# Working Through Location Restrictions to Expand the Ottumwa Midland Landfill

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ABSTRACT

The final Coal Combustion Residual (CCR) rule introduces new challenges for companies that develop new landfills or expand existing sites. This paper explains how Interstate Power and Light Company (IPL) overcame these challenges and expanded the Ottumwa Midland Landfill (OML) to accommodate increased byproduct disposal rates from new emission control projects. Although the existing landfill site was large enough to accommodate the expansion, location restrictions and other site constraints required IPL to navigate a complex set of changing regulations to permit and build the expansion. We will explore the OML expansion and the impacts that aquifer, unstable area, and wetland/critical habitat location restrictions had on the design, permitting, and first phase of expansion construction.

## INTRODUCTION

IPL, a wholly-owned utility subsidiary of Alliant Energy, faced a planning challenge that required them to develop a long-term expansion strategy for OML at a time when CCR disposal rules were uncertain. The Federal CCR disposal rules proposed in 2010, and draft state rules that followed shortly after, were significantly different than the rules in place for OML when IPL initiated their planning process. With new air emission control projects anticipated and changes to CCR management practices driven by pending Federal rules, IPL expected the existing airspace at OML would be in high demand; therefore, IPL needed additional capacity to support coal-fired electric generating operations in the future. IPL initiated the expansion project in 2010 after conducting an airspace survey that showed they had approximately four to five years of landfill capacity if disposal rates held steady. IPL began to develop a plan to expand the OML facility to provide disposal airspace for at least the next 25 years.

Although the challenges of planning a long-term landfill expansion are not unique to OML, the challenges at OML were magnified by the regulatory uncertainty at the time the effort took place. The most unique challenges at OML were associated with selecting an expansion footprint that could meet IPL's long-term disposal capacity

goals. Due to the history and layout of the property, the location restrictions in existing state rules and the location restrictions in rules proposed by the U.S. Environmental Protection Agency (USEPA) in June 2010 became the focus of the OML expansion team's efforts to plan, design, and permit a multi-phase landfill expansion. Now that USEPA's CCR disposal rules have been finalized, IPL's experience at OML can provide timely insight into the development of the demonstrations for location restrictions required by 40 CFR § 257.60 through § 257.64 (2015) at existing and future CCR landfills across the country.

Using the location restrictions in 40 CFR § Part 257 (2015), the CCR Rule, as a framework, we will share our experience with the planning and design of the OML expansion. Based on the OML expansion team's experience, we want others to understand the following:

- Potential impacts on your landfill expansion planning timelines
- Available resources
- Solutions are possible
- Expectations for resolution/permitting

IPL was successful in permitting an expansion of OML and has completed construction of the first phase of development. Ultimately, the expansion design met the location restrictions in place at the time the permit was issued and resulted in a state permit that allows for a long-term approach to expansion projects, by way of phased development. However, the newly constructed phase is considered an existing CCR landfill under the CCR Rule, so the demonstrations required for location restrictions under the current federal CCR Rule at OML do not all apply to the recently-constructed first phase of development. IPL will be required to revisit the location restrictions in the federal CCR Rule and local rules as future phases of the expansion are developed. The expansion planning completed by IPL in the absence of the final CCR Rule will serve only as a starting point for future compliance of new CCR units added to the facility over time. The application of the design approach developed during the expansion planning will require additional consideration of the requirements in place at initiation of construction.

## SITE BACKGROUND

The OML facility is located in Ottumwa, Iowa, which is in southeast Iowa. The facility is situated in a rural location outside of Ottumwa on 226 acres of land, which is bisected by a local road (130$^{th}$ Street). The existing landfill was opened in the mid-1990s and accepts CCR waste from several generating facilities located in the IPL territory.

At the time the expansion project was initiated, OML had 15 acres of lined disposal area. The facility also included accessory features such as storm water management systems, groundwater water and leachate pumping stations, a leachate lagoon and loadout facility, a scale and scale house, and maintenance facilities.

LOCATION RESTRICTIONS AT OML

IPL based their OML expansion planning strategy on the rules in place for CCR disposal sites in Iowa at the time they initiated their planning efforts. These rules, Iowa Administrative Code (IAC) Chapter 103 for Sanitary Landfills: Coal Combustion Residuals, were in force at the time this paper was submitted. IPL also considered the draft CCR Rule issued by USEPA in June 2010 and a draft version of IAC 103 the Iowa Department of Natural Resources (IDNR) gave to IPL. IPL used these draft rules as guidance throughout the planning process. Each set of rules included restrictions on the location of the landfill expansion. The specific restrictions varied between rules, but were generally similar in intent. They were designed to reduce the risks CCR disposal poses to human health and the environment.

Since the CCR Rule has been finalized and will be applicable into the future for those outside IPL's area of operation, we will use the location restrictions in 40 CFR § 257.60 through § 257.64 (2015) to frame our discussion. The location restrictions in the CCR Rule are different from the rules considered at the time the expansion was planned, but they provide a timely and more widely applicable framework for this discussion.

Location restrictions in the CCR Rule include:

- 257.60 – Placement Above the Uppermost Aquifer
- 257.61 – Wetlands
- 257.62 – Fault Areas
- 257.63 – Seismic Impact Zones
- 257.64 – Unstable Areas

We will briefly compare each CCR Rule requirement to the state requirement in place at the time the permit was issued for OML. We will discuss the site conditions and our assessment of each location restriction at OML, and describe how each condition was addressed during landfill planning and design, specifically with the first phase of development. We have reordered the location restrictions for discussion based on the impact or complexity involved with the OML expansion project.

<u>Seismic Impact Zones</u>

The CCR Rule requires new CCR landfills, existing and new CCR surface impoundments, and lateral expansions of CCR units to be located outside seismic impact zones (40 CFR § 257.63, 2015). A seismic impact zone is defined in the CCR Rule as an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 50 years (40 CFR § 257.53, 2015).

The CCR Rule allows flexibility from this restriction if a demonstration is made that the structural components of a CCR unit are "designed to resist the maximum horizontal acceleration in lithified earth material for the site." This demonstration must be certified

by a professional engineer. Additional guidance on this demonstration is provided by USEPA in the preamble to the CCR Rule.

The seismic impact zone location restriction does not exist in IAC 103, so this location restriction was not a requirement for permitting the OML expansion. IPL, however, considered the requirement in the planning phase because the draft version of IAC 103 and the draft CCR Rule both contained similar restrictions. IPL investigated the proximity of the site to a seismic impact zone via an inquiry to the Iowa Geological and Water Survey (IGWS). The IGWS concluded the site was not located within a seismic impact zone. This location restriction did not impact the expansion plans for OML.

Other resources are available for evaluating the location of a CCR unit with respect to seismic impact zones. The preamble to the CCR Rule includes a reference to the U.S. Geological Survey seismic zone mapping applications that industry professionals can use to view or generate seismic hazard maps to evaluate this location restriction (see http://earthquake.usgs.gov/hazards/).

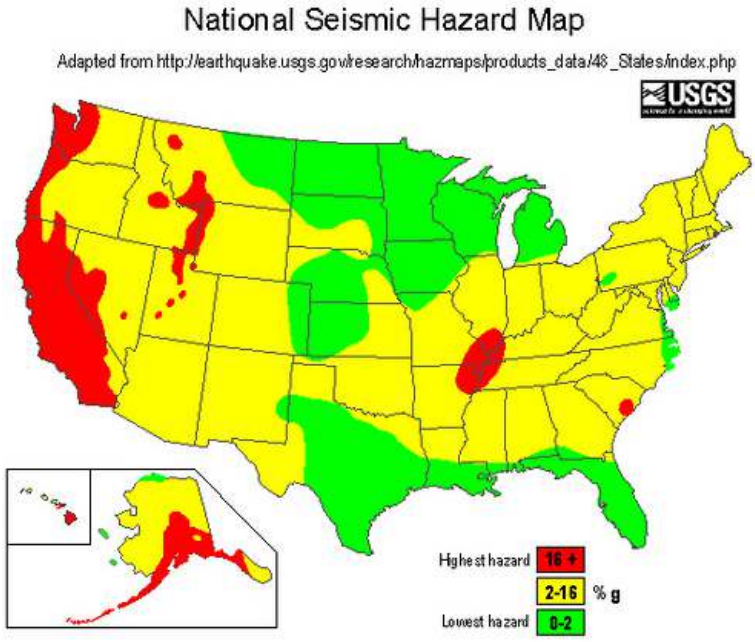



**Figure 1. National Seismic Hazard Map (Source: http://earthquake.usgs.gov/hazards/)**

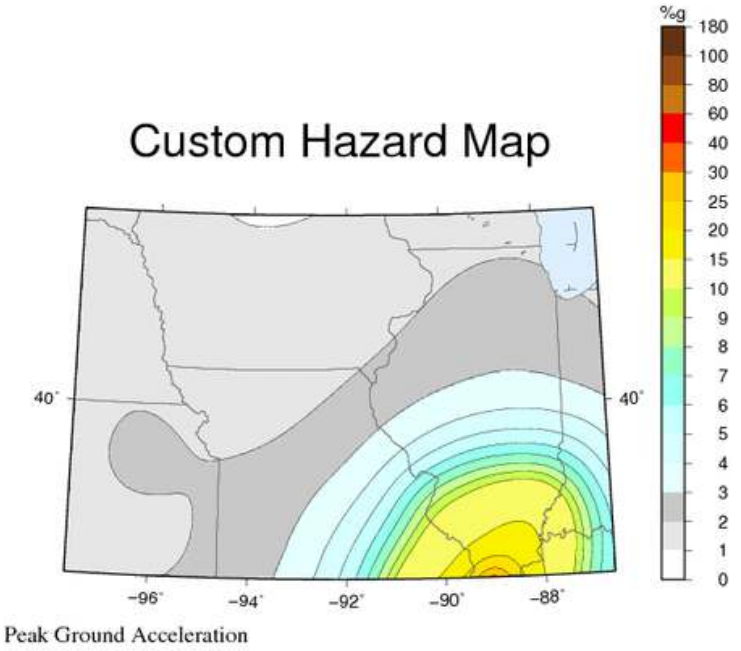



**Figure 2. Custom Seismic Hazard Map created with USGS mapping application (Source: http://earthquake.usgs.gov/hazards/)**

Fault Areas

The CCR Rule limits the location of new CCR landfills, existing and new CCR surface impoundments, and lateral expansions of CCR units to areas outside fault damage zones (40 CFR § 257.62, 2015). The CCR Rule requires these CCR units to be located at least 200 feet from the outermost damage zone of faults that have experienced displacement with the Holocene time period. The CCR Rule defines displacement as the relative movement of any two sides of a fault measured in any direction. The CCR Rule defines the Holocene time period as the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch, at 11,700 years before present, to present (40 CFR § 257.53, 2015).

The CCR Rule includes flexibility for considering reduced fault setbacks. The demonstration for a reduced setback must show that the structural integrity of the CCR unit will be maintained with movement in the nearby fault. The reduced setback demonstration must be certified by a professional engineer. Additional background on this demonstration is provided by USEPA in the preamble to the CCR Rule.

The fault area location restriction does not exist in IAC 103, so this location restriction was not required for permitting the OML expansion. However, IPL considered active faults during the planning phase because the draft version of IAC 103 and the draft CCR rule both contained similar location restrictions. IPL investigated the proximity of the site to active faults via an inquiry to the IGWS. The IGWS concluded the site was not located near an active fault as defined by IGWS. Therefore, this location restriction did not impact the expansion plans for OML.

The preamble to the CCR Rule discusses available resources and approaches for evaluating the location of a CCR unit with respect to fault areas. The preamble includes a reference to the U.S. Geological Survey earthquake hazard program website where a number of geologic hazard resources are available to inform site evaluations (see http://earthquake.usgs.gov/hazards/). The preamble also discusses the expectations that USEPA has for active fault investigations.

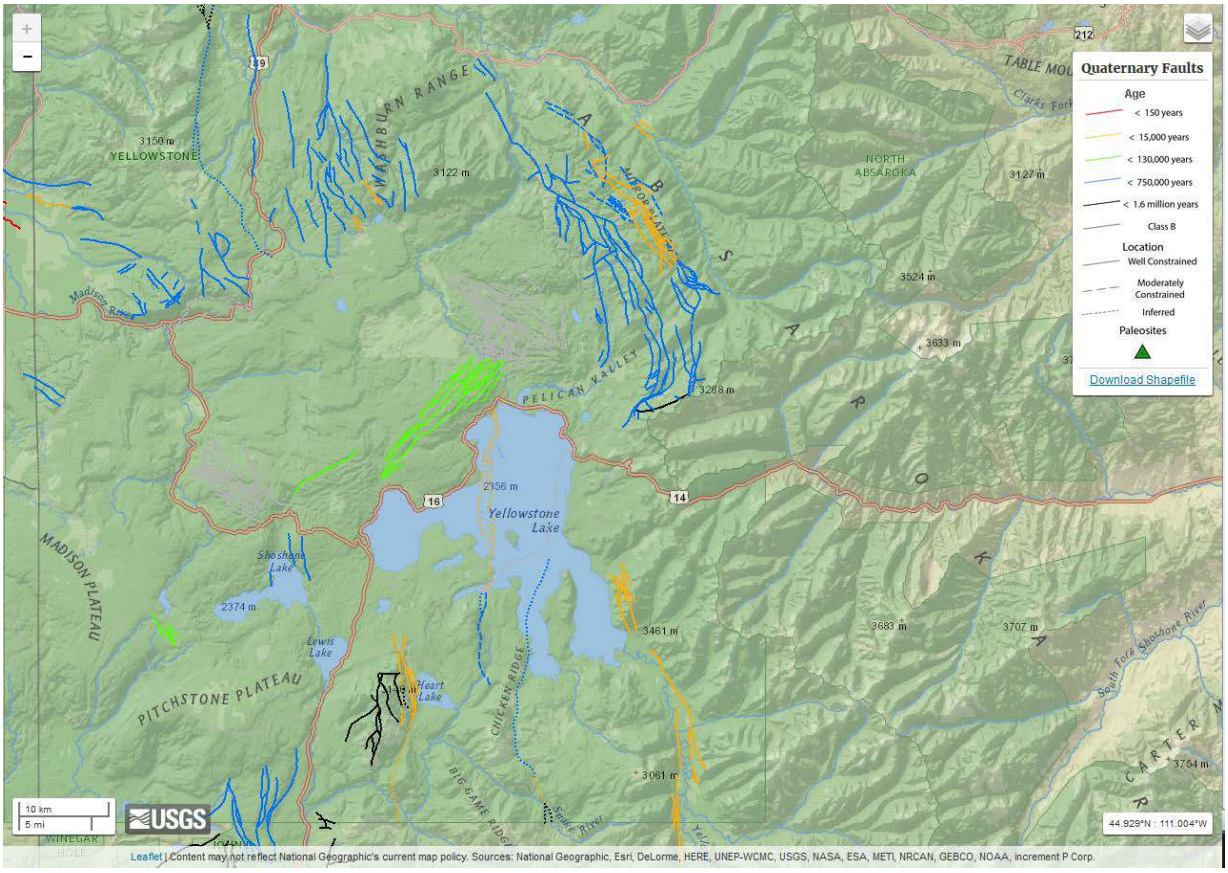



**Figure 3. Example View of USGS Interactive Fault Map**
**(Source: https://earthquake.usgs.gov/hazards/qfaults/map/#qfaults)**

## Placement Above the Uppermost Aquifer

The CCR Rule requires new CCR landfills, existing and new CCR surface impoundments, and lateral expansions of CCR units be constructed with a base that is 5 feet above the upper limit of the uppermost aquifer (40 CFR § 257.60, 2015). The CCR Rule defines the uppermost aquifer as the geologic formation nearest the natural ground surface that is an aquifer capable of yielding usable quantities of groundwater (40 CFR § 257.53, 2015).

If the 5-foot separation is not provided, the CCR Rule requires a demonstration that the base of the CCR unit and the uppermost aquifer will not be hydraulically connected with normal fluctuations in groundwater elevations. This demonstration must be certified by a professional engineer.

Although different from the CCR Rule location restriction, IAC 103 also contains a groundwater separation requirement of 5 feet between all waste and the high groundwater table. The high groundwater table is not defined in IAC 103. IPL addressed the groundwater separation requirement in IAC 103 by assessing the hydrogeologic conditions at the site in combination with the installation of a groundwater underdrain system.

OML is located within the Southern Iowa Drift Plain, which includes most of the southern half of Iowa. This region is characterized by steep hills and valleys created by many streams and rivers. The hills are topped with loess deposits, generally 8 to 10 feet thick. The loess overlies clayey glacial till that varies in thickness between 10 and 175 feet. These loess and till deposits at OML are not productive sources of groundwater. The uppermost bedrock unit in the site area consists of Pennsylvanian shales with minor siltstone, sandstone, limestone, and coal intervals. The continuity of these minor beds is variable, and they are not productive sources of groundwater. Underlying the Pennsylvanian shales are Mississippian limestones and dolomites, with some shale and sandstone. The Mississippian unit has been identified as the uppermost aquifer at OML.

The shallow depth to water in surface soils at OML had the potential to limit the expansion plan, due to the state requirement. At OML the apparent water table elevation in the unconsolidated deposits is higher than the landfill subbase (the bottom of the clay component of the liner system) in limited areas of the expansion. IPL installed a groundwater underdrain system where preconstruction groundwater elevations exceeded design subbase elevations. These areas include both the existing landfill and the first phase of development. The underdrain system in the expansion design includes a geocomposite drainage layer under the clay liner, perforated collection pipes, and solid-wall transfer pipes that are all drained by gravity. The water levels in the Mississippian unit were not a factor in the design of the expansion.

Throughout the landfill footprint, vertical groundwater gradients are indicative of downward flow. Heads measured in wells screened below the proposed subbase elevation are below the subbase elevation. The strong downward gradients indicate that groundwater from the underlying formations will not flow up under the landfill, even where saturated soil and rock are excavated to achieve the design subbase grades. With the excavation to the landfill subbase grades, existing downward hydraulic gradients and the elimination of recharge due to the liner, groundwater levels within the landfill phase area are expected to decrease with construction of each phase of the landfill. Flow to the underdrain system is primarily lateral flow from areas adjacent to the landfill where the water table is above the landfill subbase grades.

IPL assessed and eliminated location restrictions related to groundwater elevations by investigating and developing an understanding of the geology and hydrogeology of the site. Engineering controls provided further control of groundwater conditions to allow for landfill development without a loss of airspace.

Unstable Areas

The CCR Rule requires that existing and new CCR landfills, existing and new CCR surface impoundments, and lateral expansions of CCR units not be located in unstable areas (40 CFR § 257.64, 2015). The CCR Rule defines an unstable areas as a location that is susceptible to natural or human induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains (40 CFR § 257.53, 2015). The CCR Rule lists minimum factors that must be considered when evaluating whether an area is unstable. These factors include:

- On-site or local soil conditions that may result in significant differential settling
- On-site or local geologic or geomorphological features
- On-site or local human-made features or events, both surface and subsurface

If unstable areas cannot be avoided, the CCR Rule requires a demonstration that the integrity of the structural components of the CCR unit will not be disrupted. This demonstration must show that the design of the CCR unit incorporates recognized and generally accepted good engineering practices to account for the unstable conditions. This demonstration must be certified by a professional engineer.

The broad unstable area location restriction does not appear in IAC 103. Instead IAC 103 includes an unstable area restriction that is specific to sinkholes or karst features. IPL, however, considered a broader definition of unstable areas in their planning at OML due to both good engineering practice and the history of subsurface coal mining in the area of the site. The broader unstable area location restriction was also part of the draft version of IAC 103 and the draft CCR Rule that influenced IPL's decision process throughout planning.

IPL completed significant desktop and field investigations of the conditions at the OML site to develop the expansion plan. These investigations included:

- Review of original landfill siting investigation files
- Review of IDNR geographic information system (GIS) data for karst and mine features developed since the original OML site investigation in the early 1990's
- Consult IGWS regarding the history of coal mining within the landfill expansion planning area
- Conduct a geotechnical investigation program designed around the information gained from desktop reviews and consultations
- Conduct a geophysical survey using microgravity technique following an evaluation of various geophysical techniques

IPL used these investigations to develop an expansion strategy that avoided areas of the property that may have been impacted by historic underground mining activities.

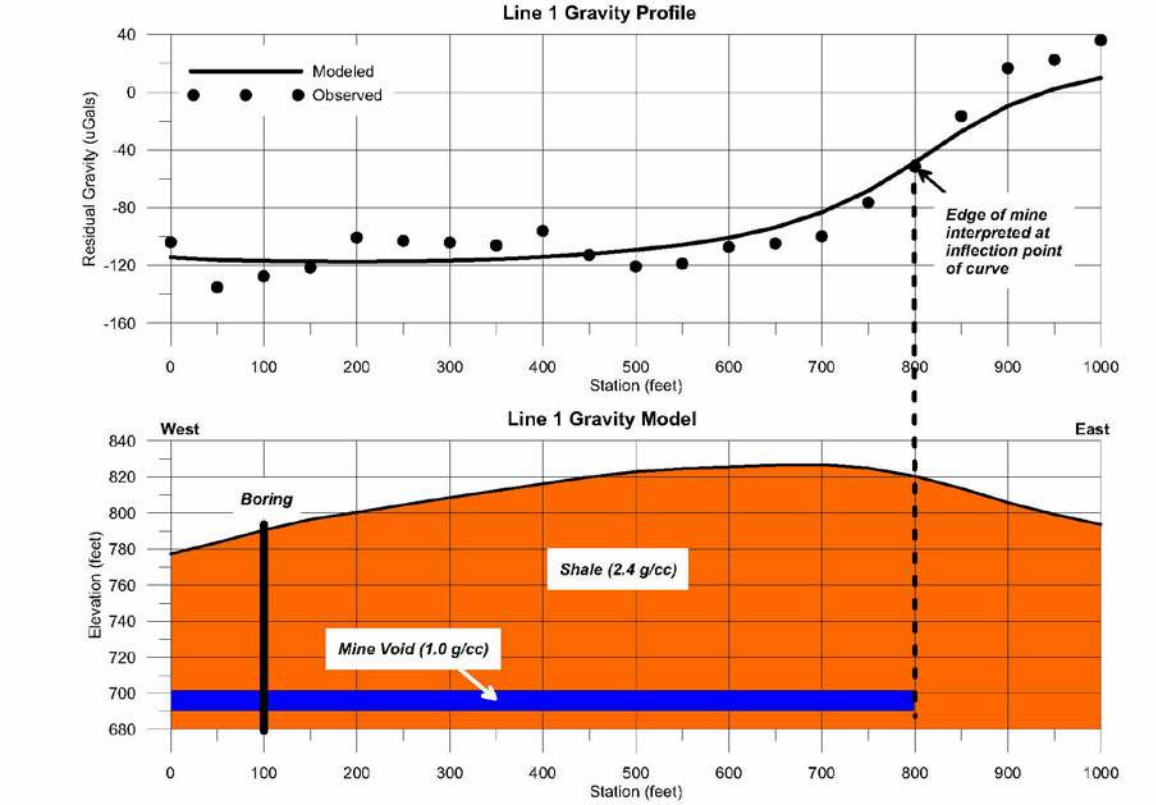



**Figure 4. Microgravity model versus field survey profile showing interpretation of potential mined area (Source: GeoView and Spotlight Geophysical Services Final Technical Report, Microgravity Survey – OML Expansion)**

<u>Wetlands</u>

Subsection 257.61 of the CCR Rule restricts new CCR landfills, existing and new CCR surface impoundments, and lateral expansions of CCR units from being located in wetlands as they are defined in 40 CFR § 232.2 (2011). Subsection 232.2 defines wetlands as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. The CCR Rule allows for flexibility using established permit processes under Section 404 of the Clean Water Act (CWA). A professional engineer must certify that the requirements in the CCR Rule are met to utilize this flexibility.

The state rules for CCR landfills like OML include a simply stated restriction that the disposal site cannot be a wetland. The draft version of the state rule and the draft CCR Rule considered by IPL in their planning both contained a wetland location restriction similar to the one in the final CCR Rule.

To develop a strategy in regards to wetland impacts, IPL completed desktop and field assessments to characterize the wetlands and waterways at the OML property. Stantec Consulting Services, Inc. (Stantec), of Independence, Iowa, completed the field assessments. The wetland assessments identified three wetland areas on the OML property:

- 0.09 acre palustrine emergent wetland
- 1.42 acre palustrine emergent wetland
- 1.6 acre palustrine emergent wetland

The assessments also identified two sections of stream on the property.

To avoid impacts to the wetlands and streams at the property, IPL evaluated several alternatives to the proposed expansion, including off-site alternatives, various on-site footprint alternatives, and a hybrid approach, which included on-site expansion and off-site disposal alternative. Many of the alternatives did not meet the basic project purpose of providing the waste disposal capacity that IPL required. Ultimately, with the concurrence of United States Army Corps of Engineers (USACE) permitting staff, IPL determined they could not avoid impacts to the on-site wetlands and streams with an expansion of OML if the purpose and needs of the project were to be met.

The landfill expansion included filling the 1.6 acre palustrine emergent wetland determined to be jurisdictional by USACE. The 0.09 acre palustrine emergent wetland determined to be non-jurisdictional by USACE will also be filled. In addition, approximately 2,600 linear feet of stream will be impacted by the development of the expansion.

IPL obtained a Section 401 certification under the CWA from the IDNR and a Section 404 permit from the USACE for wetland and stream impacts for the development of the landfill expansion. The approvals also included the mitigation of the wetland and stream impacts in other areas on the OML property. The mitigation projects include:

- Developing 2.4 acres of on-site wetlands located south of the proposed expansion area on a portion of the OML property located on the south side of 130$^{th}$ Street.

- Creating 4,550 linear feet of stabilized realigned stream along the perimeter of the expansion, and the stabilization of existing stream banks along a 400-foot segment of a stream located to the south of 130$^{th}$ Street on IPL property.

**Table 1. Mitigation Design Objectives/Performance Measures**

| Construction Phase | Est. Year of Construction | Impacted Stream Length | Stream Mitigation Length | Impacted Wetlands (Emergent) | Wetland Mitigation (Emergent) | Tree Buffer Plantings |
|---|---|---|---|---|---|---|
| 1 | 2014/2015 | 1,330' | 1,950' | 1.6 acres | 2.4 acres | 1.45 acres |
| 2 | 2018/2019 | | | | | |
| 3 | 2027/2028 | 1,330' | 3,000' | | | 0.95 acres |
| Totals | | 2,660' | 4,950' | 1.6 acres | 2.4 acres | 2.4 acres |
| Mitigation Ratio | | | 1.9:1 | | 1.5:1 | |
| | | | | | | |

**Figure 5. Completed wetland mitigation area.**

**Figure 6. Stream mitigation area after initial construction.**

As part of the Section 401/404 Joint Permit Application process, the following additional site evaluations were performed:

- Environmental resources review
- Mist net survey for the presence of the endangered Indiana Bat
- Intensive Phase I archaeological investigation

The IDNR identified the Indiana Bat as a concern during the environmental resources review. The Indiana Bat is a state- and federally-protected species. IPL performed a mist net survey with the assistance of Stantec at the property to determine the presence, or probable absence, of the Indiana Bat. No Indiana Bats were captured during the mist net survey, and the project was determined unlikely to adversely affect the Indiana Bat; a conclusion the USFWS supported. Even though no Indiana Bats were identified using the property, IPL elected to incorporate new habitat tree plantings into the wetland and stream mitigation projects at OML.

In addition, the State Section 401 Water Quality Certification and Section 404 permit restricted tree clearing activities that impacted suitable Indiana Bat habitat trees to the period of September 16 through April 14. Due to the timing of this and other approvals, IPL managed the clearing limitations through a Limited Notice to Proceed (LNTP) to allow clearing activities for the first phase of expansion construction to proceed without delay. Aside from these timing restrictions, the potential bat habitat did not have a significant impact on the expansion plan.

Bear Creek Archeology (BCA) of Cresco, Iowa, conducted an intensive Phase 1 archeological investigation. The investigation included the entire OML property, except the current landfill area and landfill support facilities. Based on the results of the archaeological investigation performed at the property, the Iowa State Historical Preservation Office (Iowa SHPO) agreed that no historic properties will be affected by the development of the proposed expansion. Aside from the cost and timing of the archaeological investigation, cultural resources did not have a significant impact on the overall expansion plan for OML.

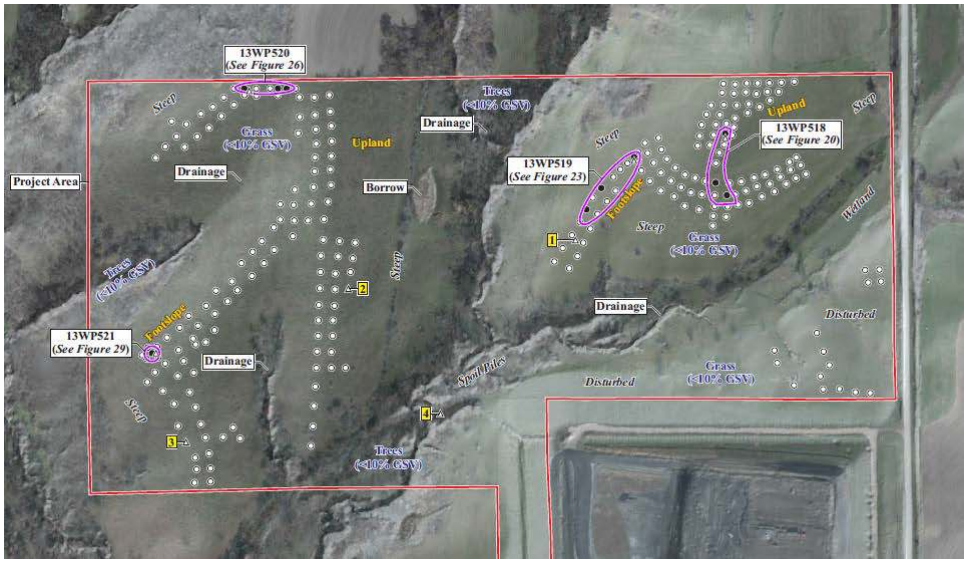
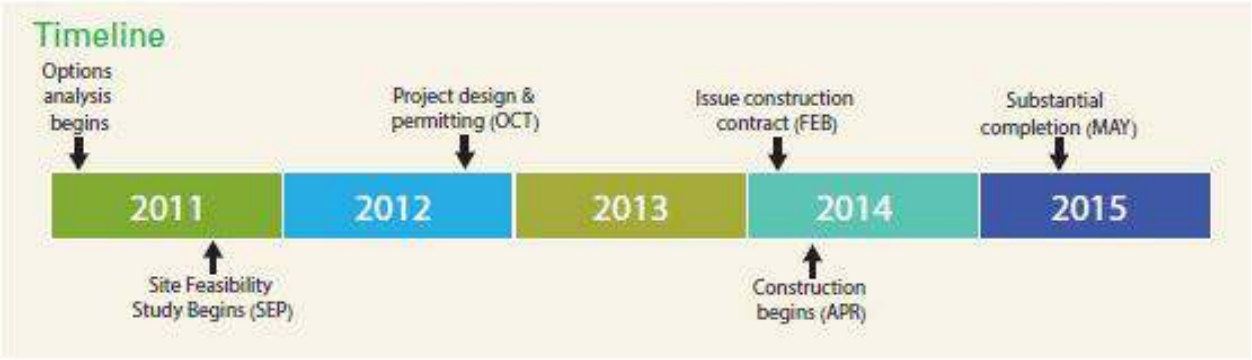



**Figure 7. Archaeological survey map of north expansion area (Source: Intensive Phase 1 Archaeological Investigation, Bear Creek Archaeology).**

## CONCLUSION

IPL successfully planned and permitted an expansion of OML from roughly 15 acres to 58 acres of disposal area in roughly three years. The first phase of expansion construction, which included the development of significant access, storm water management, contact water, and leachate management infrastructure, was completed in 18 months. All permitting activities were completed and construction initiated before the effective date of the CCR Rule.




The applicability of the location restrictions in the CCR Rule are likely to vary significantly by locale. However, assessing and addressing each restriction can take significant time and effort. Ancillary requirements such as the environmental and cultural resource reviews required to complete the Section 404 permit for OML take additional time. Reviewing agency resources may also impact the timing of your planning or demonstration process. Having reasonable expectations for the time the process of evaluating location restrictions will take is necessary. Communicating and testing these expectations through discussions with consultants, regulatory agency staff, and your stakeholders is critical.

There are significant resources available online from local, state, and federal agencies to assist with your evaluations. However, you may need specialized consultants to complete the location restriction demonstrations in the CCR Rule. Only licensed Professional Engineers can document and certify compliance with the CCR Rule. You will need to coordinate these resources to keep your project on time and in compliance. The OML case study demonstrates some of these complexities, but it also shows that with diligent planning and execution you can create working solutions to meet your goals and objectives.

ACKNOWLEDGEMENTS

The core project team of IPL and SCS Engineers acknowledges that the OML expansion project was successful in large part due to the contributions of the following:

- Stantec Consulting Services, Inc. – Environmental Resource Reviews, Mist Net Survey, and Stream Mitigation Design
- Bear Creek Archaeology, Inc. – Intensive Phase 1 Archaeological Investigation
- GeoView, Inc. and Spotlight Geophysical Services, LLC – Microgravity Survey
- Ryan Incorporated Central – Phase One Construction

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