LOS OSOS WASTEWATER PROJECT
TECHNICAL ADVISORY COMMITTEE
San Luis Obispo County Department of Public Works

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EFFLUENT DISPOSAL SYSTEMS

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LEVELS OF SEAWATER INTRUSION MITIGATION FROM WASTEWATER PROJECT

LEVEL	VOLUME MITIGATED	IMPACT RELATIVE TO CURRENT CONDITIONS	DESCRIPTION
Level 0	0 AFY	-90 AFY	No mitigation of seawater intrusion
Level 1	90 AFY *	0 AFY	Mitigation of seawater intrusion similar to current conditions
Level 2	190 AFY *	100 AFY	Maximum mitigation without 3rd party participation
Level 3	550 AFY *	460 AFY	Achievement of a balanced basin at present water usage rates
Level 4	780 AFY *	690 AFY	Achievement of balanced basin at build out

* 50 AFY of addition mitigation is possible with agriculture reuse or exchange

NOTE: One acre-foot/year (AFY) is equal to 892 gallons per day (approximately 5 households)

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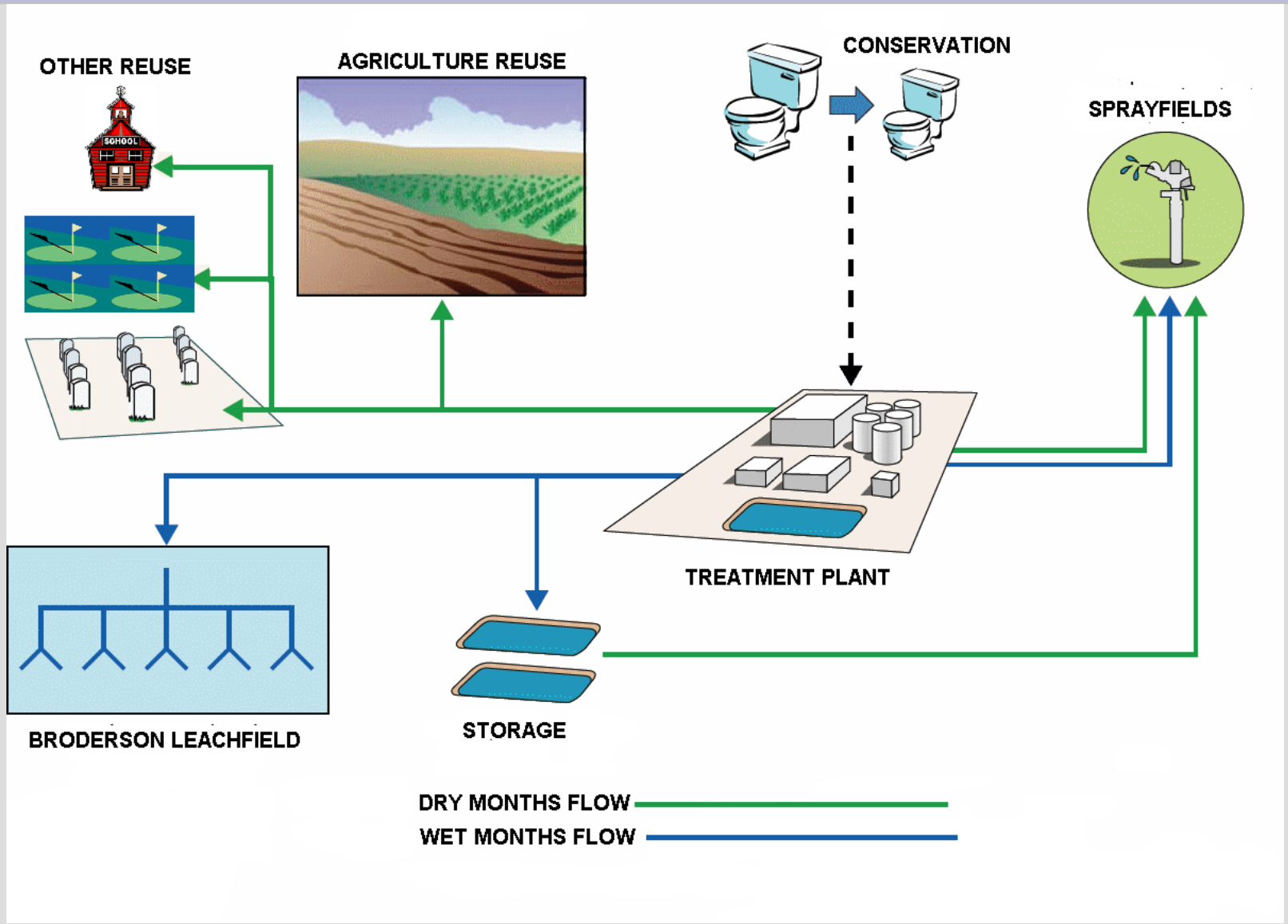

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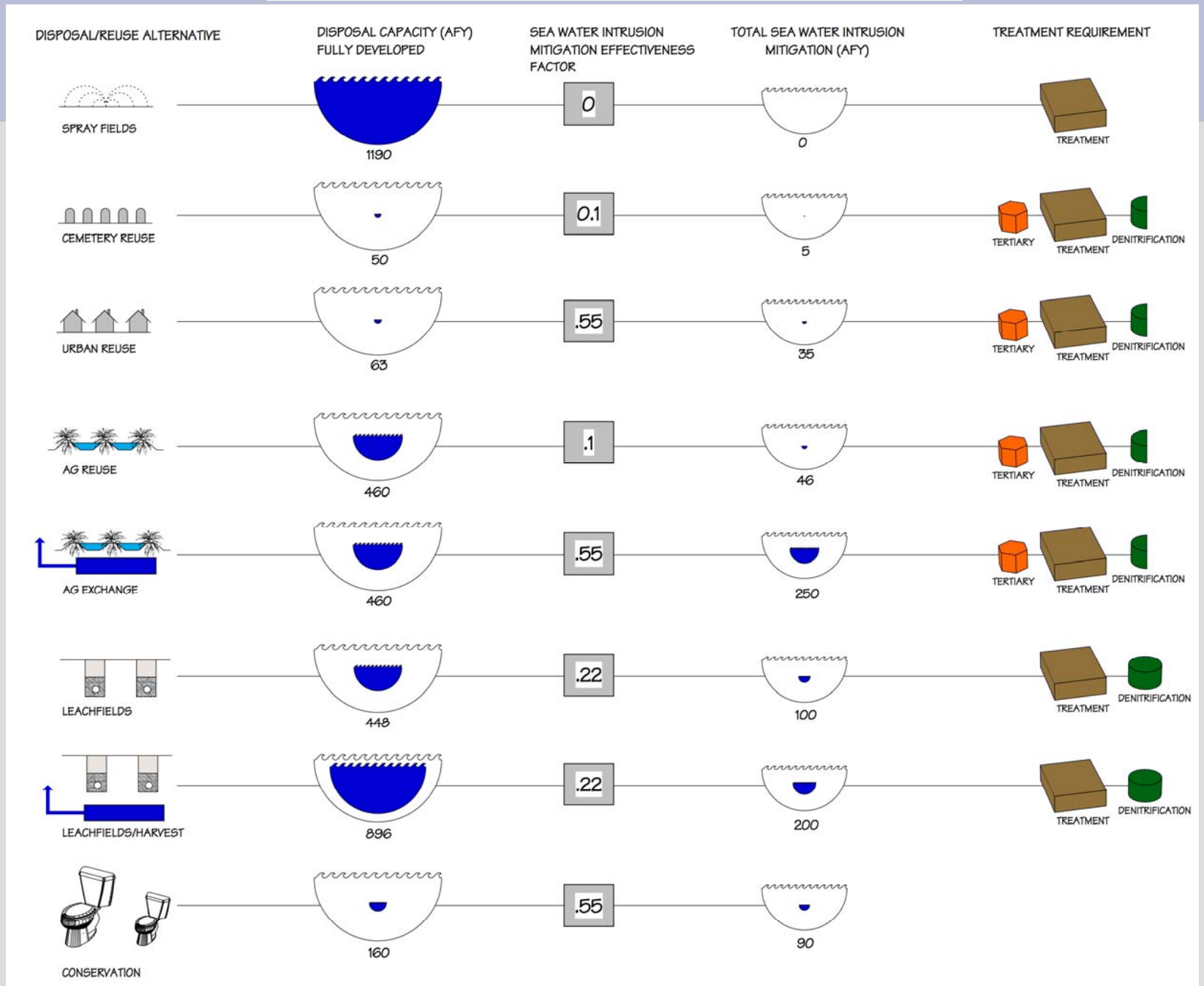

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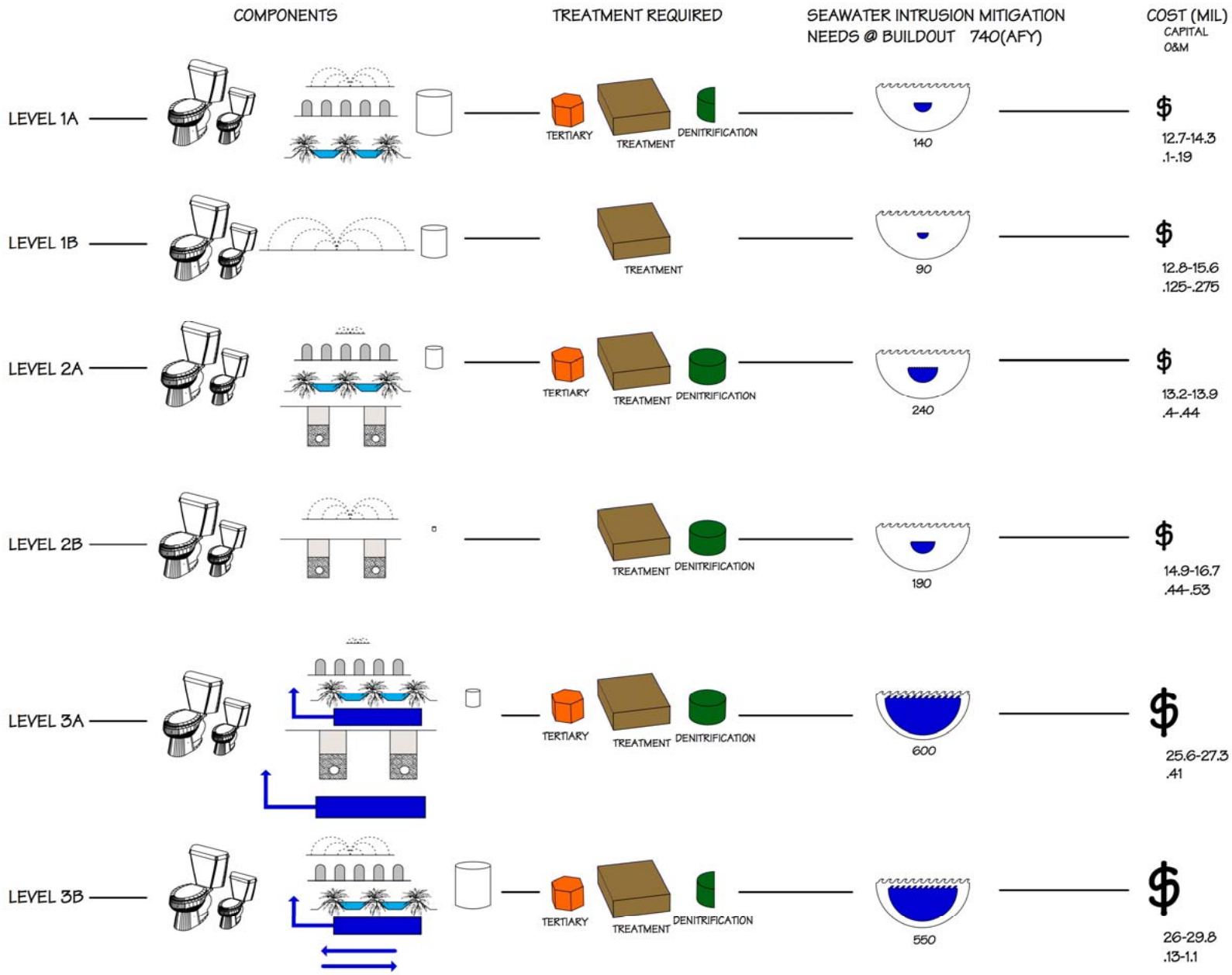
PROJECT CONFIGURATIONS



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Engineering and Water Resources Subcommittee

Criteria	Option	Pro	Con
Level of control over disposal options, multi-faceted approach that does not depend on 3rd parties	Level 1A Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF)	The spray field, conservation program and storage features are under the direct control of the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users.
	Level 1B Spray Fields (1190 AFY) Conservation (160 AFY) Storage (210 AF)	The spray field, conservation program and storage features are under the direct control of the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users.
	Level 2A Spray Fields (232 AFY) Broderson, ½ (448 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (140 AF)	The spray field, Broderson Leach Field, conservation program and storage features are under the direct control of the wastewater purveyor. The Broderson Leach Field property is already owned by the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users.
	Level 2B Spray Fields (742 AFY) Broderson, ½ (448 AFY) Conservation (160 AFY) Storage (30 AF)	All elements are under the direct control of the wastewater purveyor. The Broderson Leach Field property is already owned by the wastewater purveyor.	
	Level 3A Spray Fields (Minimal AFY) Broderson, 3/4 (680 AFY) Harvest Wells (232 AFY offset) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (115 AF)	The spray field, Broderson Leach Field, conservation program and storage features are under the direct control of the wastewater purveyor. The Broderson Leach Field property is already owned by the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users. The use of harvest wells will require the participation of the water purveyors. There is uncertainty associated with operating the Broderson Leach Field at ¾ capacity.
	Level 3B Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF) Water Purveyor Shift (400 AF)	The spray field, conservation program and storage features are under the direct control of the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users. Requires water purveyor participation.

Criteria	Option	Pro	Con
Retain water in the basin for sustainability and increased yield/seawater intrusion mitigation	Level 1A Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 686 AFY out of the groundwater basin.
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		Agricultural reuse and cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10.	Without the Broderson Leach Field, the project has no means for directly recharging the upper zone of the groundwater basin.
		This option reduces the seawater intrusion rate by 140 AFY.	
	Level 1B Spray Fields (1190 AFY) Conservation (160 AFY) Storage (210 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55. .	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 1190 AFY out of the groundwater basin.
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		This option reduces the seawater intrusion rate by 90 AFY.	Without the Broderson Leach Field, the project has no means for directly recharging the upper zone of the groundwater basin.
	Level 2A Spray Fields (232 AFY) Broderson, ½ (448 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (140 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	A limited volume of effluent is exported out of the basin to spray fields. This option exports 232 AFY.
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	

Criteria	Option	Pro	Con
		Agricultural reuse and cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10	
		The Broderson Leach Field will recharge the upper zone of the groundwater basin and will provide a seawater intrusion mitigation factor of 0.22	
		This option reduces the seawater intrusion rate by 240 AFY.	
	Level 2B Spray Fields (742 AFY) Broderson, ½ (448 AFY) Conservation (160 AFY) Storage (30 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 742 AFY out of the groundwater basin.
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		The Broderson Leach Field will recharge the upper zone of the groundwater basin and will provide a seawater intrusion mitigation factor of 0.22	
		This option reduces the seawater intrusion rate by 190 AFY.	
	Level 3A Spray Fields (Minimal AFY) Broderson, 3/4 (680 AFY) Harvest Wells (232 AFY offset) Agricultural Exchange (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (115 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	
		Cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10.	
		Agricultural Exchange, when coupled with decreased pumping from the western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	

Criteria	Option	Pro	Con
		The Broderson Leach Field will recharge the upper zone of the groundwater basin and will provide a seawater intrusion mitigation factor of 0.22	
		The export of effluent out of the groundwater basin is minimized.	
		This option reduces the seawater intrusion rate by 600 AFY.	
	Level 3B Spray Fields (680 AFY) Agricultural Exchange (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF) Water Purveyor Shift (400 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 680 AFY out of the groundwater basin.
		Cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10.	Without the Broderson Leach Field, the project has no means for directly recharging the upper zone of the groundwater basin
		Agricultural Exchange, when coupled with decreased pumping from the western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		With a water purveyor shift in pumping to the upper zone, coupled with all of the other measures of this option, the seawater intrusion rate is reduced by 550 AFY.	

Cost of various disposal options and energy consumption.	Level 1A Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF)	Construction Cost: $12,700,000 to $14,300,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $100,000 to $190,000 per year	This option will require a higher level of treatment.
	Level 1B Spray Fields (1190 AFY) Conservation (160 AFY) Storage (210 AF)	Construction Cost: $12,800,000 to $15,600,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $125,000 to $275,000 per year	
	Level 2A Spray Fields (232 AFY) Broderson, ½ (448 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (140 AF)	Construction Cost: $13,200,000 to $13,900,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $400,000 to $444,000 per year	This option will require a higher level of treatment.
	Level 2B Spray Fields (742 AFY) Broderson, ½ (448 AFY) Conservation (160 AFY) Storage (30 AF)	Construction Cost: $14,900,000 to $16,700,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $440,000 to $530,000 per year	This option will require a higher level of treatment.
	Level 3A Spray Fields (Minimal AFY) Broderson, 3/4 (680 AFY) Harvest Wells (232 AFY offset) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (115 AF)	Construction Cost: $25,600,000 to $27,300,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: Approximately $410,000 per year	This option will require a higher level of treatment.
	Level 3B Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF) Water Purveyor Shift (400 AF)	Construction Cost: $26,000,000 to $29,800,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $130,000 and up per year	This option will require a higher level of treatment.

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ENVIRONMENTAL

SPRAY FIELDS

PROS	CONS
Community owned asset Tertiary treatment not required Denitrification not required Chlorination required Purveyor's cooperation not required Future flexibility	Cost to purchase land Loss of water (no exchange/reuse) Only seasonal use Salt loading in soils No saltwater intrusion mitigation Trenching for pipeline to spray fields (degree of impact dependent on treatment plant location) Unknown future regulatory requirements

* Undetermined natural habitats impacts and visual impacts.

CEMETARY IN LIEU

PROS	CONS
Minimal saltwater intrusion mitigation Purveyors' cooperation not required If located adjacent to treatment plant minimal trenching impacts	Seasonal Partial denitrification required Tertiary treatment required Unknown future regulatory requirements

URBAN REUSE (Shallow Wells)

PROS	CONS
Minimal saltwater intrusion mitigation No off-site trenching impacts Purveyors' cooperation not required	Seasonal Partial denitrification required Tertiary treatment required

* A purple pipe system was deemed to be infeasible because of significantly higher construction costs and environmental impacts and required cooperation by the purveyors without significant additional benefits.

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ENVIRONMENTAL

AG REUSE

PROS	CONS
Minimal saltwater intrusion mitigation Purveyors' cooperation not required	Seasonal Partial denitrification required Tertiary treatment required Farmers' cooperation required Trenching for pipeline to spray fields (degree of impact dependent on treatment plant location) Unknown future regulatory requirements

AG EXCHANGE

PROS	CONS
Highest saltwater intrusion mitigation Farmers' cooperation required	Seasonal Partial denitrification required Tertiary treatment required Purveyors' cooperation required Trenching for pipeline to spray fields (degree of impact dependent on treatment plant location) Unknown future regulatory requirements

LEACHFIELDS/PERCOLATION PONDS (Broderson)

PROS	CONS
Significant saltwater intrusion mitigation Tertiary treatment not required Purveyor participation not required* Only alternative that allows recharge of both upper and lower aquifers	Full denitrification required Denitrification required Tertiary treatment required Monitoring wells require additional construction impacts and costs Grading impacts on existing habitat Negative community perception

* Without harvest wells.

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TAC Financial Working Group

Intrusion Mitigation Level	Configuration/ Capacity	PROS	CONS
Level 1a: Full Ag Reuse	Spray Fields (170 acres) 680 AF Ag Reuse 460 AF Conservation 160 AF Cemetery 50 AF Total capacity 1,350 AF Storage (290 AF)	• Total Mitigation = 140 AFY (1) • Total Capital Cost = $12.7M - $14.3M • Total O&M Cost = $100k- $190k / yr • Potential for additional Mitigation of 207 AF with Ag Exchange	• 680 AF water is permanently lost to ground water basin. • Slow ramp-up period to develop agreements with farmers • Cost to transport effluent 10,500 ft =$1.4M • Land acquisition costs (6) = $5.1M • Requires more storage
Level 1b: No Ag Reuse	Spray Fields (280 acres) 1190 AF Conservation 160 AF Storage (210 AF)	• Total Mitigation = 90 AFY • Total Capital Cost: $12.8M- $15.6M	• 1190 AF water is permanently lost to groundwater basin. • Land acquisition costs = $8.4M • Higher O&M Costs = $125k - $275k/ yr • Fails to utilize opportunity for agricultural in-lieu or exchange. • Cost to transport effluent 10,500 ft= $1.4M • Requires more storage
Level 2a: Full Ag Reuse	Spray Fields (70 acres) 232 AF Broderson 448 AF Ag Reuse 460 AF Cemetery 50 AF Conservation 160 AF 1,300 AF Storage (140 AF)	• Total Mitigation = 240 AFY • Potential for additional Mitigation of 207 AF with Ag Exchange • Total capital cost = $13.2M - $13.9M (comparable to Level 1a) • Land acquisition costs = $2.1M • Less acres required for spray fields than Level 1a, 1b, or 2b • Requires less storage than Level 1a or b projects	• 232 AF water is permanently lost to groundwater basin • Higher O&M = $400k - $440k/ yr • Cost to transport effluent 10,500 ft = $1.4M
Level 2b: No Ag Reuse	Spray Fields (180 acres) 742 AF Broderson 448 AF Conservation 160 AF Total capacity 1,350 AF Storage (30 AF)	• Total Mitigation = 190 AFY • Requires less storage than any other project • No ramp-up time required as for ag exchange	• 742 AF water is permanently lost to groundwater basin • Higher capital cost = $14.9M-$16.7M • Land acquisition costs = $5.4M • Higher O&M cost = $440k- $530k/ yr • Cost to transport effluent 10,500 ft = $1.4M • Lower mitigation than less expensive projects • Fails to utilize opportunity for mitigation through agricultural in-lieu or exchange

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TAC Financial Working Group

Level 3a: With Broderson	Spray Fields (10 acres) -0- (2) Broderson 680 AF Harvest as offset (3) Ag Exchange 460 AF Conservation 160 AF Cemetery 50 AF Total capacity 1,350 AF Storage (115 AF)	• Total Mitigation = 600 AFY • Maximizes potential for mitigation with ag exchange • O&M costs <$400k/ yr, comparable to Level 2a	• Higher capital costs = $25.6M-$27.3M • Land acquisition costs = $0.4M • Slow ramp-up period to develop agreements with farmers • Requires purveyor participation in shift in 400 AF of water production • Cost to transport effluent 10,500 ft = $1.4M • Requires more storage
Level 3b: Without Broderson	Spray Fields 680 AF Ag Exchange 460 AF Cemetery 50 AF Conservation 160 AF Shift in water production (4) Total capacity 1,350 AF Storage (290 AF)	• Total Mitigation = 550 AF • Maximizes potential for mitigation with ag exchange	• Higher Capital Costs = $26.0M - $29.8M (5) • Land acquisition costs = $20.4M • High O&M costs= $130k -$1,100,000/ yr (5) • Cost to transport effluent (10,500 ft)=$1.4M • Slow ramp-up period to develop agreements with farmers • Requires purveyor participation in shift or water importation • Requires greatest storage, as much as Level 1a project • Fails to utilize opportunity for mitigation through use of Broderson

(1) Mitigation: Ag in-lieu = 46; Conservation = 90; Cemetery = 5
(2) None during normal precipitation years
(3) Offsets pumping 232 AF/ year
(4) Shift in water production of 400 AF could involve upper aquifer pumping, water importation, or other strategies.
(5) Upper range of costs are for water importation.
(6) Land acquisition costs based on $30,000 per acre due to large size of parcel to be purchased.

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COST/ BENEFIT ANALYSIS OF EFFLUENT REUSE/ DISPOSAL ALTERNATIVES

TAC Finance Working Group

Reuse/Disposal Level	Capital Costs	Annual O&M Costs	Land (Spray field)	Storage	Seawater Intrusion Mitigation
Level 1a: Full Ag Reuse	$12.7M - $14.3M	$100k - $190k	170 acres = $5.1M	290 AF	140 AFY
Level 1b: No Ag Reuse	$12.8M - $15.6M	$125k - $275k	280 acres = $8.4M	210 AF	90 AFY
Level 2a: Full Ag Reuse	$13.2M - $13.9M	$400k - $440k	70 acres = $2.1M	140 AF	240 AFY
Level 2b: No Ag Reuse	$14.9M - $16.7M	$440k - $530k	180 acres = $5.4M	30 AF	190 AFY
Level 3a: With Full Ag Use and Broderson	$25.6M - $27.3M	< $400k (1)	10 acres = $0.4M	115 AF	

(1) According to County staff, the O&M number in the Fine Screen needs to be revised downward.

ALTERNATIVE	Mitigation Factor	PROS	CONS
Spray fields (Tonini)	-0-	• Capacity up to 1190 AFY • Unlikely that tertiary treatment is required – save $3.5M in construction and $30,000- $100,000/ year in O&M costs • Unlikely that denitrification treatment is required – save $4.6M from ponds construction	• -0- Seawater Intrusion Mitigation. Water is lost to groundwater basin. • Need up to 270 acres to dispose of 1190 AFY: land acquisition cost $5.1M • Construction Costs, incl. 10,500 feet pipe $5.2M • O&M Costs $ • Possible loss of agricultural viability • Requires winter storage $2.8M
Urban Reuse: **- Cemetery** **- Middle School, Other**	.55 = 5 AFY .55 = 35 AFY 40 AFY	• Capacity 50 AFY • Capacity 63 AFY	• Cost to transport effluent to town • Requires Tertiary treatment – add $3.5M to construction costs, and $30,000- $100,000/ year in O&M costs • Requires some nitrification/ denitrification • Urban in-lieu requires purveyor participation
Agricultural Reuse (In-Lieu using treated wastewater instead of pumping from lower aquifer)	.1 = 46 AFY	• Capacity 460 AFY • Reduces pumping from lower aquifer •	• Cost to transport effluent to farms $900k • Requires storage + $16k • Requires tertiary treatment – add $3.5M to construction costs, and $30,000- $100,000/ yr in O&M costs

Agricultural Reuse (In-Lieu using treated wastewater instead of pumping from lower aquifer)			yr in O&M costs • Requires some nitrification/ denitricication • Slow ramp-up period to develop agreements with farmers
Agricultural Exchange (using treated wastewater on fields; sending water pumped from wells to town for potable use)	.55 = 253 AFY	• Capacity 460 AFY • Replaces pumping from lower aquifer at west end: highest mitigation factor	• Cost to transport well water back to town • Requires tertiary treatment • Requires some nitrification/ denitricication • Slow ramp-up period to develop agreements with farmers • Requires purveyor participation
Broderson **- Leachfield** **- Percolation Pond**	.22 = 100AFY at 448 AFY Less at 896 AFY	• Capacity: 448 AFY without harvest wells • Capacity 896 AFY with harvest wells • Best location to recharge lower aquifer • Tertiary treatment not required - saves $3.5M in construction costs, and $30,000- $100,000 per year in O&M costs	• NWRI: If Broderson is used, it is important evaluate compliance with new DHS Groundwater Recharge Reuse criteria. • Cost for environmental mitigation of percolation ponds could be substantial. • Cost to develop leachfield = $2.4M • Cost to transport effluent to town (piping & pump) $4.4M • Value of Broderson land $4.7M • Harvest wells, treatment & water main $3.1M • Requires full nitrification/ denitricication – add $2.2M to construction costs and $90k - $250k per year for O&M costs for STEP • Requires purveyor participation • Percolation ponds problems include potential flow releases of effluent, permanent loss of sensitive habitat, odor issues, vector propagation
Storage: Need up to 30 acres **- Wells** **- Constructed Wetlands**	- 0 -	• /NWRI: winter storage will be required for land application (incl. spray fields) and for -0- discharge. • Constructed wetlands could enhance community	• Construction wetlands on Broderson will add to construction costs

* Cost figures found in Table A1

Other Strategies to Achieve Balance of Water Resources in the Groundwater Basin

Conservation	.55 = 90 AFY	• Equivalent to disposal capacity of 160 AFY	• Cost to retrofit 5,000 toilets ($200 ea) $1.3M
Storm water Runoff Detention (1)	.55 = xx AFY	• Low construction costs • Maximum mitigation factor	• Requires CSD, water purveyors support.

(1) Requires purveyor support and cooperation