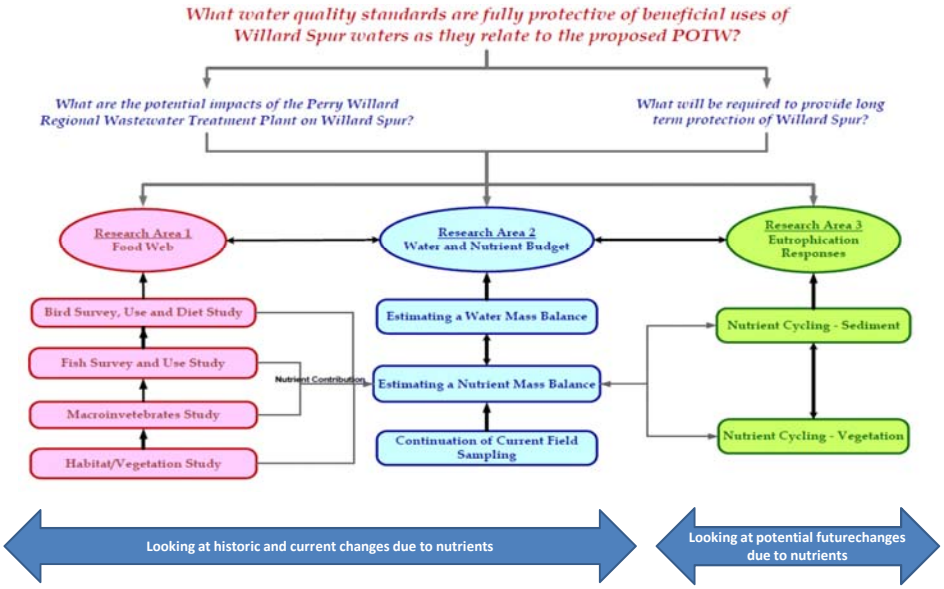
Linking Objectives & Questions to Answers & Solutions

Development of Water Quality Standards for Willard Spur



Study Question	Research Area that will address question	Specific Study/Task to address question	Possible Management Solutions
1. What are the potential impacts of the Plant on Willard Spur?			
1.1 What characteristics of the effluent are of concern?			
1.1.1 Is alteration of site hydrology a concern?	2	Hydrology monitoring	
1.1.2 Are the chemical constituents of concern?	2	2011 and 2012 Sampling Plan	Maintain Discharge Monitoring Reporting
1.2 What are the nutrient loads in the effluent with and without nutrient removal?	2	2011 and 2012 Sampling Plan, Nutrient Budget	Maintain Discharge Monitoring Reporting
1.3 What are the sources of nutrients entering Willard Spur and what is the relative significance of these sources?	2	2011 and 2012 Sampling Plan, Nutrient Budget	
1.4 How much of that load will reach Willard Spur accounting for nutrient assimilation by the wetland channel?	2	Nutrient Uptake Capacity Analysis - Special Study	
1.5 How will the wetland channel respond to the effluent's nutrient load?	2	2011 and 2012 Sampling Plan	
1.5.1 How will it respond in the long term?	2	Sampling Study, Nutrient assimilation of Harold Crane WMA	Long term monitoring plan with assessment framework
1.6 Under what conditions does the effluent reach and not reach Willard Spur?	2	Hydrology study	
1.7 Of the nutrients that reach Willard Spur, how might they change the ecosystem?	2 3 1	Site-wide Intensive Sampling Study Nutrient cycling study Vegetation/habitat mapping & lit review, Avian use lit review, Fish use lit review, Macroinvertebrate evaluation & lit review	
1.7.1 Do these changes have a deleterious effect on Willard Spur?	3	Nutrient cycling study	Change UPDES permit conditions, Permanent nutrient removal facilites at Plant
2. What will be required to provide long term protection of Willard Spur?			
2.1 What are the beneficial uses of Willard Spur?	2	2011 and 2012 Sampling Plan	Change beneficial use designation
2.2 What is the present condition of Willard Spur?	2	2011 and 2012 Sampling Plan	
2.2.1 What are the hydraulic/hydrologic characteristics of Willard Spur?	2	2011 and 2012 Sampling Plan, Hydrologic monitoring	
2.2.2 What are the sources of contaminants entering Willard Spur and what is the relative significance of these sources?	2	2011 and 2012 Sampling Plan, Nutrient Budget	
2.2.3 What are the relative concentrations of potential contaminants in water, sediment, macroinvertebrates, and fish in Willard Spur?	2	2011 and 2012 Sampling Plan	
2.2.4 What are the current vegetation, macroinvertebrate, and phytoplankton compositions in Willard Spur?	1 2	Vegetation/habitat mapping & lit review, Macroinvertebrate evaluation & lit review 2011 and 2012 Sampling Plan	
2.2.5 What are the current bird and fish componsitions in Willard Spur?	1 2 external	Avian use lit review, Fish use lit review 2011 and 2012 Sampling Plan DWR bird surveys	Address the petitioners request to reclassify Willard Spur as Category 1 Waters Assessment of beneficial use support
2.3 What are "natural" responses vs. responses to the Plant?			
2.3.1 How has Willard Spur changed over time to what we see today? What factors may have caused that change? How could nutrients affect change?			
2.3.1.1 How have hydrologic conditions changed?	2	Hydrology monitoring	
2.3.1.2 How have vegetation/habitat changed?	1	Vegetation/habitat study mapping & lit review	
2.3.1.3 How has bird use changed?	1 1	Avian use lit review 2011 Waterfowl diet study	
2.3.1.4 How has fish use changed?	1	Fish use lit review	
2.3.1.5 How has macroinvertebrate (lower food chain) use changed?	1	Macroinvertebrate evaluation & lit review	
2.3.1.5.1 What is influencing lower numbers of 2011 macroinvertebrates? Pattern doesn't match other GSL wetlands.	2	Macroinvertebrate life history analysis	
2.3.1.5.2 Where do macroinvertebrates get their food? Is food source impacted by nutrients?	2 3	Macroinvertebrate stable isotope analysis Nutrient cycling study	
2.3.2 How does the Willard Spur ecosystem respond to conditions in 2011 vs 2012 - a wet year representing optimal conditions vs dry/normal year representing critical conditions?	2 1 external external	2011 and 2012 Sampling Plan, Sonde deployment, Site-wide intensive sampling study Vegetation/habitat mapping & lit review, Avian use lit review, Fish use lit review, Macroinvertebrate evaluation & lit review Dr. Kettenring study of GSL invasive species DWR bird surveys	Long term monitoring plan with assessment framework
2.4 How is Willard Spur cycling nutrients? How does it respond to nutrients?	3	Nutrient cycling study	
2.5 What factors influence how Willard Spur is responding to nutrients?	3 2	Nutrient cycling study 2011 and 2012 Sampling Plan	
2.6 How might Willard Spur respond to increased nutrients? In short term? In long term?	3	Nutrient cycling study	Triggers for use in long term monitoring Numeric indicators with narrative criteria, Site-specific numeric criteria