

SUSTAINABLE GROUNDWATER MANAGEMENT: Can California successfully integrate groundwater and surface water under SGMA?

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Maurice Hall and Kevin O'Brien present differing scenarios for how Groundwater Sustainability Agencies might address surface water impacts of groundwater pumping

"The year 2014 was historic for groundwater in many ways," began Moderator Dorene O'Adamo, member of the State Water Resources Control Board. "First, while it wasn't recognized at the time, the state was well into one of the most serious droughts on record. There was a widespread call to action to protect the state's precious groundwater resources from scientists, regulators, policy makers, the average citizen, and politicians, which ultimately resulted in the passage of the Sustainable Groundwater Management Act."

"That historic bill also included another historic first, and that is language that recognizes the interconnectivity between surface and groundwater, so there is language in the bill requiring groundwater management agencies to avoid significant and unreasonable adverse impacts to surface water," said Dorene D'Adamo. "So tonight's lecture, 'Can California successfully integrate groundwater and surface water under SGMA?' is truly timely for all of us that are grappling with some of the uncertainties as to how to accomplish this very important goal."

Ms. D'Adamo then introduced the two speakers:

- **Maurice Hall, Associate Vice President of Water for the Environmental Defense Fund's Ecosystems Program:** Mr. Hall's work focuses on developing collaborative water management approaches to meet ecosystem needs, alongside the needs of

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farms and cities. Approaches central to his work include shaping water transaction programs that achieve resilient water supplies while protecting the environment and vulnerable communities, improving information systems to inform smart management of water resources, and shaping water governance that proactively considers multiple objectives while also responding to climate change.



■ **Kevin O'Brien, partner with the Downey Brand law firm in Sacramento:** Mr. O'Brien's practice encompasses a broad range of water issues, including frequent appearances before the State Water Board on water rights matter and litigation in both state and federal courts. He served as trial counsel in two groundwater adjudications, the Santa Maria basin adjudication in Santa Barbara County, and the Seaside Basin adjudication in Monterey County. He currently serves as counsel to the Yolo Subbasin Groundwater Agency, a JPA that is implementing SGMA in Yolo County.



Maurice Hall began by saying that the crux of the problem the state now is facing is how to make the practice of groundwater management match up with the physical realities of groundwater and surface water interaction as well as the legal realities, realities that don't actually match up very well.

The general premise for this lecture is that two different approaches or perhaps a mixture of the two will become the standard way of approaching groundwater management in California: One dominated by a SGMA-driven cooperative approach and the other a hybrid approach to the adjudication of water rights under the umbrella of SGMA, said Mr. Hall. He noted that while the discussion may tend to be Central Valley focused, the principles they will be speaking about will be applicable in different parts of the state where the geologic setting and perhaps the institutional settings are somewhat different.

"Physics tend to work wherever you are and the law will find you wherever you are," he said.



HYDROGEOLOGY BACKGROUND

Maurice Hall then discussed some general principles of groundwater and surface water interaction. In California, if there is a reasonably flat valley with a stream flowing across it, there is very likely groundwater underneath, he said, explaining that in the natural undisturbed setting, if the groundwater isn't pumped, the groundwater will tend to fill up the sediments of the valley floor until it finds a low point. Water generally flows downhill, so when the groundwater levels in the aquifer are higher than the river or stream, the water flows into the river and contributes to the streamflow; this is called a gaining stream.

When groundwater is pumped, it lowers the level in the well so that water flows from the surrounding aquifer into the well; this causes the water levels adjacent to the well to drop and eventually that cone of depression will spread. As pumping continues, groundwater

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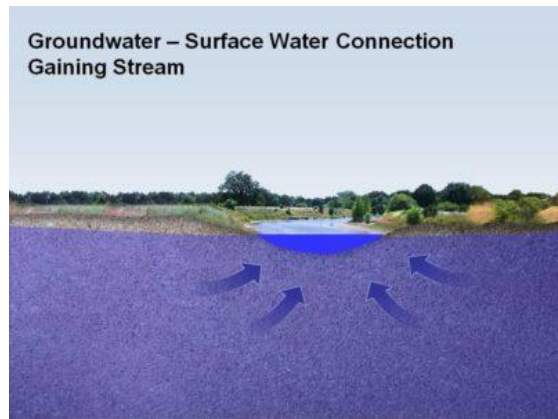
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levels are lowered over larger areas, which will in turn reduce the amount of water that is flowing from the groundwater into the stream.

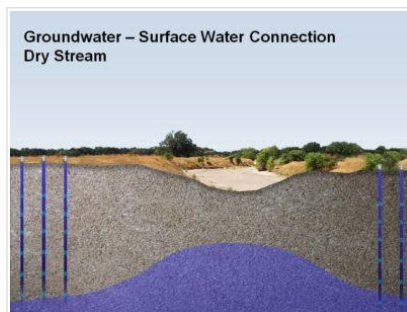
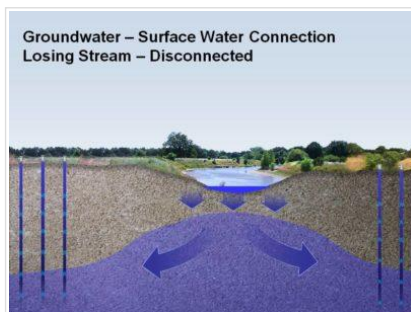
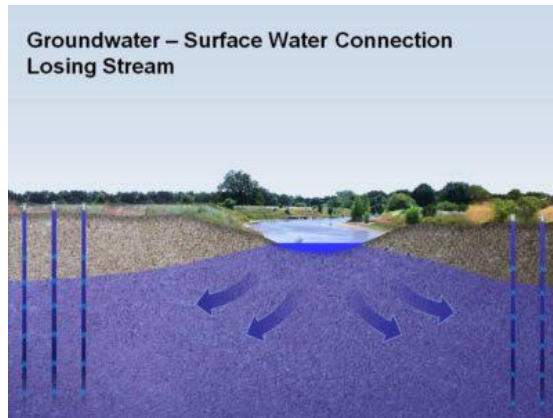
If groundwater is pumped long enough and levels of the groundwater drop low enough, it will reverse the flow, and the stream, being higher than the groundwater, will contribute

flow into the groundwater. This is called a losing stream; the stream is contributing or losing water to the groundwater and the groundwater is gaining water from the stream so it's a source of recharge for the aquifer.

In a losing stream, the rate of loss of water from the stream is determined by how steep the gradient is or how low the groundwater

levels are in the surrounding aquifer: If the groundwater levels are lower, it's going to lose water more quickly; if they are higher, it's going to lose water less quickly.

If groundwater pumping continues, the groundwater levels will continue to drop to the point where the stream becomes disconnected from the saturated groundwater. At this point, Mr. Hall said that it really doesn't matter how much further the groundwater levels are drawn down, the leakage rate or the depletion rate from the stream is independent of the groundwater level; it's determined by what the characteristics of the sediment are (lower, left).



And if the leakage from the stream that exceeds the flow of the stream, all of the water in the stream will sink into the groundwater and the stream will go completely dry (above, right).

With respect to SGMA and the stream depletion issue, SGMA specifically says that the issue only needs to be addressed where the stream and the groundwater are still interconnected, Mr. Hall said. He also noted that the depletion issue doesn't just come into play when the groundwater levels are lower than the stream and the stream is losing; they also come into play when the groundwater is gaining and your pumping reduces the

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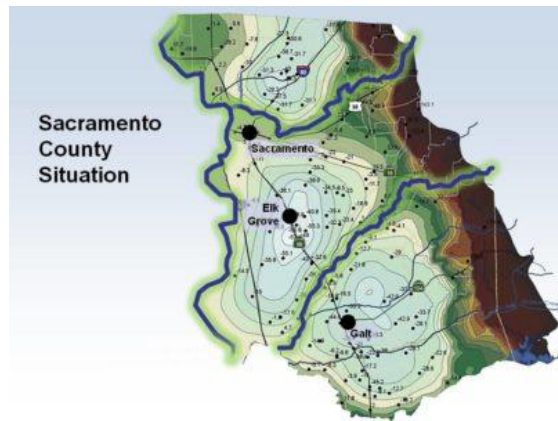
amount of gain that the stream is getting. "It's the same result; it's just a matter of which the way the water is flowing," he said.

Across the state, there is a spectrum of conditions of streams and groundwater, with some streams gaining, some streams losing, some streams disconnected, some streams dry, and dry streams that before groundwater pumping that might have flowed year round or most of the time but now flow only some of the time, or maybe they are dry all the time.

"This is an unavoidable impact of groundwater pumping and not necessarily paying attention or managing for groundwater," Mr. Hall said.

A LOCAL EXAMPLE OF GROUNDWATER AND SURFACE WATER INTERACTION

Mr. Hall then presented a map of Sacramento region, noting that Sacramento County basically runs from the Sacramento River on the west to the Sierra foothills on the east, and between that is a valley fill aquifer. This is a topographic map of groundwater levels



made using a groundwater model that is used by many of the water agencies that manage groundwater in the Sacramento region. Lighter colors indicate areas where the groundwater levels are lower; darker colors indicate areas where groundwater levels are higher.

There are three regional cones of depression, which are areas where a lot of groundwater pumping has

occurred that has drawn the groundwater levels down over time over large areas. The areas that have higher groundwater levels correspond to the rivers flowing through the area: the Sacramento River flowing in from the north, and the American River and the Cosumnes River flowing in from the east.

"The American River has a big dam on it, the Folsom Dam, and so the Sacramento River and the American River flow year round out of the mountains and they leak water into the groundwater because we have lowered the groundwater levels in the surrounding areas and that is what makes the groundwater levels higher along the river corridors," Mr. Hall said.

Mr. Hall noted that there are two different situations. The Cosumnes River is a fairly small river; it drains a fairly low elevation area and it's undammed, so its flows are relatively high in the winter and very low in the summer. The Cosumnes flows year round out of the mouth of the canyon, but as it flows out onto the valley floor, because the groundwater levels are low, it leaks water to the groundwater; in the summer when the flows are very low and when there's a high enough rate of leakage, the Cosumnes goes completely dry.

"It goes dry every year roughly around July 4th, depending on how wet the year is and how hot the summer is, and then it stays dry into the fall, sometimes even into December and January, depending upon when the big rains come," he said. "That's because there's the relatively small flow, comparatively high leakage rates."

The American River is a different story, Mr. Hall pointed out. It's a much bigger river and has Folsom Reservoir that releases water into the American River. "There are releases from Folsom Reservoir, although mainly targeted to meet water supply needs and to provide instream flows at times," he said. "Sometimes they provide Delta outflows; those releases also have to be turned up a bit in order to make up for the groundwater depletions and still meet the flow needs downstream. So the American River flows all year round, and these two rivers provide a significant amount of recharge to the

to balancing valley's water needs; and more ...

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groundwater. This happens, it's inevitable, and it's an important part of our groundwater system and surface water system statewide."

The situation is similar yet uniquely different for each setting up and down the Central Valley and across California. But just how big of a deal is this surface water depletion? A little bit? A lot? The Nature Conservancy explored this issue a few years prior to the passage of SGMA.

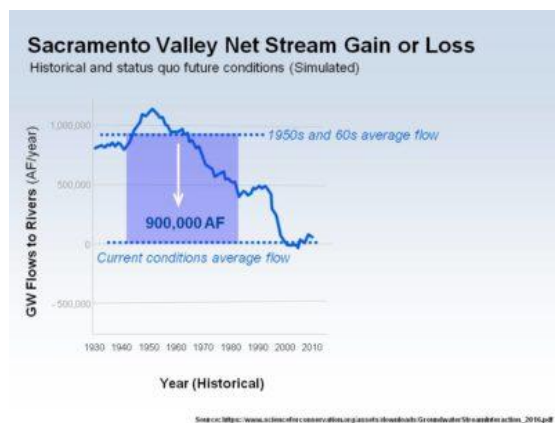
"What we did is we took the DWR Central Valley Groundwater Surface Water Model, C2VSim, and said how much water is flowing into the Sacramento River from the surrounding groundwater?," said Mr. Hall. "That model has been built to simulate history the best we can. It's still a model and there are lots of errors, but it gives us a pretty good idea and represents the best collective knowledge that we have."



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"What the model showed us is that early in the 1900s, the 1940s and 50s, the Sacramento River received a net inflow from the groundwater of something like 1 MAF a year, on average; it goes up and down in some years," Mr. Hall said. "A lot of different things changed during that time, including increased groundwater pumping. So since that time, the

groundwater levels have gone down, and the amount of water that has flowed into the Sacramento River from the surrounding groundwater has gone down accordingly to the point that when we were doing this modeling around 2010, it appeared that on average, the Sacramento River lost just about as much as it gained from the surrounding groundwater in the valley floor. This is the Sacramento River and all of its tributaries upstream of Sacramento."

"So the net effect over that period of time is there was roughly on average 900,000 acre-feet per year less water showing up in the Sacramento River at Sacramento," Mr. Hall said. "This is basically less water showing up in the river to meet the required flows in the Delta so upstream dam releases and diversions had to be adjusted to make up for that additional flow. All that's to say is that the collective groundwater pumping in the Sacramento Valley has a pretty significant impact on the flows in the Sacramento River."

GROUNDWATER-SURFACE WATER INTERACTION AND INSTREAM FLOWS

Mr. Hall then discussed the issue of how instream flow needs in streams have been addressed up to this point.

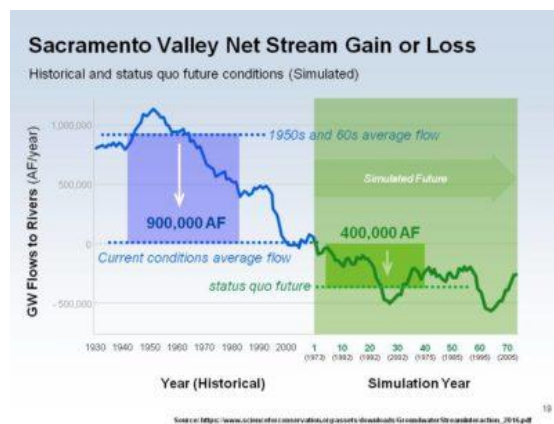
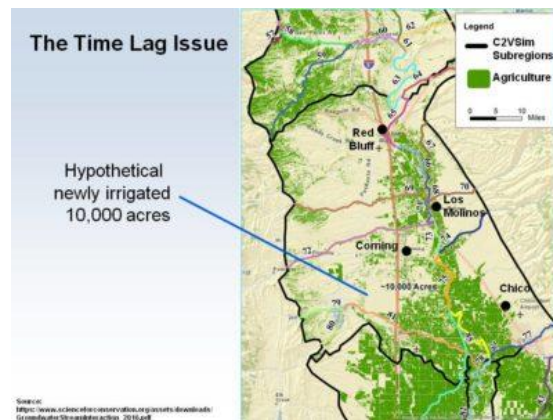
"When we have a situation in a stream or a river where there needs to be more flow in that river for some requirement – maybe it's a water supply requirement for a senior water right holder downstream, or an instream flow need for salmon or some other species, or maybe for outflow or water quality requirements in the Delta – when that had to be adjusted, we've turned to the only knobs we can turn, which are the knobs on surface water diversions and on dams and reservoirs," Mr. Hall said. "We reduced diversions or increased releases from reservoirs in order to meet those needs when in fact, part of the reason that the flow conditions are as they are is because groundwater pumping has depleted those flows. Yet there are no knobs on the groundwater basin so its difficult to turn groundwater depletion up or down very quickly, and as a result, the surface water users and the surface water managers have borne a disproportionate burden from meeting those instream flow requirements. That is one important point to take away."

There is also the time lag issue that stems from the fact that when you pump groundwater, it first lowers groundwater levels in the vicinity of the well and that well depression spreads, eventually impacting the stream or river, but it can take a long time, Mr. Hall said.

To get an idea of length of time it takes to impact the river, they used the model to simulate what would happen if a new irrigation project using groundwater was started.

"So we chose to hypothetically irrigate 10,000 new acres up on the west side of the Sacramento Valley and begin that now without changing anything else in

the model and with similar hydrology going forward, to see what it means with respect to streamflow," Mr. Hall said. "What we found was that in just a couple of years, the impact of that pumping began to show up at the Sacramento River about 15 miles away, but just a little bit. In fact, it was more than 20 years before the full new impact of this pumping showed up at the Sacramento River. 20 years. That time lag becomes really significant and it means there is a real disconnect between your management changes and the changes and the impacts to the river."



They then ran the model going forward, what is the result of continued groundwater pumping of the hypothetical 10,000 acres and found that per the model, if pumping were to continue at the same level into the future, it would have an eventual effect on reducing the average annual flow in the Sacramento River about 400,000 acre-feet, and that

is basically just a delay in impact of the pumping that had already been started. He noted that quite a bit of new agricultural lands have been brought under irrigation in recent years.

Mr. Hall noted that these are model results, so there's quite a bit of uncertainty. "Maybe it's 900,000; maybe it's 500,000, maybe it's 1.5 million ... but it's significant," he said. "Big

numbers. And the basic physics of how groundwater and surface water interaction works makes you think it's probably somewhere in this order of magnitude as it makes sense from a basic physical standpoint. And it's a big deal."

THE LEGAL PERSPECTIVE OF GROUNDWATER MANAGEMENT

Kevin O'Brien then addressed the basic legal concepts both relating to water law and SGMA, beginning with California groundwater law pre-SGMA, noting that SGMA does preserve existing groundwater law, so some of the principles water law that predated SGMA are relevant and will remain relevant going forward.

It's sometimes said that California is the only western state that treats groundwater and surface water under separate and distinct legal regimes, and while Mr. O'Brien acknowledged that is true, a case decided by the California Supreme Court in 1909 suggests that there is precedent in certain factual settings for administering rights to surface water and interconnected groundwater in an integrated fashion.

The case Hudson v. Dailey arose out of a dispute on San Juan Creek near the City of Pomona. Mrs. Hudson was a riparian who irrigated on 750 acres for 30 years; then at some point, a number of groundwater wells were drilled in the aquifer above her, which historically fed San Joaquin Creek, a gaining stream. *"Mrs. Hudson sued the groundwater pumpers and basically said, I'm a riparian, I have a paramount right, you groundwater pumpers, you have to curtail,"* said Mr. O'Brien. *"And the California Supreme Court ultimately said no, in this situation, these are overlying landowners and they have overlying rights, you are a riparian and you have a riparian right, so you essentially stand on equal footing from a priority standpoint, and we're going to take all that groundwater and surface water and put it together and we're going to determine water rights as a common supply."*

"So while California does have separate water rights systems for groundwater and surface water, I think this concept of the common supply rule is going to be more and more prominent as we move forward and will remain relevant to issues that will arise under SGMA," he said. *"So SGMA takes a step – I wouldn't call it a full step, maybe a half step, towards integrating groundwater and interconnected surface water."*

SUSTAINABLE YIELD AND UNDESIRABLE RESULTS

The whole purpose of SGMA is to have Groundwater Sustainability Agencies develop plans so that by certain deadlines, basins are operated so that pumping does not exceed sustainable yield, Mr. O'Brien said.

"Sustainable yield is defined in SGMA as the maximum quantity of water calculated over a base period representative of long-term conditions, so including wet periods and dry periods, that can be withdrawn annually without causing an undesirable result," he said. *"It's very similar to the definition of safe yield under California case law."*

Undesirable results, or the so-called 'six deadly sins,' are defined in SGMA as chronic lowering of groundwater levels, reduction in groundwater storage, sea water intrusion, degraded water quality, land subsidence, and surface water depletions that have caused significant and unreasonable adverse impacts on beneficial uses of surface water.

"So if a Groundwater Sustainability Agency, in developing a Groundwater Sustainability Plan, is confronted with a situation where groundwater pumping is causing surface water depletions that have significant and unreasonable impacts on surface water beneficial uses, that's a problem under SGMA that has to be dealt with, either by the GSA, or if the GSA doesn't act, most likely the State Water Resources Control Board," said Mr. O'Brien. *"So how do we define significant and unreasonable?"*

The term 'significant' is probably fairly easy, he said, as there are a lot of cases under CEQA on the question of significance and what is significant. *"Over time, what has happened is that agencies have been encouraged to develop thresholds of significance as part of their CEQA analyses, and I think that's exactly what's going to happen in the*

SGMA context, probably as part of the GSP process," he said.

But the question of unreasonable is a little bit different concept. *"I think it's very similar to the concept of unreasonable use under Article 10 Section 2 of the California Constitution,"* said Mr. O'Brien. *"We have cases interpreting that provision, and basically what those cases say is that it depends on the facts, it depends on the circumstances, and the concept of reasonableness changes over time, but at the end of the day, what those cases suggest at least to me is, you look at all the facts and you make a policy call."*

"Is this a reasonable impact or an unreasonable impact? I think that's an issue that GSAs are going to be grappling with all over the state when they deal with this issue, because pumping in most instances causes impacts on streamflow," he said. *"It's hard to avoid that reality, but the question of whether those impacts are significant and unreasonable is going to be a challenging problem for GSAs to grapple with around the state."*



With respect to the significance of an impact, one important element is the starting point for the analysis. *"SGMA has an interesting provision that says basically the GSPs may but are not required to address undesirable results that occurred before the date that SGMA took effect, January 1, 2015,"* said Mr. O'Brien. *"So GSAs are going to have a lot of discretion to set their baselines for purposes of these significance determinations, to either deal with pre-SGMA impacts on surface water flows or not. My guess is that in most cases, they will choose not to deal with pre-SGMA impacts."*

TOOLS FOR GSAs DEALING WITH SURFACE WATER IMPACTS

SGMA has a provision says that GSAs have very broad discretion to curtail, limit, or control groundwater pumping. *"Clearly the legislature had in mind that the GSAs, through their plans, could in fact reduce groundwater pumping,"* Mr. O'Brien said. *"There's no question about that. They have very broad authority."*

"But the counterpoint to that SGMA also says that nothing in SGMA and nothing in a GSP is intended to determine or alter water rights to surface water or groundwater," he said. *"So on the one hand, GSA has broad authority to curtail groundwater pumping; on the other hand, no alteration of water rights. So what that suggests to me is that before a GSA imposes limitations on groundwater pumping, the GSA is going to have to do some sort of analysis of water rights. That's a pretty daunting task. It's a daunting task frankly for a trial court judge, let alone a GSA that may be an irrigation district, it may be a JPA that's made up of goodwilled people who typically have experience in water matters but they are not typically experts on water rights. And so it raises an important question as to how the preservation of water rights and the respect for water rights that SGMA demands is going to play out in the SGMA process."*

The time lag issue is an important factual reality that will affect the management options and the management approaches to these problems. *"Let's say you have a stream that's essentially dried up. The Cosumnes River is an example in many years; around July 4th, the surface flow is not there,"* Mr. O'Brien said. *"You might be inclined to take the position, let's make all the groundwater pumpers reduce their pumping by 30, 40%, whatever it is. Well, in a lot of situations, you can tell the pumpers to shut off and you're not going to see any flow in the river for a long time. You have this time lag problem that exists."*



Mr. O'Brien pointed out that Colorado adopted a set of statutes integrating their water rights system for surface water and tributary groundwater; it was very controversial, there was a lot of litigation, but the Colorado Supreme Court ultimately said, you can do it. *"This time lag issue is something that Colorado has dealt with ever since*

then," he said. *"The way that the Colorado courts have dealt with this is to say in most cases, we're not going to just cut off the pumpers if the senior surface water right holders are not getting streamflow, because we understand that that's not going to do them any good and it's not going to maximize the utilization of our water resources."*

There is a lesson to be learned from California, Mr. O'Brien intimated. *"What Colorado has done is focus on what they call plans for augmentation, which are basically projects to augment the natural supply of the aquifers that feed the streams, and they will let the junior pumpers come on to the system, so long that they can show they are going to make the system whole through a plan for augmentation,"* he said. *"In California, we call those physical solutions. There's a long line of cases going back to the 20s and 30s, that basically say courts (and this is later extended to the State Board) have very broad authority not only to find, but that they have a duty to find physical solutions that will essentially maximize the utilization of the water resources and prevent waste and unreasonable use."*

Mr. O'Brien predicted that as SGMA implementation proceeds, there will be a focus on physical solutions. *"It doesn't mean there won't be any pumping curtailments,"* he said. *"I think in some areas there probably will be a combination of both, but pumping curtailments alone in this context are not necessarily going to get you where you want to go."*

A physical solution is an equitable remedy that courts (or SWRCB or GSAs) have the power to impose; it's a practical remedy that avoids waste or unreasonable use and is consistent with the water rights of the parties. There are various forms of physical solutions, such as a direct recharge project where in wet periods, water is diverted from a stream and put into a percolation pond that supplements the natural groundwater supply, or a conservation program where water can be conserved to the system.

However, Mr. O'Brien noted that those projects cost money and one of the questions that comes up regarding physical solutions is who is going to pay for all of this? In the adjudication of the City of Barstow v. Mojave Water Agency back in 2000, the physical solution was approved that basically spread the cost of the physical solution across the board, more or less evenly. The case eventually went up to the California Supreme Court who said no, you can't do it that way; you have to respect water right priorities. *"That means that the junior right holders or the junior priorities are going to pay more and the seniors are going to pay less,"* he said. *"This is a very important concept as we start to think about implementing physical solutions to comply with SGMA and to address some of these groundwater and surface water issues."*



Mr. O'Brien then gave some procedural scenarios that may play out as SGMA implementation moves forward. *"One scenario is that the GSA develops a GSP, it comes*

up with measures to address significant and unreasonable impacts of groundwater pumping on surface water beneficial uses, everybody is happy and everybody goes home," he said. "Maurice is going to talk more about that scenario in our hypothetical. But I'm more sort of the grim reaper here. I don't think that's going to happen that often."

"I think there's other two scenarios that I think could play out," he continued. "The first one is State Board intervention. Groundwater Sustainability Plans have to be reviewed by DWR and by the State Board, and the State Board has very broad authority to basically intervene in a situation where a Groundwater Sustainability Plan is either inadequate or isn't being properly implemented. I could see the State Board being very interested in the possibility of intervention if it felt that a GSP wasn't adequately addressing significant and unreasonable impacts on surface water beneficial uses."

If the State Water Board designates a basin as probationary and the deficiency is not remedied by the GSA, the State Water Board may develop an interim plan, but since the State Water Board has no authority to finance and implement a physical solution, Mr. O'Brien said the emphasis will be on pumping curtailments.

"The other possibility is an adjudication," he said. "Nobody likes to talk about adjudications, I get that. Adjudications are awful in a lot of ways ... the Santa Maria adjudication I was involved in started in 1987 although not as an adjudication; the appeal decision that ended the first part of the litigation was in 2012, so 15 years, there was actually a second court of appeal decision on some post judgment litigation, so these things go on and on, there's no question about it."



Mr. O'Brien said some (especially municipalities and regulated utilities) say adjudications are expensive, but given the value of water resources in California, they say it's worth it. He's not advocating adjudications, but when GSAs start to grapple with the question of pumping curtailments to deal with significant and unreasonable impacts on surface water beneficial uses, the GSAs who often don't

have the water rights expertise might welcome the idea of a Superior Court judge taking a little tiny piece of this process and dealing with it as judges do.

"Hearing the evidence, entering a judgement that determines what's the nature and extent of the water rights, what are the priorities, and then the GSA doesn't have to deal with that," he said. "So I think that in a number of basins, particularly the overdrafted basins, we're going to see what I call hybrid approach, where you have SGMA as the main effort, but an adjunct that's an adjudicatory process filed in Superior Court where water right issues are dealt with."

After SGMA was passed in 2014 and took effect on January 1, 2015, there was real concern in the Brown Administration and in the legislature that adjudications would be used to end run the SGMA process. So a follow-on bill was passed that streamlined the adjudication process, and more importantly, it made it clear that the SGMA process still was the controlling process, he said.

"In other words, if an adjudication is filed, that doesn't eliminate the need to meet all the SGMA deadlines to develop the plans and to do all the things you would have to do otherwise," he said. "It also gave trial courts very broad discretion to basically stay the adjudication process until the SGMA process is farther along, but it made absolutely clear that SGMA is our primary mechanism for dealing with these issues, so that's another reason why I think you probably will have these adjudications that are a small component of this larger process that is going on to address these issues."



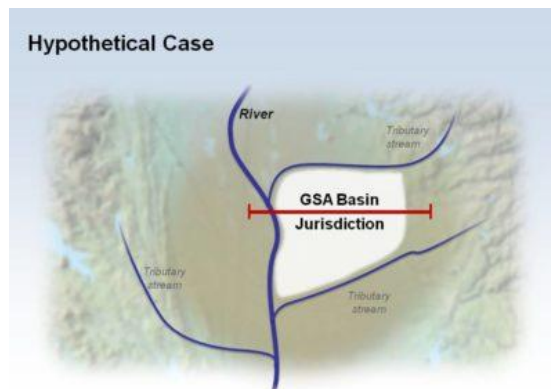
A HYPOTHETICAL BASIN

To explore how this might play out on the ground, Mr. Hall and Mr. O'Brien then discussed a hypothetical basin.

Mr. Hall said that he's quite optimistic that with patience, SGMA can be successful in integrating groundwater and surface water in most circumstances, and can provide a lot of flexibility that can benefit both the groundwater pumpers who are largely subject to SGMA and the surface water users that they would need to cooperate with.

"The central question here is how GSAs are going to address situations where they are pumping can cause or will cause or may cause significant and unreasonable impacts to the beneficial uses of surface water, beyond the levels that occurred prior to the passage of the law prior to 2015," he said.

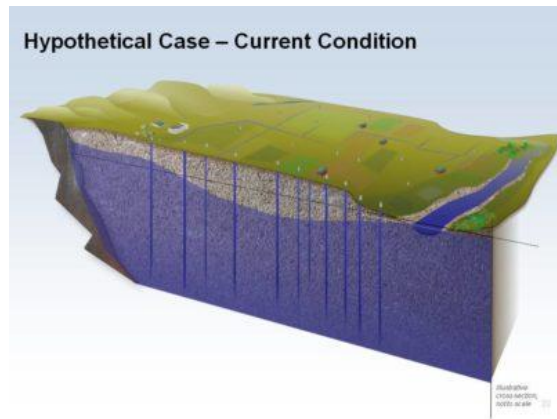
Mr. Hall then presented a map showing a hypothetical area for a GSA, noting that it's similar to the Sacramento Valley and there is always variability in the local conditions, but the principles will apply generally in other places. The hypothetical GSA is adjacent to a major river as well as a couple of tributaries that flow into that river, and bounded on the



east by the edge of the groundwater basin. For the purposes of discussion, assume the river downstream is fully allocated at some times of the year most years; he noted that's the case in many of our streams and rivers in California – not all, but certainly the case for the Sacramento and the San Joaquin. And if the river is fully allocated, the tributaries are also considered fully allocated because all of that water including the tributary flow is required to meet all of the allocated needs downstream at some point.

Mr. Hall then suggested that a rebuttable presumption be that any additional depletions of flow in the stream in the future beyond the pre-2015 levels would be impacting the beneficial uses of those surface waters. (A rebuttable presumption is an assumption made by a court that is taken to be true unless someone comes forward to contest it and prove otherwise.) *"Let's assume that and manage towards that. If you feel strongly that you want to assume something else, you can do that, but you have to provide supporting information for that. So the rebuttable presumption is if you deplete the surface waters beyond the 2015 levels, you're impacting the beneficial uses of the surface water. So that's part of the SGMA dreaded undesirable result #6, avoid impacting beneficial uses of surface water."*

Mr. Hall presented a cross-section of the hypothetical basin, noting that in this basin, they have been pumping for a long time, and the groundwater levels have been drawn down to below the level of the stream, making it a losing stretch of the stream. He pointed out

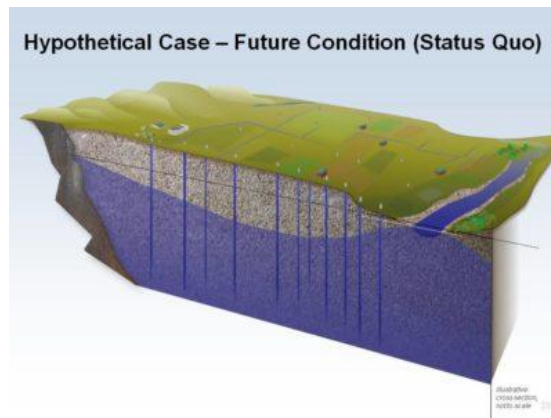


that the same principles would apply if it were a gaining reach of stream, because if the groundwater levels are drawn down further, it's going to reduce the inflow to the stream, which would still be a depletion of the stream flow.

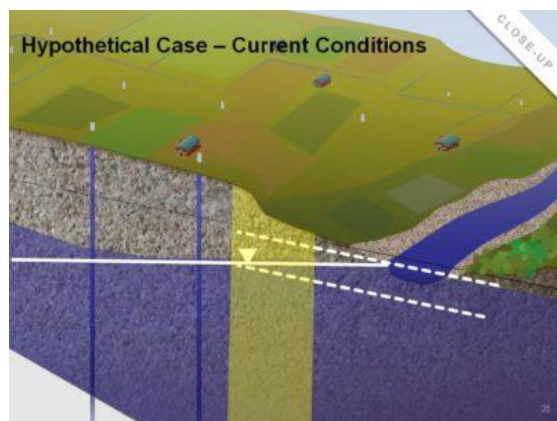
Let's assume that the GSA has developed a good model, they've simulated their system, and their

model tells them that if they continue pumping at current levels and they don't take any further corrective actions, the groundwater levels are going to go down further, he said. The time lag issue is coming into play; they've done some pumping in recent decades, and it hasn't completely shown up in the river.

Mr. Hall next presented a slide showing a future condition status quo that would occur with no additional pumping and no corrective measures taken. He explained that while he has drawn the aquifer as looking as if its finely sorted sand for illustrative purposes when in reality, the materials in aquifers is varied and complex, especially near the stream.



"There are a lot of complexities and the importance of understanding the local situation is really big, but physics tends to work similarly in all situations," he said.



"If you look really closely at the stream, and let's assume that going into the future, the streamflows are going to look fairly similar from pre-2015 levels, they are going to go up and down, but in a fairly similar way to the way they have in the past," he said. "I think there are some factors that are going to vary a little bit, but if you think of the stream as being sort of a

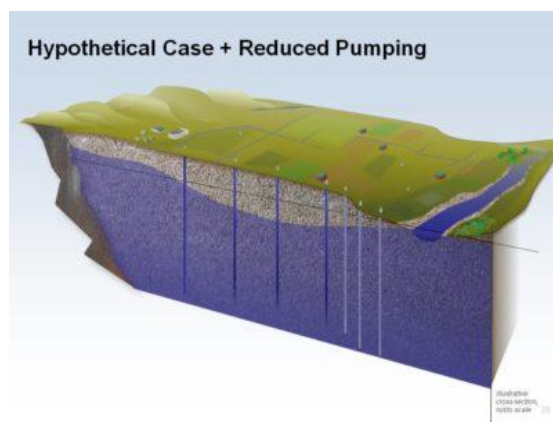
constant head boundary for the groundwater models, or a constant level going up and down but in a similar way as it has in the past, then the issue of depletion really becomes about how steep is the groundwater level moving away from the river. So the management of this river, or the depletion issue, really becomes about managing the groundwater levels in the vicinity of the stream. This is the hot zone that we need to pay attention to and you can make the argument that if you manage the levels in that and keep them at least as high as they were prior to 2015, then you're not causing any additional depletion."

He acknowledged there are a lot of complications and questions to be answered, such as what were the levels before 2015, how did they go up and down during the year, how did they go up and down through the years and drought years; there is plenty of work for those hydrogeologists and groundwater experts, he said. There are also questions about how far from the river does one set the thresholds; how many places along a stream in a given reach is needed to monitor those threshold levels; and how to account for the fact you don't really know what the pre-2015 levels were.

"There is a lot of variability, but basic principle says that if you don't let those groundwater levels go down below the level that they were pre-2015, however you're able to define that based on best information, then your depletions are no more than they were prior to 2015," he said. *"I think assumption can really help us out, because one of the issues is significant and unreasonable, so if you have different groundwater basins trying to determine what's significant, what's unreasonable, it's kind of a difficult challenge in a system like the San Joaquin or in the Sacramento where you may have dozens of these groundwater basins. So if you assume this is a rebuttable presumption, it really makes the overall management of the system much more simple, and I think meets the basic requirements of the law."*

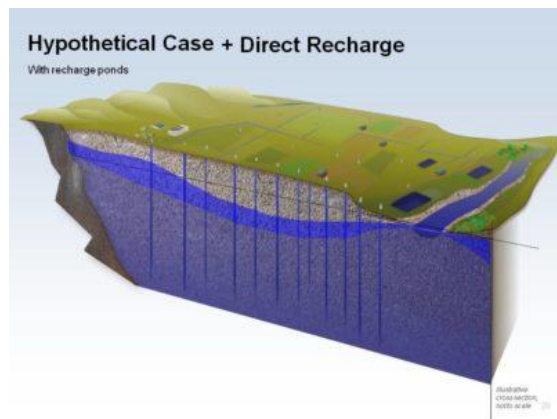
So how do we avoid the future depletions that SGMA says we have to avoid? How can the Groundwater Sustainability Agencies manage those levels to avoid that increased depletion? One example of a way to manage that is how we manage to avoid salt water intrusion, Mr. Hall said. *"It's an analogous situation. They basically need to manage the levels of the groundwater to the point so they avoid more inflow from the ocean. We have some good examples of that down in LA and Long Beach in particular and in other places where they really pay a lot of attention to those groundwater levels in the vicinity of the ocean. In this case we're looking at groundwater levels in the vicinity of the stream, and what actions can we take to make sure that those groundwater levels don't go down beyond some threshold level!"*

One way to accomplish this is to reduce pumping, which is not anyone's first choice, but it's a valuable tool, he said. *"In the case of managing for surface water depletions, you might actually want to think about how you reduce the pumping, where you reduce the pumping, you still have to deal with the overall water balance – you can't avoid that, but you might get some flexibility by avoiding pumping in the vicinity of the stream or reducing the pumping in the vicinity of stream, and then you have some longer periods to do corrective actions to bring more water in to compensate for that."*



Mr. Hall said the Environmental Defense Fund has been working on water trading programs because if they are done right, they can be very valuable. *"Water trading can allow you to help incentivize a reduction in pumping in different ways by having those who really need water routinely make deals with those who can do without water at some points with modest impacts, and shift pumping, both in time and in place, and reduce pumping overall. So reducing pumping is one option."*

Direct recharge is another tool where surface water is brought in to recharge the groundwater basins. *"Preferentially to address the streamflow issue, you might think about doing that in the vicinity of the stream,"* he said. *"It does mean that you're going to lose some of that water you put in the basin, but it also allows you to address this groundwater depletion issue."*



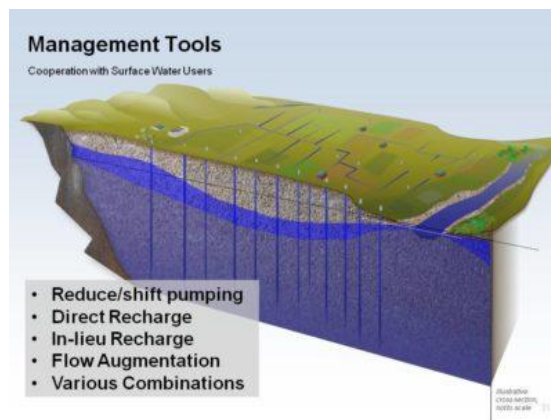
Another method would be on-farm recharge, or applying water to agricultural lands that have either been fallowed or during a fallow period. It's also an important for the Groundwater Sustainability Agencies to acknowledge that direct recharge is occurring in many cases due to the practice of irrigation with surface water. "So Groundwater

Sustainability Agencies are going to want to take measures to make sure that continues and perhaps even have more irrigation – maybe think about being a little less efficient during wet periods in order to recharge groundwater during wet periods," he said.

In-lieu recharge means finding someone who has surface water and providing that to groundwater pumpers in lieu of them pumping groundwater either some of the time or all of the time; this has quite a bit of potential as well, he said.

"It does take cooperation and so it really means that groundwater pumpers and groundwater sustainability agencies are going to need to be working with surface water rights users in their own basin, perhaps even distantly, and together, by implementing some of these things," Mr. Hall said. "The surface water users can help the groundwater users address their issues and the groundwater users can perhaps provide drought water supply for surface water users, etc."

There are other tools, such as the flow augmentation concept used in Colorado where groundwater pumpers are required to find surface water for compensate for their depletions; it could be certainly a good interim measure and perhaps a long-term measure. There are various combinations of things, all requiring cooperation. "As I looked



back at the SGMA and thought about it, I really think it provides a lot of flexibility to address these undesirable results and really sort of stabilize this long-term erosion of our surface water supplies that groundwater pumping has been causing."

"The most important thing that SGMA does is it makes sure someone is watching the ship," said Mr. Hall. "They are making measurements, they are looking at the situation, ideally they are doing modeling to understand their situation, and that basic process offers many different opportunities, it adds a lot of flexibility, and can be quite effective in addressing the surface water depletion issues."

Mr. Hall then turned the presentation over to Kevin O'Brien to discuss how he thinks this issue might play out in the hypothetical basin.

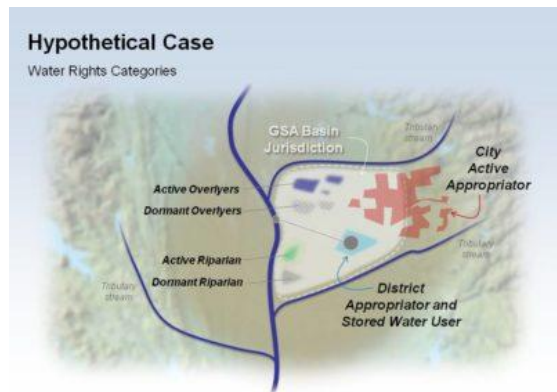
"The first thing I would say is I hope this works," said Mr. O'Brien. "Seriously, I think everybody is an economic actor and they are going to do this analysis. They're going to say, ok, I'm going to be affected by this in some way. My freedom is going to be curtailed in some way. But if it's basically rough justice and if it's basically generally consistent with what I think I would get out of an adjudication, I'm probably not going to want to go

through the court process. It doesn't make any economic sense. It's too long; it's too expensive."

But the devil is in the details, Mr. O'Brien said. "As with everything in water, it depends a lot on whose ox gets gored and how deep that gore is, so when we talk about reducing and shifting pumping, somebody near the stream is going to be told, 'we want you to reduce your pumping' and that suggests you're probably going to be reducing your irrigation," he said. "Maybe there's a way to get a substitute supply; Maurice talked about the water trading concept, maybe we can make that work. The cost of implementing the physical solution, the direct recharge and the in lieu recharge. There are significant costs there."

"If the GSA attempts to do what was done in the Mojave case that went up to California Supreme Court without taking into account water right priorities, someone may say, 'wait a minute, I'm an overlying land owner, I have a senior priority to the groundwater and I'm paying the same as the city over here that is deemed an appropriator and junior priority, and oh by the way, has the ability to pass those costs along to its municipal water customers:'"

So how this plays out in each individual situation will depend on the facts on the ground and the local politics, and whether these types of issues go in the direction of a court adjudication, who knows. "But I do think in some situations, some court assistance is going to be required to sort out the very complicated water right issues," he said.



Mr. O'Brien then presented a more complicated scenario for the hypothetical basin, noting that in the basin, there are both riparians and appropriators of surface water, some are active, some are dormant. There is a water district that diverts water that's been stored upstream in the wet period and released, so it's a supplemental supply to the

natural basin supply. There is a city that is an appropriator with a wellfield that pumps groundwater. He said it's a pretty simplistic version of what an adjudication is really like because there are different types of water users with different priorities, and the trial judge's job ultimately is to determine who gets how much and in what priority.

He noted that there are important complexities that would be dealt with in this type of a process, the first being will the common supply doctrine be applied. "Are we going to put the groundwater and surface water in one bucket, the groundwater and surface water rights in one bucket and adjudicate them together?" Mr. O'Brien said. "My personal feeling is that assuming the hydrogeology supports the notion that this is all an interconnected supply, which in most cases it will be, I think these adjudications, if they occur, will be surface water and groundwater; there's specific language in the follow on legislation that gives trial court judges in these types of adjudications the authority, if they think it would result in fair and reasonable outcome, to require surface water and groundwater rights to be adjudicated together. And I think that's exactly what will happen."

The second aspect that is important is the McCarran Amendment, which is a federal statute that basically says the federal government is willing to waive their sovereign immunity and allow the United States of America to be sued in state court in a water adjudication if it's a comprehensive adjudication. "When you think about the Sacramento Valley, and you think about the Bureau of Reclamation and its water rights to Shasta, to Folsom, and the significant amounts of water that are controlled by the federal government, I think the federal government, if it's going to be involved in those issues and

I think ultimately they would probably have to be involved, is going to insist on a comprehensive adjudication. The big question is, does that mean comprehensive in the sense of this basin and all these users, or does that mean comprehensive in the sense of the entire Sacramento Valley or the entire Central Valley? We don't know the answer to that. So there are definite complexities here procedurally that would come into play."

Another set of complexities arises from the fact there is both native groundwater in this basin feeding the streams and there is water that has been introduced to that groundwater system through artificial means, such as in a case where a district that has a contract to take water that has been previously stored in a reservoir and use it for irrigation, and some of that water percolates as return flow to the basin.

Mr. O'Brien said that in the decision in the city of Santa Maria adjudication decision, the Court of Appeal basically extended the concept of rights to recapture to the Santa Maria basin. The concept of rights of recapture came out of the City of LA versus the City of San Fernando, where the Supreme Court ruled that if you bring water in from another watershed and some of that water percolates as return flows to the basin, you have a paramount right to recapture that increment of the basin supply that is not native. *"That concept was then extended in Santa Maria to say that that also applies to water that's been stored in the watershed that would otherwise flow out to the ocean,"* he said. *"You bring it in, to the extent you augment the native supply, you have a right to recapture that increment of water."*

So not only are there priority issues as between the water users, there is also priority issues as in the water supply that exists in that system. *"My personal belief is that without the mechanism of basically a trial court to sort those issues out, to hear the evidence, and to render a decision, it's going to be very difficult to get to the end point. Maurice and I both agree what the end point is – the end point is a system that works and that doesn't result in significant and unreasonable impacts on surface water beneficial users."*

"I think the tough part is going to be how to get there," Mr. O'Brien said. *"I'm just going to say, I hope we can get there the cooperative way and I'm confident that in some areas we can. But I'm also confident that in some areas, there's going to be this hybrid approach. Hopefully it won't be too painful, but I think that's what it's going to take to get us to the end point."*

CONCLUDING REMARKS

Maurice Hall then gave some concluding remarks. *"What Kevin and I have described here is two different pathways,"* he said. *"On the one hand, a fairly friendly cooperative pathway, and on the other hand, one that is more adversarial involving the court and adjudication. But they are pathways to really the same end point, and the same end point is a physical solution, to use the terminology of adjudication. So what is the physical solution and how do you get there? In the case of the voluntary or cooperative approach, Kevin and I both agree that if you can make that work, that's the best option. With the cooperative approach, you can start having impacts now, you can have more flexibility and do that cooperation without some of the limitations and hard boundaries that adjudications tend to give you, and so I think there's actually more flexibility. From an environmental standpoint, I'm concerned about the period of the adjudication and the impacts of no action or uncertainty during that period as the adjudication is proceeding. Perhaps there are ways to mitigate that."*

"On the other hand, in the regulatory or adjudication process, there are obviously the costs associated with it," he said. *"You also have the uncertainty in the interim, and so it's really about what is the pathway that we prefer. And in the case of adjudications, in the Sacramento Valley and the San Joaquin Valley with the McCarran Act and the federal involvement, etc., you might see that 30 year Snake River adjudication seems like a cakewalk."*



DISCUSSION Q&A

Moderator Dorene D'Adamo began the discussion period by asking Mr. Hall and Mr. O'Brien to consider downstream users that are outside the GSA that aren't represented. Maybe they are represented by a different GSA but they are not in this GSA. "If the idea here is to have a collaborative solution, win win, flexible solutions, how do you achieve that cooperation if you have folks downstream that, at least initially, are not part of that discussion? And then take it further downstream. Within the stream, fish and wildlife, public trust uses, and then even further downstream say into the Delta, so complicating your example a little bit, focusing on other legal users and of course fish and wildlife."

"I think it's helpful to look at what's happening now and what's happened in history," replied Mr. Hall. *"What's happened in history is that we've had water supply needs downstream, we've had requirements that aren't being met, and we've gone to the surface water rights, the dam operators, the diverters, and said put some more water in the stream.*

At the same time, the groundwater pumping has been continually depleting the stream flow and so you've basically been working with a declining baseline with respect to the downstream water uses. And what that has done is it has basically required more of our surface water supplies and it undermines any of the proactive measures that we want to implement."

"As a starting point, with SGMA in place, and if SGMA is being implemented successfully by all of the groundwater basins on a river, you at least have a stable baseline on which to address those other issues," Mr. Hall continued. *"What I was talking about was compliance with SGMA – the SGMA requirements. That doesn't mean that there aren't other laws that come into play, including the Endangered Species Act, water quality control act, etc. Those still have to be implemented, but now we have more of a full participation of all of the participants that can affect the changes downstream."*

"We need to focus just on SGMA for purposes of this discussion as you can make this very complicated by getting into the question of what Porter Cologne requires in terms of Delta outflow and what the Endangered Species Act might require in terms of Delta inflow," said Mr. O'Brien. *"I don't think we have time to go there. But in terms of the hypothetical, if this GSA is successful in saying no further depletion of the surface water over and above what was occurring on January 1st, 2015. I think you can make a good argument to the folks downstream for SGMA purposes, that we've done our part. We've done our part for the system. We've complied with SGMA. Then it would be up for the other GSAs within this geographic area's watershed to essentially do their part. And if all the GSAs are successful in doing what Maurice is saying, you could halt the further depletion of the surface waters. I do think there is a significant issue out there as to what*



happened prior to January 1, 2015, but that will be next year's program."

Question: "It seems that in order to pull something like this off, you have to have confidence – confidence in the ideas, confidence in the GSA, and then confidence in the modeling. So how do you address this issue with varying levels of confidence in the models in determining significant and unreasonable impacts and then taking into account the time lag and getting folks to better understand that? Isn't that going to have to be accomplished through models and if there's not an agreement on the models, what's the next step?"



"There are a lot of issues wrapped up in that," said Mr. Hall. "I think initially, as we start to set our thresholds and our targets for management, we really don't know things very well. There's a lot of uncertainty. That said, if we can choose a starting point based on



the best information and then move forward with good modeling and continued monitoring, our understanding of those systems is going to improve dramatically as we proceed. We're going to learn that some areas are having more depletion than we thought, and we're going to learn that some areas are in better shape than we thought, and so what I'm suggesting is something of a grand compromise, which I think SGMA is to begin with; it's

another layer of a grand compromise in that we're all going to have to be a little bit willing to accept that uncertainty with the understanding that over the long term, we can all be in better shape, now that we have a means for proactive management of the groundwater in place."

"I think you're going to have downstream users looking upstream, perhaps hundreds of miles away, and saying, I would like to work with you, this is my need," Mr. Hall continued. "You can help me achieve that need if you can bank some of my water in your groundwater basin, and in exchange, I'm going to help you meet your requirements of SGMA because, even though it's my water in your groundwater basin, it's preventing you from having more depletions than SGMA will allow you to have."

Question: Physical solutions are attractive and provide for greater flexibility, but a lot of them are going to cost money. Someone's going to have to pay for it. And so how do you see these projects being financed? Then what about Prop 218?

"The question of the extent to which Prop 218 applies to SGMA related activities is still somewhat uncertain," said Mr. O'Brien. "There was a recent California Supreme Court case that I think clarified it to some extent, but left some questions open. I think regardless of whether 218 applies, you're going to have to go through some process where you basically get consensus that this is the right approach, and you're going to have to get

buy in from the people in the area that are going to pay the cost of these projects, that this is the right approach, it's fair, and it's better than a court process, whether it's 218 or not 218 if you can get there. I've seen this happen in some places. I've been involved down in the Salinas Valley for many years, and they years ago taxed themselves to build a project that would help address the issue of



seawater intrusion in the Salinas Valley, and the people who voted for that were primarily farmers in that valley, so it can happen that there's a perception that it's a good project and a fair allocation of costs."

"I think we have a history in California of finding public dollars for things like this, and it is certainly a state benefit to make this work," added Mr. Hall. "The sustainability of our water supply depends on doing it, and so it makes sense going forward that through bond measures or otherwise that state funds be brought to help bear the burden, and help the best projects move forward as quickly as we can."

Question: "I was intrigued by the analogy with managing seawater intrusion, and in your picture, that cross section suggests that combining a physical solution or a recharge projects and curtailing some pumping alongside the margin of the stream may be a way to sort of build up that mound and thereby avoid the significant and unreasonable impact to number 6. But the question that comes to me is then, where does that water come from to do that? Because the, in particular, many of the well owners alongside the stream will also be riparians, and therefore will be able to take water from the stream to continue irrigating or for their recharge, and so that gives your construct a nice way to seem to avoid the stream depletion, while taking more water from the stream to do so, and therefore impacting the streams. Can you give a sense of how the mass balance works in one more level of detail ...?"

"I didn't say it was easy," said Mr. Hall. "In fact, I think I said it was really hard, but there's a lot of different potentials. Certainly some areas have more water available around than others ... one of the reasons that I'm advocating thinking about that management of the groundwater levels along the river is that if you can focus on that, you have much more flexibility with what you do with the groundwater levels further away from the river, so you might be able to draw those down more further than you have, provided you don't cause any of the other undesirable results that could occur, but there's a fair bit of room to do



that in some cases. And with smart cooperation, which Californians have found they can do pretty well, you could do things like prerelease water from reservoirs with the recognition that sometimes some of that water is going to spill, and you use that to store in groundwater basins, and in some cases, as I mentioned, if you're storing that water adjacent to the stream, in some ways your compromising your ability

to store that water and use it later because some of that water is going to go into the stream."

"That said, we've all got to make this work together," said Mr. Hall. "In addition, you have surface water rights users that probably in some cases can make some water available in wetter years, they have the ability to use that water and if you have somewhere to store some of it, even though you may lose some of it, you're going to want to do that. There are so many different combinations that now that someone's watching the ship and we have accounting measures in place where we can have some confidence that what we put in the ground, we're going to be able to draw out, even though it maybe only 50% that we can draw out, we can at least have some confidence in that. Many innovative things that can happen more, that will happen in just little bits and pieces and some things that we really haven't done much of."

Question: "I think about the foresight that went into to Yolo County switching from groundwater to surface water and the impeccable timing that went there, but in your example, Maurice, would you foresee municipal diverters being on the same footing as agricultural diverters? or would there be a special dispensation for municipal diverters that didn't have the ability that Yolo County did to convert at least a portion of their supply to surface water?"

"I think one of the realities that's going to come into play and has many times, is that municipalities, even though in the strict hierarchy of water rights an appropriative right may be a lower priority than an overlying right, municipalities tend to have more money to do things, and so I think certainly there's going to be some tendency for municipalities to use their capacity to invest to develop collaborative solutions," said Mr. Hall.

"The big issue from a water rights law standpoint is that municipalities, public water districts, and regulated utilities are deemed by law to be appropriators of groundwater, so to the extent they are using groundwater, they are essentially in a second priority position to the overlying landowners," said Mr. O'Brien. "The only exception to that is in a situation where they've prescribed, which



generally involves pumping for five years or more in an overdrafted basin. So in the Sacramento Valley where we historically haven't had overdraft, thank goodness, the municipalities I think are okay because there's no real pressure to reduce pumping to get within the sustainable yield. What I hope happens is that they take some of their financial resources and help for the good of the basin as a whole so they don't get into a situation of overdraft, because I think that's the big risk we face in the north. There's a water rights aspect to it but then there's the reality that we need the cities to lead in this area, and the counties and the districts that have the financing ability to get projects implemented."

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