

**TO: HONORABLE CITY COUNCIL**

**FROM: CITY MANAGER DEPARTMENT: PUBLIC WORKS**

**DATE: JUNE 9, 2008 CMR:266:08**

**SUBJECT: BASEMENT CONSTRUCTION AND DEWATERING IMPACTS**

This is an informational report and no Council action is required.

### **BACKGROUND**

Residential and commercial basements and underground parking garages are constructed throughout Palo Alto, except where they are disallowed in the flood zones. If a basement or underground garage site has high groundwater, the contractor will need to dewater the site so they can construct the basement or garage without groundwater filling the excavation. Accordingly, the contractor prepares and submits a dewatering plan to Public Works. The plan typically includes pumping water from the shallow aquifer below the site to a settlement tank and then via a pipe or hose to the closest storm drain inlet in the street. Public Works reviews and approves the dewatering plan, charges a dewatering fee and issues a street work permit. Public Works inspectors confirm the dewatering is done per approved plans and with minimal impact to the community. Public Works currently issues 5-10 dewatering permits for residential basements annually.

Recently, a number of citizens have voiced their concerns to the Public Works Department that dewatering has many negative impacts on the community and should potentially be disallowed, especially in residential areas. The concerns have been about the discharge of large volumes of water into the storm drain system, pump noise, land subsidence, tree impacts, groundwater impacts and contaminated groundwater migration.

### **DISCUSSION**

Public Works and Planning Division staff have been aware of construction dewatering impacts and concerns for a number of years. They have conducted research and sought the advice of experts to address these concerns. In 2004, the Planning & Transportation Commission raised some of the same concerns about dewatering that citizens recently have. Consequently, the Planning Division retained an environmental consultant, EIP Associates, to research and report on these concerns. In 2004, EIP prepared the attached report titled, "Draft Technical Memorandum: Correlation between New Basement Construction and the Groundwater Regime in Palo Alto, California." Further, Public Works Engineering staff has consulted with representatives of the Santa Clara Valley Water District (SCVWD), the California Regional Water Quality Control Board (CRWQCB), the United States Geological Survey (USGS), dewatering contractors, basement contractors, architects, geotechnical engineers, and staff from Public Works' Environmental Compliance Division and the Planning and Community Environment's Planning and Building Divisions about dewatering impacts and concerns.

To assist Council in understanding the differences between shallow and deep aquifers (described more completely in EIP's attached report), staff provides the following descriptions.

Shallow aquifers are formed by rain seeping through the ground and pooling close to the ground surface. The top surface of the shallow aquifer is called the water table and is typically 10-30 feet below the ground surface in most areas of Palo Alto other than the hills. This is the aquifer that basement excavations may extend into, necessitating dewatering. Shallow aquifer water is nonpotable as it does not meet drinking water standards.

Deep aquifers are separated from the shallow aquifers by impermeable sediment layers, like rock or clay, called aquicludes that prevent shallow aquifer water from reaching the deep aquifers. In Palo Alto, the deep aquifers are approximately 200 feet below the ground surface. Dewatering basement excavations has virtually no effect on the deep aquifers.

Certain layers of permeable sediment, like sand or gravel, may trap and hold pockets of groundwater temporarily between shallow and deep aquifers, but these are typically not affected by basement dewatering operations.

Below is a brief summary of the above research organized by community key concerns.

#### Discharge Volume

A soils report is required for all projects with basements or underground garages. This report determines the depth to the shallow aquifer below the ground surface. If a contractor believes the excavation will go into the groundwater, they will typically submit a drawdown well dewatering plan to Public Works. Drawdown wells are typically installed around the perimeter of the excavation and pump water out of the shallow aquifer to draw down the level of the groundwater so the basement can be constructed without groundwater filling the excavation. These drawdown well systems pump approximately 30-50 gallons per minute into the storm drain system non-stop for 3-6 months while the contractor constructs the basement.

The volume of water pumped into the storm drain system from a drawdown well dewatering operation is substantial, typically a few million gallons. It could be used as landscaping water, but it is too large a volume for individual use and too impractical to capture and reuse for other use.

The water pumped out of the ground is discharged into the storm drains, which typically discharge into the creeks. San Francisquito Creek is a losing creek, meaning that water is lost by seeping through the creek bed and into the shallow aquifers. So, in this case, water pumped out of the shallow aquifers is added back to it. For water pumped into lined creeks, the water flows to the bay and is lost to the aquifer.

The volume of groundwater pumped out of an excavation site is a small fraction of the total volume of the aquifer and does not deplete or lower the aquifer, except, of course, in the immediate vicinity of the excavation. The USGS reports that due to natural (rain) and manmade (irrigation, leaking sewer pipes, and the SCVWD's groundwater recharge program) methods, more water is recharged into the shallow aquifers than is pumped out of it by all pumping in the Santa Clara Valley. The EIP report also confirmed that the water table is only drawn down

locally (within tens of feet of the excavation) and reestablishes itself quickly after dewatering ceases. Therefore, the cumulative effect of dewatering on the shallow aquifers is negligible.

#### Pump Noise

Dewatering pumps can make excessive noise if installed improperly, and this is a concern for neighboring residents since the pumps run 24 hours a day. Public Works is tightening the requirements for pump operation to eliminate this problem.

#### Water Table Impacts

While the City currently prohibits basements in flood zones, there is no blanket prohibition against construction in areas with shallow aquifers. Basements are not typically constructed so deep that they actually go into the water table, but they do in some cases. In other cases, the water table might rise up, as at the end of a particularly wet winter, and surround a basement. However, in these cases, the water table level and the flow of the groundwater are not changed due to the presence of basements, as reported by EIP.

#### Subsidence

Land settlement, or subsidence, caused by temporary (such as 6 months) construction dewatering is negligible, as reported by EIP and USGS. For subsidence to occur, dewatering needs to occur over a number of years.

#### Tree Impacts Relative to Water Table Changes

The Planning Division arborist reports that in most of the developed areas of Palo Alto the preponderance of absorbing tree roots are *not* found in lower soil horizon levels below seven feet. Therefore, the majority of temporary dewatering projects are not expected to impact trees. If a tree's roots are however deep enough and have been determined, on the basis of a certified arborist report or other qualified assessment, to be dependent on the water table, then the mitigation would be for the contractor to provide separate irrigation for the tree(s) during the dewatering period.

#### Contaminated Groundwater Migration

Citizens have expressed a concern that large volumes of groundwater being pumped out of the aquifers might cause nearby contaminated groundwater plumes to migrate towards the pumping site. When an application is submitted, staff checks dewatering sites against known contaminated groundwater plume maps. If a site is within a certain proximity to a known plume, staff requires the water to be tested for contaminants prior to and during discharge. The contractor must retain an independent testing service, test for the contaminants Public Works specifies, and submit those results to Public Works. If the water is contaminated, as it was in one case near the Stanford Research Park superfund site, it must be treated before it can be released or discharged to the sanitary sewer under permit from Public Works. The CRWQCB is drafting requirements for contractors to test groundwater discharged to the storm drain system. Staff awaits the adopted version of these requirements, scheduled for this summer, and will implement them at that time. To date, there has been no evidence that contaminated groundwater has been discharged into the storm drain system or that contaminated groundwater plumes have migrated.

### Discharge of Groundwater after Basement Construction

A few years ago, Public Works allowed the use of perforated drain pipes to be installed behind basement walls and under basement slabs when the geotechnical engineer reported that groundwater would not rise to the level of these pipes. The pipes are installed to capture rainwater that filters through the ground and collects behind basement walls in order to minimize the chance of the water leaking through the walls. The pipes drain to a sump where a pump then pumps the water to the street gutter. Unfortunately, after some wet winters, groundwater did rise up to these pipes and was then pumped continuously into the street gutter for long periods of time, creating a number of public nuisance and safety concerns. Accordingly, Public Works adopted a policy two years ago that prohibits the use of perforated drain pipes for basements in areas of the City with relatively high groundwater (east of Foothill Expressway) to eliminate these potential nuisances. Public Works also recommends that applicants for new basement projects retain a waterproofing consultant to ensure the basement does not leak.

Older basements that were permitted with perforated drain pipes still may occasionally discharge groundwater into the street gutter. Public Works addresses these cases by working with the homeowners to eliminate the discharge, typically accomplished by having the homeowner raise the pump in the sump above the level of the groundwater.

### Basement Excavation

Some residents have expressed a concern that the excavation pit for a basement comes too close to adjacent properties, potentially jeopardizing the stability of these properties. Although this strictly does not relate to dewatering, staff recognizes it as a legitimate concern. As previously mentioned, the Building Division requires geotechnical reports for all projects that involve basements or underground structures. A standard feature of these reports is recommendations and requirements from the geotechnical engineer that specify measures to stabilize the excavation during construction. The Building Division inspects all basement construction to ensure conformance with the geotechnical report and to verify all recommended stabilization measures are implemented. In addition, Building Inspectors will require the contractor to install extra precautionary measures before work can continue.

### Storm Drain Capacity

Staff is concerned that dewatering basement excavations may take up too much capacity in the City's storm drain pipes, minimizing the system's ability to accommodate storm water and potentially causing or exacerbating flooding. This is not a concern raised by citizens, nor has there been any incidents where dewatering has caused flooding, but staff is developing some guidelines for wintertime dewatering in an effort to avoid a problem. The draft guidelines currently disallow dewatering during the winter unless an exemption is granted by the Director of Public Works.

### CONCLUSION

Staff has researched and analyzed each of the concerns about dewatering raised by citizens. Based on that research, staff believes that the cumulative effects of dewatering basement excavations has minimal impacts on the City and that the practice should be allowed to continue. The attached EIP report essentially comes to the same conclusion. The number of residential basements permitted in the City has increased from approximately 20 a year at the start of the decade to approximately 30 a year currently. However, Public Works only issues about 5-10

dewatering permits a year. So, most basements are built without requiring dewatering. Public Works will continue to monitor dewatering activities to ensure the City's procedures remain sound and protective of Palo Alto.

**POLICY IMPLICATIONS**

Staff is currently updating dewatering requirements to ensure that dewatering has minimal impacts to the community. Limitations beyond those discussed in this report would likely result in a wholesale prohibition of basements where groundwater is present, which would be a major policy issue to be decided by Council.

Per direction from Council at the May 12, 2008 council meeting, staff will prepare a report on the array of basement construction impacts and issues, including dewatering, and present it to the Planning and Transportation Commission in the near future.

**ATTACHMENTS**

Attachment A: Draft Technical Memorandum: Correlation between New Basement Construction and the Groundwater Regime in Palo Alto, California

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