quality section of the EIR, where appropriate.

Specific impacts discussed here and summarized in the EIR include whether the project would:

#1 Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

#2 Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;

#3 Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;

#4 Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

To analyze the **project impacts on groundwater depletion and recharge (Item #1)**, the applicant's Water Balance calculations have been reviewed, including examining assumptions and verifying results.

Runoff from the undeveloped and developed project site has been estimated to gauge the **project impacts on stormwater runoff (Items #2, 3, and 4)**. San Mateo County has no drainage manual or specific drainage standards for estimating stormwater runoff due to development. However, both the Town of Atherton in San Mateo County and the neighboring Santa Clara County have significant drainage standards, which are applicable to and similar enough for the current analysis. Therefore, we have used the comprehensive Santa Clara County Drainage Manual as our main guidance document.

OVERVIEW OF PROJECT

The project plans call for development of both parcels. The larger 14.25-acre parcel to the west of the drainage channel will be developed as the Office Park (OP). The other 5.28-acre parcel to the east will be developed as the Wellness Center (WC). The hydrologic impacts of both parcels will be mitigated somewhat by installing permeable surfaces where typically impermeable surfaces are used. In particular, the parking lots for the project will consist of a surface layer of permeable concrete, underlain by a layer of large-grained gravel. Walkways along the perimeter of the parcels in between buildings are also planned to consist of permeable surfaces. The project information indicates that the permeable concrete setup has a 3 inch per hour permeability at the surface and a ½ to 1 inch per hour permeability at the bottom. For purposes of hydrologic estimates, then, *these surfaces will be considered pervious*.

Another important design parameter of the project is that much of the wastewater will be recycled, either for flushing toilets or irrigating landscaped areas. Details of the recycling system are discussed with the Water Balance calculations below.

ITEM #1 - IMPACTS ON GROUNDWATER RECHARGE (WATER BALANCE)

Two aspects of the project are relevant to determine impacts to groundwater recharge – the balance of water entering and leaving the site and effects of net withdrawals on regional aquifers.

Overview of Water Balance

Since the project includes a recycled water system that could further reduce any net withdrawals on the aquifer, it is useful to analyze the project applicant's submitted water balance. The water balance takes into account how much water will be drawn from the underlying aquifer, how it is used onsite, and how it is returned, if at all, to the underlying groundwater aquifer.

There are several important aspects of the project that affect the water balance:

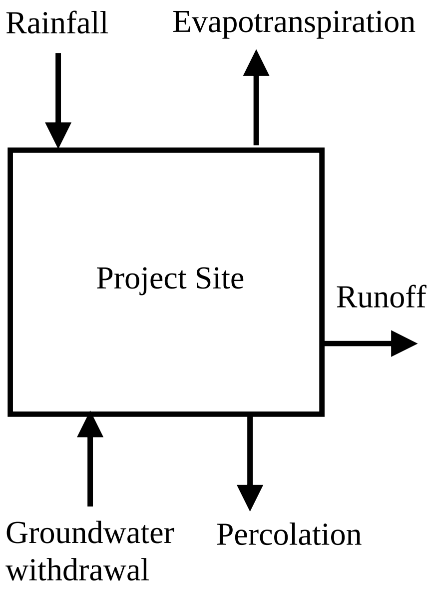
- Rainfall and stormwater runoff could contribute to groundwater recharge given the plan for rain gardens and permeable pavement.
- It is our understanding that the project site currently uses groundwater to irrigate the onsite agricultural crops, and rainfall can percolate back to the groundwater over the entire site, although some of it is estimated to runoff as discussed later.
- The project plans include an onsite wastewater recycling plant that will minimize the amount of groundwater required to meet the project's water demands.

Table 1 presents the water balance from the submitted project information, with the value in most of the rows following from the one or ones before it. The Chart 1.10 from the applicant's Facilities Plan can also be referred to. Values are in gallons per day (gpd). Balances for both "normal" rainfall years and drought years are given. These categories and values for the normal year are then discussed in the sections that follow. To analyze a mass balance for accuracy, it is important to "draw a box" around the processes and area (the system) being analyzed. We can thus draw a box around the project parcels (above the groundwater level) to analyze the net withdrawals or contributions. Figure 1 presents a graphic of this analysis. Groundwater supply and rainwater are the external inputs. Evapotranspiration, stormwater runoff, stormwater percolation, and recycled water percolation are the outputs. There are other potential inputs, including imported water, and potential outputs, including consumptive use.

Table 1 - Water Balance

		Normal	Drought	Units
Inputs	Parking lot Infiltration	10,000	5,000	gpd
	Rainwater gardens	2,700	1,350	gpd
	Well or Desalination	10,000	5,000	gpd
Internal	RO/Trtmnt	10,000	5,000	gpd
	Potable water	10,000	5,000	gpd
	Wastewater	26,000	21,000	gpd
	MBR/Recycling	26,000	21,000	gpd
	Recycled Water	10,000	16,000	gpd
	Ag/Irrigation	10,000	2,000	gpd
Output	(Evap)	9,500	9,500	gpd
	(Remaining for recharge)	500	-7,500	gpd
Output	GW Recharge	0	3,000	gpd
	Total infiltration	13,200	6,850	gpd

Figure 1 - Water Balance



Rainwater Infiltration (Input)

Rainwater infiltration is not particularly relevant in the water balance for our analysis. The existing site receives the same rainfall that the project site will receive. Both existing and project conditions allow for infiltration of received stormwater with some runoff. Given the design of the porous pavements onsite, their may be additional storage capacity, thus reducing stormwater runoff for a given storm event and even increasing site percolation for certain area's of the site. Overall, however, as detailed below, net runoff is estimated to increase. The applicant's indication that stormwater infiltration will contribute additional water for groundwater recharge is not, therefore, consistent with our calculations.

Water Demands (Input)

The 10,000 gpd estimate of water demands is being evaluated in the Utilities Section of the EIR. For the present analysis, we will assume the submitted numbers are accurate. This value will be used as the main input to the system and for a comparison with the outputs to the groundwater.

Internal Water Use and Discharge

All used potable water (i.e., wastewater) will be sent to an onsite wastewater treatment plant. This plant will have the capability to recycle wastewater. The Water Balance assumes no losses throughout the water and wastewater distribution systems. A few comments can be made on this assumption:

- Some losses are inevitable over time in piped systems, generally as much as 5%, although these will tend to recharge the underlying groundwater.
- Consumptive use (i.e., human consumption, cooking, etc.) will reduce the amount of received potable water that is returned as wastewater. Since toilet flushing will be done with recycled water, consumptive water uses may account for a significant percentage of all water usage. Consumptive use, however, is generally considered to be small.
- The MBR plant, itself, uses aeration, which tends to evaporate water from the plant.
- The MBR plant also has some consumptive use due to bacterial demand, which is then taken out of the system as sludge.

It is difficult to precisely estimate the quantities of water that would be consumed or taken out of the system by these various processes. Nevertheless, it can be noted that a perfectly closed water recycling loop does not seem reasonable and may be somewhat optimistic. If these consumptive uses were estimated to account for 10% of the water demand, then only 9,000 gpd would be available for recycling versus the entire 10,000 gpd. For the present analysis, these discrepancies have been ignored. As mentioned above, any internal recycling within the system is not relevant to a groundwater recharge analysis.

Of the remaining wastewater available for recycled water usage, the project plans call for discharge for flushing toilets and irrigating landscaped areas. The recycled water for toilet flushing, once an initial volume of water is put into the system, would operate mostly as a closed loop, and essentially draw very little additional water from the recycled water system. As an “internal” process to the system, the toilet flushing demands can be ignored in the present analysis.

Recycled water applied to the landscaping would disappear from the system, as it is projected to percolate into the groundwater. Although disappearing from the system, any irrigation water remaining after evapotranspiration would serve to recharge the aquifer from which potable water has been drawn.

Evaporation (Output)

Most of the water planned for agricultural irrigation will be lost through evapotranspiration. The Facilities Plan and Water Balance numbers indicate that only 5% of the applied irrigation will be utilized for groundwater recharge. Given the small contribution of this source, the irrigation demands can essentially be ignored in the present analysis.

Overall Balance

Given the discussions above, an overall mass balance of the water system can be performed. What happens inside the box without losing water mass – i.e., internal recycling for toilet flushing - is irrelevant to the overall mass balance. The critical parameter for a stable, no-impact balance is that inputs must match outputs.

Due to consumptive uses, the volume of discharged (waste)water that will recharge the underlying aquifer should always be less than the volume of pumped source water. The input will always exceed the output, and a closed-loop system is not possible. Precise estimates of the difference in input and output are difficult to make without a much more detailed analysis of expected water consumption patterns.

The most significant source of groundwater recharge from the project site is the stormwater percolation. Stormwater percolation occurs on the existing site, however, and will not necessarily be enhanced (or reduced) by the project.

Overall, since evaporation as an output is estimated to consume most of the applied 10,000 gpd, which is equivalent to the main groundwater input, the system will effectively be taking 10,000 gpd from the groundwater. In other words, a net withdrawal of almost 10,000 gpd is expected.

Effect on Regional Aquifers

One approach to evaluating the effects of the project's pumping on local and regional aquifers is to: (a) compare the projected demand and recharge with existing local demand and recharge; (b) evaluate how projected demand may affect off-site uses; then (c) consider effects during prolonged droughts. It is customary to use round numbers when conducting such evaluations.

(a) Existing recharge on this 20-acre site is approximately 20 acre feet per year (AFY), based on mean annual recharge of 11.5 to 12 inches (a discussion of how this number is calculated is given in Table IV.G-1 of the EIR section). Due to the alluvial deposits that form the groundwater basin, recharge also occurs throughout the basin. Significant areas that have low recharge include the Half Moon Bay Airport and the existing residential developments in the watershed. Projected recharge should be similar to the existing recharge since even the impervious areas of the site will be drained to pervious swales or detention areas that percolate to the groundwater basin.

The project site currently has an operating well that may be used for irrigation. It is possible to estimate existing irrigation (i.e., well water) demands from some knowledge of the crop's being irrigated. Based on site visits and available aerial photography, the entire area of both parcels (i.e., 19.5 acres) is essentially being irrigated. To avoid crop water stress, rainfall and irrigation must be sufficient to meet the crop's water needs, accounting for evapotranspiration (ET). At a minimum, the calculated annual ET needs to delivered via rainfall or irrigation. As detailed in Table IV.G-1 in the early part of this section, the total average evaporation for the project area is 40.81 inches versus a total average rainfall of 26.40 inches, leaving an average annual deficit of 14.41 inches or 1.2 feet. An approximation of irrigation needs for coastal parts of the Bay Area is 2.5 acre-feet per year (AFY) per acre (acre-feet per acre is equivalent to feet). For the entire project area, a range from 1.2 to 2.5 AFY per acre would equal 23 to 49 AFY or 21,000 to 44,000 gpd. If the onsite well is used to meet these demands, then 21,000 to 44,000 gpd is a rough estimate of the amount currently pumped.

The applicant has estimated the proposed water demand as 10,000 gpd or 11 AFY, which is about equal to the mean annual on-site recharge. This is less water than is currently used on site. Some of the existing water used will recharge the aquifer, but most of it is lost to evapotranspiration. Still, the project demands would still be less than the net demands from the existing site.

(b) The Coastside County Water District (CCWD) is a potential water supplier for the project. About 4% of the CCWD water supply is provided directly from wells in the airport aquifer, and is legally limited to 130 million gallons per year (MGY), which is equivalent to 400 AFY. The average annual amount pumped, however, is about 160 AFY, and is even projected to decrease further to less than 100 AFY by 2010 due to increased reliance on other sources. Another 17% of the CCWD's water supply is provided from surface diversions of Denniston Creek, which is indirectly influenced by the airport aquifer. Overall, only a quarter of the CCWD's water supply is related to the local groundwater. Most of the remainder is purchased from the San Francisco Public Utilities Commission (SFPUC) and originates from the Hetch Hetchy Reservoir. If water were provided from CCWD, the project demand of 11 AFY could add 7% more demand on the airport aquifer. However, total groundwater withdrawals from the site, as discussed above, are expected to decrease, so the project's groundwater usage will not discernibly affect the ground water supply in the regional aquifer and existing ground water users who draw from it.

(c) The CCWD has prepared an Urban Water Management Plan (UWMP) in 2005 that analyzes the effects of pumping during multiple consecutive years of drought. Groundwater would still supply about 300 AFY during three consecutive dry years, although the proportion from the airport aquifer is unclear. Nevertheless, the UWMP does not indicate that excessive groundwater pumping would be required during drought years. Therefore, groundwater availability during drought is not expected to limit community water-supply availability as projected. The project, during a drought, is actually estimated to increase groundwater recharge.

Projected ground water pumpage volumes are expected to fall well below the threshold of significance for either normal or drought-year conditions. Therefore, impacts would be less than significant.

ITEMS #2, 3, AND 4 – IMPACTS ON STORMWATER RUNOFF (HYDROLOGY)

As recommended in the Drainage Manual for small watersheds, the Rational Method (Q = CiA) has been used to estimate peak stormwater runoff flows (“Q_n”) for various return periods (“n”). The Rational Method requires the following inputs:

- Drainage coefficient (“C” or “C-value”), based on amount of impervious development;
- Intensity of rainfall (“i”), for appropriate duration and return period;
- Drainage area (“A”).

These inputs can be estimated from the applicant’s submitted project plans and other available information as detailed below.

Drainage Coefficients

For the wellness center, the existing (Pre-project) condition is essentially undeveloped, so a C-value of 0.30 is appropriate. Once developed, the parcel is estimated to have a total imperviousness of about 22%, similar to low-density single-family housing in terms of stormwater runoff. Therefore, a slightly larger C-value of 0.40 is appropriate for the Post-project site.

The estimated C-values are valid for most storm events, particularly those lower than a 100-year storm event. For a 100-year event, however, the Drainage Manual recommends raising the C-values by 10% to account for typically soaked soil conditions prior to and during a 100-year event. For the marsh, based on the presence of some dispersed but highly impervious developments, a C-value of 0.40 should be appropriate. Given the scale of the project to the entire watershed (2.5%), the project development should not affect this value significantly. Table 2 summarizes the Drainage Coefficients used in the present analysis.

Table 2 - Drainage Coefficients

	2-yr/10-yr	**100-yr**
Project Site (Pre)	0.30	0.38
Project Site (Post)	0.40	0.50
Marsh Watershed	0.40	0.50

Times of Concentration and Intensity

The rainfall intensity for the Rational Method depends on both the duration and return period of the storm event. The duration used in calculations is generally equivalent to the time of concentration, since that is the time when all of the drainage area's flow reaches the discharge point.

Times of concentration have been estimated based on the submitted grading and drainage plans and suggested methods in Santa Clara County Drainage Manual's. These methods are equivalent to the Atherton Drainage Standards.

For the undeveloped drainage areas, the Kirpich formula, $TC\ (min) = 10 + 0.0078*(L^2/S)^{0.385}$, where:

- TC is the time of concentration in minutes,
- the 10 accounts for an initial time of rainfall concentration,
- L is the overland flow length in feet,
- S is the average slope over the drainage area.

For the developed drainage areas (i.e., onsite Post-project area), times-of-concentration were estimated based on the length and slope of flow at different points in the drainage system. The longest flow paths were estimated to be from the parking lots on the north end of the sites, which drain eventually through catch basins (T_{CB}), storm drain pipes (T_{SD}), and drainage swales or rain gardens (T_{Swale}) offsite to the marsh. The basic formula for TC for the developed areas is thus:

$TC = T_i + T_{CB} + T_{SD} + T_{Swale}$, with T_i an initial time-of-concentration. T_i was set to 5 minutes, which is typical for parking lots.

Table 3 summarizes the calculated TC and intensity values for the Pre- and Post-project scenarios for both parcels. As these numbers indicate, the development alters the times-of-concentration for both sites, most significantly for the OP site.

Table 3 - Estimated Times of Concentration and Rainfall Intensities

Watershed	Scenario	TC (min)	2-yr Intensity (in/hr)	10-yr Intensity (in/hr)	100-yr Intensity (in/hr)
OP	Pre	20.47	0.96	1.61	2.51
	Post	10.83	1.32	2.22	3.45
WC	Pre	14.23	1.15	1.93	3.01
	Post	9.13	1.43	2.41	3.75

Drainage Areas

Currently, the marsh is estimated to occupy between 40 and 60 acres of area and have a total drainage area (watershed) of 785 acres. Drainage areas for the project parcels, and an estimate of the developed (i.e., impervious) project areas are summarized in Table 4.

Table 4 - Project Drainage Areas and Imperviousness

Watershed	Scenario	Drainage Area (acres)	Developed Area (acre)	Impervious (%)
OP	Pre	14.3	0.0	0.0
	Post		1.8	12.9
WC	Pre	5.3	0.0	0.0
	Post		1.2	22.2

Project Site Flowrates

Pre-project and (Post) project flowrates for the storm events of interest are calculated based on the drainage areas, drainage coefficients, and rainfall intensities described above. Table 5 summarizes these flowrates. Also in the table is the calculated ratio of Post-project flows to Pre-project flows. Post-project flows are estimated to be 1.8 times the Pre-project flows; in other words, the project is estimated to increase flowrates by about 80%, regardless of the storm event.

Table 5 - Estimated Project Site Flowrates

Watershed	Scenario	2-yr (cfs)	10-yr (cfs)	100-yr (cfs)
OP	Pre	4.1	6.9	13.4
	Post	7.5	12.6	24.6
WC	Pre	1.8	3.1	5.9
	Post	3.0	5.1	9.9
TOTAL	Pre	5.9	9.9	19.3
	Post	10.5	17.7	34.4
	Ratio	1.8	1.8	1.8

Entire Watershed Flowrates

The estimated flows to the entire 785-acre watershed of the Pillar Point Marsh are listed in Table 6 for various storm events. The percentage of flows represented by the Big Wave project site Pre-project and Post-project are also given. These percentages indicate that drainage from the project site currently represents about 3% of the stormwater flows to the marsh. After the project is completed, flows from the project site would about double but still represent only about 6% of the stormwater flows to the marsh.

Table 6 - Pillar Point Marsh Flowrates and Project Impacts

	2-yr	10-yr	100-yr
Marsh Watershed Flows (cfs)	219	369	716
Project Site Flows % (Pre)	2.9%	2.9%	2.9%
Project Site Flows % (Post)	5.8%	5.8%	5.8%

It is interesting to note that the section of the Facilities Plan regarding hydrology includes an estimate of the 100-year flow from the Marsh watershed. The estimate is 60 cfs from the western part of the watershed (listed as 320 acres) and 80 cfs from the eastern part (listed as 420 acres). The total 100-year flow to the marsh estimated by the project proponents is thus 140 cfs, substantially below even our estimate for the 2-year event. Assuming a C-value of 0.4 and given the 740 acres, the rainfall intensity is estimated as 0.47 inches, requiring an approximately 8 hour time of concentration based on the SCCDM.

Impacts on Siltation/Erosion

Since the site currently has no impervious development, the increase in imperviousness could increase runoff from the site. Increased velocities and durations of stormwater runoff could lead to erosion of onsite and offsite areas, as well as siltation of the downstream marsh. The site includes soils with a low erosion potential (see the EIR), but the relatively steep parts of the site at the edges of the development will require attention during and after construction to avoid erosion.

Erosion and siltation are typically of greatest concern during project construction. The project plans include erosion and sedimentation control and dust control plans for both project parcels. A project-specific Stormwater Pollution Prevention Plan (SWPPP) will also need to be developed for the project to minimize construction impacts on erosion and sedimentation and to be in compliance with stormwater regulations. With these erosion and sedimentation control plans in place, construction impacts should then be less-than-significant.

Project design can include various Best Management Practices (BMPs) to help the post-project site mimic pre-project conditions in terms of hydrology. These BMPs can also affect the water quality of stormwater runoff, by filtering and detaining pollutant-laden runoff onsite. Since sediment is a main carrier of pollutants and often considered a pollutant itself, these BMPs help prevent sedimentation downstream of the project site.

Stormwater BMPs, as discussed in the EIR, are planned and should help mitigate for project impacts on siltation and erosion. Further details of appropriate mitigations for siltation and erosion impacts of the project are included in the EIR.

Impacts on Flooding

Placing fill or other structures in such a way as to block existing drainage paths could result in increased onsite or offsite flooding, particularly if there is significant offsite drainage that flows through the site. Offsite runon from upstream of the project site is unlikely given that Airport Street is at the upstream border of the site. Existing stormwater drainage from upstream travels through a culvert under Airport Street and through the drainage swale between the two portions of the site into the Pillar Point Marsh.

In general, the planned rain gardens, porous pavements, and other stormwater recharge features serve to limit any increase in stormwater runoff, even during large storm events that could cause substantial flooding. However, since no drainage report was provided by the applicant, it is unknown if there are substantial stormwater discharges that would travel onto the site from neighboring areas, particularly the residential development to the northwest.

One way to gauge the impact of the project on flooding is estimating how any increased site runoff would impact the water levels in the downstream marsh. Any increase in water levels of the marsh could exacerbate existing flooding. It is possible to estimate the difference in volume of site runoff based on the standard 100-year, 24-hour storm. The difference in volume is proportional to the difference in runoff coefficient, which is equal to 0.10 (i.e., 0.40-0.30), and the 100-year total precipitation. For a site with mean annual precipitation of 26.4 inches, the Drainage Manual gives a total 100-year depth for of 7.24 inches. Thus, the project site's 19.5 acres would produce an increase of volume as follows:

Volume = 7.24 inches * 19.53 acres * (0.50-0.38) = 16.97 acre-inches.

If this 17 acre-inches of water were added to the approximately 23.5 acres of freshwater marsh upstream of West Point Avenue, it would raise the marsh at most by about seven-tenths (0.7) of an inch over the existing level under a 100-year event. The raised level could even be lower given that the marsh culvert at West Points Avenue would have increased flow under an increased water level and serve to pass some of the excess runoff faster than is done previously.

The increase in offsite flood levels thus appears to be minimal. On the other hand, without further information on the onsite drainage, we cannot fully assess the impacts on onsite flooding. The EIR details the recommended mitigation of preparing a project drainage report.

Impacts to Storm Drainage Systems

The project itself will include onsite storm drainage systems to convey stormwater runoff from the site. Upstream stormwater runoff will continue to be conveyed via the shallow drainage swale between the parcels. Downstream of the project site is the Pillar Point Marsh, which, as discussed above, will see a minimal impact from the project drainage. The marsh does drain through some culverts at West Point Avenue on its way to Pillar Point Harbor. The capacity of these culverts is not known from available information. However, since the project will minimally impact the entire marsh drainage, even under a 100-year storm event, there should be minimal if any impact on the capacity of these downstream culverts.

Addition of Polluted Runoff

Existing surface and ground water quality in the project area is discussed in the EIR. Potential pollutants from the developed project are also discussed. These pollutants include general urban stormwater pollutants, such as oil, grease, trash and debris. Sediment, as discussed above, is also considered a pollutant, mainly because of its capacity to carry other pollutants.

Since the site is currently only used for agricultural production without significant urban usage, the project is considered to have the potential to add substantial sources of polluted stormwater runoff. Planned BMPs, which serve also to mitigate peak flows, as discussed above, are considered helpful in mitigating the pollutant effects of urban stormwater runoff.

CONCLUSIONS

Several conclusions can be drawn from our hydrologic analysis and will be referenced where appropriate in the project EIR.

1. The planned water and wastewater system will produce a net withdrawal of groundwater.
2. The groundwater withdrawals for the project, however, will be less than existing withdrawals, reducing the amount of net groundwater withdrawals.
3. Project conditions are estimated to increase site stormwater discharges by 80% for various return periods.
4. Hydrologic impacts to the Pillar Point Marsh based on conditions in the entire marsh watershed appear to be minor. Although the project would increase stormwater flows from the site, these flows would still only represent 6% of the total flows to the marsh.
5. Planned stormwater Best Management Practices should serve several hydrologic and water quality functions, including maximizing groundwater recharge, minimizing quantities of stormwater runoff, and reducing pollutant loadings in stormwater runoff.

REFERENCES

Big Wave Project, 2009, Facilities Plan: Draft #2, January 2009, provided by the applicant.

Coastside County Water District (CCWD), 2005, 2005 Urban Water Management Plan, Prepared for CCWD Board of Directors, Prepared by Amanda Cox.

CCWD, 2006, Water Supply Evaluation Report, Prepared for the CCWD Board of Directors, Prepared by the CCWD Staff

MacLeod & Associates, 2009, Preliminary Grading/Drainage & Utility Plan With Permanent Storm Drainage Controls, Big Wave Office Park, Drawing No. 1584-00, April 2009, provided by the applicant.

MacLeod & Associates, 2009, Preliminary Grading/Drainage & Utility Plan With Permanent Storm Drainage Controls, Big Wave Wellness Center, Drawing No. 1608-00, April 2009, provided by the applicant.

Santa Clara County, Drainage Manual, 2007.